

# SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

## SODIUM HYPOCHLORITE

Version 1

Revision Date 31.07.2019

Print Date 05.02.2020

IS / EN

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

#### 1.1 Product identifier

Trade name : SODIUM HYPOCHLORITE

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

Use of the Substance/Mixture : Specific use(s): Industrial and professional use  
Consumer use  
Biocide  
Refer to attached exposure scenario Annex.

Recommended restrictions on use : None.

#### 1.3 Details of the supplier of the safety data sheet

Company : Nouryon Industrial Chemicals bv  
Velperweg 76  
NL 6824 BM Arnhem  
Netherlands

Telephone : +31263664433  
Telefax : +31263665830  
E-mail address : industrialchemicals.sds@nouryon.com

#### 1.4 Emergency telephone number

Emergency telephone number : 24 hours emergency response number: +31 57 06 79211

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### SECTION 2: HAZARDS IDENTIFICATION

#### 2.1 Classification of the substance or mixture

Classification (REGULATION (EC) No 1272/2008)

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Corrosive to metals, 1, H290  
Skin corrosion, 1B, H314  
Serious eye damage, 1, H318  
Short-term (acute) aquatic hazard, 1, H400  
Long-term (chronic) aquatic hazard, 2, H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

## 2.2 Label elements

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

Pictogram



Signal word

: Danger

Hazard statements

: H290  
H314

May be corrosive to metals.  
Causes severe skin burns and eye damage.

H410

Very toxic to aquatic life with long lasting effects.

Precautionary statements

: **Prevention:**

P273  
P280

Avoid release to the environment.  
Wear protective gloves/ protective clothing/ eye protection/ face protection.

**Response:**

P301 + P330 + P331

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

P303 + P361 + P353

IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.

P305 + P351 + P338 + P310

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/doctor.

P390

Absorb spillage to prevent material damage.

For the full list of P-statements please see section 16.

### Hazardous components which must be listed on the label:

Sodium hypochlorite

7681-52-9

### Additional Labelling:

EUH031 Contact with acids liberates toxic gas.

## 2.3 Other hazards

No further data available.

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PBT and vPvB assessment : This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

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## SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

### 3.2 Mixtures

Pure substance/mixture : Mixture

#### Hazardous substance

Chemical name	PBT vPvB OEL	CAS-No. EC-No. REACH No.	Classification (REGULATION (EC) No 1272/2008)	Concentration [%]
Sodium hypochlorite		7681-52-9 231-668-3 01-2119488154-34	Met. Corr. 1; H290 Skin Corr. 1B; H314 Eye Dam. 1; H318 Aquatic Acute 1; H400 Aquatic Chronic 1; H410 M-Factor (Acute): 10 M-Factor (Chronic): 1	10 - 20
Sodium hydroxide		1310-73-2 215-185-5 01-2119457892-27	Met. Corr. 1; H290 Skin Corr. 1A; H314 Eye Dam. 1; H318	<= 0,8

Remarks : Further information:  
Biocidal active substance:  
150 g/l: 12.8% Active Chlorine  
170 g/l: 14.2% Active Chlorine

For the full text of the H-Statements mentioned in this Section, see Section 16.

#### REACH - Candidate List of Substances of Very High Concern for Authorisation (Article 59).

Status : Not applicable

## SECTION 4: FIRST AID MEASURES

### 4.1 Description of first aid measures

General advice : Immediate medical attention is required.  
Move out of dangerous area.  
Show this safety data sheet to the doctor in attendance.

If inhaled : If breathed in, move person into fresh air.  
Consult a physician after significant exposure.  
Obtain medical attention.

In case of skin contact : Take off contaminated clothing and shoes immediately.  
Rinse immediately with plenty of water.  
Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and with difficulty.

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- In case of eye contact : Rinse with plenty of water.  
Get medical attention immediately. Continue to rinse during transport.  
Remove contact lenses.  
Protect unharmed eye.  
Keep eye wide open while rinsing.  
Small amounts splashed into eyes can cause irreversible tissue damage and blindness.
- If swallowed : Clean mouth with water and drink afterwards plenty of water.  
Never give anything by mouth to an unconscious person.  
Take victim immediately to hospital.  
Do not induce vomiting! May cause chemical burns in mouth and throat.

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

- Symptoms : Skin contact may provoke the following symptoms:  
corrosive effects
- Risks : Causes severe skin burns and eye damage.  
Liquid causes severe inflammation of conjunctiva and may cause severe damage of the cornea.
- Causes serious eye damage.  
Causes severe burns.

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

- Treatment : Treat symptomatically.  
In the event of an emergency, the patient may have been exposed to chlorine gas liberated from the product.

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## SECTION 5: FIREFIGHTING MEASURES

### 5.1 Extinguishing media

- Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

### 5.2 Special hazards arising from the substance or mixture

- Specific hazards during firefighting / Specific hazards arising from the chemical : Water spray may be ineffective unless used by experienced firefighters.  
Do not allow run-off from fire fighting to enter drains or water courses.  
Heating or fire conditions liberates toxic gas.
- Combustion products : No hazardous combustion products are known

### 5.3 Advice for firefighters

- Special protective equipment for firefighters : In the event of fire, wear self-contained breathing apparatus.
- Further information : Collect contaminated fire extinguishing water separately. This must not be discharged into drains.  
Fire residues and contaminated fire extinguishing water must

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be disposed of in accordance with local regulations.

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## SECTION 6: ACCIDENTAL RELEASE MEASURES

### 6.1 Personal precautions, protective equipment and emergency procedures

- Personal precautions : Use personal protective equipment.  
Wear respiratory protection.  
Ensure adequate ventilation.
- Emergency measures on accidental release : Evacuate personnel to safe areas.  
Only qualified personnel equipped with suitable protective equipment may intervene.  
Prevent unauthorised persons entering the zone.

### 6.2 Environmental precautions

- Environmental precautions : Do not flush into surface water or sanitary sewer system.  
If the product contaminates rivers and lakes or drains inform respective authorities.

### 6.3 Methods and materials for containment and cleaning up

- Methods for cleaning up /  
Methods for containment : Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust).  
Keep in suitable, closed containers for disposal.

### 6.4 Reference to other sections

- For disposal considerations see section 13.  
For personal protection see section 8.

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## SECTION 7: HANDLING AND STORAGE

### 7.1 Precautions for safe handling

- Advice on safe handling : For personal protection see section 8.  
Avoid formation of aerosol.  
Do not breathe vapours or spray mist.  
Smoking, eating and drinking should be prohibited in the application area.  
Dispose of rinse water in accordance with local and national regulations.
- Advice on protection against fire and explosion : Normal measures for preventive fire protection.

### 7.2 Conditions for safe storage, including any incompatibilities

- Requirements for storage areas and containers : Keep container tightly closed in a dry and well-ventilated place.  
Store in closed dark containers made of anti-corrosive material.
- Advice on common storage : Do not store near acids.  
Keep away from metals.
- Other data : Risk of decomposition.

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## 7.3 Specific end use(s)

Specific use(s) : Refer to attached exposure scenario Annex.

## SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

### 8.1 Control parameters

#### Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Update	Basis	Form of exposure
Sodium hydroxide	1310-73-2	STEL	2 mg/m3	2001-12-06	IS OEL	

ACGIH: American Conference of Governmental Industrial Hygienists

AGW: Arbeitsplatzgrenzwert

BEI: Biological Exposure Index

MAC: Maximum Allowable Concentration

NIOSH: National Institute for Occupational Safety and Health

OEL: OEL: Occupational exposure limit.

STEL: Short term exposure limit

TRGS: Technische Regel für Gefahrstoffe

TWA: Time Weighted Average

#### Derived No Effect Level (DNEL) according to Regulation (EC) No. 1907/2006

Substance name	End Use	Exposure routes	Potential health effects	Value
Sodium hypochlorite	Workers	Inhalation	Acute systemic effects	3,1 mg/m3
	Workers	Inhalation	Acute local effects	3,1 mg/m3
	Workers	Inhalation	Long-term systemic effects	1,55 mg/m3
	Workers	Inhalation	Long-term local effects	1,55 mg/m3
	Workers	Skin contact	Long-term local effects	0,5 %
	Consumers	Inhalation	Acute systemic effects	3,1 mg/m3
	Consumers	Inhalation	Acute local effects	3,1 mg/m3
	Consumers	Inhalation	Long-term systemic effects	1,55 mg/m3
	Consumers	Ingestion	Long-term systemic effects	0,26 mg/kg bw/day
	Consumers	Skin contact	Long-term local effects	0,5 %
	Consumers	Inhalation	Long-term local effects	1,55 mg/m3
	Sodium hydroxide	Workers	Inhalation	Long-term local effects
Consumers		Inhalation	Long-term local effects	1,0 mg/m3

#### Predicted No Effect Concentration (PNEC) according to Regulation (EC) No. 1907/2006

Substance name	Environmental Compartment	Value
Sodium hypochlorite	Fresh water	0,00021 mg/l
	Marine water	0,000042 mg/l
	Sewage treatment plant	0,03 mg/l

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	Secondary Poisoning	11,1 mg/kg food
	Intermittent water	0,00026 mg/l

## 8.2 Exposure controls

### Engineering controls

Effective exhaust ventilation system

Ensure that eyewash stations and safety showers are close to the workstation location.

