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**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

Ethanolamine BPM N-oxide

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT**Ethanolamine BPM N-oxide****1. APPLICANT**

Grace Dearborn of 1126 Sydney Road FAWKNER VICTORIA 3060 has submitted a standard notification statement in support of their application for an assessment certificate for **Ethanolamine BPM N-oxide**.

2. IDENTITY OF THE CHEMICAL

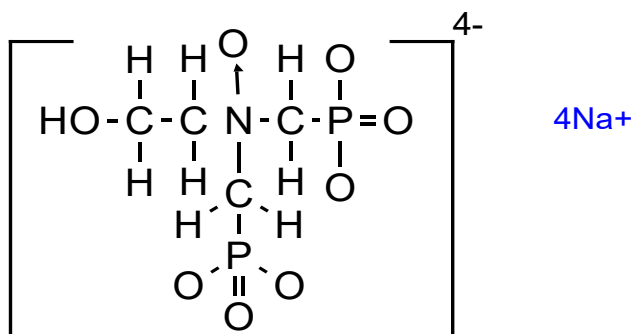
The notified substance is a mixture of two phosphonic acids which cannot be effectively isolated.

Chemical name:	mixture of: (A) sodium salt of ((2-hydroxy ethyl) imino) bis (methylene)) bis phosphonic acid, N-oxide (B) sodium salt of ((tetrahydro-2-hydroxy-4H-1,4,2-oxazaphosphorin -4-yl) methyl) phosphonic acid, N-oxide, P-oxide
Chemical Abstracts Service (CAS) Registry No.:	mixture of: (A) 136016-61-0 (B) 136016-62-1
Other names:	the raw material goes under the code names Dearborn X1646, ethanolamine BPM N-Oxide (EBO) and DLB-1079-402, also referred to as a mixture of phosphonic acid (A) and phosphonic acid (B)
Trade name:	currently no marketing name for Australia, imported formulation (35% notified chemical) will be reformulated (3.5% notified chemical) for marketing
Molecular formula:	(A) $C_4H_9NO_8P_2Na_4$ (B) $C_4H_8NO_7P_2Na_3$

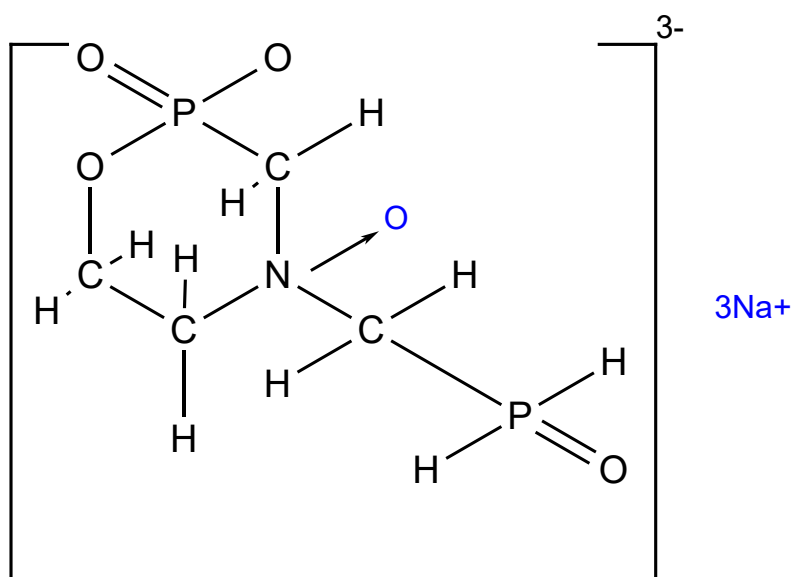
Structural formula:

(A) is linear form of salt, (B) is cyclical form

(A)



(B)



Molecular weight:

(A) 352

(B) 313

Method of detection and determination:

UV, infrared (IR) and phosphorous NMR spectra were supplied for identification of the chemical

Spectral data:

IR, major absorbance peaks were at approximately 850, 1050, 1200, 1300, 1400, 1500, 1800, 2200, 2450 cm⁻¹

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:

clear colourless to pale yellow odourless liquid

Freezing point:

