

File No: NA/540

May 1998

**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

INCA 415 Intermediate

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act* 1989 (the Act) and Regulations. This legislation is an Act of the Commonwealth of Australia. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by the National Occupational Health and Safety Commission which also conducts the occupational health & safety assessment. The assessment of environmental hazard is conducted by the Department of the Environment and the assessment of public health is conducted by the Department of Health and Family Services.

For the purposes of subsection 78(1) of the Act, copies of this full public report may be inspected by the public at the Library, National Occupational Health and Safety Commission, 92-94 Parramatta Road, Camperdown NSW 2050, between the following hours:

Monday - Wednesday	8.30 am - 5.00 pm
Thursday	8.30 am - 8.00 pm
Friday	8.30 am - 5.00 pm

Copies of this full public report may also be requested, free of charge, by contacting the Administration Coordinator on the fax number below.

For enquiries please contact the Administration Coordinator at:

Street Address: 92 Parramatta Rd Camperdown, NSW 2050, AUSTRALIA

Postal Address: GPO Box 58, Sydney 2001, AUSTRALIA

Telephone: (61) (02) 9577-9466 **FAX** (61) (02) 9577-9465

Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

FULL PUBLIC REPORT**INCA 415 Intermediate****1. APPLICANT**

Courtaulds (Australia) Pty Ltd of 115 Hyde Road YERONGA QLD 4104 has submitted a standard notification statement in support of their application for an assessment certificate for INCA 415 Intermediate.

2. IDENTITY OF THE CHEMICAL

Chemical Name:	amine epoxy adduct
Trade Name:	INCA 415 Intermediate
Number-Average Molecular Weight (NAMW):	345
Weight-Average Molecular Weight:	624
Method of Detection and Determination:	the notified chemical may be detected by gel permeation chromatography and determined by infrared (IR), ¹ H nuclear magnetic resonance (NMR) and ¹³ C NMR spectroscopy

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	straw coloured liquid with amine like odour
Viscosity:	40 poise at 25°C
Boiling Point:	not determined
Specific Gravity:	0.995-1.025
Vapour Pressure:	no data (see notes below)
Water Solubility:	> 1 g.L ⁻¹ (see notes below)

Partition Co-efficient (n-octanol/water):	no data (see notes below)
Hydrolysis as a Function of pH:	no data (see notes below)
Adsorption/Desorption:	no data (see notes below)
Dissociation Constant:	no data (see notes below)
Flash Point:	> 61°C
Flammability Limits:	not determined
Autoignition Temperature:	not determined
Explosive Properties:	not explosive
Reactivity/Stability:	stable under normal conditions of use and storage; reacts with carbon dioxide; may react violently with strong acids

Comments on Physico-Chemical Properties

No vapour pressure data were provided for the notified adduct, but since the new adduct contains around 10% of a residual amine, it is expected that the vapour pressure of the material would not exceed that of the amine which is given as 4×10^{-3} kPa at 25°C.

Water solubility of the adduct was not determined in a dedicated test, but in a test for acute toxicity to *Daphnia carinata* (see below in section on Environmental Effects) an estimate of the water solubility was obtained incidentally and indicated solubility to be in excess of 1 g.L^{-1} . A water solubility of this magnitude could be expected for adduct molecules which contain a high proportion of hydroxy and amino groups with relatively low hydrocarbon content.

The adduct contains no linkages which will be susceptible to hydrolytic degradation in the usual environmental pH region.

No partition coefficient data were provided with the original notification. However, the adduct is a complex mixture of species, all of which contain amine and/or hydroxyl groups with a high affinity for water. Since the adduct molecules (see above) contain relatively small hydrocarbon moieties, it is expected that they will have relatively high affinity for water and would consequently not partition into the oil phase. The relatively high water solubility supports this assessment.

No adsorption/desorption data were provided, but under usual environmental conditions the notified adduct is unlikely to associate with the organic component of soils and sediments due to the expected low value of P_{ow} (and consequently low K_{oc}). However, in an aqueous environment under the usual pH conditions (pH between 4 and 9) the amino groups in the adduct species would be protonated (see

below) and confer positive ionic charge on the molecules, and consequently it is likely that they will be adsorbed onto the negatively charged surfaces of silicate minerals and become bound through electrostatic interactions.

The primary and secondary amino groups in the adduct species will have pK_a of between 9.5 and 10.5, and under the usual environmental pH conditions where the pH is between 4 and 9, the majority of these will be protonated, giving the molecules a positive charge.

4. PURITY OF THE CHEMICAL

Degree of Purity: 89%

Toxic or Hazardous Impurities: an aromatic amine is present at a level of approximately 10%; no impurity is present at levels requiring the notified chemical to be considered a Type I ingredient

Non-hazardous Impurities (> 1% by weight): none known

Additives/Adjuvants: none

5. USE, VOLUME AND FORMULATION

The notified chemical is used as a curing agent for two-component, epoxy based, industrial coatings for protection of steel wharf piles and structural steel where corrosion resistance is important.

