File No: NA/837

October 2000

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Chemical in CAL 610

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Telephone: (61) (02) 9577 9514 FAX (61) (02) 9577 9465

Director
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1. APPLICANT

Clariant (Australia) Pty Ltd of 675-685 Warrigal Road CHADSTONE VIC 3148 (ACN: 069 435 552) has submitted a standard notification statement in support of their application for an assessment certificate for chemical in CAL 610.

2. IDENTITY OF THE CHEMICAL

The chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data, details of exact import volume, purity and formulation, full identity of structurally related analogue substances (Analogue A-G), specific use and end use customers have been exempted from publication in the Full Public Report and the Summary Report.

Marketing Name:	CAL 610 (imported product that contains the notified chemical at >60%)
Spectral Data:	IR spectrometric data were submitted for the identification of the notified chemical

3. PHYSICAL AND CHEMICAL PROPERTIES

Data are not available for the notified chemical. Unless otherwise indicated the following data are for the product CAL 610 or have been estimated by use of ACD software.

Appearance at 20°C & 101.3 kPa:	Transparent yellow liquid with a characteristic sulphurated compounds odour.
Melting Point:	< -10°C
Boiling Point:	> 100°C
Specific Gravity:	1.11 kg/m^3
Vapour Pressure:	No data-expected to be negligible
Water Solubility:	Highly soluble-see comments below
Partition Co-efficient (n-octanol/water):	No data-see comments below

Hydrolysis as a Function of pH:	Slowly hydrolyses under acidic conditions-see comments below
Adsorption/Desorption:	No data-see comments below
Dissociation Constant:	pK_a is low-see comments below
Flash Point:	>100°C
Flammability Limits:	Not expected to be flammable
Autoignition Temperature:	Not expected to ignite
Explosive Properties:	Not expected to be explosive
Reactivity/Stability:	May release hydrogen sulphide in contact with strong acids
Particle Size:	Not provided: imported as a liquid
Surface Tension:	See comments below

3.1 Comments on Physico-Chemical Properties

Although no report was submitted, the high water solubility is consistent with the ionic nature of the notified chemical. The notifier also supplied some calculated data for the parent acid of the notified chemical derived from Quantitative Structure Activity Relationships (QSARs – as implemented by ACD software), and the estimated water solubility of this compound is 100 mg/L. This is very much lower than for the salt (ie. the notified compound), but as discussed below, data for the parent acid is of marginal relevance.

No report on hydrolytic degradation as a function of pH was submitted. However, trade information provided by the notifier indicated that the chemical should be stored at pH>9 to prevent degradation. Also, the notifier indicated that experience with an analogue of the notified compound (a currently used industrial surface active agent) at mine sites, shows that this reagent does not build up in the process water and the major portion is recycled from the tailings thickeners suggesting that the compound degrades through hydrolysis.

No experimental data on the n-octanol/water partition coefficient (Pow) or on the potential of the compound to adsorb/desorb from soil (Koc) were provided. In common with other industrial surface active reagents, the new chemical is expected to be surface active and consequently determination of n-octanol/water partition coefficient and adsorption/desorption data would be difficult. The very high water solubility indicates the chemical would have very little affinity for the oil phase or organic matter. It may be expected to be very mobile in soils.

The notifier provided some QSAR estimates for Log Pow of 3.47±0.63 and Koc of 3.3±1 for the parent acid (un-ionised) calculated using ACD software. These values are typical for a neutral compound containing a butyl residue, but have no real relevance to the notified

compound because it is a highly water soluble ionic salt which would never exist in the neutral form except at very low pH.

No pKa data was provided, but by analogy the pKa of the compound is expected to be between 2 and 3.

As with many industrial surface active chemicals the compound is expected to be strongly surface active, and aqueous solutions would have significantly lower surface tension than that of water (around 72 dyne/cm^2). The technical data supplied by the notifier describes the chemical as a surfactant (Clariant, 1993).