253K

Boiling point:	approximately 40% of EBO (concentrate) was distilled between 372 and 377 K at a pressure of 99.8 to 102 kPa, leaving a residue which decomposed at around 422 K prior to boiling
Specific gravity:	1.5565 at 20°C
Vapour pressure:	$< 2.3 \times 10^{-11}$ kPa at 25°C
Water solubility:	totally miscible at 20°C
Partition co-efficient (n-octanol/water):	$\log P_{ow} = -4.05$
Hydrolysis as a function of pH:	not determined
Surface tension:	71.6 mN/m at 20.5°C
Adsorption/desorption:	not determined
Dissociation constant:	not determined
Flash point:	none below its boiling point
Flammability limits:	not supplied
Autoignition temperature:	332 \pm 5°C
Explosive properties:	not explosive
Reactivity/stability:	not generally reactive

Comments on Physico-Chemical Properties

Hydrolysis as a function of pH was not determined. The company states it was not technically possible to conduct the hydrolysis study because the only possible technique for monitoring hydrolytic degradation, ^{31}P -NMR, is not of the required sensitivity to detect 10% decomposition, as required in Method C7 of Commission Directive 92/69/EEC. Under basic conditions, phosphonic acid (B) (see Chemical identity section) would be expected to hydrolyse to form phosphonic acid (A). The reverse reaction is unlikely.

Adsorption/desorption characteristics of the notified chemical were not tested. Because of its high solubility in water and very low partition co-efficient, the chemical would not be expected to absorb to organic matter and sediments. High mobility is expected.

The notified chemical consists of two sodium salts which would be expected to dissociate completely in water. The chemical is imported as an aqueous solution, and further dissociation of the phosphonic acids would not be expected.

With a surface tension of 71.6 mN/m, the notified chemical is not considered to be surface active.

4. PURITY OF THE CHEMICAL

Degree of purity: the notified substance consists of 18.8% weight (A) and 16.6% weight (B) solution in water: (1:1 mole ratio of phosphonic acid (A) and (B))

Toxic or hazardous impurities:

Chemical Name	CAS No.	Weight %
nitric acid	7697-37-2	< 0.01
nitrous acid	7782-77-6	< 0.02
phosphoric acid	7664-38-2	0.75
ethanolamine	141-43-5	0.3
formaldehyde	50-00-0	< 0.1
hydrogen peroxide	7722-84-1	< 0.5

Nitric acid is listed in Worksafe Australia's *List of Designated Hazardous Substances* (1); the threshold at which a mixture requires a hazardous classification is 1% as an irritant. Nitrous acid is not listed in the *List of Designated Hazardous Substances* (1) however, it is listed in Toxline (2) as being associated with effects on the respiratory system that affect function. Nitrous acid will be a weaker acid than nitric acid.

Phosphoric acid, ethanolamine, formaldehyde and hydrogen peroxide are listed as hazardous on the *List of Designated Hazardous Substances* (1) and their respective thresholds for classification of a mixture as hazardous are: irritant 10%, irritant 20%, irritant and harmful 1% and irritant 5%. Formaldehyde is a skin sensitiser and a category 2 carcinogen (4).

Nitric acid, phosphoric acid, ethanolamine, formaldehyde and hydrogen peroxide have the following respective limits listed in Worksafe Australia's *Exposure Standards for Atmospheric Contaminants in the Occupational Environment* (4): 5.2 mg/m³ (2 ppm), 1 mg/m³, 7.5 mg/m³ (3 ppm), 1.2 mg/m³ (1 ppm) and 1.4 mg/m³ (1 ppm).

As all of the listed hazardous impurities are at very low levels the notified chemical would not be classified as hazardous according to the criteria of Worksafe Australia (3).

**Non-hazardous impurities
(> 1% by weight):**

Chemical Name	CAS No.	Weight %
hydroxymethyl phosphonic acid	2617-47-2	1.0
phosphorous acid	13598-36-2	1.0

Phosphorous acid and hydroxymethyl phosphonic acid are not listed in the *List of Designated Hazardous Substances* (1), Toxline (2) or in Sax and Lewis (5), additionally phosphorous acid will be a weaker acid and thus less corrosive than phosphoric acid.

5. USE, VOLUME AND FORMULATION

The notified chemical will be imported into Australia from the USA as a 30% aqueous solution (a 1:1 mole ratio of phosphonic acid (A) and (B)), and will come in plastic lined, steel or plastic 200 L drums. It is not anticipated that manufacture will occur in Australia.

The mixture is a raw material which is used in the formulation of scale and corrosion inhibitors for the water treatment industry, mainly in industrial cooling towers, in percentages of up to 10% by weight.

