SAFETY DATA SHEET

SODIUM DICHLOROISOCYANURATE 56%

Compilation date: 15/07/2021

Revision No: 1

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

1.1. Product identifier

Product name: SODIUM DICHLOROISOCYANURATE 56%

CAS number: 2893-78-9

Product code: 8404

Synonyms: SODIUM DICHLORO-S-TRIAZINETRIONE. SODIUM TROCLOSENE. SDIC CHLORINE GRANULES

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

Use of substance / mixture: Bleaching agent. PC19: Intermediate. Industrial cleaning agent. Swimming pool disinfectant.

1.3. Details of the supplier of the safety data sheet

Company name: Resource Chemical Ltd
Resource House
76 High Street
Brackley
Northants
NN13 7DS

Tel: +44(0)1280 843800

Fax: +44(0)1280 701745

Email: sales@resourcechemical.ltd.uk

1.4. Emergency telephone number

Emergency tel: +44(0)1933 445260 Option 1

Section 2: Hazards identification

2.1. Classification of the substance or mixture

Classification under CLP: Eye Irrit. 2: H319; Acute Tox. 4: H302; Aquatic Acute 1: H400; Aquatic Chronic 1: H410; Ox. Sol. 2: H272; STOT SE 3: H335; -: EUH031

Most important adverse effects: Contact with acids liberates toxic gas. May intensify fire; oxidiser. Harmful if swallowed. Causes serious eye irritation. May cause respiratory irritation. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.

2.2. Label elements

Label elements:

Hazard statements: EUH031: Contact with acids liberates toxic gas.
H272: May intensify fire; oxidiser.
H302: Harmful if swallowed.

[cont...]

H319: Causes serious eye irritation.

H335: May cause respiratory irritation.

H400: Very toxic to aquatic life.

H410: Very toxic to aquatic life with long lasting effects.

Hazard pictograms: GHS03: Flame over circle

GHS07: Exclamation mark

GHS09: Environmental

Signal words: Danger

Precautionary statements: P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

P280: Wear protective gloves/protective clothing/eye protection/face protection.

P301+P312: IF SWALLOWED: Call a POISON CENTRE or doctor if you feel unwell.

P304+P340: IF INHALED: Remove person to fresh air and keep 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.

P370+P378: In case of fire: Use media other than water to extinguish.

2.3. Other hazards

PBT: This product is not identified as a PBT/vPvB substance.

Section 3: Composition/information on ingredients

3.1. Substances

Chemical identity: DICHLORO-1,3,5-TRIAZINETRIONE, SODIUM SALT OF

CAS number: 2893-78-9

Section 4: First aid measures

4.1. Description of first aid measures

Skin contact: Remove all contaminated clothes and footwear immediately unless stuck to skin. Wash immediately with plenty of soap and water.

Eye contact: Bathe the eye with running water for 15 minutes. Consult a doctor.

Ingestion: Wash out mouth with water. Consult a doctor.

Inhalation: Remove casualty from exposure ensuring one's own safety whilst doing so. Consult a doctor.

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

Skin contact: There may be irritation and redness at the site of contact.

Eye contact: There may be irritation and redness. The eyes may water profusely.

[cont...]

Ingestion: There may be soreness and redness of the mouth and throat.

Inhalation: There may be irritation of the throat with a feeling of tightness in the chest. Exposure may cause coughing or wheezing.

Delayed / immediate effects: Immediate effects can be expected after short-term exposure.

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

Immediate / special treatment: Eye bathing equipment should be available on the premises.

Section 5: Fire-fighting measures

5.1. Extinguishing media

Extinguishing media: Suitable extinguishing media for the surrounding fire should be used.

5.2. Special hazards arising from the substance or mixture

Exposure hazards: In combustion emits toxic fumes.

5.3. Advice for fire-fighters

Advice for fire-fighters: Wear self-contained breathing apparatus. Wear protective clothing to prevent contact with skin and eyes.

Section 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions: Refer to section 8 of SDS for personal protection details. If outside do not approach from downwind. If outside keep bystanders upwind and away from danger point. Mark out the contaminated area with signs and prevent access to unauthorised personnel. Do not create dust.

6.2. Environmental precautions

Environmental precautions: Do not discharge into drains or rivers.

6.3. Methods and material for containment and cleaning up

Clean-up procedures: Transfer to a closable, labelled salvage container for disposal by an appropriate method.

6.4. Reference to other sections

Reference to other sections: Refer to section 8 of SDS.

Section 7: Handling and storage

7.1. Precautions for safe handling

Handling requirements: Avoid direct contact with the substance. Ensure there is sufficient ventilation of the area. Do not handle in a confined space. Avoid the formation or spread of dust in the air.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions: Store in a cool, well ventilated area. Keep container tightly closed. The floor of the storage room must be impermeable to prevent the escape of liquids.

[cont...]

7.3. Specific end use(s)

Specific end use(s): No data available.

Section 8: Exposure controls/personal protection

8.1. Control parameters

Workplace exposure limits: No data available.

DNEL/PNEC Values

DNEL / PNEC No data available.

8.2. Exposure controls

Engineering measures: Ensure there is sufficient ventilation of the area. The floor of the storage room must be impermeable to prevent the escape of liquids.

Respiratory protection: Self-contained breathing apparatus must be available in case of emergency. Respiratory protective device with particle filter.

Hand protection: Protective gloves.

Eye protection: Safety glasses. Ensure eye bath is to hand.

Skin protection: Protective clothing.

Section 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

State: Solid

Colour: White

Odour: Barely perceptible odour

9.2. Other information

Other information: No data available.

Section 10: Stability and reactivity

10.1. Reactivity

Reactivity: Stable under recommended transport or storage conditions.

10.2. Chemical stability

Chemical stability: Stable under normal conditions.

10.3. Possibility of hazardous reactions

Hazardous reactions: Hazardous reactions will not occur under normal transport or storage conditions. Decomposition may occur on exposure to conditions or materials listed below.

10.4. Conditions to avoid

Conditions to avoid: Heat.

[cont...]

10.5. Incompatible materials

Materials to avoid: Strong oxidising agents. Strong acids.

10.6. Hazardous decomposition products

Haz. decomp. products: In combustion emits toxic fumes.

Section 11: Toxicological information

11.1. Information on toxicological effects

Hazardous ingredients:

DICHLORO-1,3,5-TRIAZINETRIONE, SODIUM SALT OF

ORL	RAT	LD50	1420	mg/kg
ORL	RBT	LDLO	2500	mg/kg

Relevant hazards for product:

Hazard	Route	Basis
Acute toxicity (ac. tox. 4)	ING	Hazardous: calculated
Serious eye damage/irritation	OPT	Hazardous: calculated
STOT-single exposure	INH	Hazardous: calculated

Symptoms / routes of exposure

Skin contact: There may be irritation and redness at the site of contact.

Eye contact: There may be irritation and redness. The eyes may water profusely.

Ingestion: There may be soreness and redness of the mouth and throat.

Inhalation: There may be irritation of the throat with a feeling of tightness in the chest. Exposure may cause coughing or wheezing.

Delayed / immediate effects: Immediate effects can be expected after short-term exposure.

Section 12: Ecological information

12.1. Toxicity

Ecotoxicity values: No data available.

12.2. Persistence and degradability

Persistence and degradability: Not biodegradable.

12.3. Bioaccumulative potential

Bioaccumulative potential: Bioaccumulation potential.

12.4. Mobility in soil

12.5. Results of PBT and vPvB assessment

PBT identification: This product is not identified as a PBT/vPvB substance.

[cont...]

12.6. Other adverse effects

Other adverse effects: Toxic to aquatic organisms. Toxic to soil organisms.

Section 13: Disposal considerations

13.1. Waste treatment methods

Disposal operations: Transfer to a suitable container and arrange for collection by specialised disposal company.

NB: The user's attention is drawn to the possible existence of regional or national regulations regarding disposal.

Section 14: Transport information

14.1. UN number

UN number: UN2465

14.2. UN proper shipping name

Shipping name: DICHLOROISOCYANURIC ACID, DRY

14.3. Transport hazard class(es)

Transport class: 5.1

14.4. Packing group

Packing group: II

14.5. Environmental hazards

Environmentally hazardous: Yes **Marine pollutant:** No

14.6. Special precautions for user

Special precautions: No special precautions.

Tunnel code: E

Transport category: 2

Section 15: Regulatory information

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

Specific regulations: Not applicable.

15.2. Chemical Safety Assessment

Chemical safety assessment: A chemical safety assessment has not been carried out for the substance or the mixture by the supplier.

Section 16: Other information

Other information

Other information: according to Regulation (EC) No. 1907/2006 (REACH) with its amendment Regulation (EU) 2015/830

* indicates text in the SDS which has changed since the last revision.

[cont...]

Phrases used in s.2 and s.3: EUH031: Contact with acids liberates toxic gas.

H272: May intensify fire; oxidiser.

H302: Harmful if swallowed.

H319: Causes serious eye irritation.

H335: May cause respiratory irritation.

H400: Very toxic to aquatic life.

H410: Very toxic to aquatic life with long lasting effects.

Legal disclaimer: The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. This company shall not be held liable for any damage resulting from handling or from contact with the above product.

CHEMICAL SAFETY REPORT

Substance Name: Troclosene sodium (SDIC 56%)

EC Number: 220-767-7

CAS Number: 2893-78-9

Table of Contents

List of Tables

Part A

1. SUMMARY OF RISK MANAGEMENT MEASURES

The risk management measures are described in the Exposure Scenarios in Section 9 of the CSR.

2. DECLARATION THAT RISK MANAGEMENT MEASURES ARE IMPLEMENTED

I declare that the Risk Management Measures referred to in section 9 are implemented.

3. DECLARATION THAT RISK MANAGEMENT MEASURES ARE COMMUNICATED

I declare that the Risk Management Measures referred to in section 9 are communicated to my customers, when they are relevant for their uses.

Part B

1. IDENTITY OF THE SUBSTANCE AND PHYSICAL AND CHEMICAL PROPERTIES

1.1. Name and other identifiers of the substance

This section is included in the joint CSR.

1.2. Composition of the substance

This section is included in the joint CSR.

1.3. Physico-chemical properties

This section is included in the joint CSR.

2. MANUFACTURE AND USES

Year	Total tonnage	Uses exempted from CSR	Used for article
2016	680		
2017	780		
2018	980		

Quantities

This information is considered as confidential as in included in section 3.2 of the IUCLID dossier.

