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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

12H-Dibenzo[d,g][1,3,2]dioxaphosphocin, 2,4,8,10-tetrakis(1,1-dimethylethyl)-6-hydroxy-, 6-oxide, sodium salt (ADK STAB NA-11)

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1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Marubeni Australia Ltd (ABN:53 000 329 699)
Level 18 367 Collins St
MELBOURNE VIC 3000

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:
Names of the testing facilities
End users of the notified chemical

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
Variation to the schedule of data requirements is claimed as follows:
Dissociation constant, flashpoint, explosive properties, oxidising properties, acute inhalation study, induction of germ cell damage, 21 day Daphnia reproduction study, fish bioaccumulation study

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
None.

NOTIFICATION IN OTHER COUNTRIES
US PMN (1990), Canada (2002, listed on DSL 2003), Japan (1985 Registration No. (5)-5864), EU listed on EINECS (286-344-4).

2. IDENTITY OF CHEMICAL

CHEMICAL NAME
12*H*-Dibenzo[*d,g*][1,3,2]dioxaphosphocin, 2,4,8,10-tetrakis(1,1-dimethylethyl)-6-hydroxy-, 6-oxide, sodium salt

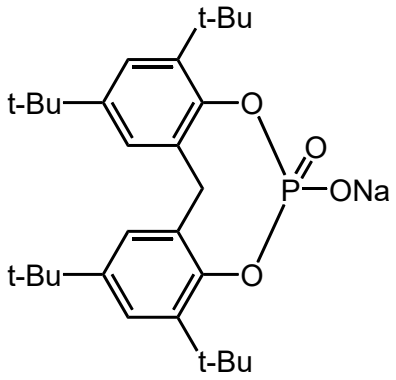
OTHER NAME(S)
2,4,8,10-Tetra(tert-butyl)-6 hydroxy-12H-dibenzo[d,g][1,3,2]dioxaphosphocin 6-oxide, sodium salt
Sodium-2,2-methylene bis(4,6-ditert-bethylphenyl)phosphate (SMBP)

MARKETING NAME(S)
ADK STAB NA-11
ADK STAB NA-11 UH

CAS NUMBER
85209-91-2

MOLECULAR FORMULA
$C_{29}H_{43}O_4P.Na$

STRUCTURAL FORMULA



MOLECULAR WEIGHT
508.61

SPECTRAL DATA

METHOD	Ultraviolet/Visible light (UV/VIS) Spectroscopy
Remarks	For ADK STAB NA-11 Batch 104Z9 (~ 100% notified chemical) λmax =270 nm; ε = 1.66 x 10^3, λmax =278nm; ε = 1.84 x 10^3 (neutral) λmax =269nm; ε = 1.17 x 10^3, λmax =276 nm; ε = 1.19 x 10^3 (acidic) λmax =270nm; ε = 1.74 x 10^3, λmax =278nm; ε = 1.92 x 10^3 (basic)
TEST FACILITY	(Test Facility A, 2000a)

SPECTRAL DATA

METHOD	Infrared (IR) Spectroscopy
Remarks	For ADK STAB NA-11 Batch 104Z9 (~ 100% notified chemical) Peaks at 3428, 2957, 2868, 1600, 1475, 1362, 1263, 1233, 1098, 921, 896, 879, 787, 700, 648, 522 cm^{-1}
TEST FACILITY	(Test Facility A, 2000b)

SPECTRAL DATA

METHOD	^{1}H Nuclear Magnetic Resonance Spectroscopy
Remarks	For ADK STAB NA-11 Batch 104Z9 (~ 100% notified chemical) Peaks at 7.252, 7.244, 7.069, 7.062, 3.348, 3.282, 2.513, 2.507, 2.501, 2.495, 2.489, 1.370, 1.258 ppm
TEST FACILITY	(Test Facility A, 2000c)

METHODS OF DETECTION AND DETERMINATION

METHOD	Ultraviolet/Visible light (UV/VIS) spectroscopy, Infrared (IR) spectroscopy, ^{1}H Nuclear Magnetic Resonance (NMR) spectroscopy, and High Performance Liquid Chromatography (HPLC).
Remarks	Reference spectra were provided.

3. COMPOSITION

DEGREE OF PURITY
99.8%

HAZARDOUS IMPURITIES/RESIDUAL MONOMERS
None.

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

ADDITIVES/ADJUVANTS
None.

4. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS
The notified chemical will not be manufactured in Australia. The notified chemical will be imported in neat form in 7kg paper bags with plastic liners or 10 kg plastic bags packed in cardboard boxes.

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

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	1	2	4	7	7

USE
The notified chemical will be used as a clarifying agent and/or a nucleating agent in the production of polypropylene products such as automotive moulded parts for the interior/exterior of motor vehicles and components of electrical appliances.

5. PROCESS AND RELEASE INFORMATION

5.1. Distribution, transport and storage

PORT OF ENTRY
Melbourne and Sydney

IDENTITY OF MANUFACTURER/RECIPIENTS
Polymer manufacturers or compound companies.

TRANSPORTATION AND PACKAGING
The notified chemical is imported by sea in plastic-lined paper bags or cardboard boxes, before being transported from the dockside by road directly to the notifier's warehouse where it is immediately dispatched to the polymer manufacture sites.

5.2. Operation description

At the polymer manufacture sites the packed notified chemical is warehoused until required.

The notified chemical, plastic powder, filler and other additives are weighed and added manually into a closed system mixer. The powders are mixed and the resultant mixture is fed automatically to a closed preheated extruder, which will produce the plastic pellets. Less than 0.5% of the notified chemical will be present in the pellets. The pellets are automatically weighed and packed into bulk bags.

During the production of the final plastic articles the plastic pellets are manually transferred into the open hopper of an injection moulding machine. The pellets are heated in the closed system moulding machine and injected as a liquid under pressure into moulds to form articles containing up to 0.5% of the notified chemical.

5.3. Occupational exposure

Number and Category of Workers

Category of Worker	*Number*	*Exposure Duration*	*Exposure Frequency*
Transport and warehousing	1-2	<8 hours/day	2 days/year
Warehousing	2-5	1 hours/day	10 days/year
Formulation of plastic pellets	5-10	2 hours/day	80 days/year
Cleaning following reformulation	2	1 hour/day	240 days/year

Moulding of finished articles	5-10	2 hours/day	80 days/year
Maintenance of moulding machinery	1-2	1 hour/day	24 days/year

Exposure Details
Transport and warehousing workers will have low exposure as under normal circumstances, they will only handle sealed packages.

During formulation, the main point of exposure to 100% notified chemical will occur when the chemical is weighed and poured into the mixer. The notified chemical is normally weighed into small plastic containers in a booth fitted with an extraction fan. Exposure will be minimised by personal protective equipment (PPE) such as a particle-filter mask, safety glasses, head covering, gloves and overalls. Local exhaust ventilation is present in the weighing and loading areas, as well as the mixers, which are exhausted to dust filter bags.

When handling the finished product (pellets containing <0.5% notified chemical), workers will wear PPE such as dust masks, gloves and overalls. Given these precautions, exposure is likely to be low.

Following reformulation, the notified chemical will be present at a concentration of <0.5% and will be encapsulated in pellets. Because of the function of the notified chemical as a nucleating agent, it is expected to be bound within the plastic and it is unlikely that there will be any leaching or blooming from the pellets of plastic products. Thus exposure to the notified chemical is not expected at this stage. At the end-use site these pellets will be used to injection mould various articles. Workers will wear gloves and eye protection. Exhaust ventilation is preset to the moulding machines.