All the product will be used in this area and it is anticipated that 10 tonnes of the formulation will be imported in the first year, increasing to 22 tonnes in the fifth year; this corresponds to approximately 3 and 6.7 tonnes of the notified chemical respectively.

The formulation has been in use overseas since 1989 as a corrosion inhibitor additive and is produced in the USA.

6. OCCUPATIONAL EXPOSURE

The notified chemical is not manufactured in Australia but imported as a 30% aqueous solution in 200 L drums. Occupational exposure during transport and warehousing will normally only occur in the event of accidental spillage. The imported formulation is not classified as hazardous under the *Australian Dangerous Goods Code* (6). It is slightly acidic, hence the use of sodium hydroxide to neutralise spills.

The main risk through occupational exposure will occur during reformulation. The product, a corrosion inhibitor, contains 10% of the imported formulation; this corresponds to 3.5% of the notified chemical. This mix is supplied to the notifier's customers who will use the formulation to treat industrial cooling towers.

The mixing process involves adding a measured amount of the imported solution (containing the notified chemical at 30%) to a heated/cooled mixing vessel. The transfer process utilises pumps. The other components added to the mixing vessel are water, dispersants, other phosphonates (listed on the Australian Inventory of Chemical Substances [AICS]), a copper based corrosion inhibitor and an alkali. The latter at a concentration of approximately 4% can be either sodium or potassium hydroxide. The mix is then supplied to an auto-fill pack off line. The mixing vessels are closed and vented with dust extractors. Additional mechanical ventilation is also used.

Technicians will be exposed to the notified chemical in its most concentrated form during measuring and addition stages, sampling and during maintenance. The notifier has estimated potential exposure of 6 hours/day for 15 days/year.

The main exposure route will be via skin contact although eye contact could occur through splashing. Inhalational exposure will be minimised through the use of mechanical ventilation/filters, a closed mixing and packaging system. Inhalational exposure will be further limited by the low volatility of the notified chemical. The low octanol/water partition coefficient indicates limited risk of systemic effects through dermal exposure. The alkaline nature of the final formulation (due to the NaOH or KOH) means that it is caustic and corrosive. The formulation is classified as a hazardous chemical, class 2R, according to the *Australian Dangerous Goods Code* (6).

The formulation supplied to the notifier's customers will contain approximately 10% of the notified chemical, occupational exposure will be consequently reduced. The formulation will be pump-transferred from the shipping drums to a chemical dosing system which will feed the cooling system by an enclosed chemical metering system. Occupational exposure for cooling system technicians will be greatest during connection/disconnection of the pump system and during maintenance. The notifier has estimated potential exposure to be of the order of 3 hours/day for 250 days/year.

7. PUBLIC EXPOSURE

The notified chemical will be transported and stored in 200 L polylined steel or plastic drums prior to reformulation. The reformulated product contains 10% of the imported formulation, ie. 3.5% of the notified chemical, and will be added into the cooling water system at the dose rate of 0.01%. Thus the notified chemical will be present at a concentration of 3.5 mg/L in the cooling tower. Very fine water droplets in the cooling tower may evaporate and pass out in the air stream. However, the notifier claimed that drift eliminators and humidifiers should reduce this to a very low level. Considering the low concentration (3.5 mg/L) of the notified chemical in the cooling tower, low vapour pressure of the notified chemical, and drift eliminators and humidifiers used in the cooling system, the amount of notified chemical which will be drawn into the air stream is expected to be very low.

The notified chemical will be discharged to the sewer system from the cooling tower. The concentration of the notified chemical in the receiving waters will be low (much lower than 80 µg/L) after dilution in the sewer and chelation in the sewage treatment plants.

Waste generated during reformulation will be disposed of by a licensed disposal contractor or discharged to the sewer. Accidental spills are to be contained by absorbent and disposed of to land-fill, and residues are flushed to sewer. Because the notified chemical is very soluble in water, leaching into groundwater may occur.

8. ENVIRONMENTAL EXPOSURE

Release

Storage will be on the Grace Dearborn Fawkner site in palletised containers, with quantities of up to one tonne per month. Containers will be 200 L polylined steel or plastic bung top drums. Customer sites will be supplied with up to 500 kg per month depending on individual inventory levels.

