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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

PSO

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Director
Chemicals Notification and Assessment

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1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Nalco Australia Pty Ltd (ABN No. 000 424 788), 2 Anderson St BOTANY NSW 2019

NOTIFICATION CATEGORY
Standard: Chemical other than polymer (more than 1 tonne per year).

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication: chemical name, CAS No., molecular and structural formulae, spectral data.

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
No variation to the schedule of data requirements is claimed.

Variation to the schedule of data requirements is claimed as follows: Repeat dose toxicity eye irritation.

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
No.

NOTIFICATION IN OTHER COUNTRIES
USA, Canada, Korea.

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
PSO

MOLECULAR WEIGHT
250 – 1400 (NAMW ~ 250)

METHODS OF DETECTION AND DETERMINATION

ANALYTICAL METHOD	Mass spectroscopy.
TEST FACILITY	Research Analytical (2001).

3. COMPOSITION

DEGREE OF PURITY
99.7%

HAZARDOUS IMPURITIES/RESIDUAL MONOMERS
None.

NON HAZARDOUS IMPURITIES/RESIDUAL MONOMERS (> 1% by weight)
None.

ADDITIVES/ADJUVANTS
None.

The notified chemical will be introduced as a 40% aqueous solution containing:

Sodium maleate (CAS No. 18016-19-8), ~ 2% w/w
Sodium phosphite (CAS No. 15475-67-9), ~ 1% w/w
Ammonium sodium sulfate (CAS No. 13863-45-1), ~ 3.5% w/w

4. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS
As a 40% aqueous solution in 200 L drums and 1000 L IBCs.

MAXIMUM INTRODUCTION VOLUME OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	2 - 5	2 – 5	2 – 5	2 – 5	2 - 5

USE
Water cooling system chemical.

5. PROCESS AND RELEASE INFORMATION

5.1. Distribution, Transport and Storage

PORT OF ENTRY
Sydney.

IDENTITY OF MANUFACTURER/RECIPIENTS
The notifier will repackage the imported formulation and transport to a variety of customers.

TRANSPORTATION AND PACKAGING
The notified chemical will be transported to one site at Botany, NSW.

5.2. Operation Description

The notified chemical will be formulated and repackaged into a range of products intended for use in water cooling systems. The products will be repackaged in 15 L plastic carboys, 200 L plastic mauser drums and 1000 L plastic tote boxes. The concentration of the notified chemical in the end products is expected to be < 10%.

5.3. Occupational exposure

Number and Category of Workers

Category of Worker	*Number*	*Exposure Duration*	*Exposure Frequency*
Waterside workers	~ 2	2 – 3 hours/day	10 – 15 days/year
Truck drivers	~ 5	"	"
Receiving clerks	~ 2	"	"
Forklift drivers	~ 2	"	"
QC chemists	~ 2	2 hours/day	8 days/year
Operators	~ 4	2 – 5 hours/day	30 days/year
Sales representatives	~ 15	1 – 4 hours/day	60 days/year
Storage workers for products	~ 5		
Customer wastewater treatment operators	~ 30	1 – 2 hours/day	340 days/year

Exposure Details
Transport and storage workers should only be exposed to the notified chemical in the event of an accident. QC chemicals will test samples of the imported product and samples of the final products. QC workers will wear laboratory coats, gloves and safety glasses.

Operators will collect samples for QC analysis, and connect automated pumping equipment and transfer lines. Possible exposure is to spills. Local exhaust ventilation will be employed and workers will wear coveralls, chemical resistant gloves and chemical splash goggles.

Both sales representatives and customer wastewater treatment operators will be potentially exposed to the final product while setting up the dosing/feeding equipment and testing the dosage levels. Exposure should be for 5 – 10 minutes at a time during dosing, testing and calibration of the feed equipment. These workers will wear coveralls, chemical resistant gloves and chemical splash goggles.

5.4. Release

RELEASE OF CHEMICAL AT SITE

The amount of waste generated from repackaging and blending is process dependent. The notifier estimated that 0.5 kg of notified chemical will remain in 200 L import drums after transfer is carried out using a spear and pump. Less than 5 kg of residues is expected to remain in the 8-10 ton import vessels. The decanted vessels are filled with water after drainage, boiled for several hours and then the water is discharged to the sewer via on-site effluent treatment facilities. The waste is diluted and analysed prior to release. No other estimates were provided for release.