2.1. Manufacture

Manufacturing process

2.2. Identified uses

Table 1. Uses by workers in industrial settings

Confidential	IU number	Identified Use (IU) name	Substance supplied to that use	Use descriptors
	1	Formulation of products		**Process category (PROC):** PROC 1: Use in closed process, no likelihood of exposure PROC 2: Use in closed, continuous process with occasional controlled exposure PROC 3: Use in closed batch process (synthesis or formulation) PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 14: Production of preparations or articles by tabletting, compression, extrusion, pelletisation PROC 15: Use as laboratory reagent **Market sector by type of chemical product:** PC 1: Adhesives, sealants PC 20: Products such as ph-regulators, flocculants, precipitants, neutralisation agents PC 21: Laboratory chemicals PC 23: Leather tanning, dye, finishing, impregnation and care products PC 34: Textile dyes, finishing and impregnating products; including bleaches and other processing aids PC 35: Washing and cleaning products (including solvent based products) **Environmental release category (ERC):** ERC 2: Formulation of preparations **Sector of end use (SU):** SU 10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys) **Subsequent service life relevant for that use?:** yes
	4	Use of general products		**Process category (PROC):** PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at

		(surface treatments and adhesives)		non-dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 10: Roller application or brushing PROC 13: Treatment of articles by dipping and pouring **Market sector by type of chemical product:** PC 1: Adhesives, sealants PC 9a: Coatings and paints, thinners, paint removes PC 9b: Fillers, putties, plasters, modelling clay PC 20: Products such as ph-regulators, flocculants, precipitants, neutralisation agents **Environmental release category (ERC):** ERC 5: Industrial use resulting in inclusion into or onto a matrix ERC 8b: Wide dispersive indoor use of reactive substances in open systems ERC 8e: Wide dispersive outdoor use of reactive substances in open systems **Sector of end use (SU):** SU 21: Consumer uses: Private households (= general public = consumers) SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen) **Subsequent service life relevant for that use?:** no
	5	Industrial manufacture of articles		**Process category (PROC):** PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 10: Roller application or brushing PROC 13: Treatment of articles by dipping and pouring **Market sector by type of chemical product:** PC 15: Non-metal-surface treatment products PC 23: Leather tanning, dye, finishing, impregnation and care products **Environmental release category (ERC):** ERC 2: Formulation of preparations

				Sector of end use (SU): SU 0: Other: SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites **Subsequent service life relevant for that use?:** yes

Table 2. Uses by professional workers

Confidential	IU number	Identified Use (IU) name	Substance supplied to that use	Use descriptors
	2	Textile treatment		**Process category (PROC):** PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 10: Roller application or brushing PROC 13: Treatment of articles by dipping and pouring **Market sector by type of chemical product:** PC 23: Leather tanning, dye, finishing, impregnation and care products PC 34: Textile dyes, finishing and impregnating products; including bleaches and other processing aids **Environmental release category (ERC):** ERC 5: Industrial use resulting in inclusion into or onto a matrix ERC 6b: Industrial use of reactive processing aids ERC 8b: Wide dispersive indoor use of reactive substances in open systems **Sector of end use (SU):** SU 21: Consumer uses: Private households (= general public = consumers) SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen) **Subsequent service life relevant for that use?:** no
	3	Use of cleaning products		**Process category (PROC):** PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers

				at non-dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 10: Roller application or brushing PROC 13: Treatment of articles by dipping and pouring **Market sector by type of chemical product:** PC 35: Washing and cleaning products (including solvent based products) **Environmental release category (ERC):** ERC 8b: Wide dispersive indoor use of reactive substances in open systems ERC 8e: Wide dispersive outdoor use of reactive substances in open systems **Sector of end use (SU):** SU 21: Consumer uses: Private households (= general public = consumers) SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen) **Subsequent service life relevant for that use?:** no
	4	Use of general products (surface treatments and adhesives)		**Process category (PROC):** PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 10: Roller application or brushing PROC 13: Treatment of articles by dipping and pouring **Market sector by type of chemical product:** PC 1: Adhesives, sealants PC 9a: Coatings and paints, thinners, paint removes PC 9b: Fillers, putties, plasters, modelling clay PC 20: Products such as ph-regulators, flocculants, precipitants, neutralisation agents **Environmental release category (ERC):** ERC 5: Industrial use resulting in inclusion into or onto a matrix ERC 8b: Wide dispersive indoor use of reactive substances in open systems ERC 8e: Wide dispersive outdoor use of reactive substances in open systems

				Sector of end use (SU): SU 21: Consumer uses: Private households (= general public = consumers) SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen) **Subsequent service life relevant for that use?:** no

Table 3. Uses by consumers

Confidential	IU number	Identified Use (IU) name	Use descriptors
	2	Textile treatment	**Chemical product category (PC):** PC 23: Leather tanning, dye, finishing, impregnation and care products PC 34: Textile dyes, finishing and impregnating products; including bleaches and other processing aids **Environmental release category (ERC):** ERC 8b: Wide dispersive indoor use of reactive substances in open systems **Subsequent service life relevant for that use?:** no
	3	Use of cleaning products	**Chemical product category (PC):** PC 35: Washing and cleaning products (including solvent based products) **Environmental release category (ERC):** ERC 8b: Wide dispersive indoor use of reactive substances in open systems ERC 8e: Wide dispersive outdoor use of reactive substances in open systems **Subsequent service life relevant for that use?:** no

Most common technical function of substance (what it does):

Tanning agents
Laboratory chemicals
Biocide substances
Bleaching agents

2.3. Uses advised against

There are no uses advised against.

3. CLASSIFICATION AND LABELLING

This section is included in the joint CSR.

4. ENVIRONMENTAL FATE PROPERTIES

4.1. Degradation

This section is included in the joint CSR.

4.2. Environmental distribution

This section is included in the joint CSR.

4.3. Bioaccumulation

This section is included in the joint CSR.

4.4. Secondary poisoning

This section is included in the joint CSR.

5. HUMAN HEALTH HAZARD ASSESSMENT

5.1. Toxicokinetics (absorption, metabolism, distribution, and elimination)

This section is included in the joint CSR.

5.2. Acute toxicity

This section is included in the joint CSR.

5.3. Irritation

This section is included in the joint CSR.

5.4. Corrosivity

This section is included in the joint CSR.

5.5. Sensitisation

This section is included in the joint CSR.

5.6. Repeated dose toxicity

This section is included in the joint CSR.

5.7. Mutagenicity

This section is included in the joint CSR.

5.8. Carcinogenicity

This section is included in the joint CSR.

5.9. Toxicity for reproduction
This section is included in the joint CSR.

5.10. Other effects
This section is included in the joint CSR.

5.11. Derivation of DNEL(s) / DMEL(s)
This section is included in the joint CSR.

6. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICOCHEMICAL PROPERTIES

6.1. Explosivity
This section is included in the joint CSR.

6.2. Flammability
This section is included in the joint CSR.

6.3. Oxidising potential
This section is included in the joint CSR.

7. ENVIRONMENTAL HAZARD ASSESSMENT

7.1. Aquatic compartment (including sediment)
This section is included in the joint CSR.

7.2. Terrestrial compartment
This section is included in the joint CSR.

7.3. Atmospheric compartment
This section is included in the joint CSR.

7.4. Microbiological activity in sewage treatment systems
This section is included in the joint CSR.

7.5. Non compartment specific effects relevant for the food chain (secondary poisoning)
This section is included in the joint CSR.

7.6. Conclusion on the environmental hazard assessment and on classification and labelling
This section is included in the joint CSR.

PBT AND VPVB ASSESSMENT

8.1. Assessment of PBT/vPvB Properties
This section is included in the joint CSR.

8.2. Emission Characterisation

This section is included in section 9 within the exposure scenarios.

9. EXPOSURE ASSESSMENT

Table 4: Overview on exposure scenarios and coverage of substance life cycle

ES number	Volume (tonnes)	Manufacture	Identified uses			Resulting life cycle stage		Linked to Identified Use	Sector of Use (SU)	Preparation Category (PC)	Process category (PROC)	Article category (AC)	ERC
			Formulation	End use	Consumer use	Service life (for articles)	Waste stage						
ES 1 Formulation of products	*1000*	*X*	*X*					*1*	**10**	1,20,21,23,34,35	1,2,3,4,5,8a,9,14,15	-	2
ES 2 Textile treatment	*500*			*X*	*X*			*2*	**5, 22**	23,34	8a,9,10,13	-	5,6b,8b
ES 3 Use of cleaning products	*100*			*X*	*X*			*3*	**21, 22**	35	8a,9,10,13	-	8b,8e
ES 4 Use of general products (surface treatments and adhesives)	*200*			*X*				*4*	**21, 22**	1,9a,9b,20	8a,9,10,13	-	5,8b,8e
ES 5 Industrial manufacture of articles	*200*	*X*						*5*	**3**	15,23	5,8a,9,10,13	5	2
ES 6 Biocidal Products[1]	*>3,500,000*		*X*	*X*	*X*			*6*	**3, 5, 21, 22**	8,35,37		-	

[1] The substance for use in biocidal products will not be included as the substances for this use are already considered as registered under REACH (substance under evaluation in the Existing Substance Review Programme of the BPD (98/8/EC).

9.1 ES 1 Formulation of products (SU 10; PC 1,20,21,23,34,35 PROC 1,2,3,4,5,8a,9,14,15; ERC 2)

9.1.1 Exposure scenario

9.1.1.1 Description of activities and processes covered in the exposure scenario

Manufacture of the substance

Manufacture and processing of the substance into the required physical preparation (i.e. granules or tablets) may be performed separately or as part of the same production process. There is no separation of processes for manufacture and processing of the substance for either chemical or biocidal use.

The substance is produced in a continuous contained process, where the air emissions are treated to avoid emissions of the substance or other chlorine containing materials. Raw materials required for the production are chlorine, caustic soda, and cyanuric acid. The cyanuric acid is reacted with chlorine and caustic soda in water to produce a slurry of the required active substance. The slurry is filtered, washed, and dried to produce the solid active substance.

After drying, the active substance is granulated using compaction and milling techniques, if required. The final form of the active substance is then packaged for supply in either 1000 kg bags or 5, 10, 25 or 50 kg PP or PE buckets or drums.

Some of the granulated active substance is reprocessed to form tablets. The tableting batch size is 1000 kg, taking 1 hour, with approximately 17 batches processed per day. The granulated product is sieved and mixed with a further component, for example, boric acid which functions as a lubricating agent during tablet production. The mixture is then compressed through the tableting machine and the tablets packaged. The tablets are re-packaged in plastic (polypropylene) buckets or drums of 1, 2, 3, 5, 10, 25 or 50 kg.

All gas emissions are filtered for dust and treated with sodium hydroxide to remove chlorine and other volatile chlorinated species. Dry solid residues from air filtration systems are collected and recycled back into the process. Sodium hypochlorite, produced by the reaction of the volatile chlorine species and the sodium hydroxide, is sold for use in other chemical industries.

