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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

CI-166 Solid

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

CI-166 Solid

1. APPLICANT

BetzDearborn Australia Pty Ltd of 69-77 Williamson Road INGLEBURN NSW 2565 has submitted a standard notification statement in support of their application for an assessment certificate for CI-166 Solid. The submission included a summary of information from the notification dossier for the United Kingdom.

2. IDENTITY OF THE CHEMICAL

The chemical name, other names, CAS number, molecular and structural formulae, molecular weight and spectral data have been exempted from publication in the Full Public Report and the Summary Report.

Trade Names: CI-166 Solid; Continuum Dianodic Series

3. PHYSICAL AND CHEMICAL PROPERTIES

The notifier provided physico-chemical data for both the sodium salt form (CI-166 Solid) and the neutral acid form (CI-TTA Solid) of the notified chemical.

	CI-166 Solid	CI-TTA Solid
Appearance at 20°C and 101.3 kPa:	off-white (beige) powder	
Melting Point:	decomposes without melting at temperatures in excess of 233°C	122-193°C; decomposes at temperatures in excess of 214°C
Specific Gravity:	1.52 g/cm^3 at 20°C	1.25 g/cm^3 at 20°C
Vapour Pressure:	2.9 x 10^{-10} kPa at 25°C	4.8 x 10^{-10} kPa at 25°C
Water Solubility:	795 g/L at 20°C and pH 12.7	0.31 g/L at 20°C and pH 6.6
Partition Co-efficient (n-octanol/water):	log P_{ow} = -0.31 at 20°C and pH 10	log P_{ow} = 2.05 at 20°C and pH 8
Hydrolysis as a Function of pH:	not hydrolysable; see comments below	$T_{1/2}$ >1 year at 25°C; see comments below
Adsorption/Desorption:	log K_{OC} <1.8 at 20°C	log K_{OC}= 1.83 at 20°C

Dissociation Constant:	not applicable	$9.2<pK_a<10.2$ at 20°C
Flash Point:	no test performed	no test performed
Flammability Limits:	imported solution is aqueous and non-flammable	imported solution is aqueous and non-flammable
Autoignition Temperature:	no self-ignition for temperatures up to 450°C	301°C
Explosive Properties:	not explosive	not explosive
Reactivity/Stability:	not reactive (not oxidising)	not reactive (not oxidising)
Particle Size Distribution:	>400μm 81.7% w/w 125-400μm 12.9% w/w 75-125μm 2.9% w/w 30-75μm 2.3% w/w <30μm 0.2% w/w	
Surface tension:	A 90 % saturated solution has surface tension of 57.9 mN/m at 18.5 °C - see comments below.	A 1,000 mg/L solution has surface tension of 64.1 mN/m at 23 °C - see comments below.

Comments on Physico-Chemical Properties

No original test reports accompanied the notification dossier, but the physico- chemical data listed and the test methods used to obtain the results were taken from the summary of the notification dossier for the chemical prepared for the UK authority. Tests were performed according to EC test guidelines (European Commission, 1992) at Huntingdon Life Sciences Ltd, Huntingdon, Cambridgeshire, UK. These facilities comply with UK Principles of Good Laboratory Practice. Full test reports were submitted to the UK authority.

Dissociation (pK_a) tests suggested that below pH 9.2 the notified chemical is in its neutral form (CI-TAA) and from pH 10.2 above it is fully ionised. The water solubility of the salt form (CI-166) is very much higher than the protonated form. This is to be expected for compound of this nature, and this property is exploited for the economic transportation of large quantities of the chemical in aqueous solution.

The *n*-octanol/water partition coefficient for the neutral form (CI-TTA) is modest and indicates some affinity for the oil phase. The salt form (CI-166) is ionised and will not partition to the oil phase.

The notified chemical does not contain any groups that are likely to be susceptible to hydrolysis under ambient conditions. A test for hydrolytic degradation of the neutral acid (CI-TTA), which is the form that will dominate in the environmental pH region of 4-9, was conducted over 5 days at 50°C. The results showed 3.9%, 5.7% and 6.8 % degradation at pH 4, 7 and 9, respectively. When extrapolated to 25°C this indicated a half-life of greater than one year for this pH range.

The low log K_{OC} value of 1.83 (i.e. K_{OC} = 68) for the acid form indicates the chemical has little affinity for the organic component of soils and sediments. The salt form (CI-166) would have a much lower value of log K_{OC} and be even more mobile.

The compound is not considered to be surface active when in the salt form (CI-166), since the surface tension of a concentrated aqueous solution is less than 60 mN/m, but the neutral (acid) form shows slight surface activity.

The notified chemical is not highly flammable. Flammability Limits were subsequently not determined.

4. PURITY OF THE CHEMICAL

Degree of Purity: 45-74% by weight (typically 49.5%)

Toxic or Hazardous Impurities:

Chemical name:	5-methylbenzotriazole, sodium salt
Synonyms:	sodium tolyltriazole
CAS No.:	64665-57-2
Weight percentage:	0-15% (typically 5.2%)
Toxic properties:	severe eye and skin irritant; corrosive

Chemical name:	sodium hydroxide
Synonyms:	caustic soda
CAS No.:	1310-73-2
Weight percentage:	1.9-4% (typically 2.6%)
Toxic properties:	caustic; causes severe burns (R35)

Non-hazardous Impurities (> 1% by weight):

Chemical name:	sodium chloride
Weight percentage:	19-23% (typically 21.9%)
CAS No.:	7647-14-5

Chemical name:	water
Weight percentage:	3.6-18% (typically 8.7%)
CAS No.:	7732-18-5

Chemical name:	di-C-methylbenzotriazole isomers (e.g. 5,6-)
Weight percentage:	0-15% (typically 12.1%)
CAS No.:	(4184-79-6)

Additives/Adjuvants:

The notified chemical will be imported as a 12% component (by weight) of a yellow, aqueous solution. All other components of this solution are listed above. There are no further additives.