The formulation to be imported contains the notified chemical at a concentration of 75% together with methyl isobutyl ketone, 2,4,6-tris(dimethylaminomethyl) phenol and m-xylylenediamine. The notified chemical is to be imported at a rate of approximately 40 tonnes per year for the first five years.

6. OCCUPATIONAL EXPOSURE

The formulation containing the notified chemical will be imported in 205 L steel drums to the notifier's site where repackaging into 4 L steel cans will take place. Exposure to workers involved in transport and storage should only occur in the event of an accident. Repackaging will be performed by inserting a pump into the drum. Filling of 4 L cans will occur automatically under local exhaust ventilation. Some, exposure (largely dermal) to residues on the pump or while cleaning the pump may be expected.

For application of the coating, the professional applicator will mix 4 L of the imported product with 16 L of an epoxy component in a 20 L steel pail just prior to application.

Some exposure to residues may be expected while mixing the coating and while cleaning up mixing equipment. Dermal exposure and, to a lesser extent, ocular exposure are possible during these operations.

After mixing, the coating will be applied to structural steel as a trained aerosol using an airless spray pump. The applicator places the inlet spear of the pump into the coating mixture, which is then drawn up the inlet hose to the pump piston. The liquid is pressurised and pumped to the spray gun where it is atomised to produce a well-defined spray "fan". Airless spray tip size and fluid pressure are optimised in order to minimise the amount of overspray produced during application. The coating mixture mainly will be applied outdoors for protection of steel wharf piles or structural steel in industrial "splash zone" type environments where aggressive corrosion is a problem. There is potential for dermal, ocular and inhalational exposure to aerosols during spraying. If the coating is to be applied indoors the notifier states that the immediate area of the plant will be sealed off to contain any overspray.

7. PUBLIC EXPOSURE

No significant public exposure to the notified chemical in INCA 415 Intermediate is anticipated during transport and repacking. As the notified chemical will not be sold to the public and will be used only in industry, public exposure is expected to be negligible. If exposure does occur, the notified chemical is unlikely to pose a significant hazard as it will most likely be in the cured state. Ocular irritation could occur on exposure to spray drift during application of the final coating product but this is considered unlikely provided the notified chemical is used under the recommended conditions.

8. ENVIRONMENTAL EXPOSURE

Release

The notifier indicates that transfer of the notified chemical from the 205 L drums to the 4 L drums used for distribution will involve a loss of around 0.2% (400 mL per 205 L drum). This equates to an annual loss of around 100 L of INCA 415-84 (ie 75 kg). It is estimated that about half of this will remain as residuals in the drums, while the other half will remain in the transfer/filling equipment - ie pumps, hoses and pipe work. The used drums are sent for recycling which involves shredding the drums and remelting of the steel. The notifier indicates that no release of the residual chemical is envisaged during this process, and that the residual chemical will be destroyed as a result of re-smelting (see below in the section on Fate). The transfer equipment is periodically cleaned by pumping a solvent (a mixture of aromatic hydrocarbons, ketones and alcohols) through the circuit using an automated cleaning system. The solvent is reused till completely loaded with resin materials (and pigments), and then disposed of by a licensed waste contractor. It is anticipated that the loaded solvent would be either incinerated (destroying the notified chemical), or possibly sent for solvent recovery where it is likely that residual resin material would become associated with sludge, which would itself be incinerated or possibly placed into landfill. The notifier indicates that none of these

activities results in any release of the notified chemical to the sewer.

Most release of the new chemical will be associated with its use as a hardening agent for two part epoxy industrial coatings. The notifier indicates that the new material may be used by up to 120 professional spray applicators, who will apply the maintenance coatings to steel structures exposed to corrosive environments such as marine piers and mine flotation tanks. The epoxy coating mixture is prepared by emptying the 4 L drum of INCA 415-84 into a 20 L tank (pail) and mixing with the other coating component, and it was stated in the notification that residuals in the 4 L drums are rinsed out with a small volume of solvent before these are disposed of into landfill. The coating mixture contains around 20% of INCA 415-84, and hence around 15% of the notified chemical, and the curing time for this mixture is around three hours.

The coating mixture is applied to the steel by pumping the mixture from the pail to the spray gun, and it is anticipated that around 0.5 L (ie 2.5%) of coating mixture would remain unused in the application pail. This equates to around 0.33% loss of the new chemical - ie around 130 kg per annum. However, the residual unused coating mix will cure to a semi solid mass which can be disposed of to landfill, together with the old (presumably plastic) pail. Once incorporated into a solid mass of cured epoxy resins, the notified material will be effectively locked into a polymer matrix and have little potential for leaching into the environment if placed into a landfill.