4. PURITY OF THE CHEMICAL

Degree of Purity: Very high

Hazardous Impurities: None

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

Additives/Adjuvants: None

5. USE, VOLUME AND FORMULATION

The notified chemical is an industrial surface active agent for use in mining process operations. At present, use at one site has been confirmed.

The notified chemical will be imported in 200 L plastic drums as a component (>60%) of the product CAL610 at greater than 10 tonnes per annum for the first five years. No manufacturing of the notified chemical will take place in Australia.

At the time of this assessment the notified chemical is in use in Australia under a NICNAS Commercial Evaluation permit (Permit No.:416) granted under section 21G of the Act.

In use the notified chemical is pumped from 200 L plastic drums to flotation tanks. An automatically controlled pump is used to regulate flow, mix reagents and deliver reagents to the addition points in the processing operation.

6. OCCUPATIONAL EXPOSURE

Category & Number of Worker	*Maximum Potential Exposure Duration & Personal Protective Equipment*

Transport and Storage, 10	1 hour/day; 20 days/year. Industrial standard overalls.
Reagent Handlers, 12	1 hour/day; 20 days/year. Industrial standard overalls, safety gloves, safety goggles, safety boots and helmets.
Plant Operators, 6	1 hour/day; 20 days/year. Industrial standard overalls, safety gloves, safety goggles, safety boots and helmets.
Maintenance workers, 4	Negligible. Industrial standard overalls.
QC/Lab Technicians, 4	1 hour/day; 20 days/year. Industrial standard overalls, safety gloves and safety goggles.

Transport and Storage
Transport and storage workers will not be directly exposed to the notified chemical except in the event of a spill.

Reagent Handlers
Reagent handlers are responsible for connecting pump lines between the import containers and the processing operations. The potential for dermal contact from drips and spills exists during the connection process and when the dosage flow rate is checked via a measuring cylinder.

Plant Operators
During regular shift inspections at the mine sites, plant operators may have need to assist reagent handlers in pumping CAL 610 and may receive dermal contact from drips and spills as pump equipment is manipulated.

Maintenance Workers
Maintenance involves servicing pump equipment used in reagent transfer operations. The notifier indicates that exposure is expected to be negligible during the operations.

QC & Laboratory Technicians
Technicians may receive dermal contact from drips and spills as they collect samples and analyse the contents.

Control of Exposure
Personal protective clothing compliant with Australian Standards is recommended by the notifier and is listed in the table above against each worker category. Automated pumping equipment is in use to prevent direct worker exposure. The notifier stated that drums of reagents, including CAL 610 are stored in ventilated, bunded areas to prevent fumes from entering the workplace.

Worker Education and Training

At the mine site, workers receive instruction and training in the handling of all chemicals on site.

Health Conditions and Adverse Effect Reporting

The notifier advised that the notified substance is not known to cause any health conditions or to affect any existing health conditions.

7. PUBLIC EXPOSURE

Exposure of the general public to the notified chemical during transport, reformulation, and storage is unlikely, except in the event of an accidental spill. In the event of a spill, the notified chemical should be removed with liquid binding materials, for example, sand, soil, and diatomaceous earth, and transferred to sealed containers for incineration. Contaminated areas should be washed with water and detergent. The notified chemical should be prevented from entering drains and watercourses. The notified polymer will not be sold to the general public under the proposed use.

8. ENVIRONMENTAL EXPOSURE

8.1 Release

Most of the chemical (the notifier indicates >99%) remains bound to mineral surfaces and becomes incorporated in mineral concentrates. The high temperature of the blast furnaces or sintering processes would destroy the compound during smelting. Some of the remaining reagent may become attached to the surface of the gangue (waste) minerals, and be deposited into the tailings dams. However, as the compound has only low affinity for the surface of waste minerals, only a small fraction of the reagent is expected to be released in this manner. Any of the reagent which remains in the aqueous phase (ie unattached to the surface of mineral or gangue material) would be returned to the process.