### Personal protective equipment

Respiratory protection : In the case of vapour or aerosol formation use a respirator with an approved filter.  
Combination filter:  
Gas cartridge B (acid gases, grey).  
P3 filter

Hand protection : PVC  
  
Rubber gloves

Eye protection : Tightly fitting safety goggles  
Wear face-shield and protective suit for abnormal processing problems.

Skin and body protection : Protective suit

Hygiene measures : Handle in accordance with good industrial hygiene and safety practice.  
Wash hands before breaks and at the end of workday.

### Environmental exposure controls

General advice : Do not flush into surface water or sanitary sewer system.  
If the product contaminates rivers and lakes or drains inform respective authorities.

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## SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

### 9.1 Information on basic physical and chemical properties

#### Appearance

Form : liquid  
Aqueous solution

Colour : yellow

Odour : irritating

Odour Threshold : No data available

#### Safety data

pH : 13,5 at 150 g/l solution In water at 20 °C

Melting point/freezing point : < -16 °C



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Boiling point	: Not relevant., Decomposes on heating.
Flash point	: Not applicable
Evaporation rate	: not determined
Flammability (solid, gas)	: Not applicable
Flammability (liquids)	: The product is not flammable.
Lower explosion limit	: Not applicable
Upper explosion limit	: Not applicable
Vapour pressure	: 17 hPa at 20 °C
Relative vapour density	: not determined
Density	: 1.220 kg/m <sup>3</sup> at 20 °C
Relative density	: 1,22 at 20 °C
Water solubility	: completely miscible
Solubility in other solvents	: not determined
Partition coefficient: n-octanol/water	: Not applicable
Auto-ignition temperature	: Not applicable
Decomposition temperature	: Decomposes on heating.
Viscosity, dynamic	: 2,65 mPa.s at 20 °C
Viscosity, kinematic	: not determined
Explosive properties	: Not explosive
Oxidizing properties	: Oxidizing Material

## 9.2 Other information

Corrosive to metals : Corrosive to metals

This safety datasheet only contains information relating to safety and does not replace any product information or product specification.

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## SECTION 10: STABILITY AND REACTIVITY

### 10.1 Reactivity

Stable under normal conditions.

### 10.2 Chemical stability

Risk of decomposition.

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## 10.3 Possibility of hazardous reactions

Contact with acids liberates toxic gas.  
Heating can release hazardous gases.

## 10.4 Conditions to avoid

Conditions to avoid : Extremes of temperature and direct sunlight.  
UV light causes decomposition.

## 10.5 Incompatible materials

Materials to avoid : Iron  
Copper  
Acids  
Nickel

## 10.6 Hazardous decomposition products

Hazardous decomposition products : Chlorine dioxide gas may evolve from solution.  
Oxygen

Thermal decomposition : Decomposes on heating.

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## SECTION 11: TOXICOLOGICAL INFORMATION

### 11.1 Information on toxicological effects

#### Product information:

Acute toxicity : Not classified based on available information.

Skin corrosion/irritation : Causes severe burns.

Serious eye damage/eye irritation : Causes serious eye damage.

Respiratory or skin sensitisation : Respiratory sensitisation: Not classified based on available information.  
Skin sensitisation: Not classified based on available information.

Germ cell mutagenicity : Not classified based on available information.

Carcinogenicity : Not classified based on available information.

Reproductive toxicity : Not classified based on available information.

STOT - single exposure : Not classified based on available information.

STOT - repeated exposure : Not classified based on available information.

Aspiration hazard : Not classified based on available information.

Further information : No further data available.

#### Toxicology data for the components:

##### Sodium hypochlorite

#### Acute toxicity:

Acute oral toxicity : LD50: 1.100 mg/kg

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	Species: Rat Method: OECD Test Guideline 401
Acute inhalation toxicity	: LC50 (Rat): 10,5 mg/l Exposure time: 1 h Test atmosphere: vapour Method: OECD Test Guideline 403 Assessment: The component/mixture is minimally toxic after short term inhalation.
Acute dermal toxicity	: LD50: > 20.000 mg/kg Species: Rabbit Method: OECD Test Guideline 402
Skin corrosion/irritation	: Classification: Causes burns.  Species: Rabbit Result: Mild skin irritation Method: OECD Test Guideline 404 Aqueous solution (5,25%)
Serious eye damage/eye irritation	: Classification: Causes severe skin burns and eye damage.  Species: Rabbit Result: Eye irritation Method: OECD Test Guideline 405 Aqueous solution (5%)
Respiratory or skin sensitisation	: Buehler Test Species: Guinea pig Result: Not sensitizing. Method: OECD Test Guideline 406
Repeated dose toxicity	: Species: Rat, males NOAEL: 50 mg/kg bw/day Application Route: Oral Exposure time: 90 d Method: OECD Test Guideline 408  Species: Rat, females NOAEL: 57,2 mg/kg bw/day Application Route: Oral Exposure time: 90 d Method: OECD Test Guideline 408  Species: Rat, male and female LOAEL: mg/m <sup>3</sup> , <= 3 Application Route: Inhalation Exposure time: 30 d Method: OECD Test Guideline 412
Germ cell mutagenicity Genotoxicity in vitro	: Ames test Salmonella typhimurium Result: negative

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	Method: OECD Test Guideline 471
	Chromosome aberration test in vitro Chinese hamster lung fibroblasts Result: positive, Ambiguous results Method: OECD Test Guideline 473
	Chromosome aberration test in vitro Human fibroblasts Result: Ambiguous results Method: OECD Test Guideline 473
Genotoxicity in vivo	: Chromosome aberration test in vivo Species: Mouse Method: OECD Test Guideline 474 Result: negative
	Chromosome aberration test in vivo Species: Mouse Method: OECD Test Guideline 475 Result: negative
	DNA damage and/or repair Species: Rat Result: negative
	in vivo mouse sperm head abnormality assay Species: Mouse Result: Ambiguous results
Carcinogenicity	: Species: Rat Application Route: Oral Exposure time: 2 years Method: OECD Test Guideline 453 Result: Animal testing did not show any carcinogenic effects.
	Species: Rat Application Route: Oral Exposure time: 2 years Method: OECD Test Guideline 451 Result: Animal testing did not show any carcinogenic effects.
Reproductive toxicity/Fertility	: Species: Rat Application Route: Oral General Toxicity - Parent: No observed adverse effect level: >= 5 mg/kg bw/day General Toxicity F1: No observed adverse effect level: >= 5 mg/kg bw/day Method: OECD Test Guideline 415
Reproductive toxicity/Development/Teratog enicity	: Species: Rat Application Route: Oral Teratogenicity: No observed adverse effect level: >= 5,7 mg/kg bw/day

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Method: OECD Test Guideline 414

## Sodium hydroxide

### Acute toxicity:

- Skin corrosion/irritation : Result: Causes severe burns.
- Serious eye damage/eye irritation : Result: Risk of serious damage to eyes.
- Respiratory or skin sensitisation : Result: Does not cause skin sensitisation.
- Germ cell mutagenicity
- CMR effects Mutagenicity : In vivo tests did not show mutagenic effects, Tests on bacterial or mammalian cell cultures did not show mutagenic effects.
- Genotoxicity in vitro : In vitro tests did not show mutagenic effects

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## SECTION 12: ECOLOGICAL INFORMATION

### Product information:

#### Ecotoxicology Assessment

- Additional ecological information : An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.  
Very toxic to aquatic life with long lasting effects.  
Toxic to aquatic life with long lasting effects.

### 12.1 Toxicity

#### Components:

#### Ecotoxicology Assessment

#### Sodium hydroxide

- Long-term (chronic) aquatic hazard : This product has no known ecotoxicological effects.