RELEASE OF CHEMICAL FROM USE

The water treatment products will be used in industrial plants for treatment of water in closed cooling systems. During water treatment, the efficacy of the chemical diminishes, and hence new water treatment solution is continually added to the system to ensure that adequate treatment levels are maintained. The water treatment products are typically fed continuously via a small dosing pump into the suction side of pumps in re-circulating cooling water systems to maintain a dispersion concentration of between 1-2 mg/L (product based).

Continual bleeding and discharge of the treated water is expected to take place to compensate for replenishment of the chemical in the system, and during maintenance cleaning. Typical blowdown volumes range between 50-500 m^3/day (EPG 1997), depending on plant size. Spent blowdown water is normally released into the sewer under trade waste agreements where it undergoes treatment at the local wastewater treatment plant. As such, all of the notified chemical will eventually be released into the sewer either directly, or by way of the end-user's on-site effluent treatment plants.

5.5. Disposal

Empty drums are sent to a government-licensed recycler.

5.6. Public exposure

There is little potential for public exposure as the notified chemical will be used in industrial wastewater treatment systems. There is some potential for public exposure in the event of a transport accident.

6. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa	Light yellow liquid.
Boiling Point	Not determined.
Density	1390 kg/m^3 at 16°C
Vapour Pressure	0.372 kPa at 32°C.
Water Solubility	> 43.2 g P/L at 20°C

METHOD Not stated.

Remarks The test substance is in liquid form and contains 40% weight PSO in water. As such, the concentration of the test substance in solution was not calculated. Instead, the average percentage of phosphorus was used to predict the concentrations. The solubility is reported in grams of phosphorus.

The approximate water saturation concentration was determined from the percentage of water contained in the test substance. Aqueous solutions of the test substance were equilibrated at 20°C, with no precipitation occurring over a 72-hour period. The concentrations of the test substance at 24, 48 and 72 hours were 42, 43.9 and 43.7%, respectively. The percentages of solids determined at 66 h, and at days 6, 9, and 64 were 43.98, 43.55, 43.5 and 43 g P/L, respectively.

Due to the unknown specific chemistry of the test substance, persulfate acid digestion was performed to hydrolyse organic phosphorus to inorganic phosphorus. The P content was then quantified using an ascorbic acid colorimetric spectrophotometric method.

TEST FACILITY T.R. Wilbury (undated summary report)

Hydrolysis as a Function of pH

METHOD OECD TG 111 Hydrolysis as a Function of pH.

Remarks Hydrolysis of the test substance is expected to result in an increase in ortho-free phosphate. The percentage of hydrolysis was determined by measuring the total available P using the persulfate-acid digestion method. No hydrolysis of the test substance occurred in the presence of pH 4, 7, and 9 buffers held at a temperature of 50°C for 5 days.

TEST FACILITY T. R. Wilbury Laboratories (2001a)

Partition Coefficient (n-octanol/water) Pow at 20°C = -2.08 ± 0.62.

METHOD OECD 107 Shake Flask Method.

Remarks The test substance was supplied in water, and recovery of the test substance was not calculated. Instead, the average percentage of phosphorus was determined to predict the concentration of the test substance in solution. Stock solutions were made up of water and n-octanol at ratios of 1:5, 1:10 and 1:20. The test vessels were shaken overnight and centrifuged prior to analysis for P content. The majority of the octanol layers extracted contained no phosphorus, indicating an absence of the test substance. Due to the unknown specific chemistry of the test substance, persulfate acid digestion was performed to hydrolyse organic phosphorus to inorganic phosphorus. The P content was then quantified with ascorbic acid colorimetric spectrophotometric method using potassium phosphate monobasic solution as an analytical standard. The test substance is not soluble in n-octanol.

TEST FACILITY T.R. Wilbury (2002)

Adsorption/Desorption

Remarks Data was provided for an analogue (PBTC), which contains multiple acidic protons (IPCS, 1998). Similar sorption behaviour is expected for the notified chemical. The data indicated that 100% of PBTC sorbs to sludge in waste water treatment facilities with tertiary treatment (flocculation with Al or Fe salts). In a SCAS test 60% of PBTC was adsorbed and a Koc value of 1250 L/kg was estimated.

Dissociation Constant

METHOD Algorithm modelling ACD/pKa v6.0..