The wastes from tableting are estimated to be less than 0.1%. The waste dust from this process is sent to an external waste treatment site for disposal.

Any aqueous waste from the manufacturing process is filtered to remove solids, which are recycled back into the process. The water is also treated to remove any available chlorine species before release to a waste-water treatment plant. Solid wastes from this process are sent to an external waste treatment site for disposal.

There is no release of substance via gaseous or aqueous emissions from this process. Wastes from the process are the hydrolysis products; available chlorine (HOCl) and cyanuric acid. On average, less than 1% of the total available chlorine in the system is released to waste. About 150 kg/day of CYA is sent to sewage treatment plants (STP) with a total of 30 kg/day of CYA released to surface waters from the STP.

For an average continuous manufacturing process the cycle from raw materials to finished product will take approximately 5 hours, with 1000 kg processed per hour.

Forced-air systems are used during the tableting process to ensure a clean air supply. Workers routinely wear Personal Protective Equipment (PPE) of safety glasses, gloves, coverall, helmet and Respiratory Protective Equipment (RPE) of a half-face respirator with chlorine filter (EN140). RPE is not used in conjunction with the forced-air supply.

During maintenance and cleaning, workers will additionally wear gloves, disposable respirators, acid resistant coveralls and boots. Full-face autonomous respirators with air tanks are available if required.

Dry formulation and repackaging

Dry formulations are normally prepared in a batch operation by adding the various components to a blender, running the blender to mix the components and then discharging the blender into a filling machine which dispenses the blended

formulation into the desired container for sale. If a tablet is being produced, the blended product normally flows from the blender directly into the press feed-hopper. The press compresses the blended product into tablets, which then flow out of the press into the container. Once filled to the proper weight, the container is moved out of the filling machine or away from the press and then closed or sealed. Small closed containers will then be placed in a carton, while larger pails do not require a carton. The cartons or pails would typically be placed on a pallet for storage and shipment. After a production run, the equipment may be cleaned to remove residual product in preparation for the next production run.

The operation is very similar when pure NaDCC or NaDCC dihydrate is being repackaged, except that the blender is replaced by a simple hopper and no other materials are mixed in. Tableted products are almost always blended products, particularly for non-biocidal uses.

The dispensing and container closing operations may be operated manually or automatically, with smaller volume products being more manual and larger volume products being more automated. Smaller volume products will be normally be blended and packaged on non-dedicated equipment (PROC 8) while larger volume products may be blended and packaged on dedicated equipment (PROC 9). For example, a formulator might sell several different cleaning formulations based on NaDCC or NaDCC dihydrate, all of which are blended and packaged on the same production line.

Drum emptying

Worker exposure can occur when adding the pure NaDCC to the blender. Most formulators will use NaDCC in drums and an operator must open the drum and control the flow of product into the blender, although equipment may be available to hold and tip over the drum. A worker adding products to the blender would normally wear PPE/RPE consisting of gloves, coverall, safety glasses and half-face respirator with chlorine cartridges as some dust and fumes will be present. In addition, local exhaust ventilation and air filtration systems are used to minimize worker exposure and prevent dust emissions. Opening and emptying a drum normally requires only a couple of minutes, after which the blender is closed so that the formulation can be blended and then packaged. The time between batches depends on the production rate and the size of the blender, but a typical time between blends might be 30-60 minutes.

Therefore, for emptying drums:

Workers exposed to pure NaDCC
No. of workers exposed = 1
Exposure time per batch = 2 minutes
Number of exposures per 8 hr work shift = 8 - 16
RMM = PPE (gloves, coverall, safety glasses) and RPE (half-face respirator) and engineering controls

The blender and discharge line would normally be a closed system, with ventilation through a filter to control dust emissions, so that there will be no exposure during this step.

Packaging

Worker exposure can occur to the full, but open, containers when closing the containers. During this task, the exposure is to the formulated product, which might contain 3 - 25% of NaDCC or NaDCC dihydrate. For example automatic dishwash formulations contain ca. 6% NaDCC and cleaners contain 6 - 25% NaDCC or NaDCC dihydrate. When repacking occurs, the product is 100% NaDCC or NaDCC dihydrate.

Worker exposure is greatest near the point where the containers are filled and less where the lids or seals are added. If the formulation is being tableted, the exposure is greatest near the press, and less where the containers are filled and less where the lids or seals are added. For dry formulations (PROC 8), there will probably be one person operating the filling machine or press and another closing the containers. For PROC 9, these tasks may be more automated, so there will probably be one person operating the filling machine or press, closing containers, and placing closed containers into cartons. Exposure will occur whenever the containers are being filled, i.e., except when the blender is being filled and running. Workers would normally wear PPE consisting of gloves, coverall, safety glasses and half-face respirator with chlorine cartridges. In addition, there should be local exhaust ventilation at the point where the containers are filled, since generation of dust or vapours is likely.

Therefore, for filling/closing containers (PROC 8 or 9):

Workers exposed to formulation with 6 - 25% NaDCC or repacking 100% NaDCC
No. of workers exposed = 2 or 1
Total exposure time per 8 hr work shift = 6 - 7 hr
RMM = PPE (gloves, coverall, safety glasses) and RPE (half-face respirator) and engineering controls

Indirect exposure

There may also be indirect exposure to other workers in the area who are moving materials into and out of the production area or are working in an adjacent production area. This exposure will be at lower levels and for shorter periods of time

than for the workers filling containers, but these other workers might not be wearing as much PPE/RPE. Productions facilities should monitor work areas for fume and dust levels and require RPE in areas that exceed the occupational exposure limits.

Therefore, for workers with indirect exposure:

Workers exposed to formulation with 6 - 25% NaDCC or repacking 100% NaDCC
No. of workers exposed = 1 - 6
Total exposure time per work shift = 2 hr at levels below occupational exposure limits
RMM = PPE (gloves, coverall, safety glasses) and engineering controls

During cleaning and maintenance, workers will use similar PPE/RPE described above for production workers.

9.1.1.2 Risk management measures

Workers will not wear respiratory protective equipment as standard. The use of a half-face respirator with chlorine cartridges (EN140) is required during opening of drums and filling of containers. An IOEL of 1.5 mg/m^3 chlorine is applicable.

The substance is corrosive so risk mitigation measures, i.e. wearing PPE consisting of gloves, coverall and safety glasses, whilst handling the raw material during opening of drums and filling of containers, where exposure may be possible, would apply.

It is expected that engineering controls, i.e. ventilation, are in place in areas where opening of drums and filling of containers occurs.

9.1.1.3 Waste related measures

Air
NaDCC and NaDCC dihydrate are of low volatility. During use of the substance dust and chlorinated fumes can be generated. Engineering controls are in place to mitigate this exposure.

All gas emissions are filtered for dust and treated with sodium hydroxide to remove chlorine and other volatile chlorinated species. Dry solid residues from air filtration systems are collected and or either recycled or disposed of, depending on the formulator.

The waste dust from formulation or tableting is sent to an external waste treatment site for disposal.

Water
Any aqueous waste from the manufacturing process is filtered to remove solids, which are recycled back into the process. The water is also treated to remove any available chlorine species before release to a waste-water treatment plant. Solid wastes from this process are sent to an external waste treatment site for disposal.

In the UK the non-statutory environmental quality standards for release to waste water are:
Chloride: 250000 µg/L (AA)
Chlorine: 2 µg/L (TAC)(AA)
5 µg/L (TAC)(MAC)
TAC = Total Available Chlorine
MAC = Maximum Allowable Concentration
AA = Annual Average

For a single manufacturing site, about 150 kg/day of CYA is sent to sewage treatment plants (STP) with a total of 30 kg/day of CYA released to surface waters from the STP.

9.1.2 Exposure estimation

Production and formulation occurs all year.

9.1.2.1 Tier 1

Exposure estimations were performed using the Ecetoc TRAworker tool (July 09). The input values are as follows:

NaDCC Molecular weight:	220
NaDCC Inhalation DNEL:	8.11 mg/m^3
NaDCC Dermal DNEL:	2.30 mg/kg bw/d
Fugacity:	low
Protective equipment:	No protective equipment used.

All PROC codes were run with and without the use of ventilation.

However, the guidance on information requirements and chemical safety assessment, part D, page 41 states: For dermal exposure the tool should be used assuming no local exhaust ventilation (LEV), as it has been found that the tool underestimates the dermal exposure when the presence of local exhaust ventilation is assumed. Use of the LEV function in the tool assumes the same protection factor for dermal exposure as would be achieved by application of the default factor of 90% protection for use of gloves.

Table 5: ES 1 - Worker exposure estimations - Output from EcetocTRAworkerJuly09 – dry formulation

Process Category	Activity Type	Indoors or Outdoors use?	Ventilation present?	Presumed efficiency %	Maximum duration (hours)	Respiratory protection used?	Presumed efficiency %	Substance is in a Preparation?	Dermal exposures may arise from this Exposure Scenario, assuming a maximal exposed skin area (cm2)	Inhalative Exposure Estimate (ppm)	Inhalative Exposure Estimate (mg/m3)	Dermal Exposure Estimate (mg/kg bw/day)
1 - Use in closed process, no likelihood of exposure	Industrial	Indoors	No		>4 hours (default)	No		No	240	0.001090909	0.01	0.3429
2 - Use in closed, continuous process with occasional controlled exposure	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.001090909	0.01	1.3714
3 - Use in closed batch process (synthesis or formulation)	Industrial	Indoors	No		>4 hours (default)	No		No	240	0.010909091	0.1	0.3429
4 - Use in batch and other process (synthesis) where opportunity for exposure arises	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.054545455	0.5	6.8571
4 - Use in batch and other process (synthesis) where opportunity for exposure arises	Industrial	Indoors	Yes	90	>4 hours (default)	No		No	480	0.005454546	0.05	0.6857

Process Category	Activity Type	Indoors or Outdoors use?	Ventilation present?	Presumed efficiency %	Maximum duration (hours)	Respiratory protection used?	Presumed efficiency %	Substance is in a Preparation?	Dermal exposures may arise from this Exposure Scenario, assuming a maximal exposed skin area (cm2)	Inhalative Exposure Estimate (ppm)	Inhalative Exposure Estimate (mg/m3)	Dermal Exposure Estimate (mg/kg bw/day)
5 -Mixing or blending in batch processes (multistage and/or significant contact)	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.054545455	0.5	13.7143
5 -Mixing or blending in batch processes (multistage and/or significant contact)	Industrial	Indoors	Yes	90	>4 hours (default)	No		No	480	0.005454546	0.05	0.0686
8a -Transfer of chemicals from/to vessels/ large containers at non dedicated facilities	Industrial	Indoors	No		>4 hours (default)	No		No	960	0.054545455	0.5	13.7143
8a -Transfer of chemicals from/to vessels/ large containers at non dedicated facilities	Industrial	Indoors	Yes	90	>4 hours (default)	No		No	960	0.005454546	0.05	0.1371
8b -Transfer of chemicals from/to vessels/ large containers at dedicated facilities	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.010909091	0.1	6.8571