#### Test result

#### Sodium hypochlorite

- Toxicity to fish : LC50: 0,06 mg/l  
Exposure time: 96 h  
Species: Oncorhynchus mykiss (rainbow trout)  
Test Type: Fresh water

LC50: 0,032 mg/l  
Exposure time: 96 h  
Species: Oncorhynchus kisutch  
Test Type: Marine water

- Toxicity to daphnia and other aquatic invertebrates : EC50: 0,141 mg/l  
Exposure time: 48 h  
Species: Daphnia magna (Water flea)  
Test Type: Fresh water  
Method: OECD Test Guideline 202

EC50: 0,035 mg/l  
Exposure time: 48 h  
Species: Ceriodaphnia dubia (water flea)

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	Test Type: Fresh water Method: OECD Test Guideline 202
	EC50: 0,026 mg/l Exposure time: 48 h Species: Crassostrea virginica Test Type: Marine water
Toxicity to algae	: NOEC: 0,0021 mg/l Exposure time: 7 d Species: algae Test Type: flow-through test Fresh water
	EC50: 0,0499 mg/l Exposure time: 7 d Species: algae Test Type: flow-through test Fresh water
M-Factor (Acute)	: 10
M-Factor (Chronic)	: 1
Toxicity to bacteria	: EC50: > 3 mg/l Exposure time: 3 h Species: activated sludge Test Type: static test
	EC50: 77,1 mg/l Exposure time: 3 h Species: activated sludge Test Type: static test Method: OECD Test Guideline 209
	EC10: 46,9 mg/l Exposure time: 3 h Species: activated sludge Test Type: static test Method: OECD Test Guideline 209
Toxicity to fish (Chronic toxicity)	: NOEC: 0,04 mg/l Exposure time: 28 d Species: Menidia peninsulae Test Type: Marine water
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	: NOEC: 0,007 mg/l Exposure time: 15 d Species: Crassostrea virginica Test Type: Marine water
<b>Sodium hydroxide</b>	
Toxicity to daphnia and other aquatic invertebrates	: EC50: 40,4 mg/l Exposure time: 48 h Species: Ceriodaphnia (water flea)

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Test Type: Immobilization

## 12.2 Persistence and degradability

**Product information** : No information available.

### Components:

#### Sodium hypochlorite

Biodegradability : Result: hydrolyses

#### Sodium hydroxide

Biodegradability : Result: Not applicable  
inorganic

## 12.3 Bioaccumulative potential

**Product information** : No information available.

### Components:

#### Sodium hypochlorite

Bioaccumulation : Does not bioaccumulate.

#### Sodium hydroxide

Bioaccumulation : Does not bioaccumulate.

## 12.4 Mobility in soil

**Product information** : No information available.

### Components:

#### Sodium hypochlorite

Mobility : Can be leached out from soil.

#### Sodium hydroxide

Mobility : Can be leached out from soil.

Distribution among environmental compartments : Transport to air is not expected.

## 12.5 Results of PBT and vPvB assessment

### Product information:

PBT and vPvB assessment : This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

### Components:

#### Sodium hypochlorite

PBT and vPvB assessment : This substance is not considered to be persistent, bioaccumulating and toxic (PBT).  
This substance is not considered to be very persistent and very bioaccumulating (vPvB).

#### Sodium hydroxide

PBT and vPvB assessment : This substance is not considered to be a PBT (Persistent, Bioaccumulation, Toxic)  
This substance is not considered to be vPvB (very Persistent nor very Bioaccumulating)

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## 12.6 Other adverse effects

**Product information** : No information available.

### Components:

#### Sodium hypochlorite

Biochemical Oxygen Demand (BOD) : No data available

#### Sodium hydroxide

Biochemical Oxygen Demand (BOD) : Not applicable

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## SECTION 13: DISPOSAL CONSIDERATIONS

### 13.1 Waste treatment methods

Waste Code : European Waste Catalogue Code: 16 09 04\*

Product : The product should not be allowed to enter drains, water courses or the soil.  
Do not contaminate ponds, waterways or ditches with chemical or used container.  
Hazardous waste  
Dispose of contents/container in accordance with local regulation.

Contaminated packaging : Empty remaining contents.  
Dispose of as unused product.

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## SECTION 14: TRANSPORT INFORMATION

### 14.1 UN number

ADR : UN 1791  
RID : UN 1791  
IMDG-Code : UN 1791  
IATA-DGR : UN 1791

### 14.2 Proper shipping name

ADR : HYPOCHLORITE SOLUTION  
RID : HYPOCHLORITE SOLUTION  
IMDG-Code : HYPOCHLORITE SOLUTION  
IATA-DGR : Hypochlorite solution

### 14.3 Transport hazard class

ADR : 8  
RID : 8  
IMDG-Code : 8  
IATA-DGR : 8

### 14.4 Packing group

ADR  
Packing group : II  
Classification Code : C9  
Hazard Identification Number : 80  
Labels : 8  
Tunnel restriction code : (E)  
RID



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Packing group : II  
Classification Code : C9  
Hazard Identification Number : 80  
Labels : 8

## IMDG-Code

Packing group : II  
Labels : 8  
EmS Code : F-A, S-B  
Remarks : Handle with care.

## IATA-DGR

Packing instruction (cargo aircraft) : 855  
Packing instruction (passenger aircraft) : 851  
Packing instruction (LQ) : Y840  
Packing group : II  
Labels : 8  
Remarks : Handle with care.

## 14.5 Environmental hazards

### ADR

Environmentally hazardous : yes

### RID

Environmentally hazardous : yes

### IMDG-Code

Marine pollutant : yes (Sodium hypochlorite)

### IATA-DGR

Environmentally hazardous : yes

## 14.6 Special precautions for user

Remarks : Handle with care.

## 14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

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## SECTION 15: REGULATORY INFORMATION

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

Seveso III: Directive 2012/18/EU of the European Parliament and of the Council on the control of major-accident hazards involving dangerous substances.

		Quantity 1	Quantity 2
E1	ENVIRONMENTAL HAZARDS	100 t	200 t

### Notification status

DSL : YES. All components of this product are on the Canadian DSL  
AICS : YES. On the inventory, or in compliance with the inventory  
NZIoC : NO. Not in compliance with the inventory  
ENCS : YES. On the inventory, or in compliance with the inventory  
ISHL : YES. On the inventory, or in compliance with the inventory

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KECI	: YES. On the inventory, or in compliance with the inventory
PICCS	: YES. On the inventory, or in compliance with the inventory
IECSC	: YES. On the inventory, or in compliance with the inventory
TCSI	: YES. On the inventory, or in compliance with the inventory
TSCA	: YES. All chemical substances in this product are either listed on the TSCA Inventory or in compliance with a TSCA Inventory exemption.

For explanation of abbreviation see section 16.

## 15.2 Chemical safety assessment

Sodium hypochlorite	: A Chemical Safety Assessment has been carried out for this substance.
Sodium hydroxide	: A Chemical Safety Assessment has been carried out for this substance.

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## SECTION 16: OTHER INFORMATION

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

H290	: May be corrosive to metals.
H314	: Causes severe skin burns and eye damage.
H318	: Causes serious eye damage.
H400	: Very toxic to aquatic life.
H410	: Very toxic to aquatic life with long lasting effects.
H411	: Toxic to aquatic life with long lasting effects.

### Classification procedure:

Corrosive to metals, 1, H290, Based on product data or assessment  
Skin corrosion, 1B, H314, Calculation method  
Serious eye damage, 1, H318, Calculation method  
Short-term (acute) aquatic hazard, 1, H400, Calculation method  
Long-term (chronic) aquatic hazard, 2, H411, Calculation method

### Full list of P-statements.

#### Prevention:

P234	Keep only in original container.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.

#### Response:

P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER/doctor.
P390	Absorb spillage to prevent material damage.
P391	Collect spillage.

#### Storage:

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P406 Store in corrosive resistant/ .? container with a resistant inner liner.

**Disposal:**

P501 Dispose of contents/ container to an approved waste disposal plant.

**Full text of other abbreviations**

IS OEL : Iceland. Regulation on occupational exposure limits.

IS OEL / STEL : Short term exposure

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road; AICS - Australian Inventory of Chemical Substances; 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; 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; TRGS - Technical Rule for Hazardous Substances; TSCA - Toxic Substances Control Act (United States); UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative

**Further information**

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

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## Annex :

Manufacture

Formulation [mixing] of preparations and/or re-packaging

Industrial use as intermediate

Industrial use in textile industry.