Remarks Data was provided for an analogue (PBTC), which contains multiple acidic protons with differing acid dissociation constants. Similar dissociation behaviour is expected for the notified chemical. The results indicate that the phosphinic group should always remain charged, and all components are predicted to carry at least one or more anionic charges in the environmental pH range.

Particle Size Not applicable.

Flash Point	> 93.3 ºC according to the MSDS.
Flammability Limits	Not flammable.
Autoignition Temperature	Not determined.
Explosive Properties	Not explosive.
Reactivity	Not reactive.

7. TOXICOLOGICAL INVESTIGATIONS

Where data on the notified chemical itself is lacking (eye irritation, skin sensitisation, repeat dose toxicity, chromosomal aberrations) data on analogues has been accepted. For eye irritation and skin sensitisation and chromosomal aberrations a different salt of the notified chemical has been used. For repeat dose toxicity the chemical analogues PBTC and DEQUEST® 2010 Phosphonate have been used and have the same use pattern. For repeat dose toxicity only summary data are available and are described in the relevant section below.

Endpoint and Result	*Assessment Conclusion*
Rat, acute oral LD50 > 2000 mg/kg bw	low toxicity
Rat, acute dermal LD50 > 2000 mg/kg bw	low toxicity
Rabbit, skin irritation	non-irritating
Rabbit, eye irritation	slight irritant
Guinea pig, skin sensitisation - adjuvant test.	no evidence of sensitisation
Rat, Dog, oral repeat dose toxicity - 90 days.	NOEL = 10000 ppm for DEQUEST® 2010 Phosphonate in rats, dogs/NOAEL = 375 mg/kg/day in rats for PBTC
Genotoxicity - bacterial reverse mutation	non mutagenic
Genotoxicity – in vitro chromosomal aberrations	non genotoxic

7.1. Acute toxicity – oral

TEST SUBSTANCE Notified chemical.

METHOD OECD TG 401 Acute Oral Toxicity – Limit Test.
Species/Strain Rat/Wistar
Vehicle None.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
1	5/sex	2000	None.

LD50 > 2000 mg/kg bw
Signs of Toxicity Wetness of the anogenital area, dyspnea, diarrhea and red staining of the mouth/nose area.
Effects in Organs None.

CONCLUSION The notified chemical is of low toxicity via the oral route.

TEST FACILITY MB Research (2001a).

7.2. Acute toxicity - dermal

TEST SUBSTANCE Notified chemical.

METHOD OECD TG 402 Acute Dermal Toxicity – Limit Test.
Species/Strain Rat/Wistar.
Vehicle None.
Type of dressing Occlusive.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
1	5/sex	2000	None.

LD50	> 2000 mg/kg bw
Signs of Toxicity - Local	Lethargy in 2 males on days 1 and/or 2.
Signs of Toxicity - Systemic	None.
Effects in Organs	None.
Remarks - Results	Erythema (mainly slight), scales and scabs were seen in the treated area during the observation period.

CONCLUSION The notified chemical is of low toxicity via the dermal route.

TEST FACILITY Notox (2002a).

7.3. Acute toxicity - inhalation

No data provided.

7.4. Irritation – skin

TEST SUBSTANCE Notified chemical.

METHOD OECD TG 404 Acute Dermal Irritation/Corrosion.

Species/Strain	Rabbit/New Zealand White
Number of Animals	3
Vehicle	None.
Observation Period	72 hours.
Type of Dressing	Semi-occlusive.

RESULTS

Lesion	*Mean Score* Animal No.*			*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
	1	2	3			
Erythema/Eschar	0	0	0	0		0
Oedema	0	0	0	0		0

*Calculated on the basis of the scores at 24, 48, and 72 hours for EACH animal.

CONCLUSION The notified chemical is non-irritating to skin.

TEST FACILITY MB Research (2001b).

7.5. Irritation - eye

TEST SUBSTANCE Ammonium salt of PSO.

METHOD EC Directive 92/69/EEC B.5 Acute Toxicity (Eye Irritation).

Species/Strain	Rabbit/New Zealand White
Number of Animals	3
Observation Period	72 hours.

RESULTS

Lesion	*Mean Score* Animal No.*			*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
	1	2	3			
Conjunctiva: redness	0	0	0	1	< 24 hours	0
Conjunctiva: chemosis	0	0	0	2	< 24 hours	0
Conjunctiva: discharge	0	0	0	1	< 24 hours	0
Corneal opacity	0	0	0	0		0
Iridial inflammation	0	0	0	0		0

*Calculated on the basis of the scores at 24, 48, and 72 hours for EACH animal.