Any reagent disposed of with the tailings, either attached to gangue particles or dissolved in the water, would not be likely to be released to the wider environment. The tailings dams at base metal mines are sealed with special geo-textile lining fabric designed to prevent influx or efflux of water. The compound is expected to have a short residence time in tailings dams since decomposition is a probable consequence of low pH conditions expected in these dams.

The notifier indicates that as much CAL 610 as possible will be pumped from the import containers, so very little residue of the notified chemical will remain. Emptied drums will be rinsed in a washing area, with rinse water pumped into flotation tanks. All drums will then be retained on site in a drum holding area, or may be used on site.

8.2 Fate

The use pattern of the compound is such that most (> 99%) is expected to be destroyed during smelting, with production of water vapour and oxides of carbon and sulphur. The

remainder will be associated with the tailings solids and waters and confined to the tailings dams.

Although the notifier indicated that almost all the compound would be exported with the concentrates, some of the compound (possibly around 1% or up to 1 tonne per annum) may be released to tailings dams with gangue or surplus process water. The water in the tailings dams is expected to be very acidic (commonly between pH 1 and 2). The notified chemical is very likely to hydrolyse under low pH conditions and decompose to simpler compounds.

A summary report on the biodegradation of Analogue A (method not specified) indicated that after 28 days the compound was degraded between 10 and 30%, so it may not be regarded as readily biodegradable. The use pattern of the chemical is such that very little will be released to natural waterways containing the usual bacteria and biota capable of degrading organic matter. Almost all the compound not incorporated during the process will be disposed of into the mine tailings dams, where the low pH and high levels of toxic metals preclude the growth of all but the most specialised bacteria.

Similarly, bioaccumulation data was not submitted, but the high water solubility indicates little potential for bioaccumulation. As none of the chemical is likely to be released to natural waters the issue of bioaccumulation is largely irrelevant.

9. EVALUATION OF TOXICOLOGICAL DATA

The notifier stated that toxicological studies are not available for the notified chemical or the product CAL 610. However, to support their claims for variation to the schedule requirements the notifier has submitted test data on a surrogate substance; Analogue A at 45% in an aqueous formulation. Based on structural similarities, the notified chemical is expected to share the same toxicological profile as that of Analogue A. Data for analogue A covered three of the eight toxic end points where data is required under Part C of the Schedule to the Act.

Further supporting toxicity data from the published literature was provided by the notifier or sourced independently by NICNAS on other structurally related analogues identified as:

Analogue Substances– Masked Names	Approximate Molecular Weight
Analogue B[1,2]	160
Analogue C[3]	190
Analogue D[4]	210
Analogue E[5]	215
Analogue F[6]	355
Analogue G[7]	775

[1] RTECS, 2000.
[2] TOXLINE, 2000.
[3] RTECS, 2000; HSDB, 2000.

[4] RTECS, 2000; HSDB, 2000.
[5] RTECS, 2000; HSDB, 2000.
[6] RTECS, 2000; HSDB, 2000.
[7] HSDB, 2000; Brooks et al, 1983; Hewstone, 1985; Hewstone, 1994.

Of the surrogate data submitted, Analogue A and Analogue E are considered for this assessment to be the most closely related analogues to the notified chemical.

The studies provided are summarised and the toxicity end points are compared with the supplementary data obtained from the literature.