The notifier has estimated a 20 kg discharge of Ethanolamine BPM N-oxide in year one which is related to the manufacturing discharge limits applicable in a blending situation due to reformulation at the notifiers Victorian site. At this site, the chemical will be reformulated into a water based scale/corrosion inhibitor, containing up to 10% by weight of the imported aqueous solution (ie around 3% by weight of the notified chemical). The discharge will be in water and will be directed to a waste treatment facility. Waste plant recovered solids are handled by a licensed disposal contractor, with remaining liquid wastes discharged to sewer.

The chemical will be used in industrial cooling towers exclusively. During end use, the notified chemical is present in cooling towers at a concentration of around 3 mg/L (10 mg/L Ethanolamine BPM N-oxide). The towers will be connected to the sewer system. The notifier estimates less than 1% of released chemical will be lost as a result of drift. All other release will be due to blowdown (around 5% of cooling tower circuit volumes is indicated by the notifier), and will be sent to sewer. In the fifth year of operation, with an import volume of 6.6 tonnes (22 tonnes Ethanolamine

BPM N-oxide), the notifier estimates a daily release through blowdown operations of 4.5 kg per day of the notified chemical (15 kg per day Ethanolamine BPM N-oxide).

Bulk drums are expected to be sent to drum reconditioners. Where customers do not have these facilities, the notifier collects empty drums upon delivery of new stock, and sends them to a drum reconditioner. Smaller plastic containers are expected to be incinerated or sent to land-fill.

Fate

Due to the high solubility, and very low partition co-efficient, this chemical would be expected to be highly mobile in water. A proportion of the released chemical may chelate to cations such as Ca^{2+} and Al^{3+} in the sewage treatment plant and precipitate out of solution to form part of the sludge. This would be landfilled or incinerated.

Chemical which does reach the aquatic compartment may also chelate to cations and precipitate out to form part of the sediments.

The biodegradation test showed Ethanolamine BPM N-oxide (Concentrate) attained 12% degradation after 28 days and so cannot be considered as readily biodegradable under OECD Guideline No. 301D (closed bottle test). This, and the low potential for further hydrolysis suggest the chemical will be persistent in the aquatic environment.

Bioaccumulation studies were not performed. Based on the high water solubility and very low partition co-efficient, the chemical is not expected to bioaccumulate.

Material Safety Data Sheet (MSDS) instructions to cope with accidental spillage include containing all spills within a bund; use of adsorbent sand or similar (not combustibles such as sawdust); and collecting in drums for disposal. Residues are to be flushed with water. These instructions are adequate.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Toxicity

Summary of the acute toxicity of Ethanolamine BPM N-oxide

Test	Species	Outcome	Reference
acute oral toxicity	rat	LD ₅₀ > 2 720 mg/kg	7
acute dermal toxicity	rat	LD ₅₀ > 2 720 mg/kg	9
skin irritation	rabbit	not an irritant	10
eye irritation	rabbit	slight irritant	12
skin sensitisation	guinea pig	not a sensitiser	13

9.1.1 Oral Toxicity (7)

<i>Species/strain:</i>	Sprague-Dawley rat
<i>Number/sex of animals M/F:</i>	5/5
<i>Observation period:</i>	14 days
<i>Method of administration:</i>	gavage, as a solution in distilled water at a dose level of 2 720 mg/kg
<i>Clinical observations:</i>	none
<i>Mortality:</i>	nil
<i>Morphological findings:</i>	no abnormalities
<i>Test method:</i>	based on OECD Guidelines for Testing Chemicals (8)
<i>LD₅₀:</i>	> 2 720 mg/kg
<i>Result:</i>	low oral toxicity, no signs of systemic toxicity

9.1.2 Dermal Toxicity (9)

<i>Species/strain:</i>	Sprague-Dawley rat
<i>Number/sex of animals M/F:</i>	5/5
<i>Observation period:</i>	14 days
<i>Method of administration:</i>	24 hour exposure, occluded dressing, to intact skin of test article (liquid) at a dose of 2 720

	mg/kg
<i>Clinical observations:</i>	no signs of skin irritation or systemic toxicity
<i>Mortality:</i>	nil
<i>Morphological findings:</i>	no abnormalities
<i>Test method:</i>	based on OECD Guidelines for Testing Chemicals (8)
<i>Result:</i>	low dermal toxicity

9.1.4 Skin Irritation (10)

<i>Species/strain:</i>	New Zealand white rabbit
<i>Number/sex of animals M/F:</i>	2/1
<i>Observation period:</i>	72 hours
<i>Method of administration:</i>	4-hour semi-occluded, 0.5 mL of test article
<i>Draize scores (11):</i>	0
<i>Test method:</i>	based on OECD Guidelines for Testing Chemicals (8)
<i>Result:</i>	not a skin irritant

9.1.5 Eye Irritation (12)

<i>Species/strain:</i>	New Zealand white rabbit
<i>Number/sex of animals M/F:</i>	3 M
<i>Observation period:</i>	72 hours
<i>Method of administration:</i>	0.1 mL of test article into conjunctival sac of one eye.