5.4. Release

RELEASE OF CHEMICAL AT SITE
There will be no release in Australia due to manufacture as the notified chemical will not be manufactured here.

Release to the environment during shipping, transport and warehousing will only occur through accidental spills or leaks of the polyethylene bag container. This is expected to be minor due to the packaging of the material.

RELEASE OF CHEMICAL FROM USE
There will be some residual powder left in the empty import bags. This is estimated to be less than 0.1% of the annual import volume (i.e. up to 7 kg annually). Empty bags and any residuals will be disposed of to regulated landfill.

During the extrusion process to incorporate the notified chemical into plastic pellets (masterbatch) and the production of the final plastic article, waste will be generated by spillage, off-cuts, out-of-specification material and equipment cleaning. This waste accounts for up to 3% of the imported notified chemical (i.e. up to 210 kg annually) and will be collected and disposed of.

The process equipment will not be washed between batches. In each batch the first lot of product is discarded. Any spilt material will be collected and placed into sealable containers ready for disposal.

In the end product the notified chemical is incorporated in an inert matrix and will not be released to the environment.

5.5. Disposal

All the solid wastes generated containing the notified chemical will either be disposed of to landfill or by incineration. In landfill the notified chemical will not be mobile and will slowly undergo abiotic and biotic degradation.

5.6. Public exposure

The public may come into contact with finished articles containing the notified chemical however because the notified chemical is a nucleating agent it is expected to be bound within the plastic, and no release of the notified chemical from the finished articles is expected.

6. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20ºC and 101.3 kPa White powder

Melting Point/Freezing Point Decomposes from 313ºC

METHOD EC Directive 92/69/EEC A.1 Melting/Freezing Temperature.
Remarks The test substance was examined using differential scanning calorimetry by heating from 20ºC to 400ºC at a heating rate of 20ºC/min and 67ºC to 400ºC at a heating rate of 20ºC/min.

Melting temperature was not observed. At high temperatures (313 - 334ºC) reaction or decomposition of the test substance was observed.

In the first experiment, only small heat effects were observed. At temperatures greater than 334ºC an exothermic effect was observed which increased with increasing temperature. This effect was probably caused by reaction or decomposition of the test substance. At lower temperatures (105-240ºC) a small exothermic effect was observed. It was not clear what process caused this effect and it was not reproduced in the second experiment. At the end of the experiment no significant mass change of the sample was observed, the sample did not appear to have been molten, the colour of the sample was changed from white to light grey.

In the second experiment at temperatures above 313ºC an exothermic effect was observed with increased temperature. This effect is probably caused by reaction or decomposition of the test substance. After the experiment the sample had lost 1% of its mass; the sample did not appear to have been molten. The colour of the sample changed from white to light grey.

TEST FACILITY Test Facility A (2000d)

Boiling Point Not determined.

Density 1180 kg/m^3 at 20ºC

METHOD EC Directive 92/69/EEC A.3 Relative Density.
Remarks Testing carried out using a gas comparison pycnometer.
TEST FACILITY Test Facility A (2000e)

Vapour Pressure $1.1x10^{-4}$kPa at 20ºC

METHOD EC Directive 92/69/EEC A.4 Vapour Pressure.
Remarks Static vapour pressure measurements were made with a capacitance manometer fitted with a 133 Pa capacitive sensor. The reference pressure at the right-hand side of the pressure sensor was kept below 10^{-4} Pa. The temperature of the sample was measured with a platinum resistance thermometer. A total of 54 measurements were made between 38.17 and 24.60ºC, and the vapour pressure at 20ºC calculated from the vapour pressure curve.

The notified chemical is moderately volatile according to the classification of Mensink et al (1995).

TEST FACILITY Test Facility A (2000f)

Water Solubility 1.85 g/L at 20ºC

METHOD OECD TG 105 Water Solubility.

EC Directive 92/69/EEC A.6 Water Solubility.

Remarks Flask Method
Three samples of the test material (~300 mg) were dissolved in 25 mL of double distilled water, stirred for 72 h at 19.5 ± 0.5°C and analysed with HPLC after a 125 fold pre-dilution with the mobile phase.

This result indicates that the notified chemical is readily soluble (Mensink et al., 1995)

TEST FACILITY Test Facility A (2000g)

Hydrolysis as a Function of pH

METHOD OECD TG 111 Hydrolysis as a Function of pH.
EC Directive 92/69/EEC C.7 Degradation: Abiotic Degradation: Hydrolysis as a Function of pH.

pH	*T (°C)*	*$t_{½}$ <hours or days>*
4	25°C	Not Determined
7	25°C	>1 year
9	25°C	>1 year

Remarks The solubility of the test material in the buffer solutions was observed to be far lower than that observed in double distilled water. The solubility of the test material in the buffer solutions was determined be 4.7 mg/L, 369 mg/L and 465 mg/L at pH 4, 7 and 9 respectively. The low water solubility of the test material in the pH 4 buffer prevented the determination of the hydrolysis behavior, particularly as the samples required dilution by a factor of 5 to overcome interference of the buffer solution during analysis lowering the concentration below the detection limit. The low solubility of the compound at pH 4 reflects the protonation of the chemical to form a neutral species reducing solubility. The results indicate that the test material is hydrolytically stable in neutral and basic solutions.

TEST FACILITY Test Facility A (2000h)

Partition Coefficient (n-octanol/water) log Pow > 6.2 at 20ºC at pH 1 (HPLC Method)
log Pow = 0.8 at 20ºC (Estimation Method)

METHOD OECD TG 117 Partition Coefficient (n-octanol/water).
EC Directive 92/69/EEC A.8 Partition Coefficient.

Remarks HPLC Method/Flask Method
The partition coefficient was determined using HPLC at low pH. The test material is a salt and under the conditions of low pH it is expected to be protonated and hence have a much lower solubility (as reflected by the results of the hydrolysis study in which the solubility at pH 4 was much lower than at pH 7 and pH 9).

The estimation of the partition coefficient from the solubility of the test material in water and octanol reflects the partition coefficient of the deprotonated or salt form of the test material and is consequently much lower.

TEST FACILITY Test Facility A (2000i)

Adsorption/Desorption – main test log K_{oc} = 3.19 (soil 115)*
= 2.91 (soil 164)*
= 3.66 (soil 230)*

* Tested at 20 ± 2ºC

METHOD OECD TG 106 Adsorption - Desorption
Determined according to test guidelines using a procedure that measures the

decrease in concentration when aqueous solutions of a chemical are in contact under laboratory conditions with three different soils common in the agricultural regions in western Europe.

Soil Type	*Organic Carbon Content (%)*	*pH*	*Koc (mL/g)*
Cranfield 115	1.6	8.1	1566
Cranfield 164	2.0	7.2	808
Cranfield 230	0.8	5.1	4671

Remarks Adsorption and desorption were determined at an initial concentration of 5.06 mg/L using 0.01 M $CaCl_2$ solution with 16 hours shaking for both the adsorption and desorption (2 cycles) phases. The supernatants were analysed by HPLC. The notified chemical mixture can be considered immobile in all three soils, according to the classification scheme by Mensink (1995).

TEST FACILITY Test Facility A (2000j)

Dissociation Constant pKa = 2.10

METHOD Calculated using pKalc version 3.2 (module in PALLAS version 2.1)
Remarks Attempts to determine the dissociation constant of the test material using titration and a spectrophotometric method were unsuccessful due to the precipitation of the test material at low pH.