9.1 Acute Toxicity

Summary of the acute toxicity of Analogue A:

Test	*Species*	*Outcome*	*Reference*
acute oral toxicity	rat	LD_{50}>3 150 mg/kg	(Pharma Research Toxicology and Pathology, 1987a)
skin irritation	rabbit	Moderate Irritant	(Pharma Research Toxicology and Pathology, 1987d)
eye irritation	rabbit	Severe Irritant	(Pharma Research Toxicology and Pathology, 1987c)

9.1.1 Oral Toxicity (Pharma Research Toxicology and Pathology, 1987a)

Test Substance:	Analogue A
Species/strain:	Rat/Wistar
Number/sex of animals:	10/sex
Observation period:	14 days
Method of administration:	Oral (gavage) of 3 150 and 4 000 mg/kg of body weight in female and male rats, respectively. Both sexes also received a dose of 5 000 mg/kg.
Test method:	OECD TG 401
Mortality:	Three females and two males in the 5 000 mg/kg group died by the first day post-treatment. All females receiving 3 150 mg/kg and all males receiving 4 000 mg/kg survived.
Clinical observations:	The following clinical symptoms were seen in surviving animals: reduced spontaneous activity; squatting posture; flanks held close; piloerection; locomotor disturbances;

	abnormal breathing noises and narrowed eye lids. The symptoms were reversible from the second day onwards.
Morphological findings:	At necropsy, decedents displayed the following: lung discoloured (bright red); reddened stomach mucosa; stomach filled with a colourless, clear liquid; stomach/intestinal tract filled with reddish brown liquid (blood); small intestine filled with colourless, clear liquid. Animals killed at the end of the observation period had no visible macroscopic peculiarities.
LD_{50}:	>3 150 mg/kg
Result:	Analogue A was of very low acute oral toxicity in rats.

Acute Oral Toxicity in Rats

Test Substance	*LD_{50}*	*References*
Analogue B	694 mg/kg	RTECS, 2000
Analogue C	4 510 mg/kg	RTECS, 2000
Analogue D	18 100 mg/kg	RTECS, 2000
Analogue E	1 817 mg/kg	HSDB, 2000
Analogue F	2 140 mg/kg	RTECS, 2000
Analogue G	3 100 mg/kg	HSDB, 2000

9.1.2 Dermal Toxicity in Rabbit (RTECS, 2000)

Test Substance	*LD50*
Analogue F	1 250 mg/kg

9.1.3 Inhalation Toxicity in Rat (RTECS, 2000)

Test Substance	*LC_{50} (4hr)* *Toxic Effects*
Analogue B	1 700 mg/m^3; Lacrimation, dyspnoea, changes in structure or function of salivary gland.
Analogue C	1 640 mg/m^3;

Somnolence, dyspnoea, weight loss or decreased weight gain.

9.1.4 Skin Irritation (Pharma Research Toxicology and Pathology, 1987d)

Test Substance: Analogue A

Species/strain: Rabbit/New Zealand Albino

Number of Animals: 3

Observation period: 7 days

Method of Administration: A semi-occlusive application of 0.5 mL undiluted test substance was made on the dorsal skin. After 4 hours, the substance carefully removed with tap water.

Test Method: TG 404

Draize scores:

Time after treatment (days)	***Animal #***		
	1	***2***	***3***
Erythema			
1	[a]2	2	3
2	2	2	2
3	0	2	2
Oedema			
1	1	0	1
2	1	0	1
3	0	0	0

[a] see Attachment 1 for Draize scales

Mean Individual Scores (24,48 & 72 hour observations: Erythema and scab formation: 1.3, 2.0, 2.3.
Oedema: 0.7, 0.0, 0.7

Comment: By the seventh day post-treatment, all signs of irritation had disappeared except for one animal, which still had dry and brittle skin.

Result: Analogue A was moderately irritating to the skin of rabbits.

Skin Irritation in Rabbit

Test Substance	*Skin Irritancy*	*Reference*
Analogue B	Moderate	RTECS, 2000
Analogue C	Mild	RTECS, 2000
Analogue F	Severe	RTECS, 2000
Analogue G	Severe	HSDB, 2000

9.1.5 Eye Irritation (Pharma Research Toxicology and Pathology, 1987c)

Test substance: Analogue A

Species/strain: Rabbit/New Zealand Albino

Number of animals: 3

Observation period: 7 days

Method of administration: A single dose of 0.1 mL of test substance was applied to the conjunctival sac of the left eye of each animal, with the right untreated eye serving as control. Treated eyes were rinsed thoroughly with saline 24 hours post-treatment.