Considerable loss of coating mix (containing 15% of notified chemical) will occur as a result of overspray during application. The notifier indicates that around 15% of the mix would be "wasted" during spray application and consequently around 5.7 tonnes of the notified chemical will be lost in this manner. A good deal of the coating application will take place in outside areas where it is anticipated that wherever possible the overspray will be captured in protective sheets, allowed to cure into a solid mass and then disposed of into landfill or possibly be incinerated. The notifier estimates that up to 80% of the overspray will be captured in this manner, but nevertheless, despite these protective measures, some material (around $0.2 \times 15 = 3\%$, or 1 120 kg) may be lost and would be deposited onto soil, or possibly released into stormwater drains. In the majority of cases this would be as part of the solid resin mass, where as described above leaching of the notified chemical would be unlikely.

However, it is anticipated that considerable quantities of the new material may be used in coating marine structures, and in view of the toxic nature of the material to aquatic organisms (see section on Environmental Effects below), the losses from overspray are of some concern - see further below in section on Environmental Hazard. In these situations the notifier indicates that, where possible, the overspray will be trapped using floating boom devices. Nevertheless, around 20% is likely to be lost and enter the aqueous marine environment.

Overall it is estimated on the basis of the information supplied by the notifier that an annual release of around 15% of the notified chemical may occur. This amounts to nearly 6 tonnes per annum, the majority of which is likely to be placed into landfill as a component of a semi solid mass of cured epoxy polymer, although some may be lost to the land, marine, sewer or freshwater compartments.

Fate

Any of the notified chemical disposed of into landfill (eg as a consequence of waste disposal from collected overspray) will be incorporated in a solid crosslinked epoxy polymer matrix where it will be immobilised. The crosslinked polymer is expected to be very slowly degraded through the biological and abiotic processes operative in landfills, and will degrade to gases such as methane, ammonia, and carbon dioxide. A similar fate is predicted for the cured coating material associated with old steel which is disposed of into landfill, although most of this could be expected to be recycled where the polymer coating would be destroyed through incineration in the re-smelting operations.

Some waste materials containing the new chemical may be incinerated, and here the chemical would be completely destroyed with production of water vapour and oxides of carbon and nitrogen.

Any uncured material released as a result of accidents (or inefficient application methods) is likely to become protonated in the environment due to the high content of primary and secondary amino groups, and this will confer high water solubility on the released material, and much will therefore remain dissolved. However, it is likely that the positive charges will enable adsorption onto negatively charged ion exchange sites on soil and clay particles, and consequently some of the material would become associated with sediments and be slowly broken down by natural biological and abiotic processes. Similarly, it is likely that any particles of cured material (eg from abraded dust etc) released into stormwater or sewage systems would deposit into sediments, and be slowly destroyed through similar processes.

The notified material is not readily biodegradable, and in a 28-day biodegradation test [protocol as AS 4351 Part 5 - technically equivalent to OECD Test Guideline 301D] only 5% degradation was observed. However, most organic material is degraded eventually through the agency of biological and abiotic processes, and it could be expected that the new compound would be degraded in an aerobic environment to water, and oxides of carbon and nitrogen, while in an anaerobic situation the products would likely be water, methane and ammonia.

No bioaccumulation data were included with the notification. However, although the various adduct species present in the new chemical are of relatively low molecular weight, the high polarity and resultant reasonable water solubility indicates only low potential for bioaccumulation.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Toxicity

Summary of the acute toxicity of INCA 415 Intermediate

Test	Species	Outcome	Reference
acute oral toxicity	rat	LD ₅₀ = 2 428 mg.kg ⁻¹	(1)
acute dermal toxicity	rat	LD ₅₀ > 2 000 mg.kg ⁻¹	(2)
skin irritation	rabbit	slight irritant	(3)
eye irritation	rabbit	severe irritant	(4)
skin sensitisation	guinea pig	non-sensitiser	(5)

9.1.1 Oral Toxicity (1)

<i>Species/strain:</i>	rat/Sprague-Dawley		
<i>Number/sex of animals:</i>	20/sex		
<i>Observation period:</i>	14 days		
<i>Doses:</i>	0, 1 000, 1 750, 2 500 and 3 250 mg.kg ⁻¹		
<i>Method of administration:</i>	gavage using corn oil as vehicle		
<i>Clinical observations:</i>	piloerection, soiled coat, reduced activity, red discharge from the eyes and nose, diarrhoea and hunched appearance		
<i>Mortality:</i>	<i>dose mg.kg⁻¹</i>	<i>#males</i>	<i>#females</i>
	1 000	1/5	0/5
	1 750	0/5	0/5
	2 500	3/5	3/5
	3 250	4/5	4/5
<i>Morphological findings:</i>	in premature decedents: light coloured fluid in the stomach and intestines and bright red or pale lungs		
<i>Test method:</i>	according to OECD guidelines (6)		
<i>LD₅₀:</i>	2 428 mg.kg ⁻¹ (2 363 mg.kg ⁻¹ in males, 2 551 mg.kg ⁻¹ in females)		
<i>Result:</i>	the notified chemical was of low acute oral toxicity in rats		