For determination of the purity of the notified chemical, the organic constituents can be separated and detected by HPLC and GLC analysis. Individual components are then determinable by UV/visible, infrared and nuclear magnetic resonance spectroscopy. The inorganic constituents can be determined by ICP and moisture balance analyses.

5. USE, VOLUME AND FORMULATION

The notified chemical will not be manufactured in Australia. It will be imported as a component of a 12% yellow, aqueous solution in 205 litre drums or 1500 litre intermediate bulk containers (IBCs). Import volume is expected to be up to 50 tonnes per annum.

Reformulation into specialty blended products at the Ingleburn facility will be performed as required. The imported solution and/or reformulated products containing the notified chemical will be distributed to industrial customers in 205 litre drums or 1500 litre IBCs.

The notified chemical will be used as a copper corrosion inhibitor for aqueous systems, such as industrial cooling water systems in the petroleum, paper and primary metals industries.

6. OCCUPATIONAL EXPOSURE

The notified chemical will always be handled in solution in Australia, so the most likely means of exposure will be via skin contact. Inhalation exposure may occur if mists or aerosols are generated at any time (e.g. during mixing of solutions).

Transport and storage

The notified chemical will be transported from the docksite directly to the BetzDearborn facility at Ingleburn, NSW. It will be stored in a cool, well ventilated chemical warehouse in a bunded area, prior to being dispatched to customer sites, or reformulated and dispatched to the customer site.

Waterside and transportation workers (3-6 personnel), as well as warehouse staff at the

notifier's site (2-3 personnel, 2 hours/day, 25 days/year) will handle any drums containing the notified chemical. For these groups, worker exposure is unlikely except in the event of an accident.

Reformulation

BetzDearborn plant operators (6-10 personnel, 8 hours/day, 100 days/year) may be exposed to the product containing the notified chemical during reformulation. The notified chemical will be reformulated into specialty blended products using 5,000 or 10,000 litre mixing tanks with appropriate engineering controls and bunding. The concentration of notified chemical in blended products was not provided. The process is automated and transfer of notified chemical from drums to the mixing tanks is by metered dose pumps. Local and general ventilation are used to extract any fugitive vapours during decanting.

Skin contamination may occur during the connection and disconnection of transfer lines to the drum, mixing vessel and final product containers. Dermal exposure may also occur during the cleaning and maintenance of reformulation equipment.

End use

At the customer site, a drum of solution containing the notified chemical is usually connected to an automatic feed system for addition to cooling water where the final concentration of notified chemical will be typically 1-3 ppm, although levels of up to 10 ppm are possible. The chemical is added neat (12% w/w) or may be pre-diluted. Plant operators (approximately 1-2 personnel, 0.5-1 hour/day, 100 days/year) may be exposed to the solution (with a maximum concentration of 12% with respect to the notified chemical) while handling the drums, removing bungs and connecting pumping equipment.

To prevent plant operator exposure during reformulation and end use, personnel will be required to wear impervious gloves, coveralls and eye protection (chemical splash goggles) to ensure there is no skin and eye contact during connection and disconnection of transfer lines to containers and during cleaning and maintenance of equipment.

7. PUBLIC EXPOSURE

As the majority of the notified chemical will be released into the atmosphere as continuous cooling tower blowdown, there could be widespread dermal, inhalation and ocular exposure of the public to the acid form (CI-TTA) of the notified chemical.

The public could be exposed to the CI-166 salt form if an accidental spillage occurred during transport; however, the likelihood of the public coming into contact with an accidental spill is rare.

8. ENVIRONMENTAL EXPOSURE

Release

During reformulation the required volume of new chemical is transferred from the drums or IBCs by metered dosing pumps to large mixing tanks (typically 5000 litres) where it is diluted with water and mixed with other chemicals to prepare the required formulation. All mixing equipment is contained within adequately bunded areas and after mixing the product is pumped to 200 litre drums or 1500 litre IBCs prior to dispatch to customers. Due to the automated nature of the mixing and filling processes, little release of the chemical is anticipated, but any spills would be contained by the bunding and combined with other liquid wastes from the notifier's facility which are then collected and treated at a liquid waste treatment plant. Similarly, residuals and washings from the empty drums and IBCs are collected and sent to this treatment facility. While the notifier provided no estimates of the quantity of material likely to be released as a result of spills during reformulation and the cleaning of containers, this is unlikely to exceed a total of 5% of import quantity or a maximum of 1.5 tonne per annum.

However, the use pattern of the chemical in cooling towers is such that all will eventually be released due to continuous cooling tower blowdown. Consequently, most of the new chemical is expected to be released into sewage systems or drains. This release would be at its ambient concentration in the cooling tower, which is typically 3 mg/L, but could be as high as 10 mg/L.

