Competent Authority Report

2,2-Dibromo-2-cyanoacetamide

(DBNPA)

Assessment report

Summary of the Active Substance

From Specialty Electronic Materials Switzerland GmbH for use in PT4

Rapporteur Member State: Denmark
August 2019

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STATEMENT OF SUBJECT MATTER AND PURPOSE

This assessment report has been established as a result of the evaluation of the active substance 2,2-Dibromo-2-cyanoacetamide (DBNPA) in product-type 4 (Disinfectants for surfaces which come into contact with foodstuffs and animal fodder), carried out in the context of Regulation (EU) No 528/2012, with a view to the possible approval of this substance.

On July 25th, 2007 the eCA DK competent authorities received a dossier from the applicant. The Evaluating Competent Authority accepted the dossier as complete for the purpose of the evaluation on February 1st, 2008.

On December 27th, 2016, the Evaluating Competent Authority submitted to ECHA a copy of the assessment report containing the conclusions of the evaluation, hereafter referred to as the competent authority report (CAR). Before submitting the CAR to ECHA, the applicant was given the opportunity to provide written comments in line with Article 8(1) of Regulation (EU) No 528/2012. On June 12th, 2017 an updated report was submitted to ECHA. The assessment for endocrine disruption properties of DBNPA followed on 11th November 2018.

In order to review the CAR and the comments received on it, consultations of technical experts from all Member States (peer review) were organised by ECHA. Revisions agreed upon were presented at the Biocidal Products Committee and its Working Groups meetings and the competent authority report (CAR) was amended accordingly.

The aim of the assessment report is to support the opinion of the Biocidal Products Committee and a decision on the approval of DBNPA for product-type 4 and, should it be approved, to facilitate the authorisation of individual biocidal products. In the evaluation of applications for product authorisation, the provisions of Regulation (EU) No 528/2012 shall be applied, in particular the provisions of Chapter IV, as well as the common principles laid down in Annex VI.

For the implementation of the common principles of Annex VI, the content and conclusions of the assessment report, which is available from the web-site of ECHA shall be taken into account.

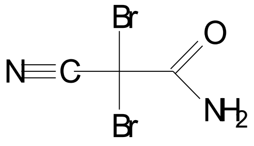
However, where conclusions of this assessment report are based on data protected under the provisions of Regulation (EU) No 528/2012, such conclusions may not be used to the benefit of another applicant, unless access to these data for that purpose has been granted to that applicant.

ASSESSMENT REPORT

Summary

1 PRESENTATION OF THE ACTIVE SUBSTANCE

1.1 IDENTITY OF THE ACTIVE SUBSTANCE

Main constituent(s)	
ISO name	2,2-Dibromo-2-cyanoacetamide (DBNPA)
IUPAC or EC name	2,2-Dibromo-2-cyanoacetamide
EC number	233-539-7
CAS number	10222-01-2
Index number in Annex VI of CLP	-
Minimum purity / content	≥ 980 g/kg
Structural formula	

Relevant impurities and additives		
IUPAC name or chemical name or EC name	**Maximum concentration in % (w/w)**	**Index number in Annex VI of CLP**
Dibromoacetonitrile (DBAN) CAS no. 3252-43-5	0.14	-

1.2 INTENDED USES AND EFFECTIVENESS

Use of the active substance

<table>
<tr><td>Product type</td><td>PT4</td></tr>
<tr><td>Intended use pattern(s)</td><td><table><tr><th>Product type</th><th>Use</th><th>Likely concentrations at which the A.S. will be used</th></tr></table></td></tr>
</table>

<table>
<tr><td></td><td><table><tr><td>PT 4</td><td>Food vessels / machinery disinfection</td><td>4000 ppm with 60 min contact time or 15000 ppm with 5 min contact time</td></tr></table>DBNPA is used for disinfection of food vessels and machinery. The recommended dosage is up to 4000 ppm with 60 min contact time.
Food processing vessels are treated once a day or after each batch of food. The vessels must be first thoroughly washed and rinsed (to remove food residues). The DBNPA solution is then pumped into the vessel and left for up to 60 minutes.
<i>In bottles washing lines, the bottles are washed and rinsed prior to being disinfected and rinsed again. The bottles are treated continuously along a conveying belt in automated tunnels. The disinfection step lasts up to 60 minutes.</i></td></tr>
<tr><td>Users</td><td>Only for professional use.</td></tr>
</table>

Effectiveness of the active substance

Function	DBNPA is used as a bactericide for disinfection of food vessels and machinery.
Organisms to be controlled	The active substance DBNPA is effective against bacteria.
Limitation of efficacy including resistance	It is demonstrated that DBNPA exhibits bactericidal activity in conditions with low organic load. The likely concentration at which DBNPA is efficient as a surface bactericide is 4000 ppm for uses with disinfection steps lasting 60 minutes. For product authorisation, further studies are needed on bacteria for in-use concentration and conditions in order to demonstrate bactericidal efficacy. No cases of the development of resistance has been reported. The development of resistance is unlikely, as DBNPA is a fast acting biocide and hydrolyses rapidly. Therefore, microbes are not exposed over a longer time period to DBNPA to allow the development of resistance. Microbes will not come in contact with DBNPA in a natural environment. DBNPA has multiple reaction sites on the surfaces of microorganisms. As a result, organisms have great difficulty in developing an effective resistance mechanism because multiple reactions and reaction sites are involved.
Mode of action	DBNPA acts via bromine which inactivates enzymes by converting functional –SH groups to the oxidised S-S form. DBNPA is a fast acting biocide and is exerting its biocidal action directly after its application. DBNPA has a multi-site effect.

	The easy reaction of DBNPA with sulfur-containing nucleophiles common to micro-organisms such as glutathione or cysteine, is the basis of its mode of antimicrobial action. DBNPA reacts through its bromine chemistry, i.e. via bromine which inactivates thiol-based (R-SH) amino-acids and enzymes by converting their functional –SH groups to the oxidised S-S form and forming disulfide bridges: This reaction irreversibly disrupts the function of cell-surface components, interrupting transport across cell membranes, and inhibiting key biological functions.

1.3 CLASSIFICATION AND LABELLING

1.3.1 Classification and labelling for the active substance

Hazard class/ property	**Proposed classification**
Physical hazards	
Explosives	-
Flammable gases	-
Flammable aerosols	-
Oxidising gases	-
Gases under pressure	-
Flammable liquids	-
Flammable solids	-
Self-reactive substances	-
Pyrophoric liquids	-
Pyrophoric solids	-
Self-heating substances and mixtures	-
Substances which in contact with water emit flammable gases	-
Oxidising liquids	-
Oxidising solids	-
Organic peroxides	-

Hazard class/ property	**Proposed classification**
Corrosive to metals	-
Human health hazards	
Acute toxicity via oral route	Acute Tox. 3, H301
Acute toxicity via dermal route	-
Acute toxicity via inhalation route	Acute Tox 2, H330
Skin corrosion/irritation	Skin Irrit. 2, H315
Serious eye damage/eye irritation	Eye Dam. 1, H318
Respiratory sensitisation	-
Skin sensitisation	Skin Sens. 1, H317
Germ cell mutagenicity	-
Carcinogenicity	-
Reproductive toxicity	-
Specific target organ toxicity-single exposure	-
Specific target organ toxicity-repeated exposure	STOT RE 1, H372 (respiratory tract)(inhalation)
Aspiration hazard	-
Environmental hazards	
Hazardous to the aquatic environment	Aquatic Acute 1; H400, Aquatic Chronic 1; H410
Hazardous to the ozone layer	-

Current Classification and Labelling according to Regulation (EC) No 1272/2008:

Classification		**Labelling**					
Hazard Class and Category	**Hazard statements**	**Pictograms**	**Signal word**	**Hazard statements**	**Suppl. Hazard statements**	**Precautionary statements**	**SCLs and M-factors**
No current classification according to Regulation (EC) No 1272/2008.							

Proposed Classification and Labelling according to Regulation (EC) No 1272/2008:

Classification		**Labelling**					
Hazard Class and Category	**Hazard statements**	**Pictograms**	**Signal word**	**Hazard statements**	**Suppl. Hazard statements**	**Precautionary statements**	**SCLs and M-factors**
Acute Tox. 3 Acute Tox 2 Skin Irrit. 2 Eye Dam. 1 Skin Sens. 1 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H301 H330 H315 H318 H317 H372 (respiratory tract)(inhalation) H400 H410	GHS05, GHS06, GHS08, GHS09	Danger	H301 H330 H315 H318 H317 H372(respiratory tract)(inhalation) H410	-	-	M = 1 (acute)

1.3.2 *Classification and labelling for the representative product(s)*

Proposed Classification and Labelling according to Regulation (EC) No 1272/2008:

The biocidal product addressed in this dossier is the same as the technical active substance as manufactured. Therefore, the same classification is proposed as for the active substance itself, please refer to section 1.3.1 above.

Packaging of the biocidal product:

Type of packaging	**Size/volume of the packaging**	**Material of the packaging**	**Type and material of closure(s)**	**Intended user (e.g. professional, non-professional)**	**Compatibility of the product with the proposed packaging materials (Yes/No)**
IBC drums	-	HDPE	-	Industrial	Yes

2 SUMMARY OF THE HUMAN HEALTH RISK ASSESSMENT

Summary of the assessment of effects on human health

Endpoint	Brief description
Toxicokinetics	In a metabolism study in rats using DBNPA, no evidence for bioaccumulation was found as could be expected based on the hydrophilic properties of DBNPA. After oral administration DBNPA is rapidly and efficiently absorbed and excreted. The vast majority is excreted within one day (>85% of radioactivity administered), almost exclusively in the urine. This means that DBNPA is almost completely bioavailable. DBNPA is considered to be equally distributed over the blood circulation to all tissues and organs. Two metabolic pathways are present: The debromination and subsequent desamination of DBNPA lead to cyanoacetamide and cyanoacetic acid, whereas desamination and decarboxylation of the amide function result in oxalic acid. Malonic acid, dibromoacetonitrile (DBAN) and dibromoacetamide (DBAA) were not found in rat urine although the study authors suggested the formation of these molecules. No studies have been conducted on dermal absorption and default values according to the EFSA guidance is used.
Acute toxicity	DBNPA was shown to be toxic upon ingestion with the LD50 in the range of 167-224 mg/kg bw (males and females) resulting in a classification as Acute toxic 3, H301. When DBNPA was administered via the dermal route, no deaths and also no systemic toxicity were observed at the limit dose of 2000 mg/kg bw. The LD50 was greater than 2000 mg/kg bw. No classification and labelling for acute dermal toxicity is required based on the result of the study. The administration of DBNPA by inhalation with respirable particles resulted in an LC50 of 0.31 and 0.24 mg/L for males and females, respectively (0.275 mg/L combined). All animals, except the low dose females, showed distinct signs of systemic toxicity, thus a classification and labelling with Acute toxic 2, H330 is proposed.
Corrosion and irritation	The compound was irritating to the skin and corrosive to the eyes of rabbits and DBNPA thus requires classification as Skin irritant cat 2, H315 and as able to produce severe Eye damage cat 1, H318.
Sensitisation	DBNPA showed potential for skin sensitisation (Buehler test) and thus requires classification as Skin sensitisation cat 1, H317.
Repeated dose toxicity	Problems with dyspnoea appeared in a short-term gavage study in rats. Oral short-term administration in dogs revealed an increase in aspartate aminotransferase (AST) in males and females given 0.15% DBNPA. However, the slight increase in AST value was not considered adverse because the value was only slightly above the historical control. There was no histopathologic correlate to the higher AST values and no elevated AST values was observed in 90-day study in dog. One male dog in the high dose group has gross observations consisting of mucus and hemorrhage in the lumen of the colon. The same animal had histopathologic findings of very slight multifocal erosions on the tips of