9.1.2 Dermal Toxicity (2)

<i>Species/strain:</i>	rat/Sprague-Dawley
<i>Number/sex of animals:</i>	5/sex
<i>Observation period:</i>	14 days
<i>Method of administration:</i>	under occlusive dressing for 24 hours; vehicle: corn oil
<i>Clinical observations:</i>	red discharge from the nose one day after dosing and slight scab formation at the test site noted 5 to 14 days after dosing
<i>Mortality:</i>	none
<i>Morphological findings:</i>	none
<i>Test method:</i>	according to OECD guidelines (6)
<i>LD₅₀:</i>	> 2 000 mg.kg ⁻¹
<i>Result:</i>	the notified chemical was of low dermal toxicity in rats

9.1.3 Inhalation Toxicity

not provided

9.1.4 Skin Irritation (3)

<i>Species/strain:</i>	rabbit/New Zealand White
<i>Number/sex of animals:</i>	2 males, 1 female
<i>Observation period:</i>	15 days
<i>Method of administration:</i>	under semi-occlusive dressing for 4 hours
<i>Draize scores (7):</i>	

<i>Animal #</i>	<i>Time after treatment</i>					
	<i>1h</i>	<i>24h</i>	<i>48h</i>	<i>72h</i>	<i>7d</i>	<i>15d</i>
<i>Erythema</i>						
1	1 ^a	2	2	2	4*	1
2	1	1	1	1	0	0
3	1	1	1	1	0	0

Oedema						
1	0	2	1	1	2	0
2	0	1	1	1	1	0
3	0	1	1	1	1	0

^a see Attachment 1 for Draize scales * score 4 given for eschar formation

Test method: according to OECD guidelines (6)

Result: the notified chemical was a slight irritant to the skin of rabbits

9.1.5 Eye Irritation (4)

Species/strain: rabbit/New Zealand White

Number/sex of animals: 1 animal

Observation period: 24 hours (experiment terminated due to severity of response)

Method of administration: 0.1 mL of the notified chemical into one eye

Test method: according to OECD guidelines (6)

Result: the notified chemical was severely irritating to the eyes of rabbits; at 1 hour there was moderate corneal opacity covering 3/4 to the whole surface of the eye, slight iritis and moderate conjunctival redness, chemosis and discharge; at 24 hours there was severe corneal opacity covering 3/4 to the whole surface of the eye which obscured the iris, moderate chemosis and a thick white discharge, redness was not recorded due to error

9.1.6 Skin Sensitisation (5)

Species/strain: guinea pig/Dunkin-Hartley

Number of animals: 20 test, 10 control

Induction procedure: 6 hour occlusive patch topical application on one day each week for three consecutive weeks; a concentration of 100% notified chemical was used in weeks one and two reduced to 50% v/v in paraffin oil for week 3 due to severe irritation at the test site

Challenge procedure: 6 hour occlusive patch application carried out two weeks after the final induction application with a concentration of 25% v/v notified chemical in paraffin oil

Challenge outcome:

Challenge concentration	Test animals		Control animals	
	24 hours*	48 hours*	24 hours	48 hours
25%	0/20**	0/20	0/10	0/10

* time after patch removal

** number of animals exhibiting positive response

Test method: according to OECD guidelines (6)

Result: the notified chemical was not a skin sensitiser in guinea pigs

9.2 Repeated Dose Toxicity (8)

No data were available on the notified chemical. The notifier has argued that the toxicological hazard of the notified chemical should be largely due to primary and secondary amino groups. In place of repeat dose toxicity data for the notified chemical, published data for triethylenetetramine (TETA) were provided.

A 90-day repeat dose toxicity study of TETA, a medical chelating agent, in the drinking water of rats and mice was conducted to identify and characterise possible toxic effects and to evaluate their relationship to the effect of TETA on circulating copper levels. Three different diets were used, a standard cereal-based diet, a purified diet and a purified copper-deficient diet.

Fisher 344 rats (18/sex/group) were given TETA in drinking water at doses calculated to be 10, 55 or 276 mg.kg⁻¹.dy⁻¹ in males and 14, 70 or 352 mg.kg⁻¹.dy⁻¹ in females for up to 92 days. TETA administration resulted in liver copper depletion at all dose levels in rats fed the purified diet and in high dose rats fed the cereal-based diet. Generally, the copper depletion was inadequate to induce overt signs of copper deficiency. However, there was an indication of copper deficiency in high dose rats fed the purified diet. The lowest level of TETA causing any effect in rats that probably was not related to its effect on copper levels was the high dose. The response noted at this level (uterine dilatation) was not considered to be of major toxicological importance.