TEST FACILITY Test Facility A (2000k)

Particle Size

METHOD OECD TG 110 Particle Size Distribution/Fibre Length and Diameter Distributions.

Range (μm)	*Mass (%)*
<10	1.965
<25	6.859
<50	19.32
<75	47.93
<100	82.09

Remarks The sample was observed under 3 conditions,:
Direct observation
Under a microscope with 100x magnification
Under a microscope with 400x magnification.
Under direct observation the sample was observed to be a fine, free-flowing, white powder. At 100x magnification, the particles appeared to be irregular needle/fibre shaped. The smallest particle size was approximately 3 μm and the largest size was 500 μm. The particle size distribution was approximately 70-80% <200 μm and 20-30% in the range of 200-500 μm. At 400x magnification the powder was made up of agglomerated small particles.

The sample was initially observed to determine whether sieving of the material was required. The final sample was then analysed using the Coulter Laser Defraction Analyser fitted with a dry powder module.

The inspirable fraction (<100 μm) was 82.09% and the respirable fraction was (<10 μm) 1.965%.

TEST FACILITY Test Facility B (2000a)

Flammability Not highly flammable.

METHOD EC Directive 92/69/EEC A.10 Flammability (Solids).
Remarks The flammability of the notified chemical was determined by measuring the burning rate of the notified chemical prepared as a pile of set dimensions. The test substance ignited on application of an ignition source. The test substance burned with a yellow flame and turned black on contact with the ignition source. No propagation throughout the test substance pile was observed. After removal of the ignition source the flame extinguished immediately.

TEST FACILITY Test Facility A (2000l)

Flammability Limits Not highly flammable.

METHOD EC Directive 92/69/EEC A.12 Flammability (contact with water).
Remarks The notified chemical does not contain groups that might lead to the evolution of highly flammable gases in dangerous quantities. Furthermore no metals, transition metals, boron, or silicon are present. The notified chemical is not water soluble. Therefore it can be concluded that the notified chemical is incapable of developing a dangerous amount of (flammable) gas in contact with air, damp air or water.

TEST FACILITY Test Facility A (2000m)

Autoignition Temperature 360°C

METHOD 92/69/EEC A.16 Relative Self-Ignition Temperature for Solids.
Remarks The test material was heated from ambient temperature to 400°C at rate of 0.5°C/min in an oven and the relative self ignition temperature was determined. The test substance showed an exothermic reaction starting at an oven temperature of about 355°C. The test substance temperature increased to >400°C (reaching a maximum temperature of 460°C) at an oven temperature of 360°C, which was taken to represent the auto ignition temperature.

TEST FACILITY Test Facility A (2000n)

Explosive Properties None

Remarks From the structural formula of the notified chemical it was concluded that the notified chemical is not explosive. The notified chemical does not contain any chemically instable or high energetic groups that might lead to an explosion.
The MSDS for the chemical notes that it can form an explosive dust/air mixture.

TEST FACILITY Test Facility A (2000o)

Oxidizing Properties None.

METHOD EC Directive 92/69/EEC A.17 Oxidizing Properties (Solids).
Remarks Examination of the structure of the notified chemical established beyond reasonable doubt that the notified chemical is incapable of burning, when mixed with cellulose at higher or equal rate compared with the maximum burning rate of a reference mixture of cellulose and barium nitrate.

TEST FACILITY Test Facility A (2000p)

Pyrophoric Properties None.

METHOD EC Directive 92/69/ECC A.13 Pyrophoric properties of solids and liquids
Remarks From the structural formula it was concluded that notified chemical was not pyrophoric. The notified chemical does contain any chemical group that might lead to spontaneous ignition a short time after coming into contact with air room temperature.

TEST FACILITY Test Facility A (2000q)

Reactivity

Remarks The notified chemical is not expected to be reactive under normal environmental conditions. Decomposition products may include oxides of carbon and phosphorus.

7. TOXICOLOGICAL INVESTIGATIONS

Endpoint and Result	*Assessment Conclusion*
Rat, acute oral LD50 >2000 mg/kg bw	low toxicity
Mouse, acute oral LD50 >7800 mg/kg bw	low toxicity
Rat, acute dermal LD50 >2000 mg/kg bw	low toxicity
Rat, acute inhalation	No data supplied.
Rabbit, skin irritation	non-irritating
Rabbit, eye irritation	slightly irritating
Guinea pig, skin sensitisation – adjuvant test	no evidence of sensitisation
Rat, repeat dose peroral toxicity – 90 days.	NOAEL = 500 mg/kg bw/day
Genotoxicity – E. Coli reverse mutation	non mutagenic
Genotoxicity – S. Typhimurium reverse mutation	non mutagenic
Genotoxicity – in vitro HGPRT point mutation assay	non genotoxic
Genotoxicity – in vitro chromosomal aberration assay	non genotoxic

7.1. Rat, acute toxicity – oral

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 423 Acute Oral Toxicity – Acute Toxic Class Method. EC Directive 96/54/EEC B.1tris Acute Oral Toxicity – Acute Toxic Class Method.
Species/Strain	Rat/Hsd:Sprague-Dawley(CD)
Vehicle	1% w/v aqueous methylcellulose
Remarks - Method	No significant protocol deviations.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
1	3/sex	2000 mg/kg bw	

LD50	>2000 mg/kg bw
Signs of Toxicity	Piloerection and loose faeces were seen in all animals within 3 hours of dosing. Hunched posture was also observed, in females only, from 3 hours post dose. These symptoms stopped by Day 3. All animals were considered to have achieved satisfactory bodyweight gains.
Effects in Organs	No abnormalities revealed at study termination.
Remarks - Results	None.
CONCLUSION	The notified chemical is of low toxicity via the oral route.
TEST FACILITY	Test Facility C (2001a)

7.2. Mouse, acute toxicity – oral

TEST SUBSTANCE	Notified chemical
METHOD	Test substance administered orally, and mice were observed for 10 days after treatment. Body weights were reported, but there is no indication that necroscopy was carried out.
Species/Strain	Mouse/ddY
Vehicle	Olive oil
Remarks - Method	The test report does not indicate that GLP was observed during the test.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
1	10/m	2731 mg/kg bw	0
2	10/m	3550 mg/kg bw	0
3	10/m	4615 mg/kg bw	0
4	10/m	6000 mg/kg bw	0
5	10/m	7800 mg/kg bw	0

LD50	>7800 mg/kg bw
Signs of Toxicity	There was a decrease in body weight between dosing and Day 1 for all groups. From Day 1-5 there was an increase in bodyweight for all groups. From Day 5-7 there was again a decrease in body weight for all groups. From days 7-10 there was an increase for all groups with the exception of the group receiving 6000 mg/kg bw. Over the 10-day observation period, all groups had increases. There was no dose-response relationship with respect to overall body weight gain.
Effects in Organs	No abnormalities revealed at study termination.
Remarks - Results	None.

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

TEST FACILITY Test Facility D (2001a)

7.3. Acute toxicity – dermal

TEST SUBSTANCE Notified chemical

METHOD OECD TG 402 Acute Dermal Toxicity.
EC Directive 92/69/EEC B.3 Acute Toxicity (Dermal).