CONCLUSION The notified chemical is slightly irritating to the eye.

TEST FACILITY Notox (2002b).

7.6. Skin sensitisation

TEST SUBSTANCE Ammonium salt of PSO.

METHOD OECD TG 406 Skin Sensitisation – Maximisation test.
Species/Strain Guinea pig/Dunkin-Hartley.
PRELIMINARY STUDY Maximum Non-irritating Concentration:
intradermal: < 10%
topical: 100%
MAIN STUDY
Number of Animals Test Group: 10 Control Group: 5
INDUCTION PHASE Induction Concentration:
intradermal injection: 20%
topical application: 100%
Signs of Irritation
CHALLENGE PHASE
1st challenge topical application: 100%
2nd challenge Not done.

RESULTS

No erythema was observed in either the test or control animals at the challenge sites.

CONCLUSION There was no evidence of reactions indicative of skin sensitisation to the notified chemical under the conditions of the test.

TEST FACILITY Notox (2002c).

7.7. Repeat dose toxicity

DEQUEST 2010 Phosphonate was tested as the sodium salt and the no effect level was 10000 ppm for 90-day studies in rats and dogs.

In a 90-day rat feeding study using doses of 0, 50, 200, 1000 and 5000 mg/kg/day using the tetrasodium salt, no signs of toxicity were observed and no effects on haematology, clinical chemistry, pathology or histopathology indicators were observed. The No Observed Adverse Effect Level was given as 375 mg/kg/day.

7.8. Genotoxicity - bacteria

TEST SUBSTANCE	Notified chemical.
METHOD	OECD TG 471 Bacterial Reverse Mutation Test. EC Directive 2000/32/EC B.13/14 Mutagenicity – Reverse Mutation Test using Bacteria. Plate incorporation procedure
Species/Strain	*S. typhimurium*: TA1535, TA1537, TA98, TA100. *E. coli*: WP2 uvrA.
Metabolic Activation System	Aroclor 1254-induced rat liver S9 fraction
Concentration Range in Main Test	a) With metabolic activation: 0 - 5000 µg/plate. b) Without metabolic activation: 0 - 5000 µg/plate.
Vehicle	Distilled water.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/plate) Resulting in:*			
	Cytotoxicity in PreliminaryTest	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1	None	None	None	No
Test 2		None	None	No
Present				
Test 1	None	None	None	No
Test 2		None	None	No

CONCLUSION	The notified chemical was not mutagenic to bacteria under the conditions of the test.
TEST FACILITY	BioReliance (2001).

7.9. Genotoxicity – in vitro

TEST SUBSTANCE	Ammonium salt of PSO.
METHOD	OECD TG 473 In vitro Mammalian Chromosomal Aberration Test. EC Directive 2000/32/EC B.10 Mutagenicity: In vitro Mammalian Chromosomal Aberration Test..
Cell Type/Cell Line	Cultured human lymphocytes.
Metabolic Activation System	Aroclor 1254-induced rat liver S9 fraction.
Vehicle	Growth medium.

Metabolic Activation	*Test Substance Concentration (µg/mL)*	*Exposure Period*	*Fixation Time*
Absent			
Test 1	1000*, 3330*, 5000*	3 hours	24 hours
Test 2	1000*, 1500*, 2000*	24 hours	24 hours
Test 2	1000*, 2000*, 3000*	48 hours	48 hours
Present			
Test 1	1000*, 3330*, 5000*	3 hours	24 hours
Test 2	1000*, 3330*, 5000*	3 hours	48 hours

*Cultures selected for metaphase analysis.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/mL) Resulting in:*			
	Cytotoxicity in PreliminaryTest	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1	MI[a] 99% at 5000	MI 77% at 5000		None
Test 2	MI 21% at 5000	MI 30% at 3330		None
Test 2	MI 20% at 5000	MI 19% at 4000		None
Present				
Test 1	MI 86% at 5000	MI 76% at 5000		None
Test 2		MI 94% at 6000		None

[a] Mitotic Index

CONCLUSION The notified chemical was not clastogenic to cultured human lymphocytes treated in vitro under the conditions of the test.

TEST FACILITY Notox (2002d).