The notification dossier stated that small cooling towers typically have a blowdown of 500 litres per hour, while large facilities may discharge as much as 21,000 litres per hour. Assuming continuous plant operation (24 hours, 365 days per year) and that the cooling tower water contains 10 mg/L of the new chemical, the annual discharge from small and large cooling towers is 44 and 1,830 kilograms, respectively. The company indicated that cooling tower blowdown comprises 60% of waste effluent from typical facilities, consequently the concentration of the new chemical in the waste may be as high as 6 mg/L.

Fate

The notified chemical is very water soluble in the salt form (i.e. CI-166) and moderately so in the acidic form (i.e. 0.31 g/L for CI-TTA). The latter is likely to be the dominant form in the natural environment and regardless of the means of disposal or release, almost all the chemical is likely to enter the water compartment.

The chemical is not readily biodegradable, and in a Modified Sturm Test (OECD 301B) less than 5 % degradation had taken place after 28 days, and neither is the chemical susceptible to hydrolytic degradation. Given the K_{oc} value presented, it is not likely to associate with sediments to any significant extent and instead will prefer the aqueous phase. Consequently the notified chemical should persist in the environment and degrade slowly through biological processes and other physical mechanisms.

Although likely to be persistent in the aquatic compartment, the compound is not likely to bioaccumulate because of the moderately high water solubility and low P_{ow}.

9. EVALUATION OF TOXICOLOGICAL DATA

Toxicological data for CI-TTA Solid were provided, rather than on the salt form, which is the form being imported. The notification statement included copies of communications between the toxicological testing laboratories and the UK regulatory authorities, justifying the lack of data generation for CI-166 Solid. The reasons given were :

- the notified substance is manufactured and imported in the salt form because the water solubility at high pH facilitates transport and industrial application, and not because of inherent differences in efficacy between the acid and salt forms;
- the toxicological properties of the two forms are expected to be similar, based on the structural similarities between the two forms;
- the high pH of the salt form would preclude the use of this form in animal studies on ethical (animal welfare) grounds;
- the excess sodium hydroxide present would mask the inherent properties of the notified chemical;
- when used as intended, the notified chemical is added to industrial cooling tower systems which are at approximately neutral pH and under these conditions the substance is in the acidic form.

While this argument may be valid for persons exposed to the notified chemical via cooling tower water, it is not valid for workers exposed by skin or eye contact to the 12% aqueous solution and maybe the speciality formulations. Consequently, the risk assessment for these workers will need to account for the corrosive nature of the 12% imported form. Concerns based on animal welfare are valid and support the rationale for adopting a conservative approach in the risk assessment.

Toxicological data for CI-TTA Solid are reported; as indicated above they have limited applicability for CI-166 Solid, as imported.

9.1 Acute Toxicity

Summary of the acute toxicity of CI-TTA Solid (acid form of CI-166 Solid)

Test	*Species*	*Outcome*	*Reference*
Acute oral toxicity	rat	LD_{50} > 2000 mg/kg	(McRae, 1998a)
Acute dermal toxicity	rat	LD_{50} > 2000 mg/kg	(McRae, 1998b)
Skin irritation	rabbit	non-irritating	(Parcell, 1998a)
Eye irritation	rabbit	slightly irritating	(Parcell, 1998b)
Skin sensitisation	guinea pig	slightly sensitising	(Coleman, 1998)

9.1.1 Oral Toxicity (McRae, 1998a)

Species/strain:	rat/Sprague-Dawley
Number/sex of animals:	5/sex
Observation period:	15 days
Method of administration:	gavage
Clinical observations:	piloerection, hunched posture, waddling/unsteady gait, lethargy, pallid extremeties, abnormal respiration, walking on toes, eyes dull in colour, ungroomed appearance, prostration (collapsed state), increased lacrimation and partially closed eyelids among males and females and protruding eyes, increased salivation and blue/cold extremities among males only; recovery complete by day 5; all rats considered to have achieved satisfactory bodyweight gains during the study
Mortality:	no deaths observed during the study
Morphological findings:	no abnormalities detected on day 15
Test method:	limit test, as in EC Annex to Directive 92/69/EEC
LD_{50}:	> 2000 mg/kg
Result:	the test substance was of very low acute oral toxicity in rats

9.1.2 Dermal Toxicity (McRae, 1998b)

Species/strain:	rat/Sprague-Dawley
Number/sex of animals:	5/sex
Observation period:	15 days
Method of administration:	single topical application; dose level of 2000 mg/kg bodyweight

Clinical observations:	slight dermal irritation (Grade 1 erythema with or without Grade 1 oedema) observed in 5 rats; resolved by day 5; desquamation seen in one animal on day 4; low bodyweight gain evident in 1 male and 2 females on day 8; no signs of systemic reaction to treatment throughout the study
Mortality:	no deaths observed during the study
Morphological findings:	no abnormalities detected on day 15
Test method:	limit test similar to OECD TG 402
LD_{50}*:*	> 2000 mg/kg
Result:	the test substance was of low acute dermal toxicity in rats

9.1.3 Inhalation Toxicity

An acute inhalation toxicity study was not available. It was claimed by the notifier that the imported product, which will be a 12% aqueous solution of the notified chemical, is not expected to generate aerosols during either reformulation or application. In addition, the notified chemical has a low vapour pressure. This argument was accepted as grounds for not requiring an acute inhalation toxicity study.