Species/Strain	Rat/Hsd:Sprague-Dawley (CD)
Vehicle	1% aqueous methylcellulose
Type of dressing	Semi-occlusive.
Remarks - Method	No significant protocol deviations. 24-hour exposure period, followed by washing with warm water.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
1	5/sex	2000	0

LD50	>2000 mg/kg bw
Signs of Toxicity - Local	Slight erythema and/or oedema was seen in four males and all females, resolving by day 4. Spots and/or scabbing were observed in three females from day 6, resolving by day 11.
Signs of Toxicity - Systemic	A notably low bodyweight gain was noted in one male and all females on day 8 and for two females on day 15.
Effects in Organs	No abnormalities recorded during necroscopy.
Remarks - Results	

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

TEST FACILITY Test Facility C (2001b)

7.4. Acute toxicity – inhalation

No data supplied.

7.5. Irritation – skin

TEST SUBSTANCE	Notified chemical
METHOD	U.S. EPA Pesticide Assessment Guidelines – Primary Dermal Irritation Study (1982)
Species/Strain	Rabbit/New Zealand White
Number of Animals	3/sex
Vehicle	None. Test material was moistened with 0.9% saline.
Observation Period	72 hours
Type of Dressing	Semi-occlusive.
Remarks - Method	No significant protocol deviations. 4-hour exposure period, followed by washing in lukewarm water.

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.

Remarks - Results	No adverse effects documented.
CONCLUSION	The notified chemical is non-irritating to the skin.
TEST FACILITY	Test Facility E (1990a)

7.6. Irritation – eye

TEST SUBSTANCE	Notified chemical
METHOD	U.S. EPA Pesticide Assessment Guidelines – Primary Eye Irritation Study (1982)
Species/Strain	Rabbit/New Zealand White
Number of Animals	3/sex
Observation Period	72 hours
Remarks - Method	No significant protocol deviations.

RESULTS

Lesion	*Mean Score**	*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
Conjunctiva: redness	1.28	2	48 hours	0
Conjunctiva: chemosis	0.33	2	24 hours	0
Conjunctiva: discharge	0.167	3	48 hours	0
Corneal opacity	0	0	-	0
Iridial inflammation	0.167	1	48 hours	0

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

Remarks - Results	The notified chemical produced iridial involvement and moderate conjunctival irritation, which cleared by the 72-hour observation. No corneal injury was observed.
CONCLUSION	The notified chemical is slightly irritating to the eye.

TEST FACILITY Test Facility E (1990b)

7.7. Skin sensitisation

TEST SUBSTANCE Notified chemical

METHOD OECD TG 406 Skin Sensitisation - Magnusson and Kligman Method.
EC Directive 96/54/EC B.6 Skin Sensitisation - Magnusson and Kligman Method.

Species/Strain Guinea pig/Dunkin-Hartley

PRELIMINARY STUDY Maximum Non-irritating Concentration:
intradermal: None. (Erythema observed at all concentrations)
topical: 65% (highest concentration tested)

MAIN STUDY

Number of Animals Test Group: 10 Control Group: 5

INDUCTION PHASE Induction Concentration:
intradermal: 0.25% w/v
topical: 65% w/v

Signs of Irritation Necrosis was observed for intradermal application. This occurred for the test item and for the control containing only water and adjuvant.

CHALLENGE PHASE

1st challenge topical: 35% and 65%

Remarks - Method No significant protocol deviations.

RESULTS

Animal	*Number of Animals Showing Skin Reactions after:*			
	35% challenge		*65% challenge*	
	24 h	*48 h*	*24 h*	*48 h*
Test Group	0	0	0	0
Control Group	0	0	0	0

Remarks - Results None.

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

TEST FACILITY Test Facility C (2001c)

7.8. Repeat dose toxicity

TEST SUBSTANCE Notified chemical

METHOD The study was conducted under a similar method to that described in OECD TG 408 Repeated Dose 90-Day Oral Toxicity Study in Rodents.

The notified chemical was suspended at 10% (w/v) and 15, 5, and 2mL/kg was administered for 13 weeks. The control group received 15mL/kg of the vehicle. Housing and feeding conditions, and observation were similar to the OECD test guidelines, except that sensory reactivity to various stimuli as not measured.

There was no recovery period.

Species/Strain Rat/Crj:Wistar

Route of Administration Oral – gavage

Exposure Information Total exposure days: 90 days
Dose regimen: 7 days per week

Vehicle 0.5% CMC-Na solution

Remarks – Method Detailed functional observation battery and sensory reactivity tests were not performed in this test.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw/day*	*Mortality*
I (control)	16/sex	0	1f (week 6)
II (low dose)	16/sex	200	0
III (mid dose)	16/sex	500	0
IV (high dose)	16/sex	1500	2m (weeks 3 and 4) 2f (weeks 10 and 12)

Mortality and Time to Death

Autopsy of the animals that died during the study revealed congestion (dark red and red spots) of the lung in all dead animals. A perforation in the esophageus was observed in one male in the 1500 mg/kg bw/day group. Other findings (congestion and autolysis of organs, retention of bloody substance in thorasic cavity) were generally consistent with death from errors with the gavage administration of the test substance.

Clinical Observations

There was a significant decrease in bodyweight gain for high dose males in week 1 (22%) and week 2 (12%). Food efficiency tended to be lower in both sexes receiving 1500 and 500 mg/kg bw/day, although the difference was not significant. Emaciation was noted during the study in two females receiving 1500 mg/kg bw/day (transient in 1 of these) and one in one male receiving 500 mg/kg bw/day (transient). These animals also exhibited other symptoms including nasal bleeding, rough breathing, loose stool, dirty fur, decreased spontaneous movement and piloerection.

Laboratory Findings – Clinical Chemistry, Haematology, Urinalysis

Urinalysis

Protein and potassium were significantly increased, and urinary volume was significantly decreased, in females receiving 1500 mg/kg bw/day. No other significant differences showing dose-dependence were observed.

Hematology

At the mid and high doses, erythrocyte count and hematocrit were all decreased in both sexes[*], while platelet count and haemoglobin levels were decreased in females only[***]. In males only, prothrombin time was increased[*] and leukocytes were decreased[#].

In the 200 mg/kg bw/day group, significant changes were seen in the hematocrit (2.9% decrease, $p<0.05$) and leukocytes (25% decrease, $p<0.05$) of males, and in the erythrocyte count (3% decrease, $p<0.01$) and hematocrit (3.9% change, $p<0.01$) of females.

Biochemistry

Total protein decreased in females[***] and males[*]. In females creatinine was decreased[***] while inorganic phosphorous increased[***]. Albumin was decreased in females[*]. GOT activity increased in males and females[#]. However GPT activity increased in females[#] and decreased in males[***]. Total bilirubin and triglycerides decreased in males[#]. Alp activity decreased in females[#]. LDH activity, total cholesterol and phospholipid increased in females[#].

[***] large (>10%) dose-dependent change
[*] small (<10%) dose-dependant change
[#] large (>10%) change, but no clear dose dependence

Effects in Organs

Absolute and relative liver weights decreased in males[#], however absolute liver weights were increased in females[*]. Very slight congestion of the liver was noted in one male receiving 1500 mg/kg bw/day, and slight hydropic degeneration was observed in two females of the 1500 mg/kg bw/day group.

Absolute and relative adrenal gland weights were increased in males[***], however absolute adrenal gland weights were decreased in females[***].

Relative kidney weights were decreased in males* and relative thymus weights were decreased in females#.

A small number of granuloma were observed in one male of the 1500 mg/kg bw group, and dark red colour of the lung was observed in one female of this group.

All other changes observed were small or inconsequential and did not show dose-dependence.