	the villi of the jejunum, and multifocal slight hemorrhage at the sites of villous erosions. When DBNPA was administered to dogs in a 90 day-study, the relative and absolute thyroid weight was increased in the mid and high dose males and females (10.7-18.3 mg/kg bw/d). Minor effects in thyroids were seen as very slight increase of colloid in dogs administered 10.7-18.3 mg/kg bw/d. When administered to rats via drinking water for 90-days DBNPA increased the body weight of female rats with 7-8% in the 100 ppm pH 8 group (15.9 mg/kg bw/day). These effects were however not considered treatment related. In the 90-day feeding study, a severe weight loss was observed. However, females in the 100 mg dose group showed significantly increased weight from day 37 and onwards. Weight gain means were 14-24% increased over controls. These effects were however not dose-response related. The increased weight was, at least in part, due to a corresponding increased feed intake. In the dermal 90-day study in rats no signs of systemic toxicity were observed. The only treatment related effects were local, dermal effects consistent with irritation.
Genotoxicity	No indication for mutagenic potential was found in vitro or in vivo.
Carcinogenicity	No treatment-related increase in neoplasms was observed in either male or female rats at any dose level in the chronic/carcinogenicity study, indicating that DBNPA did not have an oncogenic potential. Based on treatment-related hyperplasia of the thyroid follicular cells in males given 20 or 150 mg/kg/day, the no-observed-effect level (NOEL) for males was 3 mg/kg/day (actual dose of 1.431 mg/kg/day). Females given 150 mg/kg/day had treatment-related lower body weights and feed consumption, and histopathologic thyroid and liver effects.
Reproductive toxicity	In the rabbit developmental study DBNPA produced minor skeletal effects in foetuses. The foetal effects are not considered treatment related as no dose-response relationship is found for the effects. The effects are furthermore seen at maternally toxic doses. A developmental toxicity study in rats showed no malformations in pubs and no statistical significant variations. . In the two-generation rat reproductive study, no toxicity to reproduction was found.
Neurotoxicity	In the one year chronic neurotoxicity study that was conducted as part of the two-year chronic toxicity/oncogenicity study a significant decrease in male body weights and a slight decrease in hindlimb grip performance in males and females of the high-dose group was observed. The chronic dietary no-observed-effect level (NOEL) for DBNPA neurotoxicity in F344/DuCrl rats was 20 mg/kg/day (actual dose of approximately 9.6 mg/kg/day).
Immunotoxicity	No tests have been conducted on this endpoint, which is considered acceptable.
Disruption of the endocrine system	When DBNPA was administered to dogs in a 90 day-study, the relative and absolute thyroid weight was increased in the mid- and high-dose males and females (10.7-18.3 mg/kg bw/d). When DBNPA was administered to rats in a 2 years study, treatment-related hyperplasia of the thyroid follicular cells in males dosed 20 or 150 mg/kg/day and females dosed 150 mg/kg/day was seen. An assessment of the

	endocrine disrupting properties was conducted according to the scientific criteria set out in Regulation (EU) 2017/2100. The observed thyroid mediated adverse effects suggested generation of new information as none of the dossier studies measuredendocrine activity of the thyroid gland. Bromide was suggested to be the cause of the adverse effects as bromide is a wellknown inhibitor of iodide uptake in the thyroid gland via the sodium/iodide symporter, and DBNPA debrominates as part of its metabolic pathway. A systematic literature search was conducted on bromide's effects on the thyroid, and it was confirmed, that findings seen for DBNPA in the dossier studies are also seen in the published literature on bromide's effects on the thyroid in the rat, guppy and medaka. Further, a link between the hyperplasia in the thyroid and a decrease in thyroid hormone serum levels was found in the rat. Human relevance could not be disregarded due to lack of studies conducted on sensitive subpopulations, i.e. there was no studies on pre- and postnatal exposure to bromide in humans. A study on bromide in rats showed that effects on thyroid hormone levels seen in rat dams was enhanced in their pups in a dose-dependent manner. Subsequently, a biologically plausible link between the adverse effects seen on the thyroid and the endocrine activity of bromide was established. Based on the same assessment of the thyroid disrupting properties ffects on non-target populations could not be disregarded. Effects were seen interspecies (medaka, guppy, rat) and no studies displayed evidence that the effects not relevant on population level. with biological plausibility and an AOP (AOPwiki 176) that shows that the mode of action is relevant for amphibian metamorphosis. Consequently, DBNPA fulfils criterion (d) of Article 5(1) for human health and criterion (e) of Article 10(1) for the environment.
Other effects	-

Reference values

	Study	**NOAEL**	**Overall assessment factor**	**Value**
$AEL_{short\text{-}term}$	Subacute 28d dog study	3.5 mg/kg bw/day	25	0.14 mg/kg bw/day
$AEL_{medium\text{-}term}$	Subchronic 90 d dog study	5.9 mg/kg bw/day	100	0.059 mg/kg bw/day
$AEL_{long\text{-}term}$	Chronic 2 year rat toxicity/carcinogenicity study	1.4 mg/kg bw/day	100	0.014 mg/kg bw/day
ADI	Chronic 2 year rat toxicity/carcinogenicity study	1.4 mg/kg bw/day	100	0.014 mg/kg bw/day

ARfD	Subacute 28d dog study	3.5 mg/kg bw/day	25	0.14 mg/kg bw/day

Risk characterisation

Summary table: scenarios			
Scenario number	**Scenario** (e.g. mixing/ loading)	**Primary or secondary exposure Brief description of scenario**	**Exposed group** (e.g. professionals, non-professionals, bystanders)
1.	Loading	Disinfection of food vessels by automatic transfer of disinfection product to closed vessels	Industrial
2.	Consumption	Secondary exposure of the general public by residues on disinfected food vessels, e.g. bottles.	General public

Conclusion of risk characterisation for industrial user

Scenario, Tier, PPE	**Relevant reference value**	**Estimated uptake** mg/kg bw/d	**Estimated uptake/reference value** (%)	**Acceptable** (yes/no)
[1] Tier 1/no PPE	AELmedium term = 0.059 mg/kg bw/day	0.0229	39 %	Yes

Local exposure

DBNPA technical is proposed to be classified as Skin Sens. 1; H317, Skin Irrit. 2; H315, Eye Dam. 1; H318. Due to the local effects of DBNPA technical a qualitative assessment is performed. The product is only intended for industrial use, where it is expected that workers wear the required PPE/RPE. Dermal exposure of workers to DBNPA is limited by required PPE including chemically resistant gloves and clothing as well as respiratory protection. Additionally, the likelihood of exposure to DBNPA or its final in-use solution is considered negligible given the nature of the mixing and application tasks for food vessels.

Conclusion of risk characterisation for secondary exposure

The general public can be exposed to DBNPA via drinking water from bottles which have been disinfected with a solution of DBNPA.

Scenario, Tier	**Relevant reference value**	**Estimated uptake** mg/kg bw/d	**Estimated uptake/reference value** (%)	**Acceptable** (yes/no)
[2] Tier–1 - adult	ADI = 0.014 mg/kg bw/day	$2.59 * 10^{-4}$	1.8%	Yes
[2] Tier 1 – toddler	ADI = 0.014 mg/kg bw/day	$7.78 * 10^{-4}$	5.6%	Yes
[2] Tier–1 - infant	ADI = 0.014 mg/kg bw/day	$1.20 * 10^{-3}$	8.5%	Yes

3 CONCLUSION ON THE HUMAN HEALTH RISK ASSESSMENT

Industrial use
Systemic exposure
DBNPA is used for disinfection of food vessels/machinery disinfection by industrial users. During this use only exposure during automated mixing is relevant. When compared to the AEL, exposure of industrial users is 39%, which is considered acceptable even though PPE is not worn. However, it is always recommended that appropriate PPE such as gloves and coveralls is worn by the industrial users.

Local exposure

DBNPA technical is proposed to be classified as Skin Sens. 1; H317, Skin Irrit. 2; H315, Eye Dam. 1; H318. Due to the local effects of DBNPA technical a qualitative assessment is performed. The product is only intended for industrial use, where it is expected that workers wear the required PPE/RPE. Dermal exposure of workers to DBNPA is limited by required PPE including chemically resistant gloves and clothing as well as respiratory protection. Additionally, the likelihood of exposure to DBNPA or its final in-use solution is considered negligible given the nature of the mixing and application tasks for food vessels.

A qualitative assessment of local exposure has been performed. Please see the relevant section above for full details. No unacceptable risk for local exposure has been identified.

Indirect exposure as a result of use
The secondary exposure via food may be relevant. As a worst case exposure to residues from disinfected bottles are assessed.

When compared to the ADI, exposure is 8.6%, 5.6% and 1.8% for infants, toddlers and adults, respectively. Though the scenario has not been developed to assess the levels of residues from food vessels, i.e. bottles, the parameters used is considered sufficiently conservative to present a worst case assessment of the exposure of residues.

In relation to endocrine disruption properties (ED) of DBNPA no lower exposure threshold can be identified. The rinsing of DBNPA treated bottles does not exclude the presence of DBNPA residues in the bottles after rinsing, as the exposure is still 8.6, 5.6% and 1.8% for infants, toddlers and adults. A risk related to the ED properties of DBNPA can therefore not be excluded.
In the absence of guidance, no assessment of disinfectant-by-products (DBP) has been performed. More data and a refined assessment are necessary at product authorisation stage.

4 SUMMARY OF THE ENVIRONMENTAL RISK ASSESSMENT

Fate and behaviour in the environment

Summary table on compartments exposed and assessed		
Compartment	**Exposed (Y/N)**	**Assessed (Y/N)**
STP	Y	Y
Surface water/sediment	Y	Y
Soil	Y	Y
Groundwater	Y	Y
Air	Y	Y

Summary table on relevant metabolites		
Metabolite/transformation- or reaction product	**Compartment**	**% Active Substance**
Cyanoacetamide (CAM)	Sewer system, STP, Surface water, sediment, soil and ground water	100% worst case

Summary table on relevant physico-chemical and fate and behaviour parameter of the active substance			
	Value	**Unit**	**Remarks**
Molecular weight	241.9	g/mol	
Log Octanol/water partition coefficient	0.8 (pH 5) 0.8 (pH 7) 0.82 (pH 9)	Log 10	At 20 – 21° C
Solubility in water (g/l)	10.8 (pH5)	g/l	at 10°C
	14.4 (pH5)		at 20°C
	20.2 (pH5)		at 30°C
	11.5 (pH7)		at 10°C
	14.1 (pH7)		at 20°C
	18.6 (pH7)		at 30°C
	19.9 (pH9)		at 20°C

Summary table on relevant physico-chemical and fate and behaviour parameter of the active substance			
	Value	**Unit**	**Remarks**
Organic carbon/water partition coefficient (Koc)	27.3	l/kg	QSAR
Henry's Law Constant (20 °C)	1.99 x 10^{-5} 2.04 x 10^{-5} 1.45 x 10^{-5}	Pa/m3/mol	pH 5 pH 7 pH 9
Photolytic / photo-oxidative degradation of active substance and resulting relevant metabolites			Due to lack of UV absorbance in the sunlight region DBNPA is not degradable by direct photodegradation in water; however there are some indications that indirect photolysis can take place.
Biodegradability			
Readily biodegradable	NO		
Inherent biodegradable	YES		Based on aerobic biodegradation simulation test (STP simulation). DT_{50} for primary degradation is 10 minutes at 20° C and 15 minutes when recalculated to 15 °C
DT_{50} for biodegradation in surface water	5.7 hr	hr (at 12°C)	
DT_{50} for hydrolysis in surface water	12079 hr pH4 183 hr pH 7 5.6 hr pH 9	hr (at 12°C /pH)	
DT_{50} for photolysis in surface water	Stable	d or hr	
DT_{50} for degradation in soil	20.9	h (at 12°C)	
DT_{50} for degradation in air	8.022 d	d	Photo-oxidation in air
DT_{50} for degradation in sediment		d or hr	

Effects assessment

Summary table on calculated PNEC values for DBNPA	
Compartment	**PNEC**
Surface water	*0.006 mg/l*
Sediment	*0.0082 mg/kg$_{wwt}$*
STP	*0.046 mg/l*
Soil	*0.05046 mg /kg$_{wwt}$*

All metabolites have a comparable or a reduced environmental hazard compared to DBNPA and therefore the Risk Assessment (RA) for DBNPA also covers the metabolites. For PT 4 DBNPA rapidly degrades via the nucleophilic degradation route to CAM and a RA for CAM has therefore been made for completeness.