Industrial use in sewage and cooling or heating water treatment

Industrial use in pulp and paper

Industrial cleaning use

Professional cleaning use

Consumer use

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## 1. Short title of Exposure Scenario: Manufacture

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Main User Groups	: SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	: SU8: Manufacture of bulk, large scale chemicals (including petroleum products)
Environmental Release Categories	: ERC1: Manufacture of the substance
Process categories	: PROC1: Use in closed process, no likelihood of exposure 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 PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities 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)

---

## 2.1 Contributing scenario controlling environmental exposure for: ERC1: Manufacture of the substance

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### Amount used

Annual amount per site : 342600 tonnes/year

### Other given operational conditions affecting environmental exposure

Number of emission days per year : 360

Remarks : Product applied in aqueous process solution with negligible volatilization. Free available chlorine in effluent is measured as total residual chlorine (TRC) and is calculated to be below 1.0E-13 mg/L, No release to air from process expected because hypochlorite solution is non volatile., No release to soil from process expected.

### Technical conditions and measures / Organizational measures

Water : Risk to the environment is driven by freshwater exposure. Onsite wastewater treatment required. Prevent discharge of substance directly to the environment and waste water treatment is required.

Remarks : Common practices vary across sites but releases expected are negligible to waste water and soil (sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material).

### Conditions and measures related to municipal sewage treatment plant

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Type of Sewage Treatment Plant : Municipal Sewage Treatment Plant  
Flow rate of sewage treatment : 2.000 m3/day  
plant effluent  
Effectiveness (of a measure) : 100 %  
Sludge Treatment : No application of sewage sludge to soil

## Conditions and measures related to external treatment of waste for disposal

Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations.

---

## 2.2 Contributing scenario controlling worker exposure for: PROC1: Use in closed process, no likelihood of exposure

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Handle substance within a closed system., Process under low containment.

---

## 2.3 Contributing scenario controlling worker exposure for: PROC2: Use in closed, continuous process with occasional controlled exposure

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.4 Contributing scenario controlling worker exposure for: PROC3: Use in closed batch process (synthesis or formulation)

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## Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

## Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.5 Contributing scenario controlling worker exposure for: PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

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### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.6 Contributing scenario controlling worker exposure for: PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

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### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

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Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.7 Contributing scenario controlling worker exposure for: PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

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### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.8 Contributing scenario controlling worker exposure for: PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs



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followed.

## 3. Exposure estimation and reference to its source

### Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ART		Long term inhalation	0,02 mg/m <sup>3</sup>	0,01
PROC2	ART		Long term inhalation	1,10 mg/m <sup>3</sup>	0,71
PROC3	ART		Long term inhalation	1,10 mg/m <sup>3</sup>	0,71
PROC4	ART		Long term inhalation	1,20 mg/m <sup>3</sup>	0,77
PROC8a	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC8b	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC9	ART		Long term inhalation	0,91 mg/m <sup>3</sup>	0,59

PROC1: Use in closed process, no likelihood of exposure

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

PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

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)

EE8 - Qualitative approach used to conclude safe use.

### Predicted exposure concentrations (PECs)

According to the previous qualitative assessment, the worst case exposure concentration in waste water treatment plant is 1.0E-13 mg/L. The PECs for the other compartments are not applicable, because sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material and furthermore is a non-volatile substance.

### Indirect exposure of humans via the environment (oral)

Hypochlorite will not reach the environment via the sewage treatment system, as the quick transformation of the applied hypochlorite (as free available chlorine, FAC) in the sewage system ensures the absence of any human exposure to hypochlorite. Also in recreational zones located close to discharge points of chlorinated waste water, the potential for exposure to hypochlorite originating from waste water treatment is negligible as the emission of unreacted hypochlorite is non-existent.

Due to the physico-chemical properties of sodium hypochlorite no indirect exposure is thought to occur via the human food chain. Thus no indirect exposure to sodium hypochlorite is thought to occur via the environment.

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## **4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

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Guidance is based on assumed operating conditions which may not be applicable to all sites. Thus scaling is deemed necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

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## 1. Short title of Exposure Scenario: Formulation [mixing] of preparations and/or re-packaging

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Main User Groups	: SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	: SU10: Formulation [mixing] of preparations and/or re-packaging
Environmental Release Categories	: ERC2: Formulation of preparations
Process categories	: PROC1: Use in closed process, no likelihood of exposure 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 PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities 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) CS100: Production or preparation of articles by tableting, compression, extrusion or pelletisation PROC15: Use as laboratory reagent

---

## 2.1 Contributing scenario controlling environmental exposure for: ERC2: Formulation of preparations

---

### Product characteristics

Concentration of the Substance in Mixture/Article	: Covers the percentage of the substance in the product up to 25 %.
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### Environment factors not influenced by risk management

Dilution Factor (River)	: 10
Dilution Factor (Coastal Areas)	: 100

### Other given operational conditions affecting environmental exposure

Continuous exposure	
Number of emission days per year	: 360
Remarks	: Indoor use, Outdoor use
Remarks	: Product applied in aqueous process solution with negligible volatilization. Free available chlorine in effluent is measured as total residual chlorine (TRC) and is calculated to be below 1.0E-13 mg/L, No release to air from process expected because hypochlorite solution is non volatile., No release to

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soil from process expected.

## Technical conditions and measures / Organizational measures

- Water : Risk to the environment is driven by freshwater exposure. Onsite wastewater treatment required. Prevent discharge of substance directly to the environment and waste water treatment is required.
- Remarks : Common practices vary across sites but releases expected are negligible to waste water and soil (sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material)., Prevent environmental discharge consistent with regulatory requirements.

## Conditions and measures related to municipal sewage treatment plant

- Remarks : Waste water treatment is required.

## Conditions and measures related to external treatment of waste for disposal

- Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations.

---

## 2.2 Contributing scenario controlling worker exposure for: PROC1: Use in closed process, no likelihood of exposure

---

### Product characteristics

- Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

- Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

- Outdoor / Indoor : Indoor

### Technical conditions and measures

Handle substance within a closed system., Process under low containment.

---

## 2.3 Contributing scenario controlling worker exposure for: PROC2: Use in closed, continuous process with occasional controlled exposure

---

### Product characteristics

- Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

- Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

- Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

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## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.4 Contributing scenario controlling worker exposure for: PROC3: Use in closed batch process (synthesis or formulation)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.5 Contributing scenario controlling worker exposure for: PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.6 Contributing scenario controlling worker exposure for: PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.7 Contributing scenario controlling worker exposure for: PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.8 Contributing scenario controlling worker exposure for: PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

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## Frequency and duration of use

Frequency of use : 240 days/year

## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.9 Contributing scenario controlling worker exposure for: PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.10 Contributing scenario controlling worker exposure for: CS100: Production or preparation or articles by tableting, compression, extrusion or pelletisation

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

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Provide extraction ventilation at points where emissions occur., Process under medium containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.11 Contributing scenario controlling worker exposure for: PROC15: Use as laboratory reagent

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 3. Exposure estimation and reference to its source

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### Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ART		Long term inhalation	0,02 mg/m3	0,01
PROC2	ART		Long term inhalation	1,10 mg/m3	0,71
PROC3	ART		Long term inhalation	1,10 mg/m3	0,71
PROC4	ART		Long term inhalation	1,20 mg/m3	0,77
PROC5	ART		Long term inhalation	1,25 mg/m3	0,81
PROC8a	ART		Long term inhalation	1,25 mg/m3	0,81
PROC8b	ART		Long term inhalation	1,25 mg/m3	0,81
PROC9	ART		Long term	0,91 mg/m3	0,59



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			inhalation		
CS100	ART		Long term inhalation	0,23 mg/m <sup>3</sup>	0,15
PROC15	ART		Long term inhalation	0,70 mg/m <sup>3</sup>	0,45

CS100: Production or preparation of articles by tableting, compression, extrusion or pelletisation

PROC1: Use in closed process, no likelihood of exposure

PROC15: Use as laboratory reagent

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

PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

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)

EE8 - Qualitative approach used to conclude safe use.

Predicted exposure concentrations (PECs)

According to the previous qualitative assessment, the worst case exposure concentration in waste water treatment plant is 1.0E-13 mg/L. The PECs for the other compartments are not applicable, because sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material and furthermore is a non-volatile substance.

Indirect exposure of humans via the environment (oral)

Hypochlorite will not reach the environment via the sewage treatment system, as the quick transformation of the applied hypochlorite (as free available chlorine, FAC) in the sewage system ensures the absence of any human exposure to hypochlorite. Also in recreational zones located close to discharge points of chlorinated waste water, the potential for exposure to hypochlorite originating from waste water treatment is negligible as the emission of unreacted hypochlorite is non-existent.

Due to the physico-chemical properties of sodium hypochlorite no indirect exposure is thought to occur via the human food chain. Thus no indirect exposure to sodium hypochlorite is thought to occur via the environment.