Draize scores (11) of unirrigated eyes:

Time after instillation

<i>Animal</i>	<i>1 hour</i>		<i>1 days</i>		<i>2 days</i>		<i>3 days</i>					
<i>Cornea</i>	<i>o^a</i>	<i>a^b</i>	<i>o^a</i>	<i>a^b</i>	<i>o^a</i>	<i>a^b</i>	<i>o^a</i>	<i>a^b</i>				
1	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				
<i>Iris</i> 1	0		0		0		0					
2	0		0		0		0					
3	0		0		0		0					
<i>Conjunctiva</i>	<i>r^c</i>	<i>c^d</i>	<i>d^e</i>	<i>r^c</i>	<i>c^d</i>	<i>d^e</i>	<i>r^c</i>	<i>c^d</i>	<i>d^e</i>	<i>r^c</i>	<i>c^d</i>	<i>d^e</i>
1	1	1	0	0	0	0	0	0	0	0	0	0
2	1	1	1	0	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	0	0

ⁱ see Attachment 1 for Draize scales

^a opacity ^b area ^c redness ^d chemosis ^e discharge

Test method: based on OECD Guidelines for Testing Chemicals (8)

Result: slight irritant, not hazardous, irritant, according to the criteria of Worksafe Australia (11)

9.1.6 Skin Sensitisation (13)

Species/strain: Dunkin-Hartley guinea pig

Number of animals: 10 test, 5 control

Induction procedure: three pairs of injections: Freund's Complete Adjuvant (FCA) 1:1 distilled water; 17% test material in distilled water; 17% test material in FCA plus distilled water; topical induction at day 6, 0.5 mL of 10% sodium lauryl sulphate in petrolatum followed 1 day later by 0.2-0.3 mL of undiluted test material (68% purity) for 48 hours.

Challenge procedure: use of undiluted test material (68% purity) produced no reaction at either 24 or 48 hours

Challenge outcome: no response at 24 and 48 hours

Test method: based on OECD Guidelines for Testing Chemicals (8)

Result: not a sensitiser

9.2 Repeated Dose Toxicity (14)

Species/strain: Sprague-Dawley rat

Number/sex of animals M/F: 3 test and 1 control group, each 5/5

Method of administration: gavage

Dose/Study duration:: 150, 400 and 1 000 mg/kg/day for 28 days

Clinical observations: no clinically observable signs of toxicity

Clinical chemistry/Haematology no toxicologically significant changes; male low and intermediate dose animals had variable neutrophil, monocyte and platelet counts compared to the controls; high dose females had marginally higher mean monocyte counts than controls, however not considered abnormally high; some variations in clinical chemistry but either not dose related and/or not outside normal range; factors affected included plasma potassium, sodium, creatinine, glucose, chloride, calcium, inorganic phosphorous and alkaline phosphatase

Histopathology: no treatment related changes

Necropsy findings no macroscopic abnormalities, high dose males showed a slightly higher kidney weight

Test method: based on OECD Guidelines for Testing Chemicals (8)

Result: no treatment related effects in rats dosed at 400 mg/kg/day, only male rats dosed at 1 000 mg/kg/day showed increase in kidney weight; this was not accompanied by any indications of renal dysfunction or morphological changes.

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium* Reverse Mutation Assay (15)

<i>Strains:</i>	<i>S. typhimurium</i> TA 98, TA 100, TA 1535, TA 1537, TA 1538
<i>Concentration range:</i>	8 - 5 000 µg/plate with or without rat liver S9; control using sterile distilled water and positive controls; 9-aminoacridine, 90 µg/plate, 4-nitro-o-phenylenediamine, 5 µg/plate and 4-nitroquinoline-1-oxide, 0.2 µg/plate. In addition positive controls with S9 used 0.5-2 µg/plate 2-aminoanthracene
<i>Test Method:</i>	in accordance with OECD Guidelines for Testing Chemicals (8)
<i>Result:</i>	non-mutagenic in bacteria; controls gave appropriate responses