Summary table on calculated PNEC values for CAM	
Compartment	**PNEC**
Surface water	*0.2 mg/l*
Sediment	*0.185 mg/kg$_{wwt}$*
STP	*<< 0.046 mg/l*
Soil	*0.046 mg/kg$_{wwt}$*

Exposure assessment for DBNPA

Summary table on calculated PEC values								
	PEC$_{STP}$	**PEC$_{water}$**	**PEC$_{sed}$**	**PEC$_{seawater}$**	**PEC$_{seased}$**	**PEC$_{soil}$**	**PEC$_{GW}$^{1}**	**PEC$_{air}$**
	[mg/l]	[mg/l]	[mg/kg$_{wwt}$]	[mg/l]	[mg/kg$_{wwt}$]	[mg/kg$_{wwt}$]	[µg/l]	[mg/m^{3}]
Scenario 1 Entire plant								
4000 ppm. DT$_{50\ soil}$ = 20.9h Food vessels: Bottle washing:	0.00159 0.0111	0.000159 0.00111	0.0002 0.00153			1.25E-05 8.68E-05	3.45E-03 2.4E-02	4.08E-13 2.86E-12
Scenario 2. Consumption based								
4000 ppm. DT$_{50\ soil}$ = 20.9h	0.0111	0.001	0.00153			8.68E-05	2.4E-02	2.86E-12
4000 ppm. DT$_{50\ soil}$ = 300 d.	0.0111	0.0011	0.00153			2.37E-03	2.8	2.86E-12

Exposure assessment for CAM. Scenario 2 representing the worst case situation.

Summary table on calculated PEC values								
	PEC$_{STP}$	**PEC$_{water}$**	**PEC$_{sed}$**	**PEC$_{seawater}$**	**PEC$_{seased}$**	**PEC$_{soil}$**	**PEC$_{GW}$^{1}**	**PEC$_{air}$**
	[mg/l]	[mg/l]	[mg/kg$_{wwt}$]	[mg/l]	[mg/kg$_{wwt}$]	[mg/kg$_{wwt}$]	[µg/l]	[mg/m^3]
Scenario 2. Consumption based								
Tier 1[1]: Based on 100% transformation of DBNPA to CAM in the influent of the STP (0.448 kg DBNPA/d = 0.156 kg CAM/d) Rate constant in STP = 0.1 DT$_{50\ soil}$ = 30 d	0.046	0.0046	0.0043			1.38E-04	1.69E-01	9.12E-11
Tier 2[2]: Based on 100% transformation of DBNPA to CAM (4 kg DBNPA/d = 1.394 kg CAM) released to the facility drain Rate constant in STP = 0.1 DT$_{50\ soil}$ = 30 d	0.412	0.0412	0.038			1.23E-03	1.1	8.15E-10
Tier 3: Based on 100% transformation of DBNPA to CAM in the influent of the	0.046	0.0046	0.0043			1.92E-04	4.8E-01	9.12E-11

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[1] *Based on WOE a DT50 in soil for CAM can be assumed to be around 30 days according to the eCA (based on QSAR and data from the open literature). However, after further discussion within an ad hoc group following WG-I-2018 it was decided to consider CAM as inherently biodegradable (using a k-rate of 0.1h^{-1} in STP and DT$_{50}$ value of 300 days for soil by default).*

[2] *Based on WOE a DT50 in soil for CAM can be assumed to be around 30 days according to the eCA (based on QSAR and data from the open literature). However, after further discussion within an ad hoc group following WG-I-2018 it was decided to consider CAM as inherently biodegradable (using a k-rate of 0.1h^{-1} in STP and DT$_{50}$ value of 300 days for soil by default).*

STP (0.448 kg DBNPA/d = 0.156 kg CAM/d) Rate constant in STP = 0.1 $DT_{50\ soil}$ = 300 d								
Tier 4[3]: Based on 100% transformation of DBNPA to CAM (4 kg DBNPA/d = 1.394 kg CAM) released to the facility drain Rate constant in STP = 0.1 $DT_{50\ soil}$ = 300 d	0.412	0.0412	0.038			1.71E-03	4.29	8.15E-10

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[3] *At WG ENV I 18 it was recommended that degradation in the facility drain should be taken into consideration for PT 4, based on the defaults and equations given in the ESD for PT 5. This was already applied for other active substances (e.g. hydrogen peroxide and peracetic acid). It was concluded to use Tier 3 for the environmental risk assessment and that Tier 4 overestimates the risk.*

Risk characterization for DBNPA

Summary table on calculated PEC/PNEC values

	PEC/PNEC	**PEC/PNEC**	**PEC/PNEC**	**PEC/PNEC**	**PEC/PNEC**	**PEC/PNEC**
	STP	Water	Sediment	Seawater	Seasediment	soil
Scenario 1 Entire plant						
4000 ppm. $DT_{50\ soil}$ = 20.9h Food vessels: Bottle washing:	0.043 0.239	0.03 0.167	0.03 0.19			0.002 0.002
Scenario 2. Consumption based						
4000 ppm. $DT_{50\ soil}$ = 20.9h	0.239	0.167	0.19			0.002
4000 ppm. $DT_{50\ soil}$ = 300 d.	0.239	0.167	0.19			0.05

Risk characterization for CAM. Scenario 2 representing the worst case situation.

Summary table on calculated PEC values						
	PEC/PNEC	**PEC/PNEC**	**PEC/PNEC**	**PEC/PNEC**	**PEC/PNEC**	**PEC/PNEC**
	STP	Water	Sediment	Seawater	Seasediment	Soil
Scenario 2. Consumption based						
Tier 1: Based on 100% transformation of DBNPA to CAM in the influent of the STP (0.448 kg DBNPA/d = 0.156 kg CAM/d) Rate constant in STP = 0.1 $DT_{50\ soil}$ = 30 d	> 1	0.023	0.023			0.003
Tier 2: Based on 100% transformation of DBNPA to CAM (4 kg DBNPA/d = 1.394 kg CAM) released to the facility drain Rate constant in STP = 0.1 $DT_{50\ soil}$ = 30 d	> 1	0.206	0.205			0.027
Tier 3: Based on 100% transformation of DBNPA to CAM in the influent of the STP (0.448 kg DBNPA/d = 0.156 kg CAM/d) Rate constant in STP = 0.1 $DT_{50\ soil}$ = 300 d	> 1	0.023	0.023			0.004
Tier 4: Based on 100% transformation of DBNPA to CAM (4 kg DBNPA/d =	> 1	0.206	0.205			0.037

1.394 kg CAM) released to the facility drain Rate constant in STP = 0.1 $DT_{50\ soil}$ = 300 d						

5 CONCLUSION ON THE ENVIRONMENTAL RISK ASSESSMENT

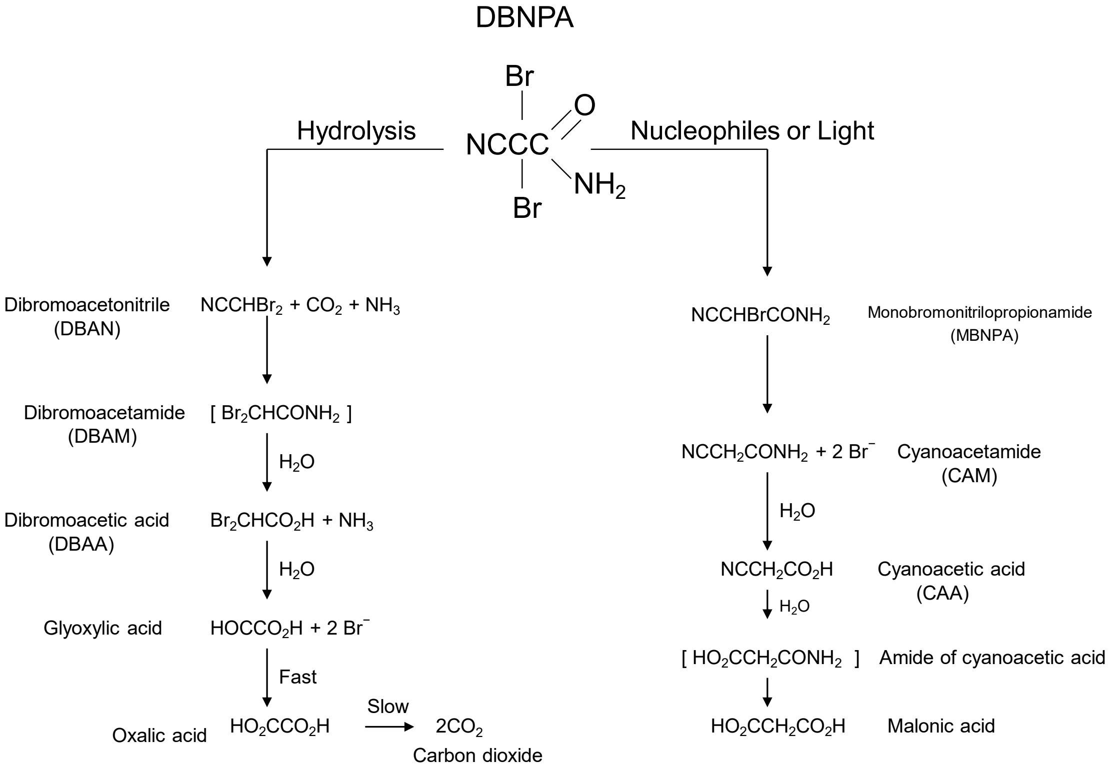
Fate and distribution in the environment:

Degradation in the environment:

According to its chemical properties, DBNPA can be degraded via two pathways:

Pathway 1 (Hydrolysis): DBNPA, DBAN, DBAM, DBAA, Glyoxylic acid, Oxalic acid, Carbon dioxide

Pathway 2 (Nucleophilic Reaction): DBNPA, MBNPA, CAM, CAA, Malonic acid



Pathway 1 (left side) is the hydrolysis pathway and pathway 2 (right side) becomes relevant when DBNPA comes in contact with sulphur containing reducing species ("nucleophiles"), light or organic material (e.g., proteins, bacteria, humus/fulvic acids, etc.) which possess nucleophilic functional groups. It is the pathway 2 (right site) which is relevant in PT 4.