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## 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

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Guidance is based on assumed operating conditions which may not be applicable to all sites. Thus scaling is deemed necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

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## 1. Short title of Exposure Scenario: Industrial use as intermediate

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Main User Groups	: SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	: SU8, SU9: Manufacture of bulk, large scale chemicals (including petroleum products), Manufacture of fine chemicals
Environmental Release Categories	: ERC6a: Use of intermediate
Chemical product category	: PC19: Intermediate
Process categories	: PROC1: Use in closed process, no likelihood of exposure 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 PROC8a: Transfer of substance or preparation (charging/discharging) from/ to vessels/ large containers at non-dedicated facilities 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)

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## 2.1 Contributing scenario controlling environmental exposure for: ERC6a: Use of intermediate

---

### Product characteristics

Concentration of the Substance in Mixture/Article	: Covers the percentage of the substance in the product up to 25 %.
---	---

### Environment factors not influenced by risk management

Dilution Factor (River)	: 10
Dilution Factor (Coastal Areas)	: 100

### Other given operational conditions affecting environmental exposure

Continuous exposure	
Number of emission days per year	: 360
Remarks	: Indoor use, Outdoor use
Remarks	: Reactions with organic intermediates in controlled closed systems. Sodium hypochlorite solution is filled into the reaction vessels through closed systems., No release in environment is expected. In worst case the free available chlorine in effluent is measured as total residual chlorine (TRC) and is anticipated to be below 1.0E-13 mg/L

### Technical conditions and measures / Organizational measures

Water	: Risk to the environment is driven by freshwater exposure. Onsite wastewater treatment required. Prevent discharge of
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Remarks : substance directly to the environment and waste water treatment is required.  
: Common release control mechanisms (all sites fall under IPPC BREF) and specific local regulations respected to minimize risk. Common practices vary across sites but no releases are expected. Off-gas from the reactor is usually treated in a thermal exhaust air decontaminator before release into the atmosphere., Prevent environmental discharge consistent with regulatory requirements.

## Conditions and measures related to municipal sewage treatment plant

Remarks : Waste water treatment is required to remove any residual organic compounds and remaining available chlorine.

## Conditions and measures related to external treatment of waste for disposal

Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations.

---

## 2.2 Contributing scenario controlling worker exposure for: PROC1: Use in closed process, no likelihood of exposure

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Handle substance within a closed system., Process under low containment.

---

## 2.3 Contributing scenario controlling worker exposure for: PROC2: Use in closed, continuous process with occasional controlled exposure

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and

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clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.4 Contributing scenario controlling worker exposure for: PROC3: Use in closed batch process (synthesis or formulation)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.5 Contributing scenario controlling worker exposure for: PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.6 Contributing scenario controlling worker exposure for: PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

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## Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

## Frequency and duration of use

Frequency of use : 240 days/year

## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.7 Contributing scenario controlling worker exposure for: PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.8 Contributing scenario controlling worker exposure for: PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

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Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 3. Exposure estimation and reference to its source

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### Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ART		Long term inhalation	0,02 mg/m <sup>3</sup>	0,01
PROC2	ART		Long term inhalation	1,10 mg/m <sup>3</sup>	0,71
PROC3	ART		Long term inhalation	1,10 mg/m <sup>3</sup>	0,71
PROC4	ART		Long term inhalation	1,20 mg/m <sup>3</sup>	0,77
PROC8a	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC8b	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC9	ART		Long term inhalation	0,91 mg/m <sup>3</sup>	0,59

PROC1: Use in closed process, no likelihood of exposure

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

PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

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)

EE8 - Qualitative approach used to conclude safe use.

### Predicted exposure concentrations (PECs)

According the previous qualitative assessment, the worst case exposure concentration in waste water treatment plant is 1.0E-13 mg/L. The PECs for the other compartments are not applicable, because sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material and furthermore is a non-volatile substance.

Indirect exposure of humans via the environment (oral)

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Hypochlorite will not reach the environment via the sewage treatment system, as the quick transformation of the applied hypochlorite (as free available chlorine, FAC) in the sewage system ensures the absence of any human exposure to hypochlorite. Also in recreational zones located close to discharge points of chlorinated waste water, the potential for exposure to hypochlorite originating from waste water treatment is negligible as the emission of unreacted hypochlorite is non-existent.

Due to the physico-chemical properties of sodium hypochlorite no indirect exposure is thought to occur via the human food chain. Thus no indirect exposure to sodium hypochlorite is thought to occur via the environment.

---

#### **4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

---

Guidance is based on assumed operating conditions which may not be applicable to all sites. Thus scaling is deemed necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

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## 1. Short title of Exposure Scenario: Industrial use in textile industry.

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Main User Groups	: SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	: SU5: Manufacture of textiles, leather, fur
Environmental Release Categories	: ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)
Chemical product category	: PC34: Textile dyes and impregnating products
Process categories	: PROC1: Use in closed process, no likelihood of exposure 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 PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities 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) PROC13: Treatment of articles by dipping and pouring

---

### 2.1 Contributing scenario controlling environmental exposure for: ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)

---

#### Product characteristics

Concentration of the Substance in Mixture/Article	: Covers the percentage of the substance in the product up to 25 %.
---	---

#### Environment factors not influenced by risk management

Dilution Factor (River)	: 10
Dilution Factor (Coastal Areas)	: 100

#### Other given operational conditions affecting environmental exposure

Continuous exposure	
Number of emission days per year	: 360
Remarks	: Indoor use, Outdoor use
Remarks	: Sulphite must be use in part of dechlorination process leading to negligible releases of NaClO in water., No release in environment is expected. In worst case the free available chlorine in effluent is measured as total residual chlorine (TRC) and is anticipated to be below 1.0E-13 mg/L



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## Technical conditions and measures / Organizational measures

- Air : Wool chlorination is performed in an acidic environment, in which gaseous chlorine formation is unavoidable. This requires a high degree of enclosure of the plants, the presence of abatement system of gaseous emission and a neutralisation stage.
- Remarks : Common release control mechanisms (all sites fall under IPPC BREF) and specific local regulations respected to minimize risk. Common practices vary across sites but no releases are expected. Off-gas from the reactor is usually treated in a thermal exhaust air decontaminator before release into the atmosphere., Prevent environmental discharge consistent with regulatory requirements.

## Conditions and measures related to municipal sewage treatment plant

- Remarks : Waste water treatment is required to remove any residual organic compounds and remaining available chlorine.

## Conditions and measures related to external treatment of waste for disposal

- Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations.

---

## 2.2 Contributing scenario controlling worker exposure for: PROC1: Use in closed process, no likelihood of exposure

---

### Product characteristics

- Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

- Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

- Outdoor / Indoor : Indoor

### Technical conditions and measures

Handle substance within a closed system., Process under low containment.

---

## 2.3 Contributing scenario controlling worker exposure for: PROC2: Use in closed, continuous process with occasional controlled exposure

---

### Product characteristics

- Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

- Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

- Outdoor / Indoor : Indoor

### Technical conditions and measures

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Provide extraction ventilation at points where emissions occur., Process under low containment.

## **Organisational measures to prevent /limit releases, dispersion and exposure**

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## **2.4 Contributing scenario controlling worker exposure for: PROC3: Use in closed batch process (synthesis or formulation)**

---

### **Product characteristics**

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### **Frequency and duration of use**

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### **Other operational conditions affecting workers exposure**

Outdoor / Indoor : Indoor

### **Technical conditions and measures**

Provide extraction ventilation at points where emissions occur., Process under low containment.

## **Organisational measures to prevent /limit releases, dispersion and exposure**

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## **2.5 Contributing scenario controlling worker exposure for: PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises**

---

### **Product characteristics**

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### **Frequency and duration of use**

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### **Other operational conditions affecting workers exposure**

Outdoor / Indoor : Indoor

### **Technical conditions and measures**

Provide extraction ventilation at points where emissions occur., Process under low containment.

## **Organisational measures to prevent /limit releases, dispersion and exposure**

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.6 Contributing scenario controlling worker exposure for: PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.7 Contributing scenario controlling worker exposure for: PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.8 Contributing scenario controlling worker exposure for: PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

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## Frequency and duration of use

Frequency of use : 240 days/year

## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.9 Contributing scenario controlling worker exposure for: PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.10 Contributing scenario controlling worker exposure for: PROC13: Treatment of articles by dipping and pouring

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

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Provide extraction ventilation at points where emissions occur., Process under medium containment., Minimise exposure by ventilated partial enclosure of the operator or equipment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

## 3. Exposure estimation and reference to its source

### Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ART		Long term inhalation	0,02 mg/m <sup>3</sup>	0,01
PROC2	ART		Long term inhalation	1,10 mg/m <sup>3</sup>	0,71
PROC3	ART		Long term inhalation	1,10 mg/m <sup>3</sup>	0,71
PROC4	ART		Long term inhalation	1,20 mg/m <sup>3</sup>	0,77
PROC5	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC8a	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC8b	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC9	ART		Long term inhalation	0,91 mg/m <sup>3</sup>	0,59
PROC13	ART		Long term inhalation	0,70 mg/m <sup>3</sup>	0,45

PROC1: Use in closed process, no likelihood of exposure

PROC13: Treatment of articles by dipping and pouring

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

PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

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)

EE8 - Qualitative approach used to conclude safe use.