Process Category	Activity Type	Indoors or Outdoors use?	Ventilation present?	Presumed efficiency %	Maximum duration (hours)	Respiratory protection used?	Presumed efficiency %	Substance is in a Preparation?	Dermal exposures may arise from this Exposure Scenario, assuming a maximal exposed skin area (cm2)	Inhalative Exposure Estimate (ppm)	Inhalative Exposure Estimate (mg/m3)	Dermal Exposure Estimate (mg/kg bw/day)
8b -Transfer of chemicals from/to vessels/ large containers at dedicated facilities	Industrial	Indoors	Yes	95	>4 hours (default)	No		No	480	0.000545455	0.005	0.6857
9 -Transfer of chemicals into small containers (dedicated filling line)	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.010909091	0.1	6.8571
9 -Transfer of chemicals into small containers (dedicated filling line)	Industrial	Indoors	Yes	90	>4 hours (default)	No		No	480	0.001090909	0.01	0.6857
14 - Production of preparations or articles by tabletting, compression, extrusion, pelletisation	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.010909091	0.1	3.4286
14 - Production of preparations or articles by tabletting, compression, extrusion, pelletisation	Industrial	Indoors	Yes	90	>4 hours (default)	No		No	480	0.001090909	0.01	0.3429

Process Category	Activity Type	Indoors or Outdoors use?	Ventilation present?	Presumed efficiency %	Maximum duration (hours)	Respiratory protection used?	Presumed efficiency %	Substance is in a Preparation?	Dermal exposures may arise from this Exposure Scenario, assuming a maximal exposed skin area (cm2)	Inhalative Exposure Estimate (ppm)	Inhalative Exposure Estimate (mg/m3)	Dermal Exposure Estimate (mg/kg bw/day)
15 - Use of laboratory reagents in small scale laboratories	Industrial	Indoors	No		1 - 4 hours	No		No	240	0.006545455	0.06	0.3429

Table 6: ES 1 - Summary of highest exposure concentrations to workers – Tier 1 - NaDCC

Routes of exposure	Concentrations	Justification
Dermal local exposure (in mg/cm^2)	-	The test material is corrosive, risk mitigation measures should be in place to prevent exposure.
Dermal systemic exposure (in mg/kg bw/d)	13.71	PROC 5: Mixing or blending in batch processes (multistage and/or significant contact) – highest dermal exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.
Inhalation exposure (in mg/m^3)	0.5	PROC 5: Mixing or blending in batch processes (multistage and/or significant contact) – highest inhalation exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.

9.1.2.2 Tier 2

Inhalation
Monitoring data from a single manufacturing site for the substance has shown that the actual exposure is 0.1 ppm (0.145 mg/m^3) chlorine (Batchelli, SS (2004)). This value is taken as the worst case inhalation exposure for an industrial process.

Dermal
The substance is corrosive and risk mitigation measures are applied to prevent exposure. Handling of the raw material should be performed with the use of chemical resistant gloves (CEFIC RMM library CW29.01). For normal use a nitrile glove should be sufficient protection. A default protection factor of 90% is applicable.

Table 7: ES 1 - Summary of exposure concentrations to workers - Tier 2 - NaDCC

Routes of exposure	Concentrations	Justification
Dermal local exposure (in mg/cm^2)	-	The test material is corrosive, risk mitigation measures should be in place to prevent exposure.
Dermal systemic exposure (in mg/kg bw/d)	1.371	PROC 5 – highest dermal exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied, plus protection factor of 90% for use of gloves to prevent local corrosive effects.
Inhalation exposure (in mg/m^3)	0.145	Monitoring data Batchelli, SS (2004)

9.1.2.3 Environmental releases

The substance hydrolyses to cyanuric acid and HOCl in aqueous solution. The substance is converted to the hydrolysis products in waste water streams or removed from air emissions and recycled back into the production system. Risk Mitigation Measures are in place to prevent release of volatile chlorine species to the environment. As there is no release of the substance to the environment from manufacture and formulation no exposure scenario will be performed.

9.1.2.3.1 Exposure concentration relevant for the food chain (Secondary poisoning)

The substance hydrolyses rapidly in use to release halogen moieties in the form of HOCl and CYA. There is no potential for bioaccumulation of NaDCC.

NaDCC has Log Pow < 1, rapidly hydrolyses to CYA, and is highly soluble in water. In addition, the chlorinated isocyanurates are highly reactive with many biological compounds such as proteins and enzymes and are therefore unlikely to bioaccumulate. A calculation of BCF using EPIWIN v3.2 software indicates that NaDCC has a BCF = 1.932 (Bland S (2007)).

CYA is also unlikely to bioaccumulate, based on its low Log Pow (-1.31). A calculation of BCF using EPIWIN v3.2 software indicates that CYA has a BCF = 3.165 (Bland S (2007)).

9.2 ES 2: Textile treatment (SU 5,22; PC 23,34; PROC 8a,9,10,13; ERC 5,6b,8b)

9.2.1 Exposure scenario

9.2.1.1 Description of activities and processes covered in the exposure scenario

The substance hydrolyses to generate HOCl and cyanuric acid. The HOCl is used in the preparation of textiles (bleaching or shrink proofing of wool). Workers will be exposed to the substance during the textile treatment process.

It is expected that the worker would be exposed to NaDCC when adding it to the process mixture. After the wet processing of the textile the substance will have converted fully to HOCl and to cyanuric acid. Up to 3 g/kg textile NaDCC (0.1 – 0.5% NaDCC) are added to either a tank or in the case of bleaching the product could be used in an automatic washer (5% solution). The textiles are added to the solution and left for up to 30 minutes. Before removal from the solution a dechlorinating agent is added. Workers will not be exposed to HOCl via contact with the treated textile.

Industrial washing machines can take single loads of up to 400 kg. Textile dyeing machines can take single loads of up to 1200 kg.

Treatment temperatures are typically around 18°C but can be up to 30°C or higher in the case of specialised treatments.

Loading tanks and washers

Worker exposure will only occur when adding the NaDCC to the tank or washer to make the aqueous solution into which the textile is added. A worker adding products would normally wear PPE/RPE consisting of gloves, coverall and safety glasses. In addition, local exhaust ventilation and air filtration systems are used to minimize inhalation exposure and prevent dust emissions. Loading time and mixing of the treatment solution would not take longer than 30 minutes. In addition the BREF for textile treatment (IPPC Reference Document on Best Available Techniques for the Textile Industry, July 2003) indicates that BAT for the textile industry is to install automatic dosing and dispensing systems and auto systems which will reduce the time workers are exposed during wet processes.

Table 8: ES 2 – Worker exposure during textile treatment

Task	Concentration of NaDCC	No of workers	Time spent per worker per task	No of tasks per 8 hour shift	Daily exposure period per worker
Emptying drums	100% NaDCC	1	5 min	6	30 min
Mixing solutions	0.1% - 0.5% solution	1	10 min	6	60 min

Professional use of textile treatments

Professional use will involve the same stages as the industrial process on a smaller scale. Washers and treatment tanks may not be closed systems. Commercial washing machines can take up to 120 kg per load. Smaller machines taking loads of 4.5 kg can have short washing cycles of 15 minutes. This would give a total of 32 washes per 8 hour shift. For larger machines the wash cycle can be 90 to 120 minutes giving a maximum of 5 washes per day.

Exposure will occur when adding the NaDCC to the washer to make the aqueous solution into which the textile is added. A professional may have access to PPE consisting of gloves, coverall and safety glasses. There are unlikely to be engineering controls for ventilation but there may be automated dosing systems which would only require the professional worker to be exposed once a day when filling the system. Loading time would not take longer than 10 minutes for large loads and 5 minutes for small loads.

Table 9: ES 2 – Daily concentrations of substance - Professional

Task	Concentration of substance (g/kg textile)	Weight of textile/load (kg)	Total amount of substance per load (g)	No of tasks per 8 hour shift	Daily amount of substance (g)

Large load: Emptying container	3 g/kg NaDCC	120 kg	360	5	1800
Small load: Emptying container	3 g/kg NaDCC	4.5 kg	13.5	32	432

Non-professional use of textile treatments

Non-professionals may also use the substance for textile treatment. In this case it is unlikely that more than one load would be treated and treatments would be intermittent, at most three or four times per annum. A standard home washing machine has a capacity of between 7 and 14 kg.

Exposure can occur when adding the pure NaDCC to the washer to make the aqueous solution into which the textile is added. Loading time would not take longer than 10 minutes.

Table 10: ES 2 – Daily concentrations of substance – Non-Professional

Task	Concentration of substance (g/kg textile)	Weight of textile/load (g)	Total amount of substance per load (g)	No of tasks per day	Daily amount of substance (g)
Emptying container	3 g/kg NaDCC	14 kg	42	1	42

9.2.1.2 Risk management measures

Workers will not wear respiratory protective equipment as standard. The use of a half-face respirator with chlorine cartridges (EN140) is required during opening of drums and filling of containers. An IOEL of 1.5 mg/m^3 chlorine is applicable.

The substance is corrosive so risk mitigation measures, i.e. wearing PPE consisting of gloves, coverall and safety glasses, whilst handling the raw material during opening of drums and filling of containers, where exposure may be possible, would apply.

It is expected that engineering controls, i.e. ventilation, are in place in areas where opening of drums and filling of containers occurs.

9.2.1.3 Waste related measures

Air

NaDCC and NaDCC dihydrate are of low volatility. During use of the substance dust and chlorinated fumes can be generated. Engineering controls are in place to mitigate this exposure. Dusts are filtered from extracted air and disposed of as chemical waste for incineration.

The substance will only hydrolyse to the degradants cyanuric acid and hypochlorous acid when added to aqueous solutions. Cyanuric acid is of low volatility and is unlikely to be vented to air. Hypochlorous acid exists in aqueous solutions and undergoes rapid degradation upon contact with organic matter. If HOCl is released from the formulation process into vented air it will rapidly react to form chloride ions which are ubiquitous in nature.