*** large (>10%) dose-dependent change
* small (<10%) dose-dependant change
# large (>10%) change, but no clear dose dependence

Remarks – Results
The mortality that occurred during the test was possibly caused by mechanical damage from administration of the test substance or aspiration of the test substance. All the animals that died (4 high dose and 1 control) were receiving 15ml/kg bw of liquid, and the autopsies revealed findings consistent with improper dosing, resulting in test material in the lungs.

There were significantly decreased bodyweight gains in the high-dose group, and food efficiency was decreased in animals receiving 500 mg/kg bw/day and above. Some animals in these groups were emaciated.

The notified chemical appears to cause slight anaemia, with lowering of the RBC count, Hb concentration, hematocrit, platelet count and prothrombin time. This effect was seen in all dose groups. Bone marrow was not examined. There was no evidence of haemolysis, in particular there was no increase in bilirubin in the blood or haemoglobin in the urine (ECB 2004). Total protein was decreased in males and females.

Other changes were inconsistent and did not show dose dependency, and are thus not considered biologically relevant.

CONCLUSION
A No Observed Effect Level (NOEL) cannot be established in this study, as there were haematological changes to animals indicative of anaemia in all treated groups. The study reported that the effects seen on low food efficiency, anemia decrease in organ weight of liver and kidney at 1500 and 200 mg/kg groups were considered as secondary effects, as non specific effects were seen at histology and autopsy. Hence the No Observed Adverse Effect level is set at 500 mg/kg bw based on changes in body weight gain.

TEST FACILITY	Test Facility F (1986)

7.9. Genotoxicity – E. Coli

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. Test 1: Plate incorporation procedure Test 2: Pre incubation procedure
Species/Strain	*E. coli*: WP2uvrA (pKM101)
Metabolic Activation System	Rat S9.
Concentration Range in Main Test	a) With metabolic activation: 5-5000 µg/plate b) Without metabolic activation: 5-5000 µg/plate
Vehicle	DMSO
Remarks - Method	No significant protocol deviations.

RESULTS

Metabolic	*Test Substance Concentration (µg/plate) Resulting in:*

Activation	*Cytotoxicity in Preliminary Test*	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1	-	5000 µg/mL	None reported.	None.
Test 2	-	5000 µg/mL	None reported.	None.
Present				
Test 1	-	5000 µg/mL	None reported.	None.
Test 2	-	5000 µg/mL	None reported.	None.

Remarks - Results: Suitable positive control substances were tested and showed a distinct increase in the number of revertant colonies.

CONCLUSION: The notified chemical was not mutagenic to bacteria under the conditions of the test.

TEST FACILITY: Test Facility C (2001d)

7.10. Genotoxicity – S. Typhimurium

TEST SUBSTANCE: Notified chemical

METHOD: OECD TG 471 Salmonella Typhimurium, Reverse Mutation Assay 1st addendum (1983)
EC Directive 84/449, L 251, p. 143-145
Plate incorporation procedure

Species/Strain	*S. typhimurium*: TA1535, TA1537, TA98, TA100
Metabolic Activation System	Rat S9.
Concentration Range in Main Test	a) With metabolic activation: 10-5000 µg/plate b) Without metabolic activation: 10-5000 µg/plate
Vehicle	Methanol
Remarks - Method	Pre-experiment for toxicity was conducted only on TA 98 and TA100 cells.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/plate) Resulting in:* *Cytotoxicity in Preliminary Test*	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1	None.	100 µg/mL (TA 100)	None reported.	None.
Test 2	-	100 µg/mL (TA 100)	None reported.	None.
Present				
Test 1	None.	1000 µg/mL (TA 100)	None reported.	None.
Test 2	-	5000 µg/mL (TA 100)	None reported.	None.

Remarks - Results: Suitable positive control substances were tested and showed a distinct increase in the number of revertant colonies.

CONCLUSION: The notified chemical was not mutagenic to bacteria under the conditions of the test.

TEST FACILITY: Test Facility G (1991a)

7.11. Genotoxicity – in vitro - HGPRT point mutation assay

TEST SUBSTANCE: Notified chemical

METHOD: OECD TG 476 In vitro Mammalian Cell Gene Mutation Test. 2nd

addendum (1984)
EC Directive 87/302, L 133, p. 61-63
EPA; 40 CFR; Part 798; Detection of Gene Mutation in Somatic Cells in Culture (1986)

Species/Strain	Chinese hamster
Cell Type/Cell Line	V79 cells
Metabolic Activation System	S9 liver microsomal fraction
Vehicle	Ethanol
Remarks - Method	No significant protocol deviations.

Metabolic Activation	*Test Substance Concentration (µg/mL)*	*Exposure Period*	*Expression Time*	*Selection Time*
Absent				
Test 1	0.03, 0.1, 0.3, 1, 2, 3 µg/mL	3 days	4 days	7-8 days
Test 2	0.03, 0.1, 0.3, 1, 2, 3 µg/mL	4 days	3 days	7-8 days
Present				
Test 1	0.1, 0.3, 1.0, 3.0, 6.0, 10.0 µg/mL	3 days	4 days	7-8 days
Test 2	0.1, 0.3, 1.0, 3.0, 6.0, 10.0 µg/mL	4 days	3 days	7-8 days

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/mL) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1	1 µg/mL	0.3 µg/mL	None reported.	None.
Test 2	-	3 µg/mL	None reported.	None.
Present				
Test 1	10 µg/mL	6 µg/mL	None reported.	None.
Test 2	-	6 µg/mL	None reported.	None.

Remarks - Results: Suitable positive control substances were tested and showed a distinct increase in induced mutant colonies.

CONCLUSION: The notified chemical was not clastogenic to Chinese hamster cells treated in vitro under the conditions of the test.

TEST FACILITY: Test Facility G (1991b)

7.9. Genotoxicity – in vitro - chromosomal aberration assay

TEST SUBSTANCE: Notified chemical

METHOD: OECD TG 476 In vitro Mammalian Cell Gene Mutation Test. 1st addendum (1983)
EC Directive 84/449, L 251, B 10, p. 131-133

Species/Strain	Chinese hamster
Cell Type/Cell Line	V79 cells
Metabolic Activation System	S9 liver microsomal fraction
Vehicle	Ethanol
Remarks - Method	No significant protocol deviations.

Metabolic Activation	*Test Substance Concentration (µg/mL)*	*Exposure Period*	*Harvest Time*
Absent			
Test 1	1, 1.5*, 2, 3 µg/mL	7 hours	48 hours
Test 2	0.1*, 0.3, 1*, 1.5, 2*, 3 µg/mL	18 hours	55 hours
Test 3	1, 1.5, 2*, 3 µg/mL	24 hours	48 hours
Present			

Test 1	4*, 6, 8, 10 µg/mL	7 hours	48 hours
Test 2	0.4*, 1, 4*, 6, 8*, 10 µg/mL	18 hours	55 hours
Test 3	4, 6, 8*, 10 µg/mL	24 hours	48 hours

*Cultures selected for metaphase analysis.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/mL) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1	0.1 µg/mL	3 µg/mL	None reported.	None.
Test 2	-	3 µg/mL	None reported.	None.
Test 3	-	3 µg/mL	None reported.	None.
Present				
Test 1	3 µg/mL	10 µg/mL	None reported.	None.
Test 2	-	10 µg/mL	None reported.	None.
Test 3	-	10 µg/mL	None reported.	None.

Remarks - Results

Suitable positive control substances were tested and showed a distinct increase in cells with structural chromosome aberrations.