9.1.4 Skin Irritation (Parcell, 1998a)

Species/strain:	rabbit/New Zealand White
Number/sex of animals:	3/female
Observation period:	4 days
Method of administration:	single dermal dose of 0.5g applied under semi-occlusive conditions for 4 hours
Test method:	according to OECD TG 404
Draize scores:	all scores zero

Comment: no clinical signs or dermal reactions produced;
no signs of toxicity or ill-health in any rabbit during the exposure or observation period

Result: the test substance was not irritating to the skin of rabbits

9.1.5 Eye Irritation (Parcell, 1998b)

Species/strain: rabbit/New Zealand White

Number/sex of animals: 3/female

Observation period: 4 days

Method of administration: single instillation of approximately 65mg (in 0.1 mL) to one eye

Test method: according to OECD TG 405

Draize scores for individual ocular reactions :

	Time after instillation									
Animal	***1 hour***		***1 day***		***2 days***		***3 days***		***4 days***	
Cornea	***d***	***a***	***d***	***a***	***d***	***a***	***d***	***a***	***d***	***a***
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0		
3	0	0	0	0	0	0	0	0		
Iris										
1	0		0		0		0		0	
2	0		0		0		0			
3	0		0		0		0			
Conjunctiva	***r***	***c***	***r***	***c***	***r***	***c***	***r***	***c***	***r***	***c***
1	1	1	2	1	1	0	0	0	0	0
2	2	2	2	2	1	1	0	0		
3	2	2	2	2	2	1	0	0		

See Attachment 1 for Draize scales
d = density a = area r = redness c = chemosis

Irrigated eyes: transient conjunctival irritation, up to Grade 2 in severity, produced in all three rabbits; resolved by day 3 after instillation;
no effects observed on the cornea or iris

Result: the test substance was slightly irritating to the eyes of rabbits; however, the test substance will not require corresponding health effects labelling

9.1.6 Skin Sensitisation (Coleman, 1998)

Species/strain:	albino guinea pigs/Dunkin-Hartley
Number of animals:	10 test, 5 control (test done twice with same numbers of animals)
Test method:	Magnusson and Kligman maximisation test, according to OECD TG 406
Induction procedure:	Day 1 (intradermal injections) to a clipped area of the scapular region, each animal received 3 pairs of intradermal injections as follows: • Freunds Complete Adjuvant (FCA): distilled water (1:1 ratio) • 1% w/v of test material in 5% acetone in Alembicol D • 1% w/v of test material in a 1:1 mixture of FCA and 5% acetone in Alembicol D Day 8 (topical application) occluded application of 0.4mL of test material, 70% w/v in acetone, to same clipped skin area for 48 hours
Challenge procedure:	Day 22 topical application of 70% w/v test material in acetone on the shorn, left anterior flank and similarly applied 35% w/v test material in acetone on the shorn, left posterior flank of each animal for 24 hours

Challenge outcome, Test 1 *(no. of animals exhibiting positive response) :*

	Test animals (10)		***Control animals (5)***	
Challenge Concentration	***24 hours****	***48 hours****	***24 hours****	***48 hours****
35%	0	0	0	0
70%	2	0	0	0

*time after patch removal

Similar results were observed for Test 2

Comment:	one animal died prior to challenge dose; cause of death unknown; four animals out of 19 reacted positively to the challenge dose; all dermal reactions were slight erythema/oedema;
Result:	the test substance was slightly sensitising to the skin of guinea pigs under the conditions of this test system; however, it will not require corresponding health effects labelling

9.2 Repeated Dose Toxicity (Chambers, 1998)

Species/strain:	rat/Sprague-Dawley
Number/sex of animals:	5/sex/group
Method of administration:	oral (gavage)
Dose/Study duration::	0, 15, 150 or 1000 mg/kg for 28 days, once daily
Test method:	according to OECD TG 407
Clinical observations:	immediate salivation in all high dose animals and some mid-dose animals; associated brown perioral staining and wet coat in some high dose animals, together with walking on toes and paddling motions of the forepaws; salivation and walking on toes persisted on occasion for up to 30 minutes after dosing; no deaths observed
Neurobehavioural Screening:	a full battery of tests was conducted during the pre-dose period and in week 4; a shortened battery was conducted in weeks 1, 2 and 3; observations in the treatment period were made prior to dosing behavioural changes were noted in females (decreased activity counts in week 3 and decreased rearing counts in week 4); these were not dose related and were not observed in males; high dose male had staining of the back during weeks 3 and 4; this was attributed to salivation; walking on toes was observed in treated and control animals and was not significantly different between the groups

Clinical chemistry/ Haematology	minor changes in some parameters (haemoglobin, mean corpuscular haemoglobin concentration, neutrophil count) at high dose levels, but all either fell within historical control ranges or were not considered of toxicological importance
Biochemistry:	mean triglyceride values elevated at high dose levels, statistically significant in females, no associated enzyme changes; minor and inconsistent changes in albumin; other biochemical changes were minor and largely within historical control ranges
Organ weights	minor changes in liver, kidney and spleen weights noted among high dose level females; considered by authors not to be of toxicological importance
Histopathology:	no treatment related abnormalities (macroscopic or microscopic) were observed;
Comment:	based on the clinical observations at the two higher doses, the NOEL is 15 mg/kg/day
Result:	the clinical and biochemical symptoms do not constitute major functional disturbance and so the test substance will not require corresponding health effects labelling

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium/Escherichia coli* Reverse Mutation Assay (Kitching, 1998)