8. ENVIRONMENT

8.1. Environmental fate

8.1.1. Ready biodegradability

TEST SUBSTANCE: EH&S 01-114 (40% weight notified chemical)

METHOD
- Inoculum: Activated sewage sludge
- Exposure Period: 28 days
- Auxiliary Solvent: None
- Analytical Monitoring: BOD, COD
- Remarks - Method: Following 2 preliminary tests, which were terminated on days 5 and 14, due to oxygen depletion in the oxygen and inoculum blank, a successful definitive test was performed. In this test, unacclimated microorganisms were exposed to nominal concentrations of 5 mg/L of the test chemical, an inoculum blank containing no test chemical, or a positive control containing sodium benzoate. Oxygen concentrations were determined on days 5, 15, 21 and 28.

RESULTS

Test substance		*Sodium benzoate*	
Day	*% degradation*	*Day*	*% degradation*
5	0	5	0
15	91	15	90
28	91	28	108

Remarks - Results: The positive control containing sodium benzoate yielded 108% of the theoretical degradation during the test, demonstrating the viability of the inoculum. The loss of oxygen in the test vessel containing the test substance indicated 91% biodegradation by day 15, following an initial 5 day lag phase.

CONCLUSION: The test substance is classified as readily biodegradable under the conditions of the test.

TEST FACILITY: T.R. Wilbury Laboratories (2001)

8.1.2. Bioaccumulation

No bioaccumulation of the notified chemical is expected. The low octanol water/partition coefficient indicates a poor affinity to lipids.

8.2. Ecotoxicological investigations

8.2.1. Acute toxicity to fish (1)

TEST SUBSTANCE: EH&S 01-114 (40% weight PSO in water)

METHOD
- Species: Oncorhynchus mykiss
- Exposure Period: 96 hours
- Auxiliary Solvent: None
- Water Hardness: 48 mg $CaCO_3$/L
- Analytical Monitoring: None
- Remarks – Method: Following a range finding test in which no fish died when exposed to

	nominal concentrations of 0 (control), 0.1, 1.0, 10 and 1000 mg/L of the notified chemical, a definitive test was performed. In this test, 3 replicates of 10 fish each were exposed under static conditions to concentrations of 0 (control) and 1000 mg/L of the test chemical. The number of surviving organisms and the occurrence of sublethal effects were recorded after 24, 48, 72 and 96 hours.
RESULTS	
LC50	>1000 mg/L at 96 hours.
NOEC	1000 mg/L at 96 hours.
Remarks – Results	The notified chemical affected the pH and conductivity of the test media at the start of the test. The pH decreased and the conductivity increased with increasing test chemical concentrations. No insoluble material was observed in the test water at any time during the test. No mortalities or sublethal effects were observed in fish exposed to the notified chemical.
CONCLUSION	The notified chemical is not toxic to Rainbow trout.
TEST FACILITY	T. R. Wilbury (2001c)

8.2.2. Acute toxicity to fish (2)

TEST SUBSTANCE	EH&S 01-114 (40% weight PSO in water)
METHOD	US EPA TSCA 797.1400
Species	Fathead Minnow (*Pimephales promelas*)
Exposure Period	96 hours
Auxiliary Solvent	None
Water Hardness	44 mg $CaCO_3$/L
Analytical Monitoring	
Remarks – Method	Following a range finding test, in which no fish died when exposed to nominal concentrations of 0 (control) 0.99, 10 and 1000 mg/L of the notified chemical, a definitive test was performed. In this test, 3 replicates of 10 fish each were exposed under static conditions to concentrations of 0 (control) and 1000 mg/L of the test chemical. The number of surviving organisms and the occurrence of sublethal effects were recorded after 24, 48, 72 and 96 hours.
RESULTS	
LC50	>1000 mg/L at 96 hours.
NOEC	1000 mg/L at 96 hours.
Remarks – Results	The pH and conductivity of the test media were affected by the test substance. The pH ranged from 6.6 to 8.1. No insoluble material was observed in the test water at any time during the test. Three fish died in one of the 3 replicates exposed to 1000 mg/L, while no deaths occurred in the remaining 2 replicates. The LC50 could not be calculated as there was >50% survival at the concentration tested.
CONCLUSION	The notified chemical is not toxic to Fathead Minnow.
TEST FACILITY	T. R. Wilbury (2001d)

8.2.3. Acute/chronic toxicity to aquatic invertebrates

TEST SUBSTANCE	EH&S 01-114
METHOD	US EPA TSCA 797.1300
Species	*Daphnia magna*

Exposure Period	48 hours
Auxiliary Solvent	None
Water Hardness	172 mg $CaCO_3$/L
Analytical Monitoring	
Remarks - Method	In a range finding test, daphnids were exposed to 0 (control), 1, 10 and 100 mg/L of test chemical. After 48 hours of exposure there was 100% survival in the control and 1.0 mg/L, 70% survival at 10 mg/L and 50% survival at 100 mg/L. Following this, a definitive test was performed in which 3 replicates, each containing 10 daphnids, were exposed to 0 (control) and 1000 mg/L of test substance.