B6C3F1 mice (20/sex/group) received TETA in drinking water at doses calculated to be 17 to 22, 92 to 107 or 443 to 551 mg.kg⁻¹.dy⁻¹ for 92 days. Signs of TETA toxicity at the high dose were observed in animals fed the purified diet. These signs were inflammation of the lung interstitium, haematopoietic cell proliferation of the spleen, liver periportal fatty infiltration, kidney weight reduction, reduced renal cytoplasmic

vacuolation, and body weight gain reduction. These signs do not appear to be related to copper deficiency. Neither the low copper diet nor TETA had significant effects on plasma levels of Cu, Zn or Fe.

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium* Reverse Mutation Assay (9)

<i>Strains:</i>	TA 1535, TA 1537, TA 98 and TA 100
<i>Concentration range:</i>	1 - 100 µg.plate ⁻¹ (higher concentrations exhibited precipitation and toxicity)
<i>Test method:</i>	according to OECD guidelines (6)
<i>Result:</i>	the notified chemical was not mutagenic in <i>S. typhimurium</i> in either the presence or absence of metabolic activation provided by rat liver S9 fraction; some toxicity was evident at 100 µg.plate ⁻¹ ; the highest non-toxic concentration was judged to be 31.6 µg.plate ⁻¹

9.3.2 Micronucleus Assay in the Bone Marrow Cells of the Mouse (10)

<i>Species/strain:</i>	mouse/B6C3F1
<i>Number and sex of animals:</i>	5/sex/treatment group (harvest after 24, 48 or 72 hours)
<i>Doses:</i>	0, 31.5 mg.kg ⁻¹
<i>Method of administration:</i>	intraperitoneal
<i>Test method:</i>	according to OECD guidelines (6)
<i>Result:</i>	the notified chemical did not induce micronuclei in mouse bone marrow polychromatic erythrocytes (PCE)

9.4 Overall Assessment of Toxicological Data

The notified chemical exhibited low acute oral (LD₅₀ = 2 428 mg.kg⁻¹) or dermal (LD₅₀ > 2 000 mg.kg⁻¹) toxicity in rats. It was a slight skin irritant and a severe eye irritant in rabbits but was not a skin sensitiser in guinea pigs using 50 - 100% concentration as the induction dose. No evidence of genotoxicity was observed in assays for mutagenicity in *S. typhimurium* or induction of micronuclei in bone marrow PCE in mice. However, it should be noted that the doses used in these experiments were low due to toxicity.

No repeat dose studies were available for the notified chemical. However, it was argued that the major toxicological hazard would be by primary or secondary amino groups. In a 90-day repeat dose feeding study using TETA, a medical chelating agent used to treat the effects of excess copper in humans, organ toxicity (lung, liver, kidney, spleen) was observed in mice at a dose of approximately 500 mg.kg⁻¹.d⁻¹. These effects were not related to copper deficiency. Although liver copper levels were reduced in rats, this did not lead to signs of copper deficiency.

The notified chemical would be classified as hazardous according to NOHSC's *Approved Criteria for Classifying Hazardous Substances* (11) (Approved Criteria) in relation to eye irritancy.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The notifier supplied reports documenting the results obtained in ecotoxicology tests on fish fry (Eastern rainbow fish), *Daphnia carinata* and freshwater green algae (*Selenastrum capricornutum*). It is to be noted that these tests were conducted on species native to the Australian environment in Australian laboratories (12, 13, 14).

The imbalance tests on fish fry were conducted using Sydney tap water, which had been, filtered (5 micron filter followed by carbon filter) and UV sterilised. The tests were conducted over a 96 hour period with nominal concentrations of the test substance (supplied as a white translucent paste).

Test	Species	Results
Subacute Toxicity to Fish Fry [OECD 203]	Eastern Rainbow Fish <i>Melonotaenia duboulayi</i>	EC ₅₀ (96 h) = 1.17 mg.L ⁻¹ NOEC = 0.5 mg.L ⁻¹
Acute Immobilisation [OECD 202]	<i>Daphnia carinata</i>	LC ₅₀ (24 h) = 0.80 mg.L ⁻¹ LC ₅₀ (48 h) = 0.28 mg.L ⁻¹ LOEC* (48 h) = 0.094 mg.L ⁻¹
Growth Inhibition [OECD 201]	Algae <i>Selenastrum capricornutum</i>	EC ₅₀ (72 h) = 0.163 mg.L ⁻¹ NOEC* (72 h) = 0.03 mg.L ⁻¹

* L(N)OEC - low (no) observable effect concentration

of 0.01, 0.05, 0.5, 2, 5 and 10 mg.L⁻¹, and the tests were performed in triplicate with controls using 5 fish fry for each test. A static methodology without replacement of water was employed, and gentle aeration was employed in all test vessels to maintain dissolved oxygen (DO) levels. The pH, temperature, conductivity and DO levels were monitored throughout the test period, and the ranges for these physico-chemical parameters were respectively 7.18-7.75, 21.6-23.7°C, 158-167 µS.cm⁻¹ and > 80% saturation [8.7 mg.L⁻¹ at 25°C].