Strains:	*Salmonella typhimurium* TA1535, TA1537, TA98 and TA100 *Escherichia coli* CM891
Concentration range:	1.5 to 5000 μg/plate
Test method:	According to OECD TG 471/472
Comment:	no evidence of mutagenic activity observed at any dose level of test material in either mutation assay, in the absence or presence of metabolic activation provided by rat liver S9 fraction

Result:	the test substance was not considered to be mutagenic to the bacterial strains tested

9.3.2 Micronucleus Assay in the Bone Marrow Cells of the Mouse (Proudlock, 1998)

Species/strain:	mouse/SPF CD-1 outbred albino (Swiss origin)
Number and sex of animals:	5/sex/group
Doses:	60, 120, 240 mg/kg bodyweight
Method of administration:	notified chemical and negative control via intraperitoneal injection; positive control group dosed orally with mitomycin C at 12 mg/kg bodyweight
Test method:	according to OECD TG 474
Comment:	no increase in the incidence of micronucleated immature erythrocytes with the test substance, nor any substantial decrease in the proportion of immature erythrocytes with the test substance
Result:	the test substance did not produce any evidence of chromosome damage or bone marrow toxicity; it was not clastogenic in bone marrow cells of the mouse *in vivo*

9.3.3 Chromosome Aberration Assay in Human Lymphocytes (Akhurst, 1998)

Cells:	human (male) lymphocytes
Dose levels:	*First test* no S9 mix (3 hours treatment, 18 hours recovery) 210, 420 and 840 μg/mL with S9 mix (3 hours treatment, 18 hours recovery) 210, 420 and 630 μg/mL *Second test* no S9 mix (21 hours continuous treatment) 100, 150 and 200 μg/mL with S9 mix (6 hours treatment, 15 hours recovery) 450, 500 and 600 μg/mL
Test method:	According to OECD TG 473

Comment:	in the absence of S9 mix, the notified chemical caused a statistically significant increase ($p<0.01$) in the proportion of metaphase figures containing chromosomal aberrations at the high dose level in the second test only; in both tests including S9 mix, statistically significant increases (<0.01) in the proportion of metaphase figures containing chromosomal aberrations were observed; seen at the highest dose level in the first test and at the lowest and intermediate dose levels in the second; no significant increases in the proportion of polyploid cells were seen; all positive control compounds caused large, statistically significant increases in the proportion of aberrant cells
Result:	under the conditions of the study, the test substance was clastogenic

9.4 Overall Assessment of Toxicological Data

The chemical CI-TTA Solid (acid form of CI-166 Solid) is of very low acute oral toxicity and low acute dermal toxicity in rats (oral LD_{50} >2000 mg/kg, dermal LD_{50} >2000 mg/kg).

CI-TTA Solid is slightly irritating to rabbit eyes, but is not considered to be a skin irritant. Skin sensitisation was observed in a Magnusson and Kligman guinea pig study; however, the response was not sufficient to warrant a health effects classification under the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1994a).

In a 28 day repeat dose oral toxicity study in the rat, no evidence of major functional disturbance was observed at the highest dose level of 1000 mg/kg/day. However, salivation and staining was observed at 150 and 1000 mg/kg/day, and walking on toes and paddling motions of the forepaws were observed at 1000 mg/kg/day. Minor haematological and biochemical changes and slight organ weight changes were also observed at this dose. The NOEL was therefore set at 15 mg/kg/day.

CI-TTA Solid was not found to be mutagenic in bacteria and did not induce an increase in micronuclei in the *in vivo* mouse micronucleus assay. CI-TTA Solid induced clastogenic effects in the *in vitro* human lymphocyte cytogenetic assay, so is taken as having some mutagenic potential.

Based on the data provided, CI-TTA Solid would not be classified as a hazardous substance under NOHSC (1994a).

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The notifier provided the following ecotoxicity data in support of their application. The ecotoxicity tests were conducted with CI-TTA, the form that is likely to dominate in the natural environment, and were performed in accordance with OECD Test Guidelines.

Test	Species	Results (Measured)
Acute Toxicity [OECD 203]	*Pimephales promelas* (fathead minnow)	LC_{50} (96 h) = 20.6 mg/L NOEC (96 h) = 2.3 mg/L
Chronic Exposure Reproduction [OECD 202, Part 2]	*Pimephales promelas* (fathead minnow)	<u>Embryo Survival</u> NOEC = 5.80 mg/L LOEC >5.80 mg/L <u>Fry Survival</u> NOEC = 0.64 mg/L LOEC = 1.24 mg/L MATC = √(NOEC•LOEC) = 0.89 mg/L
Acute Immobilisation [OECD 202, Part 1]	*Daphnia magna* (water flea)	EC_{50} (48 h) = 32.3 mg/L NOEC (48 h) = 23.6 mg/L
Chronic Exposure Reproduction [OECD 202, Part 2]	*Daphnia magna* (water flea)	EC_{50} (21 day) = 8.7 mg/L NOEC (21 day) <1.1 mg/L
Inhibition of Algal Growth [OECD 201]	*Selanastrum capricornatum*	E_bC_{50} (72 h) = 6.84 mg/L NOEC (72 h) = 2.2 mg/L E_rC_{50} (0-72 h) = 18.6 mg/L
Inhibition of Bacterial Respiration [OECD 209]	Activated sludge bacteria	IC_{50} (3 h) = 182 mg/L

The tests on fathead minnow were performed using solutions of the test material made up in dechlorinated water. The tests were conducted over a 96 hour period at a controlled temperature of 22 ± 2 °C in a semi static procedure, with daily renewal of the test media. Five solutions of the chemical with nominal concentrations of 3.42, 7.51, 16.5, 36.4 and 80 mg/L were tested (the corresponding mean measured concentrations were 2.27, 6.78, 13.6, 31.2 and 61.6 mg/L), together with one control. Solution analysis was conducted by HPLC and the measured results were always significantly less than the nominal concentrations.