Water

The substance is totally hydrolysed during use to HOCl and CYA. There will be no release of the substance to waste water. Waste is neutralised and diluted to comply with release limits for chlorine and chloride. In the UK the non-statutory environmental quality standards for release to waste water are:

Chloride: 250000 µg/L (AA)
Chlorine: 2 µg/L (TAC)(AA)
5 µg/L (TAC)(MAC)
TAC = Total Available Chlorine
MAC = Maximum Allowable Concentration
AA = Annual Average

9.2.2 Exposure estimation

Industrial Worker
To determine worker exposure the BEAT (Baysian Exposure Assessment Toolkit) developed by HSE for use under the Biocidal Products Directive contains an appropriate worker exposure model for loading of slimicides into a closed system. Related scenarios for loading of zinc oxide into a closed system can be used to develop a generic exposure value. Potential dermal exposure to the hands is the 75th percentile taken from UK POEM model (TNsG v2, Annex 1, Models for mixing and loading, 10&20 litre data). 50 ml per operation = 50 µl/min assuming a 10 minute operation, and related database scenarios for loading of zinc oxides. The UK POEM model indicates that potential body exposure for this scenario is negligible.

Inhalation is assumed negligible for this exposure scenario. However, monitoring data form manufacturing and formulation shows that the inhalation in this scenario which can be assumed to be worst case (8 hour exposure to dust) is equivalent to 0.145 mg/m^3 chlorine.

Table 11: ES 2 - Industrial worker exposure estimation for NaDCC - Output from BEAT for textile manufacture

Loading of NaDCC in textile treatment	
Product	
active substance % (w/w)	100.00%
Potential body exposure	
Indicative value mg/min	0
Duration min	30
Potential dermal deposit mg	0
Clothing type	Dry cotton coveralls, 20% penetration
Clothing penetration %	20%
Actual dermal deposit [*product*] mg	0
Hand exposure	
Indicative value mg/min (potential)	10
Duration min	30
Hand deposit mg	300
Mitigation by gloves	0.1
Actual hand deposit [*product*] mg	30
Total dermal exposure	
Total dermal deposit [*product]* mg	30
Active substance mg	30
Dermal absorption %	100.00%
Systemic exposure via dermal route mg	30.0000
Exposure by inhalation	
Indicative value mg/m^3	0
Duration	30
Inhalation rate m^3/h	1.25
Mitigation by RPE	4
Inhaled [*product*] mg	0.00
Systemic exposure via inhalation route mg	0.000
Systemic exposure	
Total systemic exposure a.i. mg	30.0000
Body weight kg	70

Systemic exposure mg kg^{-1} day^{-1}	**0.42857**	

Table 12: ES 2 - Summary of exposure concentrations from textile manufacture - Industrial

Routes of exposure	Concentrations	Justification
Dermal systemic exposure (in mg/kg bw/d)	0.429	Output from BEAT model
Inhalation exposure (in mg/m^3)	0.145 mg/m^3	Monitoring data Batchelli SS (2004)

Professional

Table 13: ES 2 - Professional exposure estimation for NaDCC- Output from BEAT for textile manufacture

Loading of NaDCC in textile treatment Product	Small load	Large load
active substance % (w/w)	100.00%	100.00%
Potential body exposure		
Indicative value mg/min	0	0
Duration min	160	50
Potential dermal deposit mg	0	0
Clothing type	Dry cotton coveralls, 20% penetration	Dry cotton coveralls, 20% penetration
Clothing penetration %	20%	20%
Actual dermal deposit [*product*] mg	0	0
Hand exposure		
Indicative value mg/min (potential)	4.2	4.2
Duration min	160	50
Hand deposit mg	672	210
Mitigation by gloves	0.1	0.1
Actual hand deposit [*product*] mg	67.2	21
Total dermal exposure		
Total dermal deposit [*product]* mg	67.2	21
Active substance mg	67.2	21
Dermal absorption %	100.00%	100.00%
Systemic exposure via dermal route mg	67.2000	21.0000
Exposure by inhalation		
Indicative value mg/m^3	0	0
Duration	160	50
Inhalation rate m^3/h	1.25	1.25
Mitigation by RPE	4	4
Inhaled [*product*] mg	0.00	0.00
Systemic exposure via inhalation route mg	0.000	0.000
Systemic exposure		
Total systemic exposure a.i. mg	67.2000	21.0000

Body weight kg	70	70
Systemic exposure mg kg^{-1} day^{-1}	**0.96000**	**0.30000**

Table 14: ES 2 - Summary of exposure concentrations from textile manufacture - Professional

Routes of exposure	Concentrations	Justification
Small load: Dermal systemic exposure (in mg/kg bw/d)	0.96 mg/kg bw/d	Output from BEAT model
Large load: Dermal systemic exposure (in mg/kg bw/d)	0.3 mg/kg bw/d	Output from BEAT model
Inhalation exposure (in mg/m^3)	0.145 mg/m^3	Monitoring data Batchelli, SS (2004)

Non-Professional

A non-professional will not use gloves during the loading operation. Dry clothing will give the same protection factor as a dry cotton overall. AISE predicts that for a consumer using bleaching products that exposure will be less than a minute when loading a washing machine and 5-10 minutes for hand-washing (FinalAISE Habits_Practices_Total consumer_products-031109.xls). The typical amount of product that the non-professional could be exposed to is between 25 g (tablet) and 60 g (powder). From the loading rate supplied a typical case of 42 g of NaDCC per load is a reasonable assumption. As a worst case the non-professional could get 0.1% of the total volume on the hands (42 mg over a 10 minutes loading time = 4.2 mg/min). Inhalation exposure will not be greater than that observed in the formulation process.

Table 15: ES 2 - Non-Professional exposure estimation for NaDCC - Output from BEAT for textile treatment

Loading of NaDCC in textile treatment	
Product	
active substance % (w/w)	100.00%
Potential body exposure	
Indicative value mg/min	0
Duration min	10
Potential dermal deposit mg	0
Clothing type	Dry cotton coveralls, 20% penetration
Clothing penetration %	20%
Actual dermal deposit [*product*] mg	0
Hand exposure	
Indicative value mg/min (potential)	4.2
Duration min	10
Hand deposit mg	42
Mitigation by gloves	0
Actual hand deposit [*product*] mg	42
Total dermal exposure	
Total dermal deposit [*product]* mg	42
Active substance mg	42
Dermal absorption %	100.00%
Systemic exposure via dermal route mg	42.000
Exposure by inhalation	
Indicative value mg/m^3	0
Duration	10

Inhalation rate m^3/h	1.25
Mitigation by RPE	4
Inhaled [*product*] mg	0.00
Systemic exposure via inhalation route mg	0.000
Systemic exposure	
Total systemic exposure a.i. mg	42.000
Body weight kg	70
Systemic exposure mg kg^{-1} day^{-1}	**0.6000**

Table 16: ES 2 - Summary of exposure concentrations from textile treatment – Non-Professional

Routes of exposure	Concentrations	Justification
Dermal systemic exposure (in mg/kg bw/d)	0.6	Output from BEAT model
Inhalation exposure (in mg/m^3)	0.145 mg/m^3	Monitoring data Batchelli, SS (2004)

9.2.2.1 Environmental releases

The substance hydrolyses to cyanuric acid and HOCl in aqueous solution. HOCl is used in the textile manufacturing process as a chlorine donor and will react to give chloride ions. Chloride is ubiquitous and is not of concern for release to the environment. All chlorinated isocyanurates hydrolyse to leave cyanuric acid to be released to the environment. As there is no release of the substance to the environment from this use no exposure scenario will be performed.

9.3 ES 3: Use of cleaning products (SU 21,22; PC 35; PROC 8a,9,10,13; ERC 8b,8e)

9.3.1 Exposure scenario

9.3.1.1 Description of activities and processes covered in the exposure scenario

The substance is formulated into cleaning products which may be used by professionals outside the industrial area or by the general public (ES 1). The substance is incorporated into the cleaning product at a maximum concentration of 5%. Upon contact with an aqueous solution the substance will hydrolyse generating cyanuric acid and HOCl, which reacts rapidly upon contact with organic matter to form chloride ions. Users of the cleaning products will only be exposed to the substance from handling of the products during loading and mixing processes.

The substance is used in a wide range of cleaning products including auto-dishwashing solids and surface cleaners. The main source of exposure to the products during use is dermal contact, hands only. There is minimal potential for inhalation exposure from dust generated from use of the product. The substance is sold in cleaning products which are dry powders or tablets only. The dry powders or tablets are often used to make up aqueous solutions for washing and cleaning immediately before use. It is not sold in liquid, gel or spray cleaners, as it is not stable for long periods of time in these forms.

All environmental releases from use will be sent to waste water via an STP. The waste water will not contain the substance.

Professional cleaners will be exposed to the dry products for a maximum of 300 days per year. Mixing of the cleaning solutions may take place up to 16 times a day (8 hour shift). Professional users may use gloves to perform tasks where a

daily 8-hour exposure to the product could occur. The product is normally in the form of tablets or granules. In accordance with AISE use mapping (AISE_IIusesandexposures021109), professional use of a dishwashing product for manual cleaning will take a total of 8 minutes in an 8 hour shift; i.e. 1 minute, 8 times a day. Loading the product into an automated dosing commercial dishwasher would take 10 minutes once a day. Mixing of surface cleaners takes a maximum of 16 minutes a day (8 x 2 minutes/day). For both dish washing and surface cleaning the total duration of mixing the products in water will take 26 minutes.

The AISE predictions for weekly use of cleaning products by consumers are given in the following table taken from “FinalAISE Habits_Practices_Total consumer_products-031109”. The daily use can be derived from this table and the professional use patterns described before. Loading of the product for manual dish-washing 1 minute per task, average of 3 tasks per day is 3 minutes per day. For surface cleaning, 2 minutes per day. For both dish washing and surface cleaning the total duration of mixing the products in water will take 5 minutes.

Table 17: ES 3 - Summary of AISE consumer practices

CATEGORY	Grams/Task			Use Frequency: # Tasks per week			Duration of Task		
	Min.	Max.	Typ.	Min.	Max.	Typ.	Min.	Max.	Typ.
LAUNDRY REGULAR									
Powder	55	290	150	1	18	5	Machine wash: < 1 min.		
LAUNDRY ADDITIVES									
Powder Bleach	50	70	60				Machine: < 1 min.		
Tablet	20	30	25						
MACHINE DISHWASHING									
Powder	20	46	--						
Tablet	20	50	--						
SURFACE CLEANERS							Min.	Max.	Typ.
Powder (a)	20	40	--	1	7	2	10	20	--

9.3.1.2 Waste related measures

All wastes from use of cleaning products will be sent to waste water via STP.

9.3.2 Exposure estimation

Professional
To determine professional exposure the BEAT (Baysian Exposure Assessment Toolkit) developed by HSE for use under the Biocidal Products Directive contains an appropriate worker exposure model for loading of slimicides into a closed system. Related scenarios for loading of zinc oxide into a closed system can be used to develop a generic exposure value. Potential dermal exposure to the hands is the 75th percentile taken from UK POEM model (TNsG v2, Annex 1, Models for mixing and loading, 10&20 litre data). 50 ml per operation = 50 µl/min assuming a 10 minute operation, and related database scenarios for loading of zinc oxides. The UK POEM model indicates that potential body exposure for this scenario is negligible.