For the tests performed with nominal test substance concentrations of 0.5 mg.L⁻¹ and less, no imbalance in the fry was observed over the 96-hour test period, but after 24

hours exposure at 2 mg.L⁻¹, 47% of the fry were affected, and this had increased to 87% after 96-hour exposure. For the higher test concentrations 100% imbalance was apparent after 24 hours exposure. The calculated EC₅₀ was 1.17 mg.L⁻¹ (95% confidence) and the NOEC was 0.5 mg.L⁻¹. No LOEC could be determined, and no imbalance in the fish fry was observed in the controls. These results indicate the notified chemical to be at least moderately toxic to this species.

The tests on *Daphnia* were conducted in artificial pond water prepared by dissolving 0.5 g NaCl and 152 mg of CaCl₂.2H₂O in one litre of deionised water. This water had a pH of 7.8, total hardness 98 mg.L⁻¹ as CaCO₃ and magnesium hardness of 4 mg.L⁻¹. This water was used to prepare a stock solution of the test substance containing approximately 940 mg.L⁻¹ of test substance (see notes in Comments on Physico-Chemical properties above), and the tests were conducted using four replicates at nominal test substance concentrations of 0 (control), 0.03, 0.094, 0.30, 0.94, 3.01 and 9.4 mg.L⁻¹. Between 9 and 11 neonate *D. carinata* were added to each test vessel, and the tests were conducted over a 48-hour period. The pH, temperature and DO were monitored at the start and at 24 and 48 hours, and were in the ranges 7.4-7.9, 19.8-20.0°C and 9.61-10.08 mg.L⁻¹ respectively.

The Lowest Observed Effect Concentration (LOEC) was 0.094 mg.L⁻¹ after 48 hour exposure with 15% immobilisation (7.5% after 24 hours), while after 48 hours exposure at 3 mg.L⁻¹ there was 100% immobility (deaths). The results indicate that the test substance is highly toxic to this species.

The tests on inhibition of algal growth were conducted in a standard culture medium to which the test substance had been added the calculated amount of the test material dissolved in acetone at the nominal concentrations of 0 (control) 0.001, 0.01, 0.03, 0.1, 0.3 and 1 mg.L⁻¹. The test at each concentration was performed in triplicate at a temperature maintained at 24± 2°C, and residual acetone in the test flasks never exceeded 0.3%. Cell density was recorded daily using a Coulter particle analyser for three successive days, and the algal cell growth rate calculated from the slope of the plot of log₁₀(Cell Density) against time. The results obtained indicate that the new chemical is highly toxic to green algae, with the 72 hour EC₅₀ determined as 0.163 mg.L⁻¹, and the NOEC as 0.03 mg.L⁻¹.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The new chemical is very toxic to aquatic organisms if released into the environment alone, but this is likely only in the case of a serious accident. However, some material will be used in coatings for marine piers, and in view of the anticipated application losses (up to 15% - see above) and significant toxicity to aquatic organisms some hazard exists during application of these coatings. The notifier indicates that when applying the protective coating to marine wharf piers this would usually be applied by brush rather than by spraying, and also that floating booms are employed to collect the lost material. It is anticipated that around 80% of the lost material is contained by these measures, and so in a worst case scenario only 0.2 X 15% = 3% of the new hardener is lost into the marine environment during application. A large project of this nature may require application of 2 500 L of epoxy coating (containing 15% of the new chemical) and, assuming 3% loss to the aquatic

environment, around 11.2 kg of the new chemical could conceivably be released into the water for each such application. As pointed out in the notification, it is very difficult to estimate the effective volume of water into which the material would be released, but this is likely to be large, and continuous dilution will also occur through the agency of tides and other dynamic processes. However, if as calculated by the notifier that the wharf piers are surrounded by a 10 000 000 L **static** body of water (ie 10mX10mX100m = 10 000 m³ = 10 000 000 L), then the Predicted Environmental Concentration (PEC) is around 1.1 mg.L⁻¹. At this concentration the material is well in excess of its lowest toxic concentrations for all organisms against which it has been tested - see above.

However, it should be appreciated that even if released shortly after preparation of the coating mix, it is likely that a good deal of crosslinking of the components of the notified chemical to the major resin component will have taken place, and this would likely decrease the solubility and mobility of the amines and consequently decrease the intrinsic toxicity. Further, association of the amino materials with suspended organic matter and sediments would also mitigate toxicity.