Seven fish were tested at each concentration and during these tests the pH of the solutions was always between 7.7 and 8.4, while dissolved oxygen levels were always between 86 and 106% of saturation. The water hardness was always around 212 mg/L as $CaCO_3$.

The acute study results indicate that the new chemical is slightly toxic to the fathead minnow with a 96 hour LC_{50} of 20.6 mg/L, determined using standard statistical methods. The data were such that probit analysis was not possible, but the LC_{50} should lie between 13.6 and 31.2 mg/L. Sublethal effects observed during the fish test included darkened pigmentation, hyperventilation, lethargy, localised haemorrhaging, erratic swimming and loss of co-ordination.

A report of a study on subchronic exposure of fathead minnow was also submitted. This study investigated the effect of continuous exposure on the most sensitive phase of the life cycle of the fish (i.e. hatchability of embryos; 4 day study duration) and fry survival (monitored over 28 days). In this study a minimum of 30 embryos were exposed to mean concentrations of the notified chemical of 0.31, 0.63, 1.25, 2.5 and 5.0 mg/L, together with a control, over a 4 day hatching period at a temperature of 25 $\pm$ 2^{o}C. The test was conducted under intermittent flow conditions and was performed in duplicate. During the tests the dissolved oxygen was always between 6.5 and 8.6 mg/L, the pH between 7.5 and 8.2 and the conductivity of the water around 300 mS/cm. At the end of this period the hatchlings were observed for mortality, physical abnormalities and lethargy in swimming behaviour. Following the hatching period, the new fry were exposed over a 28 day period to a range of similar test concentrations (i.e. control, 0.37, 0.64, 1.24, 2.41 and 5.8 mg/L) and the cumulative mortality and/or overall behaviour were monitored over this period.

The results of the chronic exposure study were analysed using accepted statistical methods and provided the NOEC and LOEC values tabulated above. The Maximum Acceptable Toxic Concentration (MATC) was 0.89 mg/L which, according to Mensink *et al.* (1995), indicates that the chemical is slightly toxic to this species of freshwater fish.

The acute immobilisation tests on *Daphnia magna* were performed using solutions of the notified chemical made up in dechlorinated water. Five solutions with (mean) concentrations of 6.66, 11.7, 23.6, 44.2 and 81.7 mgL were tested, together with one control. Solution analysis by HPLC was conducted on samples taken at 0 and 48 hours. Five daphnia were tested at each concentration, with each test performed with four replicates. During these tests the pH of the test solutions was always between 7.2 and 7.9, while dissolved oxygen levels were always between 96 and 99% of saturation and water hardness was 236 mg/L as $CaCO_3$.

The results indicate that the chemical is slightly toxic to daphnia with a 48 hour EC_{50} of 32.3 mg/L, determined using standard statistical methods. The data were such that probit analysis was not possible, but the LC_{50} should lie between 23.6 and 44.2 mg/L.

A chronic study on *Daphnia magna* was also reported in the notification dossier. This study was conducted over a 21 day period at 20 $\pm$ 1^{o}C, using a semistatic procedure. The mean test concentrations of the notified chemical of between 1.1 and 32 mg/L were always between 69 and 146% of the nominal concentrations. Four replicates were conducted at each concentration using ten daphnia in each test. The test media was renewed three times per week with analyses for the notified chemical performed on both the fresh and "spent"

solutions. The number of live and dead daphnia were counted every three days and the data analysed using Dunnett's multicomparison method.

During the tests it was noted that the new chemical appeared to have a stimulatory effect on the production of juveniles, but this lead to a higher rate of mortality (when compared with the control) in the mature population. The chronic test showed the chemical to be very slightly toxic to *Daphnia magna* (Mensink *et al.*, 1995).

A test on the inhibition of algal growth was conducted on *Selanastrum capricornutum* over a 72 hour incubation period at 24°C, with mean concentrations of the notified chemical of 2.2, 4.07, 8.29, 16.7, 33.3 and 64.3 mg/L, together with a control. The solutions were made up in dechlorinated water and the measured test concentrations were between 96 and 115% of the nominal concentrations.

The results show that the notified chemical is moderately toxic to this species of green algae. However, the chemical appeared to be algistatic since at the end of the tests those algal cultures exposed to the higher concentrations grew normally when transferred to fresh culture medium containing no chemical.

The test on inhibition of bacterial respiration was conducted with activated sludge suspended in an artificial sewage medium made up from meat extract, peptone and salts in dechlorinated tap water having a hardness of 200-250 mg/L as $CaCO_3$ and pH 7.0 at 20 ± 2°C. After three hours exposure of the bacteria to a range of test concentrations, respiration was inhibited at test concentrations >10 mg/L. There was 21% inhibition at exposure to 10 mg/L and 72% inhibition at 1,000 mg/L. The reference material used in these tests (3,5-dichlorophenol) produced 83% inhibition when present at 32 mg/L.