Inhalation is assumed negligible for this exposure scenario. However, monitoring data form manufacturing and formulation shows that the inhalation in this scenario which can be assumed to be worst case (8 hour exposure to dust) is equivalent to 0.145 mg/m^3 chlorine.

Table 18: ES 3 - Professional exposure estimation for NaDCC - Output from BEAT for cleaning products.

Loading of NaDCC in cleaning products **Product**	
active substance % (w/w)	5.00%
Potential body exposure	
Indicative value mg/min	0
Duration min	26
Potential dermal deposit mg	0
Clothing type	Dry cotton coveralls, 20% penetration
Clothing penetration %	20%
Actual dermal deposit [*product*] mg	0
Hand exposure	
Indicative value mg/min (potential)	10
Duration min	26
Hand deposit mg	260
Mitigation by gloves	1
Actual hand deposit [*product*] mg	260
Total dermal exposure	
Total dermal deposit [*product]* mg	260
Active substance mg	13
Dermal absorption %	100.00%
Systemic exposure via dermal route mg	13.0000
Exposure by inhalation	
Indicative value mg/m^3	0
Duration	26
Inhalation rate m^3/h	1.25
Mitigation by RPE	4
Inhaled [*product*] mg	0.00

Systemic exposure via inhalation route mg	0.000
Systemic exposure	
Total systemic exposure a.i. mg	13.0000
Body weight kg	70
Systemic exposure mg kg^{-1} day^{-1}	**0.18571**

Table 19: ES 3 - Summary of exposure concentrations from cleaning products - Professional

Routes of exposure	Concentrations	Justification
Dermal systemic exposure (in mg/kg bw/d)	0.18571	Output from BEAT model
Inhalation exposure (in mg/m^3)	0.145 mg/m^3	Monitoring data Batchelli, SS (2004)

Non-professional
The same BEAT scenario used for professionals can be used for non-professionals.

Table 20: ES 3 - Non-Professional exposure estimation for NaDCC - Output from BEAT for cleaning products.

Loading of NaDCC in cleaning products	
Product	
active substance % (w/w)	5.00%
Potential body exposure	
Indicative value mg/min	0
Duration min	5
Potential dermal deposit mg	0
Clothing type	Dry cotton coveralls, 20% penetration
Clothing penetration %	20%
Actual dermal deposit [*product*] mg	0
Hand exposure	
Indicative value mg/min (potential)	10
Duration min	5
Hand deposit mg	50
Mitigation by gloves	1
Actual hand deposit [*product*] mg	50
Total dermal exposure	
Total dermal deposit [*product]* mg	50
Active substance mg	2.5
Dermal absorption %	100.00%
Systemic exposure via dermal route mg	2.5000
Exposure by inhalation	
Indicative value mg/m^3	0
Duration	5
Inhalation rate m^3/h	1.25
Mitigation by RPE	4

Inhaled [*product*] mg	0.00
Systemic exposure via inhalation route mg	0.000
Systemic exposure	
Total systemic exposure a.i. mg	2.5000
Body weight kg	70
Systemic exposure mg kg^{-1} day^{-1}	**0.03571**

Table 21: ES 3 - Summary of exposure concentrations from cleaning products – Non-Professional

Routes of exposure	Concentrations	Justification
Dermal systemic exposure (in mg/kg bw/d)	0.03571	Output from BEAT model
Inhalation exposure (in mg/m^3)	0.145 mg/m^3	Monitoring data Batchelli, SS (2004)

9.3.2.1 Environmental releases

The substance hydrolyses to cyanuric acid and HOCl in aqueous solution during use. HOCl will react with organic matter and other molecules to give chloride ions. Chloride is ubiquitous and is not of concern for release to the environment. All chlorinated isocyanurates hydrolyse to leave cyanuric acid to be released to the environment. As there is no release of the substance to the environment from this use no exposure scenario will be performed.

9.4 ES 4: Use of general products (surface treatments and adhesives) (SU 21,22; PC 1,9a,9b,20 PROC 8a,9,10,13; ERC 5,8b,8e)

9.4.1 Exposure scenario

9.4.1.1 Description of activities and processes covered in the exposure scenario

The substance may be used in the production of products for surface treatment and in the use of adhesives. Articles that are surface treated may be leather goods such as shoes. The substance used in this manner for surface pretreatment will normally be used by industry or professional workers. In preparation of the surfaces to be treated or bonded, a solution of the substance is rolled or brushed on to the surface or the article can be dipped into the product. Dipping processes will be automated. Rolling can be automatic or manual. The surface is then wiped to remove the product before treating.

The substance hydrolyses to generate HOCl and cyanuric acid. Workers will be exposed to the substance during formulation of the aqueous solutions which are then applied to the articles. The solutions will not contain the substance.

It is expected that the worker would be exposed to NaDCC when adding it to the process mixture. After application to the article the substance will have converted fully to HOCl and to cyanuric acid. Workers will not be exposed to HOCl via contact with the treated article.

Loading tanks

Industry and professional workers will use the substance in the same manner. Worker exposure will only occur when adding the NaDCC or NaDCC dihydrate to the tanks to make the aqueous solution which will be applied to the article. A worker adding products would normally wear PPE/RPE consisting of gloves, coverall and safety glasses. In addition, local exhaust ventilation and air filtration systems are used to minimize inhalation exposure and prevent dust emissions. Loading time and mixing of the treatment solution would not take longer than 30 minutes.

Therefore, for manufacture of treated articles:

Table 22: ES 4 – Worker exposure during use of general products

Task	Concentration of NaDCC	No of workers	Time spent per worker per task	No of tasks per 8 hour shift	Daily exposure period per worker
Emptying drums	100% NaDCC	1	5 min	6	30 min
Mixing solutions	6 – 25% solution	1	10 min	6	60 min

9.4.2 Exposure estimation

Workers exposed to formulation with 6 - 25% NaDCC
No. of workers exposed = 1 or 2
Total exposure time per 8 hr work shift = 1.5 hr
Production taking place all year round (300 days).

9.4.2.1 Risk management measures

Workers will not wear respiratory protective equipment as standard. The use of a half-face respirator with chlorine cartridges (EN140) is required during opening of drums and filling of containers. An IOEL of 1.5 mg/m^3 chlorine is applicable.

The substance is corrosive so risk mitigation measures, i.e. wearing PPE consisting of gloves, coverall and safety glasses, whilst handling the raw material during opening of drums and filling of containers, where exposure may be possible, would apply.

It is expected that engineering controls, i.e. ventilation, are in place in areas where opening of drums and filling of containers occurs.

9.4.2.2 Waste related measures

Air
NaDCC and NaDCC dihydrate are of low volatility. During use of the substance dust and chlorinated fumes can be generated. Engineering controls are in place to mitigate this exposure. Dusts are filtered from extracted air and disposed of as chemical waste for incineration.

The test substance will only hydrolyse to the degradants cyanuric acid and hypochlorous acid when added to aqueous solutions. Cyanuric acid is of low volatility and is unlikely to be vented to air. Hypochlorous acid exists in aqueous solutions and undergoes rapid degradation upon contact with organic matter. If HOCl is released from the formulation process into vented air it will rapidly react to form chloride ions which are ubiquitous in nature.

Water
The substance is totally hydrolysed during use to HOCl and CYA. There will be no release of the substance to waste water. Waste is neutralised and diluted to comply with release limits for chlorine and chloride. In the UK the non-statutory environmental quality standards for release to waste water are:
Chloride: 250000 µg/L (AA)
Chlorine: 2 µg/L (TAC)(AA)
5 µg/L (TAC)(MAC)
TAC = Total Available Chlorine
MAC = Maximum Allowable Concentration
AA = Annual Average

9.4.3 Exposure estimation

Industrial Worker

9.4.3.1 Tier 1

Exposure estimations were performed using the Ecetoc TRAworker tool (July 09). The input values are as follows:

NaDCC Molecular weight:	220
NaDCC Inhalation DNEL:	8.11 mg/m^3
NaDCC Dermal DNEL:	2.30 mg/kg bw/d
Fugacity:	low
Protective equipment:	No protective equipment used.

All PROC codes were run with and without the use of ventilation.

However, the guidance on information requirements and chemical safety assessment, part D, page 41 states: For dermal exposure the tool should be used assuming no local exhaust ventilation (LEV), as it has been found that the tool underestimates the dermal exposure when the presence of local exhaust ventilation is assumed. Use of the LEV function in the tool assumes the same protection factor for dermal exposure as would be achieved by application of the default factor of 90% protection for use of gloves.

Table 23: ES 4 - Worker exposure estimations - Output from EcetocTRAworkerJuly09

Process Category	Activity Type	Indoors or Outdoors use?	Ventilation present?	Presumed efficiency %	Maximum duration (hours)	Respiratory protection used?	Presumed efficiency %	Substance is in a Preparation?	Dermal exposures may arise from this Exposure Scenario, assuming a maximal exposed skin area (cm2)	Inhalative Exposure Estimate (ppm)	Inhalative Exposure Estimate (mg/m3)	Dermal Exposure Estimate (mg/kg bw/day)
8a -Transfer of chemicals from/to vessels/ large containers at non dedicated facilities	Industrial	Indoors	No		>4 hours (default)	No		No	960	0.054545455	0.5	13.7143
8a -Transfer of chemicals from/to vessels/ large containers at non dedicated facilities	Industrial	Indoors	Yes	90	>4 hours (default)	No		No	960	0.005454546	0.05	0.1371
8b -Transfer of chemicals from/to vessels/ large containers at dedicated facilities	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.010909091	0.1	6.8571
8b -Transfer of chemicals from/to vessels/ large containers at dedicated facilities	Industrial	Indoors	Yes	95	>4 hours (default)	No		No	480	0.000545455	0.005	0.6857
9 -Transfer of chemicals into small containers (dedicated filling line)	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.010909091	0.1	6.8571