Biodegradation:

Based on the results of the two ready biodegradability tests of DBNPA according to OECD guideline 301B it has to be concluded that DBNPA is not readily biodegradable even though a rapid degradation of DBNPA is observed in biodegradation studies in activated sludge, water and sediment.

The results of the activated sludge die away test show a fast biodegradability of DBNPA under a real life situation. DBNPA sems to degrade immediately as no DBNPA was found at the first sample collection at 1 minute; however, 26.4% oft he radioactivity was in the non-extrable fraction at time 0. Due to general measurement uncertainties and lack of informations of e.g. LOD and LOQ, a conservative assumption was made by RMS that the DT_{50} for primary degradation of DBNPA is 10 minutes at 20°C. DBNPA was transformed to an unknown metabolite. For the unknown metabolite of DBNPA, the DT_{50} was calculated to be 9.9 hours. Based on the retension time of 2.6 min (HPLC) it is expected that the metabolite will be similar to one of the smaller acides or amides (CAM = 3.15 and CAA = 3.10). The results of this test, i.e. the DT_{50} for primary degradation of DBNPA (19 min at 12°C and 15 min at 15°C), are used in the environmental risk assessment as disappearance rate for DBNPA in the STP.
QSAR and results from the literatuere used as a in a weight of evidence approach indicate that CAM is readily biodegradable; however as a realistic worse case CAM is considered as inherent in the STP.

Dibromoacetic acid (DBAA) is a metabolite of DBNPA of the abiotic hydrolytic degradation in the absence of organic material and sulphur containing reducing species. It was concluded that Dibromoacetic acid can be considered as exhibiting inherent biodegradability
DBAN, also a metabolite oft he abiotic hydrolytic degradation is readily biodegradable, but failing 10-d window (according to Guidance for BPC: Volume IV).

Abiotic degradation:

Considering the hydrolytic stability of DBNPA determined under environmental pH and temperature conditions, it is expected that hydrolytic processes may contribute to the degradation of DBNPA in the environment in some cases; however not in PT4 where the nucleophile pathway is most relevant. The following Half-Lives for DBNPA can be used in a Risk Assessment.

For DBNPA:

At pH 4: 578 hours at 50 °C, recalculated to 12 °C 12079 hours.

At pH 7: 65 hours at 25 °C, recalculated to 12 °C 183 hours.

At pH 9: 5.2 hours at 13 °C, recalculated to 12 °C 5.6 hours.

Due to lack of UV absorbance in the sunlight region DBNPA is not degradable by direct photodegradation in water; however there are some indications that indirect photolysis can take place. However, photolysis of DBNPA may be only relevant for direct discharges to surface water, but such discharges do not occur in PT4. DBNPA is not disposed of directly to water as the effluents are either sent to a sewage treatment plant or deactivated. There is therefore no direct emission to surface water. Furthermore, the DBNPA is not persistent to other degradation processes (e.g. biodegradation and hydrolysis) which indicates that the rate of indirect aqueous photolysis is of minor importance in the fate process for this substance.

Photodegradation in air

Half-life of 8.022 days (24 hour day, 5 x 10^5 OH radicals/cm^2. It should be noted that a DT_{50} of 2 days is a widely accepted trigger for long-range transport potential. However, considering the fact that DBNPA is only slightly volatile for both its pure form (vapour pressure = 1.19 x 10^{-3} Pa at 19.2 °C), and from aqueous solution (estimated Henry's Law Constant = 2.04 x 10^{-5} Pa m^3 mol^{-1}at pH 7 and 20 °C) a significant exposure to air by the use of DBNPA does not seem likely.

Degradation of DBNPA in surface water

A DT_{50} value of 2 hours for the degradation of DBNPA in surface waters at 25°C corresponding to 5.7 hours at 12°C will be used in the Risk Assessment.

Fate and behaviour in soil

A $DT_{50\ soil}$ of 4 - 25 hours (primary degradation) at pH 4.8 - 7.5 and at room temperature. A DT_{50} of 11 hours is calculated (geometric mean, n = 7) at 20°C, corresponding to 20.9 hours at 12°C. A DT_{50soil} value of 20.9 hours at 12°C will be use fort he RA. In addition the default value (for inherent) of a DT_{50} = 300 days will be used.

Volatilisation from water.

The Henry's law constant of DBNPA, calculated on the basis of the vapour pressure and the water solubility, is 2.04 x 10^{-5} Pa m^3 mol^{-1}at pH 7 and 20ºC. Hence, volatilisation of DBNPA from surface waters is expected to be negligible.

Adsorption onto/desorption from soils.

The mean adsorption coefficient was calculated as $K_{ads\ oc\ F}$ = 236.9 L/kg based on an adsorption /desorption screening test. Although using the experimentally determined K_{oc} rather than QSAR estimated value is preferable, it should be taken into account that this value does not correspond to DBNPA alone but also to the sum of its degradation products. No specific analytical determination of DBNPA was carried in the assay, but the concentration was determined via scintillation counting and combustion, therefore does not allow differentiating between DBNPA and any degradation products formed. Accordingly, it has been chosen to use the QSAR K_{oc} of 27.3 L/kg for the PNEC calculation using the equilibrium partitioning method.

Accumulation.

There is no risk of bioaccumulation of DBNPA in aquatic organisms as indicated by the log P_{OW} of 0.8, which is below the trigger value of 3, and supported by the results of the bioconcentration study in fish.

Effect Assessment:

$PNEC_{aquatic}$

The toxicity of DBNPA to aquatic organisms is well-documented by acute and long-term studies. NOECs are presented in the following which are used for the derivation of $PNEC_{aquatic}$. Long-term toxicity NOECs for DBNPA are available for three species (fish, *Daphnia* and algae) representing three trophic levels:

- Fish (*Rainbow trout, Salmo gairdneri*) NOEC (85 d) = 0.47 mg DBNPA/L
- Aquatic invertebrate (*Daphnia magna*) NOEC (21 d) = 0.06 mg DBNPA/L
- Algae (*Scenedesmus subspicatus*) NOEC (72 h) = 0.36 mg DBNPA/L.

The lowest NOEC value (*Daphnia magna*) of 0.06 mg DBNPA/L is considered for the PNEC calculation; an assessment factor of 10 is applied since long-term NOECs are available from all three trophic levels:

$PNEC_{aquatic}$ = 0.06 mg DBNPA/L / 10

= 0.006 mg DBNPA/L

= 6 µg DBNPA/L

The **$PNEC_{aquatic}$** was calculated to be **6 µg DBNPA/L**.

$PNEC_{sediment}$

There is no tests available with sediment-dwelling organisms. Therefore, the $PNEC_{sediment}$ was calculated for freshwater sediment on the basis of the $PNEC_{aquatic}$, using the equilibrium partitioning method:

By using the given values in the formula '$PNEC_{sediment} = (K_{susp\text{-}water}/RHO_{susp}) \times PNEC_{aquatic} \times 1000$', a **$PNEC_{sediment}$** of 0.0082 mg/kg wwt **= 8.2 µg/kg wwt (37.72 µg/kg dwt)** was calculated for DBNPA.

$PNEC_{STP}$

There is one activated sludge respiration inhibition test available for PNEC calculation. An EC_{50} of microorganisms of 4.6 mg DBNPA/L is determined by the test, an assessment factor of 100 was applied to calculate the $PNEC_{STP}$.

$PNEC_{STP}$ = 4.6 mg DBNPA/L /100
= 0.046 mg DBNPA/L
= 46 µg DBNPA/L

The **$PNEC_{STP}$** was calculated to be **46 µg DBNPA/L**.

$PNEC_{soil}$

For the effect assessment of the soil, compartment tests are available for two trophic levels (earthworms and plants):

- Earthworms (*Eisenia fetida*):

LC_{50} (14 days) = 216 mg DBNPA/kg soil (dry weight).

- Terrestrial plants (*Lactuca sativa*):

EC_{50} (21 days) = 57.02 mg DBNPA/kg soil (dry weight).

The lowest result was obtained in the study with plants. A $PNEC_{soil}$ was calculated on basis of the EC_{50} from the study with plants using an assessment factor of 1000.

PNEC$_{soil}$ (initial value) = 57.02 mg DBNPA/kg dry weight soil/1000

= 0.05702 mg DBNPA/kg dry weight soil

= 57.02 µg DBNPA/kg dry weight soil

The **PNEC$_{soil}$ value for DBNPA of 50.46 µg/kg wet weight soil** is calculated taking into account a conversion factor for soil concentration wet-dry weight soil of 1.13.

PNEC values for degradation products

The hazard characterisation of several metabolites is presented below. DBNPA rapidly degrades via the nucleophilic degradation route to CAM and subsequently CAA. Robust QSAR predictions as well as the eco-toxicty testing support that CAM has a significant lower toxicity to aquatic species compared to DBNPA. CAA is a subsequent product of degradation with a low molecular weight, a high polarity, thus is predicted to have an even lover toxicity to aquatic species. QSAR prediction with the neutral organic- acids support that CAA acute effects are greater than 1000 mg/L.

The weight of evidence of the hazard data available supports that metabolites have a reduced environmental hazard compared to DBNPA.

The following table provides an overview on the available aquatic eco-toxicity studies on relevant degradation products:

Degradation product	Relevant Degradation Pathway	Method of determination	LC50 Fish (mg/L)	EC50 Aq. Invertebrate (mg/L)	E_rC50 Algae (mg/L)
2,2-Dibromo-3-nitrilopropionamide (DBNPA)	-	QSAR (ECOSAR Haloanitriles)	1.57	0.81	0.08
		Experimental	3.4 (RI = 1) 2.3 (RI = 3) 2.3 (RI = 3) 1,8 (RI = 3)	0.72 (RI = 1)* 0.17 (RI = 3)* 0.6 (RI = 3)	2.3 (RI = 2) E_bC50 = 0.28 (RI = 3)
Dibromoacetonitrile (DBAN)	1	QSAR (ECOSAR Halonitriles)	**1.58**	-	**0.07** [a]
		Experimental	0.55 (RI = 3)	0.2 (RI = 2)	0.167 (RI = 3)
Dibromoacetamide (DBAM)	1	QSAR (ECOSAR Haloacetamides)	**75**	**113**	**1.3**[b]
		Experimental	69 (RI = 3)	-	-
Dibromoacetic acid (DBAA)	1	QSAR (ECOSAR Halo Acids)	2,820	-	0.05
		Experimental	1,000 – 1,800 (proposed RI =3)	> 100 (RI = 1)	48 (RI = 2)
Monobromonitrilopropion-amide (MBNPA)	2	QSAR (ECOSAR Haloanitriles)	**1.74**	**0.77**	**0.07**[a]
		Experimental	3.4 (RI = 3)	-	-
Cyanoacetamide (CAM)	2	QSAR (ECOSAR Amides) (Toolbox)	**1510** **3003** **1000**	**12752** **19100**	**50.8** **1350** **200**

		DK QSAR Database [d]			
		Experimental	1,800 (RI = 3)	12,000 (RI = 3)	-
Dibromomalonamide (DBMAL)	1	QSAR (ECOSAR Haloacetamides)	62.6	101	0.9
		Experimental	51.46 (RI = 1)	20.8 (RI = 1)	10.4 (RI = 1)

*marine species. Bold QSAR values are accompanied by full QMRF and QPRF reports.
Note:
a. QSAR prediction for 96 hr algae growth inhibition for substance class Halonitriles is based on one substance, which is DBNPA. These predictions are therefore considered as low reliability.
b. QSAR prediction for 96 hr algae growth inhibition for substance class Haloacetamides includes only herbicides from the class of the chloroacetanilides. Beyond the differences in structures, theses substance have specific mode of action on alga, which is not expected for DBAM, DBAA, and DBMAL. These predictions are therefore considered as low reliability.
c. Please note that experimental studies with a RI = 3 are only regarded as supplementary information and no study summaries has been provided.
d. Please note that only the lowest value (rounded value) which are within the domain is indicated.