9.3.2 Chromosome Aberration Test in Human Lymphocytes *In Vitro* (16)

<i>Doses:</i>	2 650 µg/plate with and without rat liver S9
<i>Method of administration:</i>	test article was dissolved in sterile distilled water and added to lymphocyte cultures; control using sterile distilled water and positive controls; ethyl methanesulphonate, 500 µg/ml, dissolved in dimethyl sulphoxide
<i>Test method:</i>	in accordance with OECD Guidelines for Testing Chemicals (8)
<i>Result:</i>	non clastogenic; controls gave appropriate response

9.4 Overall Assessment of Toxicological Data

The notified chemical has low oral and dermal toxicity to rats with LD₅₀ values of > 2 720 mg/kg. It is not classified as hazardous as it is not a skin or eye irritant in rabbits according to the criteria of Worksafe Australia (11), however it did produce chemosis, redness and discharge and apparent pain in the test animals at one hour after application to the eye. It was not a skin sensitiser in guinea pigs.

In a 28 day repeat dose study in rats there were no statistically significant treatment related effects apart from an increased kidney size in male rats at a dose rate of 1 000 mg/kg/day. There were also some effects on haematology

and blood chemistry although these were either not dose related and/or within the normal range encountered for these parameters.

On the basis of the toxicology data submitted the notified chemical would not be classified as hazardous according to the criteria of Worksafe Australia (11).

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

Results of ecotoxicity tests are summarised in Table 1. The chemical can be classified as practically non-toxic to fish and water fleas, and moderately toxic to algae.

Table 1. Ecotoxicity test results

Test	Species	Results (mg/L)
96h acute toxicity (semi-static)	rainbow trout	NOEC > 100
48h acute toxicity (static)	<i>Daphnia magna</i>	NOEC > 100
72h growth inhibition (continuous illumination)	Algae (<i>Scenedesmus subspicatus</i>)	ERC ₅₀ (24h-48h) = 6.8 EBC ₅₀ (72h) = 5.4 NOEC = 2.0

* NOEC - no observable effect concentration

The 96-h acute test on rainbow trout and 48-h acute test on water flea both yielded NOEC values > 100 mg ai/L (a.i = active ingredient). As such, it was considered unnecessary and unrealistic to test at concentrations in excess of 100 mg ai/L.

During the algal growth inhibition test, at the test concentration of 16 mg ai/L, the cells were observed to be clumped together. Additionally, the pH values of the control and test cultures were observed to increase from 8.0 to as high as 10.3 over the duration of the test (72 hours). The company considers this effect may be due to large numbers of algal cells respiring oxygen and producing carbonates and bicarbonates as part of photosynthesis/respiration giving rise to alkaline conditions in solution. The rise in pH was not considered to affect the integrity of the test.

The toxicity control in the biodegradation experiment, containing both Ethanolamine BPM N-oxide (concentrate) and sodium benzoate, attained 35% degradation after 28 days, confirming that the notified substance was not toxic to the sewage treatment micro-organisms used in the study.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

Klaine et al,1995 (17) describe a risk assessment approach for the use of a biocide in industrial cooling systems. The Tier One Risk Assessment approach provides for a conservative calculation of direct discharge exposure from cooling towers. This approach has been modified for this assessment and makes the following assumptions:

- 1) Application rate of 3 mg/L.
- 2) Application rates are constant, 24 h/d, 365 d/y.
- 3) No chelation of the notified substance occurs prior to entering waterways.
- 4) Discharge is from "once-through" systems, ie, water is passed through the cooling system once only before entering the waste stream.
- 5)
 - i) All release occurs in one major city
 - ii) 10% release occurs in a large country town.

Environmental Hazard Calculations:		City	Country
A	Import volume (yr 5)	6 600 kg	660 kg
B	Daily release	18.08 kg	1.81 kg
C	Application concentration	3 mg/L	3 mg/L
D	Daily flow of cooling towers (B / C)	6 ML	0.6 ML
E	Sewer rate per day	250 ML	7.5 ML ^a
F	Dilution factor in sewer (E / D)	41.7	12.4
G	Concentration in sewer (C / F)	0.072 mg/L	0.24 mg/L
H	Dilution factor in receiving waters	10	3
I	Concentration in receiving waters (G / H)	7.2 µg/L (ppb)	80 µg/L

a) Town of 50,000 people at 150 L per person.