RESULTS

Concentration mg/L		*Number of D. magna*	*Number Immobilised*	
Nominal	*Actual*		*24 h [acute]*	*48 h [acute]*
0	-	3 X 10	30	30
1000	-	3 X 10	30	16

LC50	>1000 mg/L at 48 hours
NOEC	<1000 mg/L at 48 hours
Remarks - Results	No insoluble material was observed in the test water at any time during the test. The pH ranged from 6.5 to 7.6 during the test. The test substance affected the pH and conductivity of the test media at the start of the test, with the pH decreasing and the conductivity increasing with increasing test substance concentrations. In the definitive test, 5, 6, and 5 daphnids (of 10) were alive in each replicate after 48 hours of exposure. The LC50 could not be calculated as there was >50% survival (i.e. 53%) at the concentration tested.

CONCLUSION The test substance is very slightly toxic to *Daphnia* (Mensink *et al* 1995).

TEST FACILITY T. R. Wilbury (2001e)

8.2.4. Algal growth inhibition test

TEST SUBSTANCE EH&S 01-114

METHOD US EPA OPPTS 850.5400: Growth and reproduction toxicity test with the freshwater alga, *Selenastrum capricornutum*.

Species	*Selenastrum capricornutum*
Exposure Period	96 hours
Concentration Range Nominal	0, 150, 250, 400, 600, 1000 mg/L
Concentration Range Actual	Not determined
Auxiliary Solvent	None
Water Hardness	Not stated
Analytical Monitoring	None
Remarks - Method	Test water was adjusted to a target pH of 7.5; however, the target pH could not be attained. At the start of the test ranged between 6.9 and 7.5. At the end of the test, the pH ranged between 7.6 and 10.3. It was noted in the report that the test substance did not affect the pH of the stock solution at the start of the test.

RESULTS

Biomass		*Growth*	
EC50	*NOEC*	*EC50*	*NOEC*
mg/L at 96 h	*mg/L*	*mg/L at 96 h*	*mg/L*
330	150	800	250

Remarks - Results

No insoluble material was noted during the test. The test substance reduced the growth and biomass of algae to between 97% (150 mg/L) and 4% (1000 mg/L) of the control. No effects on size, shape, colour or flocculation of algal cells was observed.

CONCLUSION

The notified chemical is slightly toxic to algae (Mensink *et al*. 1995).

TEST FACILITY

T. R. Wilbury (2001f)

9. RISK ASSESSMENT

9.1. Environment

9.1.1. Environment – exposure assessment

Release estimations and information are provided in Section 5 above. Usage patterns indicate that almost all of the notified chemical will ultimately enter the environment during end use, and with smaller amounts released during reformulation and repackaging.

a) REFORMULATION/REPACKAGING

During reformulating and repackaging, residues in containers are expected to vary from 0.5 kg to 5 kg per vessel, depending on the size of the containers or vessels. The wastes containing the notified chemical are treated on site in the notifier's effluent treatment plant. During treatment, the chemical is expected to form a precipitate with Al and Fe salts and become part of the sludge waste. The solid wastes are separated by gravity settling into sludge pits. The effluent is diluted to wastewater license agreement limits established by Sydney water prior to release into sewer. Any PSO retained on suspended solids and released to sewer is expected to be treated at the treatment facilities and to be biodegraded in its anaerobic digester.

b) END-USE

During end-use, the notified chemical will pass through the end user's water cooling systems during blowdown, cleaning and continuous bleed, from where it will enter on-site effluent treatment facilities prior to being released into the sewer. Because cooling water blowdown volumes are variable and depend on the size of the industrial plant, the cooling duty, and the quality of the feed water supply (EPG 1997), exposure assessment is based on maximum importation volumes and diffuse use patterns rather than typical blowdown volumes. Thus based on importation volumes, up to 5 tonnes per annum of notified chemical could be released into the sewer.