CAM:

DBNPA biodegrades rapidly via the nucleophilic pathway to CAM. The acute toxicity was assessed in laboratory and QSAR studies. The experimental data was evalutated as invalid. QSAR predictions with the QSAR tool box,ECOSAR and the Danish QSAR Database support the low toxicity of CAM to fish, invertebrate and algae. Acute aquatic toxicity studies/QSAR estimations clearly shows that CAM has a significantly lower toxicity to aquatic organisms, compared to DBNPA. As CAM poses a significantly lower hazard to aquatic organisms than the active substance it is not considered as an ecotoxicologically relevant metabolite; however for the risk assessment a LC50 value of 1000 mg/L is used for fish; a EC50 value of 13000 mg/L for invertebrate and a EC50 value of 200 mg/L for algae.

The **PNEC$_{aquatic}$** was calculated to be **0.2 mg CAM/L**.

PNEC $_{sediment}$ = 0.185 mg/kg wwt (based on equilibrium portioning).

PNEC $_{soil}$ = 0.0463 mg/kg wwt (based on equilibrium portioning)

Exposure Assessment:

The following environmental exposure of DBNPA is attributed to PT4:

<u>Food vessels / machinery disinfection</u>

The mixing and loading process takes place in completely closed systems by utilising vacuum suction techniques. Thus, the environmental exposure during mixing and loading is considered to be negligible compared to the actual application of DBNPA.
The main emission of DBNPA occurs during application. The emission estimations for the use of DBNPA in PT4 has been decided at WGI 2017 (EFF). The EFF WG agreed that a concentration of 4000 ppm (and 60 min contact time) should be used for HH and ENV risk assessment.

Scenario 1: Tonnage based scenario: ESD for PT 4: Assessment of entire plants.
Based on amount of DBNPA (4000 ppm) as agreed by the EFF WG.

Scenario 2: Consumption based scenario: Food processing vessels or bottle washing
Based on amount of DBNPA (4000 ppm) as agreed by the EFF WG.

It could be shown that DBNPA decomposes rapidly in contact with nucleophilic substances or in the presence of high contents of organic substance. The half-life of DBNPA in sewage was estimated to 10 minutes (at 20°C, recalculated to 19 minutes at 12°C). However, as the DBNPA solution is replaced on a weekly basis in the food processing scenario and in the bottle washing scenario it is replaced daily, it may seem inappropriate to use degradation while in-use in these scenarios, as a DT50 of 19 minutes would render the product unsuitable for this purpose. Furthermore, it is questionable if so fast degradation occurs during disinfection as system is thoroughly cleaned prior to disinfection. Fast degradation during application seems therefore unlikely. Therefore, the emission to the facility drain is 4 kg/d and this will be used as a worst case unless sufficient monitoring data is submitted.

As food processing and bottle washing are two distinct industries, hence the emissions should not be cumulated.

Scenario 1: Tonnage based scenario: ESD for PT 4- Assessment of the entire plant (IHO 2006)

Based on the amount of DBNPA (4000 ppm) supported by the efficacy data submitted.
For Food vessels:
The calculations were made using the ECHA spreadsheet for PT 4 and EUSES version 2.1. Emission values were taken from the model IHO 2006 (ESD Table 5).

Input parameters for calculating the local emission			
Input	**Value**	**Unit**	**Remarks**
Scenario: *Disinfection of entire plants*			
Concentration of active substance in the product		*200 000 mg/L*	
Amount of biocidal active substance used per year in the local plant	132	kg/yr	33 days for food vessels (based on one release per week, each 4 kg)
Number of emission days per year[1]	231	d/yr	Default
Fraction released to waste water[1]	1	-	Default
Capacity of on-site STP[1]	112.7	m^3/d	Default
Capacity of off-site STP[1]	2000	m^3/d	Default
Dilution factor in surface water (standard default according to the TGD)[1]	160	-	Default
Number of application per day	1	d^{-1}	

[1] IHO 2006

Based on the ECHA PT 4 spreadsheet.

Output from IHO 2006

Effluent concentration of active substance in the effluent of the on-site STP [3]	$C_{effluent}$ = $Clocal_{water}$	**0.0317**	mg.l^{-1}
Influent concentration of active substance in the off-site STP	$C_{influent}$	**0.286**	mg.l^{-1}

Using the calculations above the daily release to off-site STP is 0.572 kg/day.

For Bottle washing:

The calculations were made using the ECHA spreadsheet for PT 4 and EUSES version 2.1. Emission values were taken from the model IHO 2006 (ESD Table 5).

Input parameters for calculating the local emission			
Input	**Value**	**Unit**	**Remarks**
Scenario: *Disinfection of entire plants*			
Concentration of active substance in the product	200 000	*mg/L*	
Amount of biocidal active substance used per year in the local plant	924	kg/yr	231 d for bottle washing
Number of emission days per year[1]	231	d/yr	Default
Fraction released to waste water[1]	1	-	Default
Capacity of on-site STP[1]	112.7	m^3/d	Default
Capacity of off-site STP[1]	2000		Default
Dilution factor in surface water (standard default according to the TGD)[1]	160	-	Default
Number of application per day	1	d^{-1}	

[1] IHO 2006

Based on the ECHA PT 4 spreadsheet.

<u>Output from IHO 2006</u>

Effluent concentration of active substance in the effluent of the on-site STP [3]	$C_{effluent}$ = $Clocal_{water}$	**0.222**	$mg.l^{-1}$
Influent concentration of active substance in the off-site STP	$C_{influent}$	**2.0**	$mg.l^{-1}$

Using the calculations above the daily release to off-site STP is 4.0 kg/day.

Scenario 2: Consumption based scenario: Food processing vessels or bottle washing

In food processing vessels, the DBNPA solution (4000 ppm) is re-used and replaced on a weekly basis. A 1 m^3 tank with 4000 ppm requires 4 kg of DBNPA, which are poured to the drain on a weekly basis.
The water of the bottle cleaning line is recycled to some extent; part of it is discarded to the drain. Basically, there is a continuous purge and a continuous make-up stream. Some of the added biocide leaves the bottle washing unit together with the purge; it is directed to a waste water treatment plant together with the washing water where the impurities (surfactants, dirt, etc.) have to be removed.
The bottles disinfection washer is a small piece of equipment with ca. 1 m^3 of water; which is renewed on a daily basis

On the basis of the above described application scheme, the local emission to waste water was estimated as follows:

- Food vessel: the maximum amount of DBNPA that might reach the facility drain (once a week) is **4 kg** per day when the 1 m³ - DBNPA storage tank is emptied.
- Bottle rinsing: the maximum amount of DBNPA that might reach the facility drain (daily) from the disinfection washer is **4 kg per day**.

Determination of local release rates.

No degradation

The local daily emission to waste water when degradation in the application phase was not taken into account was estimated to be:

Scenario 1

0.572 kg/d for Food vessels and **4.0 kg/d** for Bottle washing.

Scenario 2:

On the basis of the above described application scheme, the local daily emission to waste water when degradation in the application phase was not taken into account was estimated to be: **4 kg/d.**

Degradation in the sewer system:

Most of the DBNPA entering the sewer system will react with the microbial biomass and nucleophiles present in the facility drain, thereby entering the "nucleophilic" degradation pathway.

It could be shown that DBNPA decomposes rapidly in contact with nucleophilic substances or in the presence of high contents of organic substance. The load of organic substances and other trace substances in raw sewage in the facility drain or in waste water collecting tanks is very high. Degradation of DBNPA in the raw sewage is likely to occur and was therefore considered in the emission estimation. The half-life of DBNPA in sewage was estimated to 10 minutes (at 25°C, recalculated to 19 minutes at 12°C).

A sewer residence time of 1 h, proposed as default value in the ESD for PT5, was used for the calculation. The value of 1 hour is based upon an average distance of 4.5 km from the point of release to the STP and an estimated flow rate of 1.5 km in 20 minutes in the municipal canal sewer system.

In case of an on-site STP, retention may be significantly shorter as the installation is located neighbouring the plant. However, as it is assumed that even in this case the waste water will after the on-site STP be released to a municipal STP. Therefore, the emission estimation is worst case.

The degradation of DBNPA in the sewer system was calculated, assuming first order kinetic, using the following equation:

Calculation:	**EMISSION to the WWTP**
$M_{t1} = M_{t0} * EXP^{(-k * t1)}$ M_{t1} = total amount of substance present at time 1 [kg] Scenario 1: M_{t0} = total amount of substance at time 0 [kg] (0.572) kg/d for Food vessels M_{t0} = total amount of substance at time 0 [kg] (4.0) kg/d for Bottle washing Scenario 2: M_{t0} = total amount of substance at time 0 [kg] (4) kg/d k = rate constant (k = 2.19 h^{-1}, calculated from the DT_{50} at 12°C: ln2/DT_{50}) t 1 = time [h] (= 1 h)	Scenario 1: Food vessels = 0.064 kg/d Bottle washing = 0.448 kg/d Scenario 2: 0.448 kg/d

The amount of DBNPA that is theoretically emitted to the STP after one hour residence time in the sewer system was calculated and these values were used as input parameters for the exposure assessment, i.e. for the calculation of the DBNPA influent concentration in the STP.

Overall summary of the emission estimation

In the following table, the local emission to the environment as calculated for PT4 is summarised.

Table 8.3 - 02: Overview on amount of DBNPA released per use (local emission)

Product Type	**Emission point**	**Elocal/Clocal**	**Elocal_{water} considering degradation in the facility drain**
PT4			
Food vessels / machinery disinfection	Active substance to the offsite STP		
Scenario 1:		0.572 kg/d* 4.0 kg/d**	**0.064 kg/d*** **0.448 kg/d****
Scenario 2:		4 kg/d***	**0.448 kg/d*** **

n.r. = not relevant; * = For Food vessels; **: For bottle washing; ***: both for Food vessels and bottle washing.

The environmental exposure assessment was conducted based on fate and distribution properties of the active substance, as determined in several laboratory studies. EUSES version 2.1.2 (European Union System for the Evaluation of Substances), which follows the calculation patterns described in the Guidance for BPR: Volume IV, were used to calculate the distribution in the environment and the predicted environmental concentrations (PECs) for sewage treatment plants, surface water, sediment, soil, groundwater and air.
STP: No risk was identified for STP.

The effluent of the STP are diluted in the surface water. According to the Guidance for BPR: Volume IV, complete mixing of the effluent in the surface water is assumed, whereas volatilisation, degradation and sedimentation are not considered in the local assessments, because of the short distance between the point of effluent discharge and the exposure location. The standard dilution factor of 10 (STP → surface water) was used for the PEC calculation. No risk was identified for surface water.