CONCLUSION

The notified chemical was not clastogenic to Chinese hamster cells treated in vitro under the conditions of the test.

TEST FACILITY

Test Facility G (1991c)

8. ENVIRONMENT

8.1. Environmental fate

8.1.1. Ready biodegradability

TEST SUBSTANCE	Notified Chemical
METHOD	OECD TG 301 B Ready Biodegradability: CO_2 Evolution Test (Modified Sturm Test)
Inoculum	Fresh activated sludge from municipal sewage treatment plant
Exposure Period	28 days
Auxiliary Solvent	None
Analytical Monitoring	Titration 0.05M HCl with remaining $Ba(OH)_2$
Remarks - Method	Test concentration 12 mg TC/L Reference Substance – sodium acetate Treatments: – test substance and inoculum × 2 – inoculum control × 2 – positive control (reference substance and inoculum) × 1 – toxicity control (test substance, reference substance and inoculum) × 1 Titrations done every 2 or 3 days for first 10 days then every 5 days. Theoretical CO_2 production could not be determined. Therefore TC was determined of a sample of the pure test substance. The pH was measured before test started and on day 28.

RESULTS

Day	*Test substance % degradation*	*Positive control % degradation*	*Toxicity control % degradation*
2	0.5, 0.7 = 0.6	5.5	9.0
5	1.1, 2.1 = 1.6	32.2	11.7
9	1.1, 2.7 = 1.9	65.6	28.3
14	1.5, 2.7 = 2.1	80.6	34.9
23	2.3, 3.5 = 2.9	93.2	43.2
29	4.9, 4.2 = 4.5	97.8	44.8

Remarks - Results	On day 14, the reference substance had degraded by 80.6% and on day 28/29 it reached 97.8% degradation, thus satisfying the 60% degradation by day 14 criteria. The toxicity control reached 34.9% degradation on day 14, thus indicating that test material was not inhibitory to the sewage sludge organisms. The temperature range during the study was 20.5 to 22°C, while the pH ranged from 7.5 to 7.8.
CONCLUSION	Degradation of the test material was less than 5% throughout the study. Therefore the test substance is not readily biodegradable.
TEST FACILITY	Test Facility A (1997a).

8.1.2. Bioaccumulation

Not attempted.

8.2. Ecotoxicological investigations

8.2.1. Acute toxicity to fish

TEST SUBSTANCE: Notified chemical

METHOD: OECD TG 203 Fish, Acute Toxicity Test – semi-static.
EC Directive 92/69/EEC C.1 Acute Toxicity for Fish - semi-static.

Species	Rainbow trout (*Oncorhynchus mykiss*)
Exposure Period	96 hours
Auxiliary Solvent	None
Water Hardness	150-200 mg $CaCO_3$/L
Analytical Monitoring	HPLC
Remarks – Method	Based on range-finding tests it was determined that the definitive test concentrations would be 4.27, 9.39, 20.7, 45.5 and 100 mg/L. A measured amount of test substance was homogenized in water by ultrasonication (30 mins), stirred (30 mins) and then added to the test chamber. The concentration and stability of the test solution was determined at 0, 24, 72 and 96 hours. For the three lowest concentrations the solutions were initially clear and colourless, at 45.5 (39.4) mg/L the solution was a colourless and hazy dispersion, and at 100 (75.8) mg/L it was a white opaque dispersion. However, during the test particulate material was visible on the bases of the test vessels or surface in the concentrations 9.39 (7.83) mg/L and greater. The media was renewed daily. The test vessels, each with 7 fish, were covered, maintained at 15±2°C, exposed to a photoperiod of 16 dark/8 hours light and were aerated throughout the study. Temperature (13.3 – 15.4°C), pH (8.0 – 8.3 for both test vessel and control) and dissolved oxygen (83 – 105% in the test solution and 96 – 101% in the control) were recorded daily. The range of environmental test conditions were all acceptable.

RESULTS

Concentration mg/L		*Number of Fish*	*Mortality*					
Nominal	*Actual*		*0.25 h*	*2 h*	*24 h*	*48 h*	*72 h*	*96 h*
0	-	7	0	0	0	0	0	0
4.27	3.11	7	0	0	0	0	0	0
9.39	7.83	7	0	0	0	0	0	0
20.7	18.3	7	0	0	1	7	7	7
45.5	39.4	7	0	0	7	7	7	7
100	75.8	7	0	7	7	7	7	7

LC50	12.0 mg/L (95% C.L. 7.83-18.3 mg/L) at 96 hours.
NOEC	3.11 mg/L at 96 hours.
Remarks – Results	Abnormal behaviour and physical characteristics were observed in concentration of 9.39 mg/L and above. They included hyperventilation darkening of pigmentation, reduced opercular movement and loss of orientation. Hyperventilation was also observed in the control at the first set of observations (0.25 h) only. Probit analysis was used to determine the EC50s

CONCLUSION: Under the test conditions the notified chemical is harmful to aquatic life (UN 2003).

TEST FACILITY: Test Facility C (2001e)

8.2.2. Acute toxicity to aquatic invertebrates

TEST SUBSTANCE	Notified Chemical
METHOD	OECD TG 202 Daphnia sp. Acute Immobilisation Test and Reproduction Test – semi-static. EC Directive 92/69/EEC C.2 Acute Toxicity for Daphnia - semi-static.
Species	*Daphnia magna*
Exposure Period	48 hours
Auxiliary Solvent	Methanol (100 mg/L)
Water Hardness	250 mg $CaCO_3$/L
Analytical Monitoring	HPLC
Remarks - Method	A stock solution was prepared by diluting the test substance at 1:1 in methanol. Aliquots of the stock solution were then taken and diluted with test medium to obtain the test concentrations. All the test concentrations solutions were slightly turbid. From the results of a range-finding it was determined that the test concentrations should be 56 and 100 mg/L. There was also a blank control and a methanol control. Samples were taken at 0 and 24 hours for analysis to check concentration from the test vessels. Observations on behaviour and mobility were taken at 24 and 48 hours. Dissolved oxygen and pH were measured at 0, 24 and 48 hours in all test vessels and temperature was measured daily in a control vessel. Environmental parameter findings DO 8.2-8.6 mg O_2/L, pH 8.1-8.2 and temperature 20.2-20.3°C. These environmental test conditions ranges were all acceptable. Potassium dichromate (0.1, 0.18, 0.32, 0.56, 1.0 and 1.8 mg/L) was used as a reference substance.

RESULTS

Concentration mg/L		*Number of D. magna*	*Number Immobilised*	
Nominal	*Actual*		*24 h*	*48 h*
0 (Blank)	-	20	0	0
0 (methanol)	-	20	0	0
56	58.2-62.0	20	0	1
100	102-104	20	7	20

LC50	115 mg/L (95% F.L. 95.3-171.2 mg/L) at 24 hours 74 mg/L (95% F.L. 69-79 mg/L) at 48 hours
NOEC	<56 mg/L at 48 hours
Remarks - Results	Probit analysis was used to determine the EC50s. The reference substance had a 48 h EC50 of 0.28 mg/L.
CONCLUSION	Under the test conditions the notified chemical is harmful to aquatic life (UN 2003).
TEST FACILITY	Test Facility A (1997b)

8.2.3. Algal growth inhibition test

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 201 Alga, Growth Inhibition Test. EC Directive 92/69/EEC C.3 Algal Inhibition Test.
Species	*Selenastrum capricornutum*

Exposure Period	72 hours
Concentration Range	Nominal: 4.27, 9.39, 20.7, 45.5 and 100 mg/L Actual (mean): 3.56, 7.74, 17.0, 38.6 and 85.1 mg/L
Auxiliary Solvent	
Water Hardness	Not stated
Analytical Monitoring	HPLC
Remarks - Method	A measured amount of test substance was homogenized in culture medium by ultrasonication (30 mins), stirred (60 mins) and then filtered. The filtrate was used as the stock solution to prepare the test concentrations by dilution and then an aliquot of algal inoculum was added to give an initial algal cell density of $1X10^4$/mL. The cultures were incubated in an orbital incubator at 23±2ºC under continuous illumination. The study was done in triplicate. Temperature and pH were measured at the start and end of the test in he control and test flasks. Filtered samples of the test media were analysed at time 0 and 72 hours.