Predicted Environmental Concentration (PEC) for the aquatic environment assuming direct discharge of the notified chemical from water treatment systems into the sewer in communities of varying populations are shown in the table below. Based on adsorption studies (see Section 6), we have assumed that 50% of the chemical partitions to sludge and 50% remains in the water column and there is no biodegradation or volatilisation.

Concentration in effluent	1.76 µg/L		
Concentration in biosolids	17.6 mg/L		
PECwater (µg/L) with 100% release to:			
		Ocean	River
100% population		0.18	1.76
75% population		0.23	2.34
50% population		0.35	3.51
25% population		0.70	7.03
PECsoil (mg/kg) (assumes no degradation)			
		Recycled water	Application of biosolids
Soil concentration	1 year	<0.02	0.18
	5 years	0.1	0.9
	10 years	0.2	1.8

c) ENVIRONMENTAL FATE

The notified chemical is highly water soluble, and is predicted to carry an anionic charge in the environmental pH range, therefore, it should form precipitates with cations in the aqueous environment. No adsorption data was provided for the notified chemical. However, data for a structurally similar chemical (PBTC) indicated 100% adsorption to sludge in waste water treatment facilities with tertiary treatment (by flocculation with Al or Fe salts), while in an SCAS test 60% was adsorbed. An EPG (1997) report predicted lower values of between 20-30% adsorption to sludge for organophosphate sodium salts in wastewater treatment plants.

The notified chemical is readily biodegradable, with 91% degradation by sewage micro-

organisms occurring within 15 days. As such, biodegradation should also occur in the sewer and in the natural environment.

9.1.2. Environment – effects assessment

Results from toxicological studies provided by the notifier indicate the notified chemical is very slightly toxic to fish and daphnia, and is slightly toxic to algae, according to the classification of Mensink *et al*. (1995). Fish and Daphnia had LC50 values greater than 1000 mg/L, and algae had LC50 values of 330 mg/L (biomass) and 800 mg/L (growth). The NOEC values for fish and Daphnia were 1000 mg/L, and for algae were 150 and 250 mg/L, for biomass and growth, respectively.

Applying a safety factor of 100, a predicted no effects concentration (PNEC) of 3.3 mg/L is determined based on the endpoint for the most sensitive algae result.

It is noted that in laboratory toxicity tests, scale inhibitors are likely to exhibit higher toxicity (i.e. lower EC_{50}) effects toward algae than would be expected to occur in the natural environment. Scale inhibitors are able to prevent scale formation by adsorbing onto the crystal nuclei of chemical compounds such as calcium carbonate, calcium phosphate, and compounds of magnesium and silica, thereby preventing crystal growth on the surfaces of equipment (EPG, 1997). Inhibition of algal cell growth by scale inhibitors is thought to result from the substance sequestering critical micronutrient metals in the growth medium, and hence starving the algae. This phenomenon has been documented for a number of scale inhibitor substances (eg. Schowanek *et al*. 1996). However, dissolved chemical released into natural surface water is expected to have much of its scavenging capabilities reduced because the active sites will already be loaded with Ca^{2+}, Mg^{2+} and other ions scavenged from water treatment systems and the nutrient-rich sewage effluent. As such, it should not limit available nutrient in the natural environment.

It is suggested that both NOEC and EC_{50} values given by algal growth inhibition tests may be overestimated by at least one order of magnitude for strongly chelating chemicals (Schowanek *et al*. 1996).

9.1.3. Environment – risk characterisation

The PEC/PNEC ratios, shown in the table below, for aquatic exposure risk at end use are significantly less than 1 for all scenarios calculated.

PEC/PNEC when PECwater = 1.76 µg/L with 100% release to:		
	Ocean	River
100% population	5.5×10^{-5}	5.3×10^{-4}
75% population	6.9×10^{-5}	7.1×10^{-4}
50% population	1.1×10^{-4}	1.1×10^{-3}
25% population	2.1×10^{-4}	2.1×10^{-3}

These calculations indicate that when the chemical is released to the ocean or to rivers, adverse effects are not anticipated even where the release is concentrated within the population.

The polyanionic nature of the notified chemical favours strong binding to soils and sediments (Boethling and Nabholz, 1997). Consequently, a large portion of the chemical is likely to be removed in sewage treatment facilities by adsorption and settling, leaving only a small amount associated with the water compartment. Sludge from treatment works will ultimately be disposed of in landfill as solid wastes. In landfill, it is expected to adsorb strongly to soil and sediment and as such should not leach in aquatic compartments even though the chemical is water soluble.