Freshwater sediment (PEC_{sw_sed}): The PEC in bulk sediment is derived from the corresponding water-body concentration, assuming a thermodynamic partition equilibrium, following the calculation as given in the TGD (Equation 50). No environmental risk was identified for freshwater sediment.

Soil might be exposed to DBNPA either by sewage sludge from the STP or by dry and wet depositions of DBNPA from the atmosphere.

- Sewage sludge: According to the Guidance for BPR: Volume IV, sewage sludge is assumed to be applied for 10 consecutive years. To exclude potential persistence, the percentage of the steady-state situation is calculated. For the ecosystem an average time of 30 days after sludge application is used for the PEC calculation.
  For the degradation of DBNPA in soil, a DT_{50} of 20.9 hours (at 12°C) as described in the study

of Exner et al. (1973) was used. The detailed descriptions and assumptions for the calculation of PECs resulting from sewage sludge application are summarised in the respective EUSES summary reports. In addition the default value of DT_{50} 300 days will be used for Scenario 2, as a worst case scenario. No risk was identified for soil even using the worst case scenario.

- Groundwater under agricultural soil (PEC_{gw})

  According to the Guidance for BPR: Volume IV, the DBNPA concentration in the pore water of agricultural soil (after application of sewage sludge to agricultural land) is taken as an indication of potential groundwater levels. This is a worst-case assumption, because degradation in soil, transformation and dilution in deeper soil layers are not taken into account. A risk for ground water was only identified under the worst case conditions (DT_{50} = 300 days). However, as a risk for ground water was identified based on the pore water concentrations the groundwater concentrations were calculated with FOCUSPEARL. Based on these calculations a safe use can be demonstrated (less than 0.0001 mg/L) for most of the FOCUS scenarios.

- Air: It is not considered necessary to include deposition from air in the exposure assessment as environmental exposure by deposition from air is negligible compared to direct application of sewage sludge, which contains DBNPA, to agricultural land.

The following environmental exposure of CAM is attributed to PT4:

Fate of CAM in the environment and resulting PEC

DBNPA degrades rapidly in the STP and the environment (see Doc IIA, chapter 4). In consideration of the proposed use, DBNPA is unlikely to be subject to hydrolysis prior to exposure to "nucleophiles", light or organic matter (DT_{50} hydrolysis (12°C) = 183 h; DT_{50} nucleophile is estimated to be less than 30 min (at 12° C)). The degradation to DBAN as opposed to CAM is unlikely. This conclusion is supported by the hydrolysis and degradation data which show DBAN is only a major degradation product when DBNPA is in contact with purified water The proposed use places DBNPA in direct contact with residual food and other organic matter. Therefore, the nucleophilic degradation pathway will predominate over the much slower hydrolysis pathway. The degradation products in the nucleophilic pathway are predicted to show less toxicity towards aquatic organisms as shown from the measured data and QSAR predictions.
Considering the rapid primary degradation of DBNPA, exposure to DBNPA is low, thus the exposure assessment was extended for sake of completeness to the metabolite CAM for scenario 2 illustrating the worst case situation.

As a worst case situation it is assumed that a 100% transformation of DBNPA (0.448 kg/d) in the influent of the STP to CAM. Degradation of CAM in the STP is assumed; based on that CAM is inherent biodegradable (Tier 1). An absolutely worst case situation is also described where it is assumed that a 100% transformation of DBNPA (4 kg/d) based on the emission to the facility drain to CAM. Degradation of CAM in the STP is assumed; based on that CAM is inherent biodegradable (Tier 2).

The following input parameters for CAM are used:

- Clocal influent concentration of DBNPA in the off-site STP
- Molecular weight DBNPA: 241 g/mole
- Molecular weight CAM:84 g/mole
- Equation CAM in influent (84/241 x Clocal influent concentration of DBNPA
- Dilution factor 10 (from STP to surface water)

- In an exposure assessment in soil, the DT_{50} is 30 days based on a weight of evidence approach; however, an evaluation is also made based on a DT_{50} value of 300 days (which is the default rate of degradation in soil for "inherent biodegradable" substances).

Product Type	**PEC_{STP} [mg/l]**
PT4	
Scenario 2:	
Tier 1: based on 100% transformation of DBNPA (0.448 DBNPA kg/d = 0.156 kg CAM/d) in the influent of the STP to CAM.	0.046
Tier 2: based on 100% transformation of DBNPA (4 kg DBNPA/d = 1.394 kg CAM) released to the facility drain	0.412

Resulting local emission to relevant aquatic environmental compartments	
Compartment	**PEC**
Scenario 2	Food or bottle
Surface water Tier 1	0.0046 mg/L
Surface water Tier 2	0.0412 mg/L
Sediment Tier 1	0.0043 mg/$_{kgwwt}$
Sediment Tier 2	0.038 mg/$_{kgwwt}$

Soil might be exposed to CAM either by sewage sludge from the STP or by dry and wet depositions of CAM from the atmosphere.

- Sewage sludge: According to the Guidance for BPR: Volume IV, sewage sludge is assumed to be applied for 10 consecutive years. To exclude potential persistence, the percentage of the steady-state situation is calculated. For the ecosystem an average time of 30 days after sludge application is used for the PEC calculation.

  For the degradation of CAM in soil, both a DT_{50} of 30 and 300 days has been used. The detailed descriptions and assumptions for the calculation of PECs resulting from sewage sludge application are summarised in the respective EUSES summary reports.

- Groundwater under agricultural soil (PEC_{gw})

  According to the Guidance for BPR: Volume IV, the CAM concentration in the pore water of agricultural soil (after application of sewage sludge to agricultural land) is taken as an indication of potential groundwater levels. This is a worst-case assumption, because, transformation and dilution in deeper soil layers are not taken into account.

  As a potential risk was found for groundwater (using pore water) a PEARL calculation for CAM for both arable land and grassland were performed using the parameter setting for Focus groundwater model (PEARL) described in ENV 20 and ENV 31 of TAB v.1.3. Based on the results from the PEARL calculation a safe use can be found for all the scenarios except for the absolute worst case situation using a DT_{50} value for soil of 300 days.

- Air: It is not considered necessary to include deposition from air in the exposure assessment as environmental exposure by deposition from air is negligible compared to direct application of sewage sludge, which contains CAM, to agricultural land.

Resulting PEC	
Compartment	**PEC for soil and groundwater (pore water)**
Scenario 2	
	Food or Bottle
Soil	mg/ kg_{wwt}
Tier 1*: Soil (based on 100% transformation of DBNPA to CAM in the influent of the STP (0.448 kg DBNPA/d = 0.156 kg CAM/d). Rate constant in STP= 0.1and a $DT_{50\ soil}$ of 30d)	1.38E-04
Tier 2*- based on 100% transformation of DBNPA (4 kg DBNPA/d = 1.394 kg CAM) released to the facility drain. Rate constant in STP= 0.1and a $DT_{50\ soil}$ of 30d)	1.23E-03
Tier 3: Soil (based on 100% transformation of DBNPA to CAM in the influent of the STP (0.448 kg DBNPA/d = 0.156 kg CAM/d). Rate constant in STP= 0.1and a $DT_{50\ soil}$ of 300d)	1.92E-04
Tier 4**- based on 100% transformation of DBNPA (4 kg DBNPA/d = 1.394 kg CAM) released to the facility drain. Rate constant in STP= 0.1and a $DT_{50\ soil}$ of 300d)	1.71E-03
Groundwater (Based on pore water)	
Tier 1*: Soil (based on 100% transformation of DBNPA to CAM in the influent of the STP (0.156 kg CAM/d) tate constant in STP= 0.1and a $DT_{50\ soil}$ of 30d)	1,69E-04 mg/L
Tier 2*- based on 100% transformation of DBNPA (4 kg DBNPA/d = 1.394 kg CAM) released to the facility drain. Rate constant in STP= 0.1and a $DT_{50\ soil}$ of 30d)	1.15E-03 mg/L
Tier 3: Soil (based on 100% transformation of DBNPA to CAM in the influent of the STP (0.156 kg CAM/d) tate constant in STP= 0.1and a $DT_{50\ soil}$ of 300d)	4,8E-04 mg/L
Tier 4**- based on 100% transformation of DBNPA (4 kg DBNPA/d = 1.394 kg CAM) released to the facility drain. Rate constant in STP= 0.1and a $DT_{50\ soil}$ of 300d)	4.29E-03 mg/L

**Based on WOE a DT50 in soil for CAM can be assumed to be around 30 days according to the eCA (based on QSAR and data from the open literature). However, after further discussion within an ad hoc group following WG-I-2018 it was decided to consider CAM as inherently biodegradable (using a k-rate of $0.1h^{-1}$ in STP and DT_{50} value of 300 days for soil by default.*

*** At WG ENV I 18 it was recommended that degradation in the facility drain should be taken into consideration for PT 4, based on the defaults and equations given in the ESD for PT 5. This was already applied for other active substances (e.g. hydrogen peroxide and peracetic acid). It was concluded to use Tier 3 for the environmental risk assessment and that Tier 4 overestimates the risk.*

Non compartment specific exposure relevant to the food chain (secondary poisoning)

The measured log P_{ow} of DBNPA is 0.8, which is far below the relevant trigger value of 3 as stated in the TGD which may indicate a risk for bioaccumulation. It can be assumed that the potential for DBNPA to bioaccumulate is low, and a risk of secondary poisoning is not given.

The measured log P_{ow} of CAM is -0.9, which is far below the relevant trigger value of 3 as stated in the TGD which may indicate a risk for bioaccumulation. It can be assumed that the potential for CAM to bioaccumulate is low, and a risk of secondary poisoning is not given.

Overview on the risk characterization for the environment:

For the surface water a safe use has been identified for DBNPA where the release is to an off-site STP with the relevant dissipation rate in sewer applied. The requirements for acceptable risk are met: The PEC/PNEC values are below the trigger value of 1 for the assessment of scenario 1, the entire plant for Food vessels, and for Bottle washing. For scenario 2 a safe use could also be demonstrated. For CAM a safe use could be demonstrated for all scenarios.

For the freshwater sediment a safe use could be demonstrated for all uses (both for DBNPA and CAM).

For the sewage treatment plant the results show that a safe use could be demonstrated for all uses, both for DBNPA and CAM.

Exposure of the atmospheric compartment to DBNPA is considered to be of no concern, as DBNPA has a very low vapour pressure of 1.19×10^{-3} Pa at 19.2 °C, a low Henry's law constant of 1.9×10^{-5} Pa m^3 mol^{-1} and is not used in a manner, which leads to direct release to the atmosphere.

DBNPA degrades in the atmosphere by photo-oxidative degradation, having a DT_{50} value of 8.022 days.

The highest local emission value of 7.46E-11 mg/m^3 derived from the on-site STP is below the threshold of concern for atmospheric effects. No concern was found for CAM either

Soil compartment. The PEC/PNEC ratio was below the trigger value 1 for all scenarios for the soil for both DBNPA and for CAM. However, based on the pore water concentration a risk was identified for DBNPA using the absolute worst scenario Tier 4- based on 100% transformation of DBNPA (4 kg DBNPA/d = 1.394 kg CAM) released to the facility drain. Rate constant in STP = 0.1 and a $DT_{50\ soil}$ of 300d. A risk for groundwater was also found for all scenarios with CAM. *A*s a risk for ground water was identified based on the pore water concentrations the groundwater concentrations was calculated with FOCUS-PEARL. Based on these calculations a safe use can be demonstrated (less than 0.0001 mg/L) for all FOCUS scenarios except for Tier 4 for CAM, where a risk was still identified.