RESULTS

Biomass		*Growth*	
E_bC50	*NOE_bC*	*E_rC50*	*NOE_rC*
mg/L at 72 h	*mg/L*	*mg/L at 72 h*	*mg/L*
16.4 (7.74-38.6)	7.74	32 (17.0-38.6)	7.74

Remarks - Results	The EC50 were calculated using a computer program using percentage effect and the measured test concentrations. NOEC was determined using Dunnett's multicomparison test to compare the percentage inhibition in the test group with that in the control cultures.
CONCLUSION	Under the test conditions the notified chemical is harmful to aquatic life (UN 2003).
TEST FACILITY	Test Facility C (2002)

8.2.4. Inhibition of microbial activity

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 209 Activated Sludge, Respiration Inhibition Test. EC Directive 88/302/EEC C.11 Biodegradation: Activated Sludge Respiration Inhibition Test
Inoculum	Activated sludge from STP treating predominantly domestic waste.
Exposure Period	3 hours
Concentration Range	Nominal: 1, 10 and 100 mg/L Actual: Not determined
Remarks – Method	A measured amount of test substance was homogenized in water by ultrasonication for 10 minutes to produce a stock solution (500 mg/L). The test concentrations were then produced by combination of aliquots of stock solution, water, synthetic sewage and inoculum. The flasks were capped and aerated and shaken at 200 rpm for 3 hours. Temperature (20.4-22ºC) and pH (7.3-7.9) were measured at the start and finish of the test and were within acceptable ranges. Reference substance – 3,5-dichlorophenol (3, 10 and 32 mg/L)
RESULTS	
EC50	> 100 mg/L
NOEC	> 100 mg/L

Remarks – Results	Reference substance EC_{50} = 9.1 mg/L (95% C.L. 7.5-11.1 mg/L). this result validated the test conditions.
CONCLUSION	Under the test conditions, the notified chemical is not toxic to micro-organism.
TEST FACILITY	Test Facility C (2001f)

9. RISK ASSESSMENT

9.1. Environment

9.1.1. Environment – exposure assessment

The proposed use and disposal pattern for the notified chemical suggests that direct release to the aquatic and terrestrial environmental compartments of the environment is unlikely and therefore no predicted environmental concentration (PEC) has been estimated for the notified chemical.

Wastes containing the notified chemical generated during pellet formulation and end-product moulding are expected to be disposed of to landfill or incinerated. Up to 217 kg per annum of the notified chemical could be disposed of to landfill or by incineration, including as residues in empty containers. Most of this waste would be cured product in which case the chemical will be incorporated into an inert matrix and will be unavailable to the environment. It is unlikely that the notified chemical will leach into the water compartment due to its strong binding capacity.

Should blooming of the notified chemical occur in the polymers that it has been incorporated in, the chemical will slowly make its way to the surface where it will not be volatile. In the event that these surfaces come into contact with water the chemical will dissolve, through dissociation, and be washed off the surface. This will occur in a very disperse manner.

At the end of their useful lives articles made containing the notified chemical would be disposed of to landfill or recycled.

The notified chemical will dissociate in the environmental pH range. Due to its water solubility and dissociated state it is not expected to bioaccumulate.

9.1.2. Environment – effects assessment

The aquatic toxicity data submitted for the 4 taxa (fish, invertebrates, algae and micro-organisms) indicates that the chemical is harmful to aquatic invertebrates, algae and fish. The most sensitive species was fish with a reported LC_{50} of 12.0 mg/L at 96 hours. A predicted no effect concentration for aquatic organisms ($PNEC_{aquatic}$) of 120 µg/L has been derived by dividing this by a safety factor of 100 as acute data is available.

9.1.3. Environment – risk characterisation

The notified chemical does not pose a significant risk to the environment based on its reported use pattern because there will be very low environmental exposure. The majority of the chemical will be contained in a cured polymeric matrix. The majority of the notified chemical will eventually be disposed of to landfill in the final products at the end of their useful lives.

Given the low aquatic exposure a meaningful PEC cannot be calculated and levels are expected to be well below the safety margin.

Tests show that the notified chemical is not readily biodegradable. However, abiotic or slow biotic processes are expected to be largely responsible for the eventual degradation of the notified chemical.

9.2. Human health

9.2.1. Occupational health and safety – exposure assessment

Transport and warehousing workers will have low exposure as under normal circumstances, they will only handle sealed packages.

During formulation, the main point of exposure to the notified chemical in powder form will occur when the chemical is weighed and poured into the mixer. The majority of the particles are inspirable, and approximately 2% are respirable. Exposure will be minimised by personal protective equipment (PPE) such as a half-face respirator, safety glasses, head covering, gloves and overalls. Local exhaust ventilation is present in the weighing and loading areas, as well as at

the mixers. When handling the finished product at the formulation site (pellets containing <0.5% notified chemical), workers will wear PPE such as dust masks, gloves and overalls. Given these precautions, exposure is likely to be low.

Following reformulation, the notified chemical will be present at a concentration of <0.5% and will be encapsulated in pellets. No leaching or blooming is expected. Thus exposure to the notified chemical is not expected at this stage. At the end-use site these pellets will be used to injection mould various articles. Workers will wear gloves and eye protection. Exhaust ventilation is preset to the moulding machines.

9.2.2. Public health – exposure assessment

The public may come into contact with finished articles containing the notified chemical however it is expected that there will be no release of the notified chemical from the finished articles.

9.2.3. Human health – effects assessment

The notified chemical exhibits low acute toxicity via oral or dermal exposure based on tests on rats and mice.

The notified chemical was not irritating to skin when tested in a wetted powder form via a USEPA protocol. Some irritation, spotting and scabbing was observed following exposure in an acute dermal toxicity test, where the notified chemical was applied to the skin in solution form, with all effects resolving by day 10. The differing results may reflect the longer exposure time in the dermal toxicity test (24 h vs 4 h) and the different vehicles used. .

The notified chemical is slightly irritating to eyes, producing iridial involvement and moderate conjunctival irritation, which cleared by the 72-hour observation. No corneal injury was observed. There was no evidence of skin sensitisation in a guinea pig maximisation test.

The notified chemical was not found to be mutagenic to E. Coli or S. Typhimurium in Ames tests, and did not cause mutation or chromosomal aberrations in mammalian cells.

In a 90-day repeat dose peroral study there were 4 deaths in animals receiving 1500 mg/kg bw/day, and one death in the control animals. Both of these groups were receiving the largest amount of liquid (15 mL/kg bw/day), and all dead animals exhibited congestion of the lungs. After consideration, it appears most likely that these deaths occurred due to improper dosing leading to mechanical damage and aspiration, rather than systemic effects caused by the notified chemical. The significance of these observed lung effects for humans is unclear, as the notified chemical in the form administered does not meet the usual criteria for an aspiration hazard.