It is possible that the material could also be used in other applications where direct losses to the water compartment may be possible - eg in the protective maintenance of wharf infrastructure such as cranes, or operating sewage treatment plant equipment. In these cases similar processes to those described above are expected to occur, and the toxicity of the new chemical would be mitigated through dilution and incorporation into a semi-solid partly cured resin mass. If any material was released to the sewer similar considerations would apply.

Most release to the environment will be in association with an epoxy resin as part of a semi solid highly crosslinked mass which will immobilise the toxic material. Released material is expected to be placed into landfill, where very slow degradation processes will be operative and will decompose the material to water and the usual landfill gases such as ammonia, methane and carbon dioxide.

If any of the non-crosslinked material were to enter the water compartment, its inherent potential toxicity is likely to be mitigated through association with negatively charged colloidal material and eventual assimilation into sediments, where it would be expected to slowly degrade through the agency of bacteriological and abiotic processes.

The environmental hazard from the notified chemical is expected to be low when it is handled and used in the indicated manner. However, operators of spraying equipment should be aware of the toxicity of the material to aquatic organisms and take all precautions to minimise release to the water compartment.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

From the toxicological data provided the notified chemical is unlikely to be hazardous to health in terms of acute or subchronic toxicity, skin irritation, skin sensitisation or genotoxicity. The notified chemical would not be classified as hazardous according to the Approved Criteria in relation to these toxicological endpoints (although it should be noted that the tests for genotoxicity employed low levels of the notified

chemical due to toxicity considerations). However, it was demonstrated to be a severe eye irritant in rabbits and would be classified as hazardous according to the Approved Criteria in relation to serious eye damage.

Exposure of workers involved in transport and storage of the 205 L steel drums to be imported is only expected in the event of an accident.

Exposure to the notified chemical itself is possible during filling of 4 L cans from the imported 205 L drums from drips and spills and cleaning of pumps and lines. However, this exposure is likely to be low, as the process is largely automatic. Nevertheless, eye protection as described below should be worn.

During use of the notified chemical by applicators, low exposure during mixing may be possible from drips and spills and, again, eye protection should be worn. Once mixed, the coating contains the notified chemical at a level of 15% that will not change its classification according to the Approved Criteria in terms of the potential for serious eye damage. Thus, during application of the coating eye protection should be worn.

The notified chemical is imported as a formulation containing methyl isobutyl ketone (MIBK), 2,4,6-tris(dimethylaminomethyl) phenol (DMAMP) and m-XDA. MIBK has an exposure standard of 205 mg.m⁻³ TWA (307 mg.m⁻³ STEL) (15) and m-XDA has an exposure standard of 0.1 mg.m⁻³ (15). DMAMP is harmful by the oral route and is an irritant. However, the level in the formulation to be imported is below the concentration cut-off level of 20% for irritancy and 25% for ingestion (16). The formulation is a Dangerous Goods, Class 3, Resin Solution and is flammable.

During repacking the imported formulation, mixing of the 2-pack coating and spraying of the coating there is a risk of serious eye damage and eye protection as described below should be worn. If the atmospheric concentration of m-XDA rises above the exposure standard of 0.1 mg.m⁻³ there is a risk of skin irritation, percutaneous absorption and systemic injury (17). There also may be some risk of sensitisation in individuals who are hypersusceptible or otherwise unusually responsive to exposure to certain industrial chemicals (17).

The risk of adverse public health effects is considered to be low given that exposure to the notified chemical is unlikely except for serendipitous exposure to spray drift on application of the final coating.

13. RECOMMENDATIONS

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

- Good general and local exhaust ventilation should be employed when repacking the imported formulation or when mixing or spraying the 2-pack coating indoors;

- Safety goggles should be selected and fitted in accordance with Australian Standard (AS) 1336 (18) to comply with Australian/New Zealand Standard (AS/NZS) 1337 (19);
- Industrial clothing should conform to the specifications detailed in AS 2919 (20);
- Impermeable gloves or mittens should conform to AS 2161 (21);
- All occupational footwear should conform to AS/NZS 2210 (22);
- Spillage of the notified chemical should be avoided, spillages should be cleaned up promptly with absorbents which should then be put into containers for disposal;
- Good personal hygiene should be practised to minimise the potential for ingestion;
- A copy of the Material Safety Data Sheet (MSDS) should be easily accessible to employees.

It should be noted that there are hazardous components in the formulation to be imported and exposure standards as noted in section 12 above should be adhered to. In addition, where respiratory protection is required it should conform to AS 1715 (23) and AS 1716 (24).

The imported formulation is flammable and should be kept away from sources of ignition.

As the notified chemical is very toxic to aquatic organisms, to minimise environmental exposure operators of spray equipment should be aware of the toxicity of the material, and take all precautions to minimise release to the water compartment.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the formulation to be imported containing the notified chemical was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (25).