Secondary poisoning. The measured log P_{ow} of DBNPA is 0.8 at pH 7, which is far below the relevant trigger value of 3 as stated in the TGD. It is concluded that the potential for DBNPA to bio-accumulate is low and a risk of secondary poisoning does not exist.
The measured log P_{ow} of CAM is -0.9, which is far below the relevant trigger value of 3 as stated in the TGD which may indicate a risk for bioaccumulation. It can be assumed that the potential for CAM to bio accumulate is low, and a risk of secondary poisoning is not given.

Conclusion:
The risk assessment demonstrated a safe use of DBNPA for humans and for the environment including the environmental relevant metabolite CAM. Endocrine disrupting properties are not considered to have a lower exposure threshold, therefore no safe exposure level could be demonstrated for DBNPA in regard to its ED properties. DBNPA is considered to have endocrine disrupting properties relevant for both humans and non-target organisms in the environment.
Disinfection by-products (DBPs) can be formed as a consequence of the use of DBNPA. An assessment of the risks of disinfectant by-products was not performed at active substance approval level. At product authorisation level it must be demonstrated that no DBPs will be formed. Otherwise, an assessment of the risks of DBP will have to be performed.

6 ASSESSMENT OF EXCLUSION, SUBSTITUTION CRITERIA AND POP

Conclusion on exclusion criteria	DBNPA fulfils the criteria of Article 5 (1) (d) of the BPR due to its endocrine disrupting properties for human health.
Conclusion on CMR	DBNPA is not classified for CMR effects
Conclusion on ED assessment	DBNPA fulfils the criterion (d) of Article 5(1) for human health and criterion (e) of Article 10(1) for the environment.
Conclusion on PBT and vP/vB criteria	Not P or vP Not B or vB T DBNPA is not considered as a BPT or vP/vB substance.

Conclusion on substitution criteria	DBNPA fulfils the criteria of Article 10 of the BPR.

Conclusion on LRTAP/POP assessment	DBNPA does not fulfil the criteria for being a persistent organic pollutant (POP).

7 OVERALL CONCLUSIONS

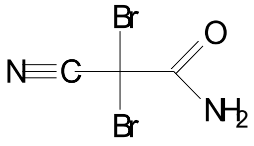
For overall conclusions regarding Exclusion, Substitution and POP criteria and Elements to be taken into account when authorising products see the relevant section in the BPC opinion.

Appendix I: List of endpoints

Chapter 1: Identity, Physical and Chemical Properties, Classification and Labelling

Active substance (ISO Name)	2,2-Dibromo-2-cyanoacetamide (DBNPA)
Product-type	PT 4

Identity

Chemical name (IUPAC)	2,2-Dibromo-2-cyanoacetamide
Other chemical names	DBNPA Dibromonitrilopropionamide 2,2-Dibromo-2-cyanoacetamide
CAS No	10222-01-2
EC No	233-539-7
Other substance No.	-
Minimum purity of the active substance as manufactured (g/kg or g/l)	≥ 980 g/kg
Identity of relevant impurities and additives (substances of concern) in the active substance as manufactured (g/kg)	The substance contains Dibromoacetonitrile being a relevant impurity. Further information on the identity and specification can be found in the confidential part of the CAR. Dibromoacetonitrile (DBAN) max. 1.4 g/kg
Molecular formula	$C_3H_2Br_2N_2O$
Molecular mass	241.9 g/mol
Structural formula	

Physical and chemical properties

Melting point (state purity)	124.5°C; purity: 98.1 ± 0.5 %
Boiling point (state purity)	Decomposes before boiling: 98.1 ± 0.5 %
Thermal stability / Temperature of decomposition	Decomposition > 201°C; purity 98%
Appearance (state purity)	Solid crystalline; off-white; mild pungent
Relative density (state purity)	Bulk density: 1.356 g/cm^3 at 25°C; purity 98%
Surface tension (state temperature and concentration of the test solution)	72.2 ± 0.6 mN · m^{-1} at 25.0 ± 0.5 °C; Purity: 98.1 ± 0.5 % Concentration: Technical DBNPA (98.1% ± 0.5 %wt) at 1 g/L

Vapour pressure (in Pa, state temperature)	1.19×10^{-3} Pa at 19.2°C; purity: 98% 2.61×10^{-2} Pa at 40.2 °C; purity: 98% 2.1×10^{-3} Pa at 25°C (calculated)
Henry's law constant (Pa m^3 mol^{-1})	pH 5 = 1.99×10^{-5} Pa m^3 mol^{-1} pH 7 = 2.04×10^{-5} Pa m^3 mol^{-1} at 20°C pH 9 = 1.45×10^{-5} Pa m^3 mol^{-1}
Solubility in water (g/l or mg/l, state temperature)	10.8 g/L (pH 5, 10°C) 14.4 g/L (pH 5, 20°C) 20.2 g/L (pH 5, 30°C) 11.5 g/L (pH 7, 10°C) 14.1 g/L (pH 7, 20°C) 18.6 g/L (pH 7, 30°C) 19.9 g/L (pH 9, 20°C) Purity: 99.23%
Solubility in organic solvents (in g/l or mg/l, state temperature)	> 250 g/L in PEG 200 and acetone at 15 ± 1 °C and 30 ± 1 °C; purity = 98.1 ± 0.5 %
Stability in organic solvents used in biocidal products including relevant breakdown products	Not applicable (organic solvents not used in biocidal products)
Partition coefficient (log P_{OW}) (state temperature)	pH 5: log Pow = 0.80 (Kow = 6.24) pH 7: log Pow = 0.80 (Kow = 6.31) pH 9: log Pow = 0.82 (Kow = 6.61) all at 20 – 21 °C Purity = 99.5%
Dissociation constant	Spectrophotometric method: pKa = 8.3 ± 0.3 Titrimetric method: pKa = 8.24 ± 0.05
UV/VIS absorption (max.) (if absorption > 290 nm state ε at wavelength)	-
Flammability or flash point	DBNPA i) does not propagate combustion, and is not classified as flammable solid in terms of its burning characteristics; purity = 98.1 ± 0.5 %
Explosive properties	DBNPA does not react with combustible material. DBNPA is not impact sensitive; purity = 98 %

Oxidising properties	DBNPA consists of carbon, hydrogen, nitrogen, oxygen and bromine. The bromines and the oxygen atom are only bonded to carbon. The oxygen balance is negative. Therefore, DBNPA does not react exothermically with combustible materials.
Auto-ignition or relative self-ignition temperature	DBNPA does not ignite before melting; purity = 98.1 ± 0.5 %

Classification and proposed labelling

with regard to physical hazards	No classification proposed
with regard to human health hazards	Acute Tox. 3, H301 Acute Tox. 2, H330 Skin Irrit. 2, H315 Eye Dam. 1, H318 Skin Sens. 1, H317 STOT RE 1, H372 (respiratory tract) (inhalation)
with regard to environmental hazards	Aquatic Acute 1, H410 Aquatic Chronic 1

Chapter 2: Methods of Analysis

Analytical methods for the active substance

Technical active substance (principle of method)	DBNPA; RP-HPLC-UV.
Impurities in technical active substance (principle of method)	Impurities; HPLC-UV.

Analytical methods for residues

Soil (principle of method and LOQ)	Dibromoacetic acid(DBAA) in soil; LC/MS/MS; LOQ = 0.05 mg/kg No method has been developed for DBNPA or Dibromoacetonitrile (DBAN), as method validation is not feasible due to instability of the compounds and hence rapid degradation.
Air (principle of method and LOQ)	DBNPA in air; HPLC-UV; LOQ = 0.004 mg/m^3 DBNPA in air; LC-HR-MS; LOQ = 0.004 mg/m^3 No method has been developed for DBAA or DBAN, as method validation is not feasible due to instability of the compounds and hence rapid degradation.

Water (principle of method and LOQ)	DBAA in water; LC/MS/MS; LOQ = 0.1 µg/L No method has been developed for DBNPA or DBAN, as method validation is not feasible due to instability of the compounds and hence rapid degradation.
Body fluids and tissues (principle of method and LOQ)	Cyanoacetamide (CAM); LC/MS/MS; LOQ =0.5 mg CAM/L rat blood and 0.5 mg CAM/kg rat liver. No method has been developed for DBNPA. Validation of an analytical method for the determination of DBNPA in rat blood and liver tissue was unsuccessful due to the instability of DBNPA in those matrices.
Food/feed of animal origin (principle of method and LOQ for methods for monitoring purposes)	DBAA; LC/MS/MS; LOQ =0.01 µg/g (milk and meat) No method has been developed for DBNPA or DBAN. Validation of an analytical method for the determination of DBNPA in rat blood and liver tissue was unsuccessful due to the instability of DBNPA in those matrices.

Chapter 3: Impact on Human Health

Absorption, distribution, metabolism and excretion in mammals

Rate and extent of oral absorption:	100 %
Rate and extent of dermal absorption*:	A dermal penetration study is not available for DBNPA. Default values for dermal absorption according to EFSAs guidance must therefore be applied.
Distribution:	-
Potential for accumulation:	No potential for bioaccumulation. DBNPA is equally distributed over the blood circulation to all tissues and organs.
Rate and extent of excretion:	The vast majority is excreted within one day (>85% of radioactivity administered), almost exclusively in the urine. The amount in faeces was 5.6% after 7 days.

Toxicologically significant metabolite(s)	DBAN (dibromoacetonitril) and DBAA (dibromoaceticamide) are separately more toxic than DBNPA. The toxicity of these molecules is considered to be covered by the studies conducted with the parent DBNPA as these molecules account for about 16% of the radioactivity applied in the rat metabolism study. Bromide is considered responsible for the thyroid disrupting properties of DBNPA. The toxicity of bromide molecule was not covered by the studies as there was data gaps related to thyroid endocrine activity. A literature search on bromide verified the observed effects for DBNPA in the thyroid..