### Predicted exposure concentrations (PECs)

According the previous qualitative assessment, the worst case exposure concentration in waste water treatment plant is 1.0E-13 mg/L. The PECs for the other compartments are not applicable, because

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sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material and furthermore is a non-volatile substance.

Indirect exposure of humans via the environment (oral)

Hypochlorite will not reach the environment via the sewage treatment system, as the quick transformation of the applied hypochlorite (as free available chlorine, FAC) in the sewage system ensures the absence of any human exposure to hypochlorite. Also in recreational zones located close to discharge points of chlorinated waste water, the potential for exposure to hypochlorite originating from waste water treatment is negligible as the emission of unreacted hypochlorite is non-existent.

Due to the physico-chemical properties of sodium hypochlorite no indirect exposure is thought to occur via the human food chain. Thus no indirect exposure to sodium hypochlorite is thought to occur via the environment.

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#### **4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

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Guidance is based on assumed operating conditions which may not be applicable to all sites. Thus scaling is deemed necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

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## 1. Short title of Exposure Scenario: Industrial use in sewage and cooling or heating water treatment

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Main User Groups	: SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	: SU23: Electricity, steam, gas water supply and sewage treatment
Environmental Release Categories	: ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)
Chemical product category	: PC20: Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents PC37: Water treatment chemicals
Process categories	: PROC1: Use in closed process, no likelihood of exposure 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 PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities 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)

---

## 2.1 Contributing scenario controlling environmental exposure for: ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)

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### Product characteristics

Concentration of the Substance in Mixture/Article	: Covers the percentage of the substance in the product up to 25 %.
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### Environment factors not influenced by risk management

Dilution Factor (River)	: 10
Dilution Factor (Coastal Areas)	: 100

### Other given operational conditions affecting environmental exposure

Continuous exposure	
Number of emission days per year	: 360
Remarks	: Indoor use, Outdoor use
Remarks	: Cooling water process must follow IPPC reference document on the application of best available techniques (BAT) to industrial cooling systems (European Commission, 2001).

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Site-specific operational conditions to be applied are determined for both chlorine and hypochlorite in the BAT document., Chlorination processes used for disinfection of wastewater in sewage treatment require a chlorine dose of 5 – 40 mg Cl<sub>2</sub>/L. The chlorine dosages are designed in order to minimise the chlorine discharges to the environment.

## Technical conditions and measures / Organizational measures

- Water : Risk to the environment is driven by freshwater exposure. Onsite wastewater treatment required. Prevent discharge of substance directly to the environment and waste water treatment is required.
- Remarks : Common practices vary across sites but no releases are expected., Prevent environmental discharge consistent with regulatory requirements.

## Conditions and measures related to municipal sewage treatment plant

- Remarks : Waste water treatment is required to remove any residual organic compounds and remaining available chlorine.

## Conditions and measures related to external treatment of waste for disposal

- Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations.

---

## 2.2 Contributing scenario controlling worker exposure for: PROC1: Use in closed process, no likelihood of exposure

---

### Product characteristics

- Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

- Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

- Outdoor / Indoor : Indoor

### Technical conditions and measures

Handle substance within a closed system., Process under low containment.

---

## 2.3 Contributing scenario controlling worker exposure for: PROC2: Use in closed, continuous process with occasional controlled exposure

---

### Product characteristics

- Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

- Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

- Outdoor / Indoor : Indoor



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## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.4 Contributing scenario controlling worker exposure for: PROC3: Use in closed batch process (synthesis or formulation)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.5 Contributing scenario controlling worker exposure for: PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.6 Contributing scenario controlling worker exposure for: PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

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### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.7 Contributing scenario controlling worker exposure for: PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.8 Contributing scenario controlling worker exposure for: PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

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### Product characteristics

Concentration of the Substance in : Covers the percentage of the substance in the product up to

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Mixture/Article 25 %.

## Frequency and duration of use

Frequency of use : 240 days/year

## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.9 Contributing scenario controlling worker exposure for: PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 3. Exposure estimation and reference to its source

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### Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ART		Long term inhalation	0,02 mg/m3	0,01
PROC2	ART		Long term inhalation	1,10 mg/m3	0,71
PROC3	ART		Long term	1,10 mg/m3	0,71

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			inhalation		
PROC4	ART		Long term inhalation	1,20 mg/m <sup>3</sup>	0,77
PROC5	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC8a	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC8b	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC9	ART		Long term inhalation	0,91 mg/m <sup>3</sup>	0,59

PROC1: Use in closed process, no likelihood of exposure

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

PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

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)

EE8 - Qualitative approach used to conclude safe use.

Predicted exposure concentrations (PECs)

According to the previous qualitative assessment, the worst case exposure concentration in waste water treatment plant is 1.0E-13 mg/L. The PECs for the other compartments are not applicable, because sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material and furthermore is a non-volatile substance.

Indirect exposure of humans via the environment (oral)

Hypochlorite will not reach the environment via the sewage treatment system, as the quick transformation of the applied hypochlorite (as free available chlorine, FAC) in the sewage system ensures the absence of any human exposure to hypochlorite. Also in recreational zones located close to discharge points of chlorinated waste water, the potential for exposure to hypochlorite originating from waste water treatment is negligible as the emission of unreacted hypochlorite is non-existent.

Due to the physico-chemical properties of sodium hypochlorite no indirect exposure is thought to occur via the human food chain. Thus no indirect exposure to sodium hypochlorite is thought to occur via the environment.

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## 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

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Guidance is based on assumed operating conditions which may not be applicable to all sites. Thus scaling is deemed necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

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## 1. Short title of Exposure Scenario: Industrial use in pulp and paper

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Main User Groups	: SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	: SU6b: Manufacture of pulp, paper and paper products
Environmental Release Categories	: ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)
Chemical product category	: PC26: Paper and board treatment products
Process categories	: PROC1: Use in closed process, no likelihood of exposure 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 PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities 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)

---

### 2.1 Contributing scenario controlling environmental exposure for: ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)

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#### Product characteristics

Concentration of the Substance in Mixture/Article	: Covers the percentage of the substance in the product up to 25 %.
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#### Environment factors not influenced by risk management

Dilution Factor (River)	: 10
Dilution Factor (Coastal Areas)	: 100

#### Other given operational conditions affecting environmental exposure

Continuous exposure	
Number of emission days per year	: 360
Remarks	: Indoor use, Outdoor use
Remarks	: The concentration of hypochlorite in the system is low, and quantities are determined so that there is negligible residual free hypochlorite at the end of the cleaning process., No release in environment is expected. In worst case the free available chlorine in effluent is measured as total residual chlorine (TRC) and is anticipated to be below 1.0E-13 mg/L

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## Technical conditions and measures / Organizational measures

- Water : Risk to the environment is driven by freshwater exposure. Onsite wastewater treatment required. Prevent discharge of substance directly to the environment and waste water treatment is required.
- Remarks : Only two specific applications are considered acceptable in pulp and paper industry: •) disinfection of the paper machine system •) - break down of the wet strength resins., Common practices vary across sites but no releases are expected., Prevent environmental discharge consistent with regulatory requirements.

## Conditions and measures related to municipal sewage treatment plant

- Remarks : Waste water treatment is required to remove any residual organic compounds and remaining available chlorine.

## Conditions and measures related to external treatment of waste for disposal

- Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations.

---

## 2.2 Contributing scenario controlling worker exposure for: PROC1: Use in closed process, no likelihood of exposure

---

### Product characteristics

- Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

- Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

- Outdoor / Indoor : Indoor

### Technical conditions and measures

Handle substance within a closed system., Process under low containment.

---

## 2.3 Contributing scenario controlling worker exposure for: PROC2: Use in closed, continuous process with occasional controlled exposure

---

### Product characteristics

- Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

- Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

- Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

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## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.4 Contributing scenario controlling worker exposure for: PROC3: Use in closed batch process (synthesis or formulation)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.5 Contributing scenario controlling worker exposure for: PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.6 Contributing scenario controlling worker exposure for: PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.7 Contributing scenario controlling worker exposure for: PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.8 Contributing scenario controlling worker exposure for: PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.