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

1. Cuthbert, J.A. & Jackson D. 1990, *MXDA Adduct: Acute Oral Toxicity (Limit) Test in Rats*, Project no., 245710/6426, Inveresk Research International, Tranent, Scotland.
2. Cuthbert, J.A. & Jackson D. 1990, *MXDA Adduct: Acute Dermal Toxicity (Limit) Test in Rats*, Project no., 245710/6427, Inveresk Research International, Tranent, Scotland.
3. Cuthbert, J.A. & Jackson D. 1990, *MXDA Adduct: Acute Skin Irritation Test in Rabbits*, Project no., 245710/6428, Inveresk Research International, Tranent, Scotland.
4. Cuthbert, J.A. & Jackson D. 1990, *MXDA Adduct: Acute Eye Irritation Test in Rabbits*, Project no., 245710/6429, Inveresk Research International, Tranent, Scotland.
5. Cuthbert, J.A. & Jackson D. 1990, *MXDA Adduct: Buehler Sensitisation Test in Guinea Pigss*, Project no., 245710/6430, Inveresk Research International, Tranent, Scotland.
6. Organisation for Economic Co-operation and Development 1995-1996, *OECD Guidelines for the Testing of Chemicals on CD-Rom*, OECD, Paris.
7. Draize, J.H. 1959, 'Appraisal of the Safety of Chemicals in Foods, Drugs and Cosmetics', *Association of Food and Drug Officials of the US*, vol. 49, pp. 2-56.
8. Greenman, D.L. *et al.* 1996, 'Subchronic Toxicity of Triethylenetetramine Dihydrochloride in B6C3F1 Mice and F344 Rats', *Fundamental and Applied Toxicology*, vol. 29, pp. 185-193.
9. Bonin, A. & Meyer-Carrive I. 1997, *Bacterial Mutagenicity Test of INCA 415 Intermediate*, Project no., W6.A, ICP Firefly at Worksafe Australia, Camperdown, NSW, Australia.
10. Bonin, A. & Meyer-Carrive I. 1997, *Micronucleus Test of INCA 415 Intermediate Sample No. S001 in the B6C3F1 Mouse*, Project no., W6.B, ICP Firefly at Worksafe Australia, Camperdown, NSW, Australia.
11. National Occupational Health and Safety Commission 1994, *Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1994)]*, Australian Government Publishing Service, Canberra.
12. Lim, R.P. 1997, *Toxicity of the Polymer Adduct INCA 415 Intermediate to the Fry of the Eastern Rainbow Fish*, Project no., E96/81/007, University of Technology, Sydney, Sydney, Australia.

13. Berry, M.J. 1996, *Report on Daphnia Acute Immobilisation Test for INCA 415 Intermediate*, Key Centre for Applied Nutritional Toxicology - RMIT, Melbourne, Australia.
14. Stauber, J.L. & Adams M.S. 1996, *Toxicity of INCA 415 Intermediate to the Freshwater Green Algae Selenastrum capricornutum*, Project no., CET/IR525R, Division of Coal and Energy Technology, Commonwealth Scientific and Industrial Research Organisation, Australia.
15. National Occupational Health and Safety Commission 1995, 'Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment, [NOHSC:1003(1995)]', in *Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards*, Australian Government Publishing Service, Canberra.
16. National Occupational Health and Safety Commission 1994, *List of Designated Hazardous Substances [NOHSC:10005(1994)]*, Australian Government Publishing Service, Canberra.
17. ACGIH 1997, *Documentation of the Threshold Limit Values and Biological Exposure Indices (Draft)*, Cincinnati, OH, USA.
18. Standards Australia 1994, *Australian Standard 1336-1994, Eye protection in the Industrial Environment*, Standards Association of Australia, Sydney.
19. Standards Australia/Standards New Zealand 1992, *Australian/New Zealand Standard 1337-1992, Eye Protectors for Industrial Applications*, Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.
20. Standards Australia 1987, *Australian Standard 2919-1987, Industrial Clothing*, Standards Association of Australia, Sydney.
21. Standards Australia 1978, *Australian Standard 2161-1978, Industrial Safety Gloves and Mittens (excluding electrical and medical gloves)*, Standards Association of Australia, Sydney.
22. Standards Australia/Standards New Zealand 1994, *Australian/New Zealand Standard 2210-1994, Occupational Protective Footwear*, Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.
23. Standards Australia/Standards New Zealand 1994, *Australian/New Zealand Standard 1715-1994, Selection, Use and Maintenance of Respiratory Protective Devices*, Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.

24. Standards Australia/Standards New Zealand 1994, *Australian/New Zealand Standard 1716-1994, Respiratory Protective Devices*, Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.
25. National Occupational Health and Safety Commission 1994, *National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]*, Australian Government Publishing Service, Canberra.

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. 1 mm)	3
Severe erythema (beet redness)	4	Severe oedema (raised more than 1 mm 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