Significantly decreased bodyweight gains were observed in the high-dose group receiving 1500 mg/kg bw/day. The notified chemical appeared to cause slight anaemia at all dose levels and thus a NOEL cannot be established. However a NOAEL was established at 500 mg/kg bw/day based on effects seen on body weight gain at the next higher dose level.

Based on the available data, the notified chemical is not classified as a hazardous substance in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC 2004).

9.2.4. Occupational health and safety – risk characterisation

Based on the available data, the notified chemical is not classified as a hazardous substance, and does not pose a toxic hazard through oral or dermal exposure. The effects on the lung due to aspiration are unclear.

The notified chemical is imported at 100% in powder form. However exposure during formulation is expected to be controlled by local exhaust ventilation and extensive use of PPE. Once formulation has occurred, the notified chemical is present at <0.5% in pellets that is expected to remain bound within the plastic and thus not be available for exposure.

The Material Safety Data Sheet (MSDS) supplied by the notifier contains a warning against inducing vomiting, because of the possible aspiration hazard of the notified chemical.

Overall, the risk to workers is considered low, in the presence of the engineering and PPE controls described for the formulation process.

9.2.5. Public health – risk characterisation

Members of the public may come into dermal contact with plastic products containing the notified chemical. However, the chemical will be encapsulated and exposure is not expected. Given the limited exposure the risk to public health is considered to be very low.

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*.

and

As a comparison only, the classification of notified chemical using the Globally Harmonised System for the Classification and Labelling of Chemicals (GHS) (United Nations 2003) is presented below. This system is not mandated in Australia and carries no legal status but is presented for information purposes.

Based on the available data the notified chemical would have an environmental classification of chronic II.

10.2. Environmental risk assessment

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 Negligible Concern to public health when used in plastic products.

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 2003). 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 1994). The accuracy of the information on the label remains the responsibility of the applicant.

12. RECOMMENDATIONS

CONTROL MEASURES
Occupational Health and Safety

- Employers should implement the following engineering controls to minimise occupational exposure to the notified chemical as introduced:
  - Local exhaust ventilation

- Employers should implement the following safe work practices to minimise both explosion hazard and occupational exposure during handling of the notified chemical as introduced:
  - Avoid generating and inhaling dusts

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified chemical as introduced, including during cleaning of the dust filter bags:
  - Half-face respirator
  - Safety glasses
  - Head covering
  - Gloves
  - Overalls

  Guidance in selection of personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

- 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

- The following control measures should be implemented by pellet producers and end product manufacturers to minimise environmental exposure during use of the notified chemical:
  - Ensure all process and storage area are bunded and have only process drains present.

Disposal

- The notified chemical should be disposed of by landfill or incineration.

Emergency procedures

- Spills/accidental release of the notified chemical should be handled by containment, then vacuuming and then placing the spilt material in labelled, sealable containers ready 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(1) of the Act; if
  - The function of the chemical changes, or is likely to change, significantly.
  - Further information becomes available on the aspiration hazard of the notified chemical.
  - A new repeat dose/subchronic toxicology study on the notified chemical becomes

available

or

(2) 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.

13. BIBLIOGRAPHY

ECB (2004) Final Report from the Working Group on Haemolytic Anemia. ECBI/07/03 Add. 11. European Chemicals Bureau.

Mensink BJWG, Montforts M, Wijkhuizen-Maslankiewicz L, Tibosch H and Linders JBHJ (1995) Manual for summarising and evaluating the environmental aspects of pesticides. National Institute of Public Health and Environmental Protection Bilthoven, The Netherlands.

NOHSC (1994) National Code of Practice for the Labelling of Workplace Substances [NOHSC:2012(1994)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.

NOHSC (2004) Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004)]. National Occupational Health and Safety Commission, Canberra, AusInfo.

NOHSC (2003) National Code of Practice for the Preparation of Material Safety Data Sheets, 2nd edn [NOHSC:2011(2003)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.

Test Facility A (1997a) Determination Of Ready Biodegradability: Carbon Dioxide (CO_2) Evolution Test (Modified Sturm Test) With [Notified Chemical].

Test Facility A (1997b) Acute Toxicity Study in *Daphnia magna* with [Notified Chemical] (Semi-static).

Test Facility A (2000a) Determination of the UV-VIS Absorption Spectra of [Notified Chemical].

Test Facility A (2000b) Determination of the IR Absorption Spectrum of [Notified Chemical].

Test Facility A (2000c) Determination of the ^1H NMR Spectrum of [Notified Chemical].

Test Facility A (2000d) Determination of the melting temperature of [Notified Chemical].

Test Facility A (2000e) Determination of the density of [Notified Chemical].

Test Facility A (2000f) Determination of the vapour pressure of [Notified Chemical].

Test Facility A (2000g), Determination of the Water Solubilty of [Notified Chemical].

Test Facility A (2000h), Determination of the Hydrolysis of [Notified Chemical] as a Function of pH

Test Facility A (2000i), Determination of the Partition Coefficient (N-Octanol/Water) of [Notified Chemical].

Test Facility A (2000j), Soil Adsorption/Desorption of [Notified Chemical] on Three Soils (Screening)

Test Facility A (2000k), Determination of the Dissociation Constant(s) of [Notified Chemical] in Water

Test Facility A (2000l) Determination of the flammability of [Notified Chemical].

Test Facility A (2000m) Statement on the flammability (contact with water) of [Notified Chemical].

Test Facility A (2000n) Determination of the relative self ignition temperature of [Notified Chemical].

Test Facility A (2000o) Statement on the explosive properties of [Notified Chemical].

Test Facility A (2000p) Statement on the oxidizing properties of [Notified Chemical].

Test Facility A (2000q) Statement on the pyrophoric properties of [Notified Chemical].

Test Facility B (2000a) Particle size analysis on a sample of [Notified Chemical].

Test Facility C (2001a) [Notified Chemical] Acute Oral Toxicity to the Rat (Acute Toxic Class Method).

Test Facility C (2001b) [Notified Chemical] Acute Dermal Toxicity to the Rat.

Test Facility C (2001c) [Notified chemical] Skin Sensitisation to the Guinea-pig (Magnusson and Kligman Method).

Test Facility C (2001d) [Notified Chemical] Bacterial Mutation Assay.

Test Facility C (2001e). [Notified Chemical] Acute Toxicity to Fish.

Test Facility C (2001f). [Notified Chemical] Activated Sludge – Respiration Inhibition Test.

Test Facility C (2002) [Notified Chemical] Algal Growth Inhibition assay.

Test Facility D (2001a) Acute Oral Toxicity Study in Mice with [Notified Chemical].

Test Facility E (1990a) Primary Dermal Irritation Study of [Notified Chemical] in Rabbits.

Test Facility E (1990b) Primary Eye Irritation Study of [Notified Chemical] in Rabbits.

Test Facility F (1986) Thirteen Week Peroral Subacute Toxicity Study of [Notified Chemical] in Rats.

Test Facility G (1991a) Salmonella Typhimurium Reverse Mutation Assay [Notified Chemical].

Test Facility G (1991b) Gene Mutation Assay in Chinese hamster V79 Cells In Vitro With [Notified chemical].

Test Facility G (1991c) Chromosome Aberration Assay in Chinese hamster V79 Cells In Vitro With [Notified chemical].