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## Frequency and duration of use

Frequency of use : 240 days/year

## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.9 Contributing scenario controlling worker exposure for: PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 3. Exposure estimation and reference to its source

---

### Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ART		Long term inhalation	0,02 mg/m <sup>3</sup>	0,01
PROC2	ART		Long term inhalation	1,10 mg/m <sup>3</sup>	0,71
PROC3	ART		Long term inhalation	1,10 mg/m <sup>3</sup>	0,71

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PROC4	ART		Long term inhalation	1,20 mg/m <sup>3</sup>	0,77
PROC5	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC8a	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC8b	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC9	ART		Long term inhalation	0,91 mg/m <sup>3</sup>	0,59

PROC1: Use in closed process, no likelihood of exposure

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

PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

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)

EE8 - Qualitative approach used to conclude safe use.

Predicted exposure concentrations (PECs)

According to the previous qualitative assessment, the worst case exposure concentration in waste water treatment plant is 1.0E-13 mg/L. The PECs for the other compartments are not applicable, because sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material and furthermore is a non-volatile substance.

Indirect exposure of humans via the environment (oral)

Hypochlorite will not reach the environment via the sewage treatment system, as the quick transformation of the applied hypochlorite (as free available chlorine, FAC) in the sewage system ensures the absence of any human exposure to hypochlorite. Also in recreational zones located close to discharge points of chlorinated waste water, the potential for exposure to hypochlorite originating from waste water treatment is negligible as the emission of unreacted hypochlorite is non-existent.

Due to the physico-chemical properties of sodium hypochlorite no indirect exposure is thought to occur via the human food chain. Thus no indirect exposure to sodium hypochlorite is thought to occur via the environment.

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## 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

---

Guidance is based on assumed operating conditions which may not be applicable to all sites. Thus scaling is deemed necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

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## 1. Short title of Exposure Scenario: Industrial cleaning use

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Main User Groups	:	SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	:	SU4: Manufacture of food products
Environmental Release Categories	:	ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)
Chemical product category	:	PC35: Washing and cleaning products
Process categories	:	PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC7: Industrial spraying PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC10: Roller application or brushing PROC13: Treatment of articles by dipping and pouring

---

## 2.1 Contributing scenario controlling environmental exposure for: ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)

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### Product characteristics

Concentration of the Substance in Mixture/Article	:	Covers the percentage of the substance in the product up to 25 %.
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### Environment factors not influenced by risk management

Dilution Factor (River)	:	10
Dilution Factor (Coastal Areas)	:	100

### Other given operational conditions affecting environmental exposure

Continuous exposure	:	
Number of emission days per year	:	360
Remarks	:	Indoor use, Outdoor use
Remarks	:	Avoid releases to the environment (surface waters or soil) or to wastewaters. However sodium hypochlorite is shown to disappear rapidly from all use scenarios presented, by either rapid reduction in factory effluent or in the sewer. Thus, no releases in environment are expected. In worst case the free available chlorine in effluent is measured as total residual chlorine (TRC) and is anticipated to be below 1.0E-13 mg/L.

### Technical conditions and measures / Organizational measures

Water	:	Risk to the environment is driven by freshwater exposure. Onsite wastewater treatment required. Prevent discharge of substance directly to the environment and waste water treatment is required.
Remarks	:	Common practices vary across sites and should comply with

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Biocide Directive 98/8/EC., Prevent environmental discharge consistent with regulatory requirements.

## Conditions and measures related to municipal sewage treatment plant

Remarks : Waste water treatment is required to remove any residual organic compounds and remaining available chlorine.

## Conditions and measures related to external treatment of waste for disposal

Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations.

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## 2.2 Contributing scenario controlling worker exposure for: PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.3 Contributing scenario controlling worker exposure for: PROC7: Industrial spraying

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under medium containment., Minimise exposure by ventilated complete enclosure of the operator or equipment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 4 hours per day., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.4 Contributing scenario controlling worker exposure for: PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 6 hours., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.5 Contributing scenario controlling worker exposure for: PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.6 Contributing scenario controlling worker exposure for: PROC10: Roller application or brushing

---

### Product characteristics

Concentration of the Substance in : Covers the percentage of the substance in the product up to

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Mixture/Article 25 %.

## Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

## Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under medium containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

---

## 2.7 Contributing scenario controlling worker exposure for: PROC13: Treatment of articles by dipping and pouring

---

### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 25 %.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor

### Technical conditions and measures

Provide extraction ventilation at points where emissions occur., Process under medium containment., Minimise exposure by ventilated partial enclosure of the operator or equipment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 3. Exposure estimation and reference to its source

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### Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC5	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC7	ART		Long term inhalation	1,20 mg/m <sup>3</sup>	0,77

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PROC8a	ART		Long term inhalation	1,25 mg/m <sup>3</sup>	0,81
PROC9	ART		Long term inhalation	0,91 mg/m <sup>3</sup>	0,59
PROC10	ART		Long term inhalation	1,00 mg/m <sup>3</sup>	0,65
PROC13	ART		Long term inhalation	0,70 mg/m <sup>3</sup>	0,45

PROC10: Roller application or brushing

PROC13: Treatment of articles by dipping and pouring

PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

PROC7: Industrial spraying

PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

EE8 - Qualitative approach used to conclude safe use.

Predicted exposure concentrations (PECs)

According to the previous qualitative assessment, the worst case exposure concentration in waste water treatment plant is 1.0E-13 mg/L. The PECs for the other compartments are not applicable, because sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material and furthermore is a non-volatile substance.

Indirect exposure of humans via the environment (oral)

Hypochlorite will not reach the environment via the sewage treatment system, as the quick transformation of the applied hypochlorite (as free available chlorine, FAC) in the sewage system ensures the absence of any human exposure to hypochlorite. Also in recreational zones located close to discharge points of chlorinated waste water, the potential for exposure to hypochlorite originating from waste water treatment is negligible as the emission of unreacted hypochlorite is non-existent.

Due to the physico-chemical properties of sodium hypochlorite no indirect exposure is thought to occur via the human food chain. Thus no indirect exposure to sodium hypochlorite is thought to occur via the environment.

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## 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

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Guidance is based on assumed operating conditions which may not be applicable to all sites. Thus scaling is deemed necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

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## 1. Short title of Exposure Scenario: Professional cleaning use

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Main User Groups	: SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
Sectors of end-use	: SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
Environmental Release Categories	: ERC8a, ERC8b, ERC8d, ERC8e: Wide dispersive indoor use of processing aids in open systems, Wide dispersive indoor use of reactive substances in open systems, Wide dispersive outdoor use of processing aids in open systems, Wide dispersive outdoor use of reactive substances in open systems
Chemical product category	: PC35: Washing and cleaning products
Process categories	: PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact) PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC10: Roller application or brushing PROC11: Non-industrial spraying PROC13: Treatment of articles by dipping and pouring PROC15: Use as laboratory reagent

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## 2.1 Contributing scenario controlling environmental exposure for: ERC8a, ERC8b, ERC8d, ERC8e: Wide dispersive indoor use of processing aids in open systems, Wide dispersive indoor use of reactive substances in open systems, Wide dispersive outdoor use of processing aids in open systems, Wide dispersive outdoor use of reactive substances in open systems

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### Product characteristics

Concentration of the Substance in Mixture/Article	: Covers the percentage of the substance in the product up to 5%.
---	---

### Environment factors not influenced by risk management

Dilution Factor (River)	: 10
Dilution Factor (Coastal Areas)	: 100
Other information	: Indoor use, Outdoor use
Remarks	: Non-hydrophobic, Substance is a unique structure, Readily biodegradable.

### Other given operational conditions affecting environmental exposure

Continuous exposure	
Number of emission days per year	: 360
Remarks	: Avoid releases to the environment (surface waters or soil) or to wastewaters. However sodium hypochlorite is shown to disappear rapidly from all use scenarios presented, by either rapid reduction in factory effluent or in the sewer. Thus, no releases in environment are expected. In worst case the free available chlorine in effluent is measured as total residual



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chlorine (TRC) and is anticipated to be below 1.0E-13 mg/L.

## Technical conditions and measures / Organizational measures

Remarks : NaClO must be reduced completely to sodium chloride during the process avoiding critical releases in environment., Common practices vary across sites and should comply with Biocide Directive 98/8/EC., Prevent environmental discharge consistent with regulatory requirements.

## Conditions and measures related to municipal sewage treatment plant

Remarks : Waste water treatment is required to remove any residual organic compounds and remaining available chlorine.

## Conditions and measures related to external treatment of waste for disposal

Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations.

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## 2.2 Contributing scenario controlling worker exposure for: PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

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### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 5%.