These calculations give a worst case scenario. Release to sewer is assumed to account for all the chemical imported. In reality, not all the Ethanolamine BPM N-oxide will be lost during blowdown, and some will form a continuous layer on the metal surface. Blowdown would account for only a percentage of circuit volumes (5% indicated by the notifier) being released to sewer. Additionally, the calculations assume all release is in one city. A number of sites have been identified by the notifier, mainly in Victoria, New South Wales, and Queensland, so release per city will be far less.

It can be seen that the most sensitive aquatic toxicity result of EBC_{50} (72 h) = 5.4 mg/L for algal growth inhibition is several orders of magnitude higher than the predicted environmental concentration (PEC) of 7.2 µg/L in coastal receiving waters, and two orders of magnitude above the PEC of 0.08 mg/L in inland receiving waters.

When allowing for chelation in sewage treatment plants, and dispersion of the chemical among several sites, the PECs could be expected to be much lower and

use of this chemical will pose a low hazard.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Occupational exposure during transport and warehousing will usually only occur in the event of an accident. The group exposed to the most concentrated form of the notified chemical will be Grace Dearborn staff involved in the reformulation of the imported formulation. They will potentially be exposed to the notified chemical for 6 hours/day for 15 days/year. The imported formulation contains 30% of the notified chemical and this is diluted to approximately 10% in the final formulation as sold to Grace Dearborn's customers. The formulation is imported in 200 L drums from which it is pumped into an enclosed mixing system with suitable scrubbers and exhaust ventilation. The imported material is added at the ratio of 1:9 with water, dispersants, other phosphonates, a copper based inhibitor and alkaline buffers such as sodium and potassium hydroxide. The latter make the formulation caustic, with a pH of 8-11. The final formulation is supplied to customers for use as a corrosion inhibitor in cooling towers. It is supplied in drums from which the contents are pumped and fed into an automatic metering system. The formulation is metered at a rate of 10 ppm resulting in a concentration of the notified chemical of less than 3.5 ppm. Therefore exposure to the notified chemical through contact with treated cooling tower water will be minimal.

No exposure to the public is expected during storage, transport and reformulation except in the case of accidental spillage.

When used in air conditioning cooling towers, very low levels of the notified chemical may be drawn into the conditioned air from the cooling water system. The notified chemical may leach into ground water from waste, spillage or landfill. However, the public exposure from these sources are expected to be low. Animal studies showed that the notified chemical is of low toxicity by acute or short-term repeat dose administration. It is not mutagenic or clastogenic *in vitro*. The potential health hazard to the public is considered to be minimal.

The impurities contained in the notified chemical were of low concentration (< 1%). Their presence are not considered toxicologically significant.

On the basis of the toxicological data, the notified chemical is not classified as hazardous according to the criteria of Worksafe Australia. The final formulation containing approximately 3.5% of the notified chemical is classified as hazardous due to its caustic and corrosive nature. The low level of the notified chemical in this formulation as well as safety precautions necessary to minimise risks from the corrosive potential of the formulation will reduce occupational exposure to the notified chemical during use.

13. RECOMMENDATIONS

To minimise occupational exposure to Ethanolamine BPM N-oxide the following guidelines and precautions should be observed during handling and use of the chemical in the imported formulation which is classified as hazardous, irritant, corrosive:

- Protective eye goggles conforming to Australian Standard (AS) 1336 (18), and Australian/New Zealand Standard (AS/NZS) 1337 (19) should be used when handling the chemical.
- Safe practices, as should be followed when handling any chemical formulation, should be adhered to - these include:
 - minimising spills and splashes;
 - practising good personal hygiene; and
 - practising good housekeeping and maintenance including bunding of large spills which should be cleaned up promptly with absorbents and put into containers for disposal.
- It is expected that, in the industrial environment, protective clothing conforming to and used in accordance with AS 2919 (20) and protective footwear conforming to AS/NZS 2210 (21) should be worn as a matter of course; in addition impermeable gloves (AS 2161) (22) should be worn to protect against unforeseen circumstances.
- A copy of the MSDS should be easily accessible to employees.
- During handling and use of the cooling tower corrosion inhibitor (containing the notified chemical) the appropriate safety equipment should be used in accordance with its hazardous chemical classification; it should be noted that the hazardous classification is due to other components than the notified chemical.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the notified chemical was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (23).

This MSDS was provided by the applicant as part of their 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. 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