The QSAR calculations of the ASTER database (US EPA, 1998) for this chemical furnished predicted acute toxicity LC_{50} data for several fish species. These included rainbow trout (12.9 mg/L), fathead minnow (30.6 mg/L), bluegill (24.0 mg/L) and channel catfish (13.2 mg/L). These calculations also furnished an acute LC_{50} of 16.6 mg/L for immobilisation of daphnia and a chronic MATC of 5.0 mg/L for fathead minnow. These results were in reasonable accord with the experimental data.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The notified chemical is at least slightly toxic to aquatic species. Almost all will be released as a consequence of blowdown of the cooling towers, with the majority likely to be discharged to sewers. However, large industrial cooling towers in rural areas may discharge directly to natural waterways (i.e. rivers and creeks). Since the chemical is not biodegradable, is moderately water soluble (in the acid form, CI-TTA Solid) and will not associate with soil, it is expected to be persistent in the water compartment.

The notifier has indicated that 90% of the notified chemical would be absorbed into sewage sludge during treatment, then disposed of to landfill with the sludge. This scenario seems

unlikely, however, since the high water solubility and low K_{oc} indicate that the majority of the chemical will remain in the water phase and will be discharged in the sewage plant effluent.

An average Predicted Environmental Concentration (PEC) can be estimated, assuming that the notified chemical is used nationwide and that all is discharged into the sewer system. Based on a total annual import (and discharge) volume of 50 tonnes and an Australian population of 18 million, each of which contributes an average of 150 litres per day to the overall sewage volume, the average concentration in sewage is estimated as 0.05 mg/L. This would be further reduced on discharge to receiving waters and dilution by a factor of 10, giving a final PEC of 5 µg/L. This is nearly three orders of magnitude lower than the level at which the compound has been shown to be toxic to fish (i.e. the LOEC from the chronic exposure study on fish was 1.24 mg/L), although it should be noted that the chronic study on toxicity to daphnia indicated a LOEC of <1.1 mg/L. This will be alluded to further below.

However, the above PEC calculation may not be entirely appropriate for a chemical which is to be used in cooling towers, since release is likely to be somewhat localised rather than uniform over the entire nation. In some cases it is possible that the blowdown (with concentration of the notified chemical between 3 and 10 mg/L) may be discharged directly to stormwater drains or creeks, where dilution levels could be significantly less than indicated above. In such cases, release of the chemical could be a hazard to the aquatic fauna. For example, in rural areas where water usage is restricted, dilution in the sewer system may only be by a factor of 3, with a similar factor for dilution on discharge to receiving waters. If blowdown is discharged at 10 mg/L, then the worst case PEC in the receiving waters would be around 1.1 mg/L. This is the demonstrated concentration at which toxicity of the chemical is apparent to fish and exceeds the chronic toxic levels for daphnia. The notifier has indicated that around 10% of the import quantity (i.e. up to 5 tonnes per annum) may be used in rural areas and consequently it is possible that toxic levels of the new chemical could be exceeded as a result of cooling tower blowdown in certain areas.

The notified chemical may present a moderate hazard to the environment when used industrially as an anticorrosive for aqueous systems, such as cooling water towers. The potential hazard is largest when the chemical is used in country areas where limitations on water availability may preclude dilution of the discharged chemical to levels that are unlikely to cause toxicity in aquatic organisms.

The notified chemical is not likely to present a major hazard to the environment when it is stored, transported and used in the proposed manner. However, the Material Safety Data Sheet (MSDS) for formulations containing the chemical should indicate that it should not be used in situations where dilution of the blowdown is likely to be insufficient to reduce concentrations of the chemical in effluent to below 0.1 mg/L in receiving waters. This is based on the assumption that most of the compound remains in the aqueous column and for clarification the company could provide a report on the exact extent of adsorption of the chemical to sediments /sludge.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

CI-TTA Solid (neutral acid form of CI-166 Solid) is of very low acute oral toxicity and low dermal toxicity and is not irritating to skin. It is slightly irritating to rabbit eyes and is a slight skin sensitiser in guinea pigs. The notified chemical did not cause systemic toxicity in a 28 day oral rat study. The NOEL based on clinical observations was 15 mg/kg/day. It was not mutagenic in Ames tests and tested negative in an *in vivo* mouse micronucleus study. However, it was clastogenic in an *in vitro* chromosome aberration assay in human lymphocytes. Based on the toxicity tests provided, CI-TTA Solid would not be classified as a hazardous substance according to the National Occupational Health and Safety Commission's *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1994a).

CI-166 Solid will be imported into Australia as a 12% component (by weight) of an aqueous solution containing an excess of sodium hydroxide. This is required to maintain the chemical in the ionised salt form, since the neutral acid is significantly less soluble and could not be transported in highly concentrated solution. It is not possible to separate the ionised salt form from the sodium hydroxide for testing.

The aqueous solution is regarded as hazardous according to the NOHSC Approved Criteria. It is a corrosive solution and carries the risk phrase R35, 'Causes severe burns'. Therefore, appropriate precautions should be taken in its handling and storage, particularly in the prevention of any dermal and eye contact.

Occupational Health and Safety

The solution containing the notified chemical will be imported in 205 litre drums or 1500 litre intermediate bulk containers. Transport and storage workers should not become contaminated with the chemical unless there is accidental spillage. Some reformulation into specialty blended products at the Ingleburn facility will be performed as required. This involves automated and enclosed transfer and blending processes, so there should be minimal release of the notified chemical.