* the dermal absorption value is applicable for the active substance and might not be usable in product authorization

Acute toxicity

Rat LD_{50} oral	167-224 mg/kg bw (females-males)
Rat LD_{50} dermal	> 2000 mg/kg bw
Rat LC_{50} inhalation	0.275 mg/L (combined males/females)

Skin corrosion/irritation	DBNPA produced signs of dermal irritation
Eye irritation	DBNPA is considered eye corrosive
Respiratory tract irritation	-
Skin sensitisation (test method used and result)	DBNPA showed skin sensitising properties (modified Buehler test, 6 of 20 animals)
Respiratory sensitisation (test method used and result)	-

Repeated dose toxicity

Short term

Species / target / critical effect	Beagle dogs /oral diet/4-week study/gastric haemorrhage in one high dose male dog Rats/dermal/28 d study/ skin reactions no biologically relevant systemic toxicity
Relevant oral NOAEL / LOAEL	3.5 mg/kg bw/d / 15.9 mg/kg bw/d
Relevant dermal NOAEL / LOAEL	309 mg/kg bw/d / 1030 mg/kg bw/d [local effects]
Relevant inhalation NOAEL / LOAEL	-

Subchronic

Species/ target / critical effect	Dogs / feeding / 90 day-study/ increased relative and absolute thyroid weight and a very slight dilatation of thyroid follicles Rats/dermal/90 d/ topical response of the skin, no findings concerning functional observable battery (FOB)
Relevant oral NOAEL / LOAEL	5.9 mg/kg bw/d / 10.7 mg/kg bw/d
Relevant dermal NOAEL / LOAEL	309 mg/kg bw/d / 1030 mg/kg bw/d
Relevant inhalation NOAEL / LOAEL	-

Long term

Species/ target / critical effect	Rats / feeding /2 years/ hyperplasia of the thyroid follicular cells
Relevant oral NOAEL / LOAEL	1.4mg/kg bw/d / 9.6 mg/kg bw/day
Relevant dermal NOAEL / LOAEL	-
Relevant inhalation NOAEL / LOAEL	-

Genotoxicity	DBNPA is not genotoxic

Carcinogenicity

Species/type of tumour	No oncogenic potential
Relevant NOAEL/LOAEL	-

Reproductive toxicity

Developmental toxicity

Species/ Developmental target / critical effect	Rabbits / dams / reduced food consumption, reduced body weight gain. Rabbits / foetuses / minor skeletal effects at maternally non-toxic doses, which were not dose related or significantly increased on a litter base
Relevant maternal NOAEL	10 mg/kg bw/d
Relevant developmental NOAEL	≥ 30 mg/kg bw/d

Fertility

Species/critical effect	Rats/gavage/ Dyspnoea, piloerection, hunched posture. No effects on pup development. No effects on fertility.
Relevant parental NOAEL	15 mg/kg bw/d
Relevant offspring NOAEL	≥ 30 mg/kg bw/d
Relevant fertility NOAEL	≥ 30 mg/kg bw/d

Neurotoxicity

Species/ target/critical effect	Rats /12 months / Diet/ Treatment-related decrease in male body weights and slight decrease in hindlimb grip performance (<20%) NOAEL: 9.6 mg/kg bw/d

Developmental Neurotoxicity

Species/ target/critical effect	-

Immunotoxicity

Species/ target/critical effect	-

Developmental Immunotoxicity

Species/ target/critical effect	-

Other toxicological studies

It has been seen in human studies that DBNPA shows mild irritation and is a skin sensitizer.

Medical data

-

Summary

	Value	Study	Safety

			factor
AEL$_{\text{long-term}}$	0.014 mg/kg bw/day	Chronic 2 year rat toxicity/carcinogenicity study	100
AEL$_{\text{medium-term}}$	0.059 mg/kg bw/day	Subchronic 90 d dog study	100
AEL$_{\text{short-term}}$	0.14 mg/kg bw/day	Subacute 28 d dog study	25
ADI	0.014 mg/kg bw/day	Chronic 2 year rat toxicity/carcinogenicity study	100
ARfD	0.14 mg/kg bw/day	Subacute 28 d dog study	25

MRLs

Relevant commodities	-

Reference value for groundwater

According to BPR Annex VI, point 68	-

Dermal absorption

Study (*in vitro/vivo*), species tested	A dermal penetration study is not available for DBNPA.
Formulation (formulation type and including concentration(s) tested, vehicle)	-
Dermal absorption values used in risk assessment	Default values for dermal absorption according to EFSAs guidance must be applied (25%).

Acceptable exposure scenarios (including method of calculation)

Formulation of biocidal product	DBNPA technical or 20% solution in water.
Intended uses	PT4; Disinfection of food production vessels.
Industrial users	Acceptable; RISKOFDERM Connecting Lines model (HEEG opinion no 1).
Professional users	-
Non-professional users	-
General public	Drinking water scenario (Water container disinfection-ART food guidance)
Exposure via residue in food	Acceptable

Chapter 4: Fate and Behaviour in the Environment

Route and rate of degradation in water

Hydrolysis of active substance and relevant metabolites (DT_{50}) (state pH and temperature)	
pH 4	**DBNPA:** 578 hours (50°C) 12079 hours (12°C) **DBAN:** 1450 hours (50°C) 30300 hours (12°C)
pH 7	**DBNPA:** 65 hours (25°C) 183 hours (12°C) **DBAN:** 390 hours (25°C) 1100 hours (12°C)
pH 9	**DBNPA:** 5.2 hours (13°C) 5.6 hours (12°C) **DBAN:** 64 hours (13°C) 69 hours (12°C)
Photolytic / photo-oxidative degradation of active substance and resulting relevant metabolites	Due to lack of UV absorbance in the sunlight region DBNPA is not degradable by direct photodegradation in water; however there are some indications that indirect photolysis can take place.
Readily biodegradable (yes/no)	*DBNPA: NO* *DBAN:* Achieved > 60% biodegradation within 28 , but did not fulfil 10-day window criterion

Inherent biodegradable (yes/no)	**DBNPA:** Yes Based on aerobic biodegradation simulation test (STP simulation). DT_{50} for primary degradation is 10 minutes at 20° C and 15 minutes when recalculated to 15 ^{0}C **DBAN:** no **DBAA:** inherently biodegradable. **CAM:** inherently biodegradable.
Biodegradation in freshwater	Aerobic: DT_{50} 2 hour at 25°C corresponding to 5.7 hours at 12°C.
Biodegradation in seawater	DBNPA is inherently biodegradable
Non-extractable residues	-
Distribution in water / sediment systems (active substance)	-
Distribution in water / sediment systems (metabolites)	-

Route and rate of degradation in soil

Mineralization (aerobic)	-
Laboratory studies (range or median, with number of measurements, with regression coefficient)	-
DT_{50lab} (20°C, aerobic):	< 2 days at 12°C **CAM:** 300 days based on the default value for inherently biodegradable substances.
DT_{90lab} (20°C, aerobic):	-
DT_{50lab} (10°C, aerobic):	-
DT_{50lab} (20°C, anaerobic):	-
degradation in the saturated zone:	-
Field studies (state location, range or median with number of measurements)	
DT_{50f}:	-
DT_{90f}:	-
Anaerobic degradation	-

Soil photolysis	-
Non-extractable residues	-
Relevant metabolites - name and/or code, % of applied a.i. (range and maximum)	-
Soil accumulation and plateau concentration	-

Adsorption/desorption

Ka , Kd Ka_{oc} , Kd_{oc} pH dependence (yes / no) (if yes type of ¤ dependence)	Ka = 0.94; Ka (Freundlich) = 1.19 Kd = 7.26 Ka_{oc} = 236.9 Kd_{oc} = 5.41 The experimentally determined mean adsorption coefficient was calculated as $K_{ads\ oc\ F}$ = 236.9 L/kg.; however, it should be taken into account that this value does not correspond to DBNPA alone but also to the sum of its degradation products. Accordingly, it has been chosen to use the QSAR K_{oc} of 27.3 L/Kg for the PNEC calculation.

Fate and behaviour in air

Direct photolysis in air	Due to lack of UV absorbance in the sunlight region DBNPA is not degradable by direct photodegradation
Quantum yield of direct photolysis	
Photo-oxidative degradation in air	Half-life of 8.022 days (24-hrday; 0.5E6 OH/cm^3)
Volatilization	Not likely

Reference value for groundwater

According to BPR Annex VI, point 68	-

Monitoring data, if available

Soil (indicate location and type of study)	-
Surface water (indicate location and type of study)	DBNPA was not found in any of the samples (monitoring study in Sweden 2008).
Ground water (indicate location and type of study)	-

Air (indicate location and type of study)	-

Chapter 5: Effects on Non-target Species

Toxicity data for aquatic species (most sensitive species of each group) for DBNPA

Species	Time-scale	Endpoint	Toxicity
Fish			
Sheepshead minnow *(Cyprinodon variegatus)*	96 hours	Mortality	LC_{50} =3.4 mg/L
Rainbow trout *(Salmo gairdneri)*	85 days	Embryo viability, survival of embryos at hatch and survival and growth (weight and length) of larvae after 60 days post-hatch exposure	NOEC: 0.47 mg/L
Invertebrates			
Mysid shrimp *(Mysidopsis bahia)*	96 hours	Mortality	LC_{50} = 0.72 mg/L
Daphnia magna	21 days	Mortality and sublethal effects that included reproduction and growth	NOEC = 0.060 mg/L
Algae			
Scenedesmus subspicatus	72 hours	Growth inhibition	E_bC_{50} = 0.9 mg/L E_rC_{50} = 2.3 mg/L NOEC = 0.36 mg/L
Microorganisms			
Activated sludge	3 hours	Respiration inhibition	EC_{50} = 4.6 mg/L

Toxicity data for aquatic species (most sensitive species of each group) for dibromoacetonitrile (DBAN):

Species	**Time-scale**	**Endpoint**	**Toxicity**
Fish			
Invertebrates			
Daphnia magna	48 hours	Mortality	EC_{50} = 0.20 mg/L

Algae			
Microorganisms			

Toxicity data for aquatic species (most sensitive species of each group) for dibromoacetic acid (DBAA):

Species	**Time-scale**	**Endpoint**	**Toxicity**
Fish			
Invertebrates			
Daphnia Magna	48 hours	Mortality	EC_{50} = >100 mg/L
Algae			
Selenastrum capricornutum	72	Growth inhibition	E_bC_{50} = 1.3 mg/L E_rC_{50} = 48 mg/L NOEC = 2.2 mg/L
Microorganisms			

Toxicity data for aquatic species (most sensitive species of each group) for : cyanoacetamide (CAM)

Species	**Time-scale**	**Endpoint**	**Toxicity**
Fish			
	96	Mortality	EC 50 = 1000 mg/L (QSAR)
Invertebrates			
Daphnia magna	48 hours	Mortality	EC50 = 13000 mg/L (QSAR)
Algae			
Green algae	72 hours	Growth inhibition	EC_{50} = 200 mg/L (QSAR)
Microorganisms			

Toxicity data for aquatic species (most sensitive species of each group) for : • Dibromomalonamide (DBMAL)

Species	Time-scale	Endpoint	Toxicity
Fish			
Invertebrates			
Daphnia magna	48 hours	Mortality	EC50 = 20.8 mg/L
Algae			
Pseudokirchneriella subspicatus	• 72 hours	• Growth inhibition	• NOEC 0.81 mg/L E_bC_{50} =3.3 mg/L E_rC_{50} = 10.1 mg/L
Microorganisms			

Effects on earthworms or other soil non-target organisms

Acute toxicity to earthworms	LC50 = 216 mg/kg soil dw
Reproductive toxicity to earthworms	.

Effects on terrestrial plants

Acute toxicity to terrestrial plants (Annex IIIA, point XIII 3.4)	EC_{50}: 21.8 mg/kg soil dw.(biomass) NOEC = 4.12 mg/kg soil dw. Normalized and converted to a standard soil: EC_{50}: 57.01 mg/kg soil dw.(biomass) NOEC = 10.78 mg/kg soil dw.

Effects on soil micro-organisms

Nitrogen mineralization	-
Carbon mineralization	-

Effects on terrestrial vertebrates

Acute toxicity to mammals	-
Acute toxicity to birds	-
Dietary toxicity to birds	-
Reproductive toxicity to birds	-

Effects on honeybees

Acute oral toxicity	-
Acute contact toxicity	-

Effects on other beneficial arthropods

Acute oral toxicity	-
Acute contact toxicity	-
Acute toxicity to ………………………………..	-

Bioconcentration

Bioconcentration factor (BCF)	-
Depration time (DT_{50})	-
Depration time (DT_{90})	-
Level of metabolites (%) in organisms accounting for > 10 % of residues	-

Chapter 6: Other End Points

None

Appendix II: Overall reference list (Separate Annex in the confidential folder)