### Frequency and duration of use

Frequency of use : 240 days/year

### Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor  
Outdoor / Indoor : Outdoor

### Technical conditions and measures

Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan., Process under low containment.

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.3 Contributing scenario controlling worker exposure for: PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

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### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 5%.

### Frequency and duration of use

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

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## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor  
Outdoor / Indoor : Outdoor

## Technical conditions and measures

Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.4 Contributing scenario controlling worker exposure for: PROC10: Roller application or brushing

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### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 5%.

### Frequency and duration of use

Frequency of use : 240 days/year

## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor  
Outdoor / Indoor : Outdoor

## Technical conditions and measures

Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan., Process under low containment.

## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 4 hours per day., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## 2.5 Contributing scenario controlling worker exposure for: PROC11: Non-industrial spraying

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### Product characteristics

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 5%.

### Frequency and duration of use

Frequency of use : 240 days/year

## Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor  
Outdoor / Indoor : Outdoor

## Technical conditions and measures

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Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan., Process under low containment.

## **Organisational measures to prevent /limit releases, dispersion and exposure**

Avoid carrying out activities involving exposure for more than 1 hour per day., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## **2.6 Contributing scenario controlling worker exposure for: PROC13: Treatment of articles by dipping and pouring**

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### **Product characteristics**

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 5%.

### **Frequency and duration of use**

Frequency of use : 240 days/year

### **Other operational conditions affecting workers exposure**

Outdoor / Indoor : Indoor  
Outdoor / Indoor : Outdoor

### **Technical conditions and measures**

Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan., Process under low containment.

## **Organisational measures to prevent /limit releases, dispersion and exposure**

Avoid carrying out activities involving exposure for more than 4 hours per day., Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

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## **2.7 Contributing scenario controlling worker exposure for: PROC15: Use as laboratory reagent**

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### **Product characteristics**

Concentration of the Substance in Mixture/Article : Covers the percentage of the substance in the product up to 5%.

### **Frequency and duration of use**

Frequency of use : 240 days/year  
Remarks : Covers daily exposures up to 8 hours

### **Other operational conditions affecting workers exposure**

Outdoor / Indoor : Indoor  
Outdoor / Indoor : Outdoor

### **Technical conditions and measures**

Provide a good standard of general ventilation. Natural ventilation is from doors, windows etc. Controlled ventilation means air is supplied or removed by a powered fan., Process under low containment.

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## Organisational measures to prevent /limit releases, dispersion and exposure

Avoid frequent and direct contact with substance., Regular cleaning of equipment, work area and clothing., Supervision in place to check that the RMMs in place are being used correctly and OCs followed.

## 3. Exposure estimation and reference to its source

### Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC5	ART		Long term inhalation	1,00 mg/m <sup>3</sup>	0,65
PROC9	ART		Long term inhalation	1,10 mg/m <sup>3</sup>	0,71
PROC10	ART		Long term inhalation	1,20 mg/m <sup>3</sup>	0,77
PROC11	ART		Long term inhalation	1,00 mg/m <sup>3</sup>	0,65
PROC13	ART		Long term inhalation	1,20 mg/m <sup>3</sup>	0,77
PROC15	ART		Long term inhalation	0,85 mg/m <sup>3</sup>	0,55

PROC10: Roller application or brushing

PROC11: Non-industrial spraying

PROC13: Treatment of articles by dipping and pouring

PROC15: Use as laboratory reagent

PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

EE8 - Qualitative approach used to conclude safe use.

### Predicted exposure concentrations (PECs)

According the previous qualitative assessment, the worst case exposure concentration in waste water treatment plant is 1.0E-13 mg/L. The PECs for the other compartments are not applicable, because sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material and furthermore is a non-volatile substance.

### Indirect exposure of humans via the environment (oral)

Hypochlorite will not reach the environment via the sewage treatment system, as the quick transformation of the applied hypochlorite (as free available chlorine, FAC) in the sewage system ensures the absence of any human exposure to hypochlorite. Also in recreational zones located close to discharge points of chlorinated waste water, the potential for exposure to hypochlorite originating from waste water treatment is negligible as the emission of unreacted hypochlorite is non-existent.

Due to the physico-chemical properties of sodium hypochlorite no indirect exposure is thought to occur via the human food chain. Thus no indirect exposure to sodium hypochlorite is thought to occur via the environment.

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## **4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

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Guidance is based on assumed operating conditions which may not be applicable to all sites. Thus scaling is deemed necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

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## 1. Short title of Exposure Scenario: Consumer use

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Main User Groups	:	SU 21: Consumer uses: Private households (= general public = consumers)
Sectors of end-use	:	SU 21: Consumer uses: Private households (= general public = consumers)
Environmental Release Categories	:	ERC8a, ERC8b, ERC8d, ERC8e: Wide dispersive indoor use of processing aids in open systems, Wide dispersive indoor use of reactive substances in open systems, Wide dispersive outdoor use of processing aids in open systems, Wide dispersive outdoor use of reactive substances in open systems
Chemical product category	:	PC34: Textile dyes and impregnating products PC35: Washing and cleaning products PC37: Water treatment chemicals
Process categories	:	: Not applicable.

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### 2.1 Contributing scenario controlling environmental exposure for: ERC8a, ERC8b, ERC8d, ERC8e: Wide dispersive indoor use of processing aids in open systems, Wide dispersive indoor use of reactive substances in open systems, Wide dispersive outdoor use of processing aids in open systems, Wide dispersive outdoor use of reactive substances in open systems

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#### Product characteristics

Concentration of the Substance in Mixture/Article : Covers percentage substance in the product up to 15%.

#### Environment factors not influenced by risk management

Dilution Factor (River) : 10  
Dilution Factor (Coastal Areas) : 100

#### Other given operational conditions affecting environmental exposure

Continuous exposure  
Number of emission days per year : 365

#### Conditions and measures related to municipal sewage treatment plant

Remarks : Household wastewater is treated in municipal sewage treatment which leads to the removal of any remaining available chlorine through reaction with organic and inorganic substances present in wastewater.

#### Conditions and measures related to external treatment of waste for disposal

Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations.

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### 2.2 Contributing scenario controlling consumer exposure for: PC34, PC35, PC37: Textile dyes and impregnating products, Washing and cleaning products, Water treatment chemicals

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## Product characteristics

Concentration of the Substance in Mixture/Article : Covers percentage substance in the product up to 12.5%  
Physical Form (at time of use) : liquid  
Vapour pressure : 25 hPa

## Frequency and duration of use

Duration of the activity : < 30 min  
Frequency of use : 2 - 7 days/week  
Remarks : Cleaning  
Duration of the activity : < 30 min  
Frequency of use : 1 - 7 days/week  
Remarks : Laundry bleaching  
Duration of the activity : < 30 min  
Frequency of use : 4 event/day  
Remarks : Spraying

## Human factors not influenced by risk management

Consumers may be exposed to the formulation when dosing the product into water and to the preparation (cleaning solution; inhalation, dermal, oral). Exposure to the solution predominantly occurs through misuse, such as poor rinsing, spilling on skin or drinking of the cleaning solution.

## Other given operational conditions affecting consumers exposure

Outdoor / Indoor : Indoor  
Room size : 4 m<sup>3</sup>  
Ventilation rate per hour : 0,5

## Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures : Safety and application notes on product label and/or package insert.

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## 3. Exposure estimation and reference to its source

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### Consumers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
			Short term oral	0,0003 mg/kg bw/day	
			Short term oral	0,0007 mg/kg bw/day	
	EASE model		Long term dermal	0,002 mg/kg bw/day	

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	EASE model		Long term dermal	0,035 mg/kg bw/day	
	EASE model		Long term inhalation	< 0,0001 mg/kg bw/day	

EE8 - Qualitative approach used to conclude safe use.

## Predicted exposure concentrations (PECs)

According to the previous qualitative assessment, the worst case exposure concentration in waste water treatment plant is 1.0E-13 mg/L. The PECs for the other compartments are not applicable, because sodium hypochlorite is destroyed rapidly in contact with organic as well as inorganic material and furthermore is a non-volatile substance.

## Indirect exposure of humans via the environment (oral)

Hypochlorite will not reach the environment via the sewage treatment system, as the quick transformation of the applied hypochlorite (as free available chlorine, FAC) in the sewage system ensures the absence of any human exposure to hypochlorite. Also in recreational zones located close to discharge points of chlorinated waste water, the potential for exposure to hypochlorite originating from waste water treatment is negligible as the emission of unreacted hypochlorite is non-existent.

Due to the physico-chemical properties of sodium hypochlorite no indirect exposure is thought to occur via the human food chain. Thus no indirect exposure to sodium hypochlorite is thought to occur via the environment.

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## 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

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Not applicable