Although dermal and eye exposure to drips, splashes and spills is expected to be low, it is most likely to be the predominant route of exposure for workers involved in reformulating the imported product, its end use applications and during disposal. Inhalation exposure is expected to be minimal because the notified chemical has a low vapour pressure and is not used in such a manner as to generate aerosols. Workers will wear safety goggles, chemical impervious gloves and industrial clothing to minimise dermal exposure. Given the corrosive nature of the imported chemical, it is essential that the engineering controls and protective clothing requirements are adopted for those handling the chemical.

Residual chemical in drums and containers may be returned to the notifier site for disposal. No description of work practices was provided. Washings from the cleaning procedure will go through a waste water treatment plant.

The chemical has high hazard (corrosive) but anticipated low level exposure if the above controls are adopted. In this situation, the occupational health risk posed to workers performing these tasks is low.

There is a NOHSC exposure standard of 2 mg/m^3 (peak limitation) for sodium hydroxide, a major component of the imported product. Employers are responsible for ensuring this value is not exceeded in the workplace.

Public Health

Based on the use pattern and toxicology of CI-TTA Solid, the notified chemical is not expected to pose a significant hazard to public health. This form of the chemical is a slight eye irritant, a slight skin sensitiser and an *in vitro* clastogen. However, the associated hazards are likely to be offset by atmospheric dilution of the cooling tower release (typically 3 mg/L), resulting in a very low atmospheric concentration of the notified chemical. Although no inhalation studies were provided, the low oral and dermal toxicity suggest that this concentration is unlikely to be hazardous.

The solution containing the CI-166 salt is corrosive to eyes and skin, is an irritant to the upper respiratory tract (as an aerosol or mist) and may cause severe gastrointestinal pain, nausea, vomiting and abdominal pain if swallowed (under the Health Effects section on the supplied MSDS). It is classified as hazardous by NOHSC and a Class 8 chemical (corrosive). However, if an accidental spillage occurred during transport, the likelihood of the public coming into contact with the spill is rare.

13. RECOMMENDATIONS

To minimise occupational exposure to notified chemical the following guidelines and precautions should be observed:

- Safety goggles should be selected and fitted in accordance with Australian Standard AS 1336 (Standards Australia, 1994) and comply with Australian/New Zealand Standard AS/NZS 1337 (Standards Australia/Standards New Zealand, 1992);

- Industrial clothing should conform to the specifications detailed in AS 2919 (Standards Australia, 1987) and AS 3765.1 (Standards Australia, 1990);

- Impermeable gloves should conform to AS/NZS 2161.2 (Standards Australia/Standards New Zealand, 1998);

- All occupational footwear should conform to AS/NZS 2210 (Standards Australia/Standards New Zealand, 1994);

- Spillage of the notified chemical should be avoided. Spillages should be cleaned up promptly with absorbents which should be put into containers for disposal;

- Good personal hygiene should be practised to minimise the potential for ingestion;
- Workers should be advised to report any skin changes to the occupational health and safety officer at their workplace;
- A copy of the MSDS should be easily accessible to employees; and
- The NOHSC exposure standard for sodium hydroxide should not be exceeded in the workplace.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the notified chemical was provided in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (National Occupational Health and Safety Commission, 1994b).

This MSDS was provided by the applicant as part of the notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of the applicant.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Act, secondary notification of the notified chemical shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

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Attachment 1

The Draize Scale for evaluation of skin reactions is as follows :

Erythema Formation	*Rating*	*Oedema Formation*	*Rating*
No erythema	0	No oedema	0
Very slight erythema (barely perceptible)	1	Very slight oedema (barely perceptible)	1
Well-defined erythema	2	Slight oedema (edges of area well-defined by definite raising	2
Moderate to severe erythema	3	Moderate oedema (raised approx. 1mm)	3
Severe erythema (beet redness)	4	Severe oedema (raised more than 1mm and extending beyond area of exposure)	4

The Draize scale for evaluation of eye reactions is as follows :

CORNEA

Opacity	*Rating*	*Area of Cornea involved*	*Rating*
No opacity	0 none	25% or less (not zero)	1
Diffuse area, details of iris clearly visible	1 slight	25% to 50%	2
Easily visible translucent areas, details of iris slightly obscure	2 mild	50% to 75%	3
Opalescent areas, no details of iris visible, size of pupil barely discernible	3 moderate	Greater than 75%	4
Opaque, iris invisible	4 severe		

CONJUNCTIVAE

Redness	*Rating*	*Chemosis*	*Rating*	*Discharge*	*Rating*
Vessels normal	0 none	No swelling	0 none	No discharge	0 none
Vessels definitely injected above normal	1 slight	Any swelling above normal	1 slight	Any amount different from normal	1 slight
More diffuse, deeper crimson red with individual vessels not easily discernible	2 mod.	Obvious swelling with partial eversion of lids	2 mild	Discharge with moistening of lids and adjacent hairs	2 mod.
Diffuse beefy red	3 severe	Swelling with lids half-closed	3 mod.	Discharge with moistening of lids and hairs and considerable area around eye	3 severe
		Swelling with lids half-closed to completely closed	4 severe		

IRIS

Values	*Rating*
Normal	0 none
Folds above normal, congestion, swelling, circumcorneal injection, iris reacts to light	1 slight
No reaction to light, haemorrhage, gross destruction	2 severe