Process Category	Activity Type	Indoors or Outdoors use?	Ventilation present?	Presumed efficiency %	Maximum duration (hours)	Respiratory protection used?	Presumed efficiency %	Substance is in a Preparation?	Dermal exposures may arise from this Exposure Scenario, assuming a maximal exposed skin area (cm2)	Inhalative Exposure Estimate (ppm)	Inhalative Exposure Estimate (mg/m3)	Dermal Exposure Estimate (mg/kg bw/day)
9 -Transfer of chemicals into small containers (dedicated filling line)	Industrial	Indoors	Yes	90	>4 hours (default)	No		No	480	0.001090909	0.01	0.6857
10 - Roller application or brushing	Industrial	Indoors	No		>4 hours (default)	No		Yes at 5 – 25% w/w	960	6	55	27.4286
10 - Roller application or brushing	Industrial	Indoors	Yes	90	>4 hours (default)	No		Yes at 5 – 25% w/w	960	0.6	5.5	1.3714
10 - Roller application or brushing	Industrial	Indoors	Yes	90	>4 hours (default)	Yes	90%	Yes at 5 – 25% w/w	960	0.06	0.55	1.3714
13 -Treatment of articles by dipping and pouring	Industrial	Indoors	No		>4 hours (default)	No		Yes at 5 – 25% w/w	480	6	55	13.7143
13 -Treatment of articles by dipping and pouring	Industrial	Indoors	Yes	90	>4 hours (default)	No		Yes at 5 – 25% w/w	480	0.6	5.5	0.6857

Table 24: ES 4 - Summary of highest exposure concentrations to workers – Tier 1

Routes of exposure	Concentrations	Justification
Dermal local exposure (in mg/cm^2)	-	The test material is corrosive, risk mitigation measures should be in place to prevent exposure.
Dermal systemic exposure (in mg/kg bw/d)	27.42	PROC 10: Roller application or brushing – highest dermal exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.
Dermal systemic exposure (in mg/kg bw/d)	13.71	PROC 8a: Transfer of chemicals from/to vessels/ large containers at non dedicated facilities and PROC 7: Treatment of articles by dipping or pouring – highest dermal exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.
Inhalation exposure (in mg/m^3)	55	PROC 10: Roller application or brushing – highest inhalation exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.
Inhalation exposure (in mg/m^3)	0.5	PROC 8a: Transfer of chemicals from/to vessels/ large containers at non dedicated facilities – highest inhalation exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.

9.4.3.2 Tier 2

Inhalation
Engineering processes such as Local Exhaust Ventilation (LEV) will be in use in areas where application of the product takes place. Use of LEV gives a protection factor of 90%.

Dermal
The test material is corrosive and risk mitigation measures are applied to prevent exposure. Handling of the raw material should be performed with the use of chemical resistant gloves (CEFIC RMM library CW29.01). For normal use a nitrile glove should be sufficient protection for water based formulations. A default protection factor of 90% is applicable for nitrile gloves.

Workers will not be exposed to the substance from application of the aqueous solution. Exposure from formulation would be the primary exposure. The exposure values from Ecetoc for PROC 8a are used to derive the worst case worker exposure to the substance.

Table 25: ES 4 - Summary of exposure concentrations from treatment of articles

Routes of exposure	Concentrations	Justification
Dermal local exposure (in mg/cm^2)	-	The test material is corrosive, risk mitigation measures should be in place to prevent exposure.
Dermal systemic exposure (in mg/kg bw/d)	1.371	PROC 8a: Transfer of chemicals from/to vessels/ large containers at non dedicated facilities – highest dermal exposure value derived by Ecetoc TRAworker tool with Protection Factor of 90% with gloves.
Inhalation exposure (in mg/m^3)	0.02	PROC 8a: Transfer of chemicals from/to vessels/ large containers at non dedicated facilities – highest inhalation exposure value derived by Ecetoc TRAworker tool with Protection Factor of 90% with LEV and RPF 4 for the half-mask respirator.

Professional
Professional workers will be exposed in the same manner to the substance as industry workers for this use. Exposure times are likely to be shorter and to lower volumes. Therefore industry workers are considered as a worst case in this scenario.

9.4.3.3 Environmental releases

The substance hydrolyses to cyanuric acid and HOCl in aqueous solution. HOCl will react with organic matter and other molecules to give chloride ions. Chloride is ubiquitous and is not of concern for release to the environment. All chlorinated isocyanurates hydrolyse to leave cyanuric acid to be released to the environment. As there is no release of the substance to the environment from this use no exposure scenario will be performed.

9.5 ES 5 Industrial manufacture of articles (SU 3; PC 15,23; PROC 5,8a,9,10,13; AC 5; ERC 2)

9.5.1 Exposure scenario

9.5.1.1 Description of activities and processes covered in the exposure scenario

Workers will be exposed to the substance during formulation of the aqueous solutions which are then applied to the articles. It is expected that the worker would be exposed to NaDCC when adding it to the process mixture. In the solution and on application to the article the substance will have converted fully to HOCl and to cyanuric acid. Workers will not be exposed to HOCl via contact with the treated article.

Loading tanks
Worker exposure will only occur when adding the NaDCC to the tanks to make the aqueous solution which will be applied to the article. A worker adding products would normally wear PPE/RPE consisting of gloves, coverall and safety glasses. In addition, local exhaust ventilation and air filtration systems are used to minimize inhalation exposure and prevent dust emissions. Loading time and mixing of the treatment solution would not take longer than 30 minutes. The product can be either rolled or brushed on to the article or the article dipped into the product. Dipping processes will be automated. Brushing and rolling can be automatic or manual.

Therefore, for manufacture of treated articles:

Table 26: ES 5 – Worker exposure during treatment of articles

Task	Concentration of NaDCC	No of workers	Time spent per worker per task	No of tasks per 8 hour shift	Daily exposure period per worker
Emptying drums	100% NaDCC	1	5 min	6	30 min
Mixing solutions	6 – 25% solution	1	10 min	6	60 min

Workers exposed to formulation with 6 - 25% NaDCC
No. of workers exposed = 1 or 2
Total exposure time per 8 hr work shift = 1.5 hr
Production taking place all year round (300 days).

9.5.1.2 Risk management measures

Workers will not wear respiratory protective equipment as standard. The use of a half-face respirator with chlorine cartridges (EN140) is required during opening of drums and filling of containers. An IOEL of 1.5 mg/m3 chlorine is applicable.

The substance is corrosive so risk mitigation measures, i.e. wearing PPE consisting of gloves, coverall and safety glasses, whilst handling the raw material during opening of drums and filling of containers, where exposure may be possible, would apply.

It is expected that engineering controls, i.e. ventilation, are in place in areas where opening of drums and filling of containers occurs.

While some adhesives use organic solvents in combination with the chlorinated isocyanurates, this will not be the case for the substance (NaDCC or NaDCC dihydrate) since the substance is not soluble in organic solvents. The substance will only be used in aqueous solution.

9.5.1.3 Waste related measures

Air
NaDCC and NaDCC dihydrate are of low volatility. During use of the substance dust and chlorinated fumes can be generated. Engineering controls are in place to mitigate this exposure. Dusts are filtered from extracted air and disposed of as chemical waste for incineration

The test substance will only hydrolyse to the degradants cyanuric acid and hypochlorous acid when added to aqueous solutions. Cyanuric acid is of low volatility and is unlikely to be vented to air. Hypochlorous acid exists in aqueous solutions and undergoes rapid degradation upon contact with organic matter. If HOCl is released from the formulation process into vented air it will rapidly react to form chloride ions which are ubiquitous in nature.

Water
The substance is totally hydrolysed during use to HOCl and CYA. There will be no release of the substance to waste water. Waste is neutralised and diluted to comply with release limits for chlorine and chloride. In the UK the non-statutory environmental quality standards for release to waste water are:
Chloride: 250000 µg/L (AA)
Chlorine: 2 µg/L (TAC)(AA)
5 µg/L (TAC)(MAC)
TAC = Total Available Chlorine
MAC = Maximum Allowable Concentration
AA = Annual Average

9.5.2 Exposure estimation

Industrial Worker

9.5.2.1 Tier 1

Exposure estimations were performed using the Ecetoc TRAworker tool (July 09). The input values are as follows:

NaDCC Molecular weight:	220
NaDCC Inhalation DNEL:	8.11 mg/m^3
NaDCC Dermal DNEL:	2.30 mg/kg bw/d
Fugacity:	low
Protective equipment:	No protective equipment used.

All PROC codes were run with and without the use of ventilation.

However, the guidance on information requirements and chemical safety assessment, part D, page 41 states: For dermal exposure the tool should be used assuming no local exhaust ventilation (LEV), as it has been found that the tool underestimates the dermal exposure when the presence of local exhaust ventilation is assumed. Use of the LEV function in the tool assumes the same protection factor for dermal exposure as would be achieved by application of the default factor of 90% protection for use of gloves.

Table 27: ES 5 - Worker exposure estimations - Output from EcetocTRAworkerJuly09

Process Category	Activity Type	Indoors or Outdoors use?	Ventilation present?	Presumed efficiency %	Maximum duration (hours)	Respiratory protection used?	Presumed efficiency %	Substance is in a Preparation?	Dermal exposures may arise from this Exposure Scenario, assuming a maximal exposed skin area (cm2)	Inhalative Exposure Estimate (ppm)	Inhalative Exposure Estimate (mg/m3)	Dermal Exposure Estimate (mg/kg bw/day)
8a -Transfer of chemicals from/to vessels/ large containers at non dedicated facilities	Industrial	Indoors	No		>4 hours (default)	No		No	960	0.054545455	0.5	13.7143
8a -Transfer of chemicals from/to vessels/ large containers at non dedicated facilities	Industrial	Indoors	Yes	90	>4 hours (default)	No		No	960	0.005454546	0.05	0.1371
8b -Transfer of chemicals from/to vessels/ large containers at dedicated facilities	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.010909091	0.1	6.8571
8b -Transfer of chemicals from/to vessels/ large containers at dedicated facilities	Industrial	Indoors	Yes	95	>4 hours (default)	No		No	480	0.000545455	0.005	0.6857
9 -Transfer of chemicals into small containers (dedicated filling line)	Industrial	Indoors	No		>4 hours (default)	No		No	480	0.010909091	0.1	6.8571

Process Category	Activity Type	Indoors or Outdoors use?	Ventilation present?	Presumed efficiency %	Maximum duration (hours)	Respiratory protection used?	Presumed efficiency %	Substance is in a Preparation?	Dermal exposures may arise from this Exposure Scenario, assuming a maximal exposed skin area (cm2)	Inhalative Exposure Estimate (ppm)	Inhalative Exposure Estimate (mg/m3)	Dermal Exposure Estimate (mg/kg bw/day)
9 -Transfer of chemicals into small containers (dedicated filling line)	Industrial	Indoors	Yes	90	>4 hours (default)	No		No	480	0.001090909	0.01	0.6857
10 - Roller application or brushing	Industrial	Indoors	No		>4 hours (default)	No		Yes at 5 – 25% w/w	960	6	55	27.4286
10 - Roller application or brushing	Industrial	Indoors	Yes	90	>4 hours (default)	No		Yes at 5 – 25% w/w	960	0.6	5.5	1.3714
10 - Roller application or brushing	Industrial	Indoors	Yes	90	>4 hours (default)	Yes	90%	Yes at 5 – 25% w/w	960	0.06	0.55	1.3714
13 -Treatment of articles by dipping and pouring	Industrial	Indoors	No		>4 hours (default)	No		Yes at 5 – 25% w/w	480	6	55	13.7143
13 -Treatment of articles by dipping and pouring	Industrial	Indoors	Yes	90	>4 hours (default)	No		Yes at 5 – 25% w/w	480	0.6	5.5	0.6857

Table 28: ES 5 - Summary of highest exposure concentrations to workers – Tier 1

Routes of exposure	Concentrations	Justification
Dermal local exposure (in mg/cm^2)	-	The test material is corrosive, risk mitigation measures should be in place to prevent exposure.
Dermal systemic exposure (in mg/kg bw/d)	27.42	PROC 10: Roller application or brushing – highest dermal exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.
Dermal systemic exposure (in mg/kg bw/d)	13.71	PROC 8a: Transfer of chemicals from/to vessels/ large containers at non dedicated facilities and PROC 7: Treatment of articles by dipping or pouring – highest dermal exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.
Inhalation exposure (in mg/m^3)	55	PROC 10: Roller application or brushing – highest inhalation exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.
Inhalation exposure (in mg/m^3)	0.5	PROC 8a: Transfer of chemicals from/to vessels/ large containers at non dedicated facilities – highest inhalation exposure value derived by Ecetoc TRAworker tool when no risk mitigation measures are applied.