Given the above considerations, the notified chemical is not expected to pose a significant threat to aquatic organisms when released into the environment in the quantities anticipated.

9.2. Human health

9.2.1. Occupational health and safety – exposure assessment

Transport and storage workers are not expected to be exposed to the notified chemical except in the event of an accident.

During reformulation and repackaging some drips and spills can be expected during transfer of the 40% imported solution to a mixing vessel. These would normally be of the order of liters or less and workers will be wearing protective clothing, gloves and footwear to minimise exposure. Little exposure is expected during QC operations and cleaning of equipment as the amounts will be small or diluted. Local exhaust ventilation will be employed and the packaging line will be automated.

Connection of product containers to water cooling systems by operators or sales representatives can potentially result in drips and spills. However, the notified chemical is at a concentration of < 10%, the spills will be likely to be small and intermittent, and the personnel will be wearing appropriate personal protective equipment.

9.2.2. Public health – exposure assessment

The public are unlikely to come into contact with the notified chemical as it is used in industrial settings. Any exposure to mist from cooling towers will result in exposure to the notified chemical at very low concentrations (parts per million). In the event of a transport accident some exposure is possible.

9.2.3. Human health - effects assessment

The notified chemical was of low acute oral and dermal toxicity in rats, was not a skin irritant in rabbits or a skin sensitiser in guinea pigs, was not mutagenic in bacteria and was not clastogenic in cultured human lymphocytes. A different salt of the notified chemical was a slight eye irritant in rabbits and analogues of the notified chemical did not exhibit systemic toxicity in 90-day oral repeat dose experiments in rats or dogs.

The notified chemical would not be classified as hazardous according to the NOSHC *Approved Criteria for Classifying Hazardous Substances.*

9.2.4. Occupational health and safety – risk characterisation

Given the likely low hazard of the notified chemical, the limited and intermittent opportunities for exposure and the use of personal protective equipment described by the notifier, the risk of adverse health effects to transport and storage workers, formulation, QC and maintenance workers, end users and sales representatives is expected to be low.

9.2.5. Public health – risk characterisation

The risk of adverse health effects to any member of the public is considered to be low given the low hazard of the notified chemical and the low probability that members of the public will come into contact with the chemical as imported or when formulated for use.

10. CONCLUSIONS – ASSESSMENT LEVEL OF CONCERN FOR THE ENVIRONMENT AND HUMANS

10.1. Hazard classification

Based on the available data the notified chemical is not classified as hazardous under the NOHSC *Approved Criteria for Classifying Hazardous Substances.*

10.2. Environmental risk assessment

On the basis of the PEC/PNEC ratio: The chemical is not considered to pose a risk to the environment based on its reported use pattern.

10.3. Human health risk assessment

10.3.1. Occupational health and safety

There is Low Concern to occupational health and safety under the conditions of the occupational settings described.

10.3.2. Public health

There is Low Concern to public health when used as described.

11. MATERIAL SAFETY DATA SHEET

11.1. Material Safety Data Sheet

The MSDS of the notified chemical provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 1994a). It is published here as a matter of public record. The accuracy of the information on the MSDS remains the responsibility of the applicant.

11.2. Label

The label for the notified chemical provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Labelling of Workplace Substances* (NOHSC, 1994b). The accuracy of the information on the label remains the responsibility of the applicant.

12. RECOMMENDATIONS

CONTROL MEASURES

Occupational Health and Safety

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified chemical as introduced:
  - impervious gloves and safety glasses
- A copy of the MSDS should be easily accessible to employees.
- If products and mixtures containing the notified chemical are classified as hazardous to health in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances*, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Environment

Disposal

- The notified chemical should be recycled where possible or disposed of in accordance with local, state, and federal regulations.

Emergency procedures

- Spills/release of the notified chemical should be soaked up with an absorbent material and place in containers for disposal.

12.1. Secondary notification

The Director of Chemicals Notification and Assessment must be notified in writing within 28 days by the notifier, other importer or manufacturer:

(1) Under Section 64(2) of the Act:

- if any of the circumstances listed in the subsection arise.

The Director will then decide whether secondary notification is required.

No additional secondary notification conditions are stipulated.

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