9.5.2.2 Tier 2

Inhalation

Engineering processes such as Local Exhaust Ventilation (LEV) will be in use in areas where brushing or rolling takes place. Use of LEV gives a protection factor of 90%.

Dermal
The test material is corrosive and risk mitigation measures are applied to prevent exposure. Handling of the raw material should be performed with the use of chemical resistant gloves (CEFIC RMM library CW29.01). For normal use a nitrile glove should be sufficient protection for water based formulations. A default protection factor of 90% is applicable for nitrile gloves.

Workers will not be exposed to the substance from application of the aqueous solution. Exposure from formulation would be the primary exposure. The exposure values from Ecetoc for PROC 8a are used to derive the worst case worker exposure to the substance.

Table 29: ES 5 - Summary of exposure concentrations from treatment of articles

Routes of exposure	Concentrations	Justification
Dermal local exposure (in mg/cm^2)	-	The test material is corrosive, risk mitigation measures should be in place to prevent exposure.
Dermal systemic exposure (in mg/kg bw/d)	1.371	PROC 8a: Transfer of chemicals from/to vessels/ large containers at non dedicated facilities – highest dermal exposure value derived by Ecetoc TRAworker tool with Protection Factor of 90% with gloves.
Inhalation exposure (in mg/m^3)	0.02	PROC 8a: Transfer of chemicals from/to vessels/ large containers at non dedicated facilities – highest inhalation exposure value derived by Ecetoc TRAworker tool with Protection Factor of 90% with LEV and RPF 4 for the half-mask respirator.

9.5.2.3 Environmental releases

The substance hydrolyses to cyanuric acid and HOCl in aqueous solution. HOCl will react with organic matter and other

molecules to give chloride ions. Chloride is ubiquitous and is not of concern for release to the environment. All chlorinated isocyanurates hydrolyse to leave cyanuric acid to be released to the environment. As there is no release of the substance to the environment from this use no exposure scenario will be performed.

9.5.2.3.1 Exposure concentration relevant for the food chain (Secondary poisoning)

The substance hydrolyses rapidly in use to release halogen moieties in the form of HOCl and CYA. There is no potential for bioaccumulation of NaDCC.

NaDCC has Log Pow < 1, rapidly hydrolyses to CYA, and is highly soluble in water. In addition, the chlorinated isocyanurates are highly reactive with many biological compounds such as proteins and enzymes and are therefore unlikely to bioaccumulate. A calculation of BCF using EPIWIN v3.2 software indicates that NaDCC has a BCF = 1.932 (Bland S (2007)).

CYA is also unlikely to bioaccumulate, based on its low Log Pow (-1.31). A calculation of BCF using EPIWIN v3.2 software indicates that CYA has a BCF = 3.165 (Bland S (2007)).

9.6 ES 6 Biocidal use (SU 3, 5, 21,22; PC 8, 35)

9.6.1 Exposure scenario

The substance is an existing active substance undergoing evaluation for Annex I inclusion under 98/8/EC The Biocidal Products Directive for use in the following Product Types and is regarded as registered for these uses:
PT 2 Private area and public health area disinfectants and other biocidal products
PT 3 Veterinary hygiene biocidal products
PT 4 Food and feed area disinfectants
PT 5 Drinking water disinfectants
PT 11 Preservatives for liquid-cooling and processing systems
PT 12 Slimicides.

9.7 Regional exposure concentrations

The substance is not stable in the environment so there are no regional concentrations of the substance. The substance hydrolyses to cyanuric acid and HOCl in aqueous solution. HOCl will react with organic matter and other molecules to give chloride ions. Chloride is ubiquitous and is not of concern for release to the environment. All chlorinated isocyanurates hydrolyse to leave cyanuric acid to be released to the environment. Cyanuric acid occurs naturally and is not a concern for the environment.

10 Risk characterisation

10.1 ES 1: Formulation (SU 10; PC 1,20,21,23,34,35 PROC 1,2,3,4,5,8a,9,14,15; ERC 2)

10.1.1 Human health

10.1.1.1 Workers

Table 30: ES 1 - Risk characterisation for workers

	Route	ES 1- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Long-term - systemic effects	Dermal	1.371 mg/kg bw/d	2.30 mg/kg bw/d	0.596
	Inhalation	0.145 mg/m^3	8.11 mg/m^3	0.018
	Combined routes			0.61

10.1.1.2 Consumers

There is no consumer exposure for this exposure scenario.

10.1.1.3 Indirect exposure of humans via the environment

There will be no indirect exposure to humans via the environment from this exposure scenario.

10.1.2 Environment

There is no environmental release of the substance. The substance hydrolyses to HOCl and cyanuric acid.

10.2 ES 2: Textile treatment (SU 5,22; PC 23,34; PROC 8a,9,10,13; ERC 5,6b,8b)

10.2.1 Human health

10.2.1.1 Workers

Table 31: ES 2 - Risk characterisation for workers

	Route	ES2- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio[2]
Long-term - systemic effects	Dermal	0.42897 mg/kg bw/d	2.30 mg/kg bw/d	0.187
	Inhalation	0.145 mg/m^3	8.11 mg/m^3	0.1695
	Combined routes			0.356

Table 32: ES 2 - Risk characterisation for Professionals

	Route	ES 2- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Long-term - systemic effects	Dermal: small load	0.96 mg/kg bw/d	2.30 mg/kg bw/d	0.417
	Dermal: large load	0.3 mg/kg bw/d	2.30 mg/kg bw/d	0.13
	Inhalation	0.145 mg/m^3	8.11 mg/m^3	0.018
	Combined routes			0.435

10.2.1.2 Non-Professionals

Table 33: ES 2 - Risk characterisation for Non-Professionals

	Route	ES 2- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Long-term - systemic effects	Dermal	0.6 mg/kg bw/d	1.15 mg/kg bw/d	0.52
	Inhalation	0.145 mg/m^3	1.99 mg/m^3	0.07
	Combined routes			0.59

10.2.1.3 Indirect exposure of humans via the environment

There will be no indirect exposure to humans via the environment from this exposure scenario.

10.2.2 Environment

There is no environmental release of the substance. The substance hydrolyses to HOCl and cyanuric acid during use.

[2] *Equal to the ratio of the relevant EC (reported in column 3) to the relevant D(M)NEL (reported in column 5)*

10.3 ES 3: Use of cleaning products (SU 21,22; PC 35; PROC 8a,9,10,13; ERC 8b,8e)

10.3.1 Human health

10.3.1.1 Workers

There is no industrial worker exposure for this exposure scenario.

Table 34: ES 3 - Risk characterisation for professionals

	Route	ES 2- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Long-term - systemic effects	Dermal	0.18571 mg/kg bw/d	2.30 mg/kg bw/d	0.08
	Inhalation	0.145 mg/m^3	8.11 mg/m^3	0.018
	Combined routes			0.098

10.3.1.2 Consumers

Table 35: ES 3 - Risk characterisation for Non-Professionals

	Route	ES 2- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Long-term - systemic effects	Dermal	0.03511 mg/kg bw/d	1.15 mg/kg bw/d	0.031
	Inhalation	0.145 mg/m^3	1.99 mg/m^3	0.07
	Combined routes			0.101

10.1.3 Indirect exposure of humans via the environment

There will be no indirect exposure to humans via the environment from this exposure scenario.

10.3.2 Environment

There is no environmental release of the substance. The substance hydrolyses to HOCl and cyanuric acid during use.

10.4 ES 4: Use of General products (surface treatment and adhesives) (SU 21,22; PC 1,9a,9b,20 PROC 8a,9,10,13; ERC 5,8b,8e)

10.4.1 Human health

10.4.1.1 Workers

Table 36: ES 4 - Risk characterisation for industrial and professional workers

	Route	ES2- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Long-term - systemic effects	Dermal	1.371 mg/kg bw/d	2.30 mg/kg bw/d	0.6
	Inhalation	0.02 mg/m^3	8.11 mg/m^3	0.0025
	Combined routes			0.6

10.4.1.2 Consumers

There will be no exposure to consumers from this use. The substance hydrolyses during use to form cyanuric acid and HOCl.

10.4.1.3 Indirect exposure of humans via the environment

There will be no indirect exposure to humans via the environment from this exposure scenario.

10.4.2 Environment

There is no environmental release of the substance. The substance hydrolyses to HOCl and cyanuric acid.

10.5 ES 5: Industrial manufacture of articles (SU 3; PC 15,23; PROC 5,8a,9,10,13; AC 5; ERC 2)

10.5.1 Human health

10.5.1.1 Workers

Table 37: ES 5 - Risk characterisation for workers

	Route	ES2- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Long-term - systemic effects	Dermal	1.371 mg/kg bw/d	2.30 mg/kg bw/d	0.6
	Inhalation	0.02 mg/m^3	8.11 mg/m^3	0.0025
	Combined routes			0.6

10.5.1.2 Consumers

There will be no exposure to consumers from this use. The substance hydrolyses during use to form cyanuric acid and HOCl.

10.5.1.3 Indirect exposure of humans via the environment

There will be no indirect exposure to humans via the environment from this exposure scenario.

10.5.2 Environment

There is no environmental release of the substance. The substance hydrolyses to HOCl and cyanuric acid during use.