Test method: OECD TG 405

Draize scores of unirrigated eyes:

	Time after instillation									
Animal	***1 hour***		***1 days***		***2 days***		***3 days***		***7 days***	
Cornea	***o***	***a***	***o***	***a***	***o***	***a***	***o***	***a***	***o***	***a***
1	[1]2		3	2	3		3	3	1	1
2	3		1	2	2		2	3	4	4
3	3		2	1	3		3	3	4	3
Iris										
1	1		1		1		1		1	
2	1		1		1		1		1	
3	1		1		1		1		1	

Conjunctiva	*r*	*c*	*d*	*r*	*c*	*d*	*r*	*c*	*d*	*r*	*c*	*d*	*r*	*c*	*d*
1	2	3	+	3	3	+	3	3	+	3	2	+	2	2	-
2	2	3	+	2	2	+	2	2	+	3	2	+	3	2	-
3	2	2	+	2	2	+	3	3	+	3	2	+	3	1	-

[1] see Attachment 1 for Draize scales
o = opacity a = area of lightening observed with fluorescein r = redness c = chemosis d = discharge + = present - = not present

Individual mean scores (24, 48 & 72 hours):

Corneal opacity: 3.0, 1.7, 2.7;
Iridial lesions: 1.0, 1,0, 1.0;
Conjunctival redness: 3.0, 2.3, 2.7;
Conjunctival chemosis: 2.7, 2.0, 2.3.

Comment:

From one hour to 7 days after application, all animals showed slight swelling of the conjunctiva to swelling with half-closed lids as well as diffuse crimson to bright red colouration. The cornea had in parts scattered to mother-of-pearl-like areas of opacity, for two animals the cornea was completely turbid at 7 days after application. Up to 72 hours after application, the irises of all animals were reddened, 7 days after application the iris of two animals could not be assessed due to the opacity.

In addition, up to 72 hours after application the following symptoms were observed in parts: clear, colourless to white slimy discharge and brown discolouration, bleeding and detachment of cornea and nictitating membrane. Seven days after application, the cornea and nictitating membranes of all animals were discoloured white to brown-white. At this assessment time point two animals showed advanced vascularisation of the cornea.

Result:

Analogue A was severely irritating to the eyes of rabbits.

Eye Irritation in Rabbit

Test Substance	*Eye Irritancy*	*Reference*
Analogue B	Severe	RTECS, 2000
Analogue C	Severe	RTECS, 2000
Analogue D	Moderate	RTECS, 2000
Analogue F	Severe	RTECS, 2000

9.1.6 Skin Sensitisation

No data on skin sensitisation were submitted.

The notifier indicates evidence of skin sensitivity was not reported in a dermal repeat dose study in rabbits or rats using analogues (see below).

9.2 Repeated Dose Toxicity

9.2.1 28 day Repeated Dose Toxicity (Hewstone, 1985; Hewstone, 1994)

The following is summarised from the published papers.

Test Substance:	Analogue G
Species/sex of animals:	Phase 1 – Rabbit (male and female); Phase 2 – Rabbits and Rats (young and mature males).
Concentration and Dosing Schedule:	Phase 1 0, 1, 3, 5, 25% solutions applied topically at 2 mL/kg/day, 5 days/week for 4 weeks; Phase 2 25% solution applied topically at 2 mL/kg/day, 5 days/week for 4 weeks, followed by a 28 day recovery period.

Findings:
Phase 1 - Rabbits
No toxic effects at 1 or 3% in males or at all doses in females.

In males at 5% and 25%, aspermatogenesis and testicular tubular hyperplasia and skin damage (fissuring and exfoliation) and bodyweight loss (extent of body weight loss was not reported) was observed. No effects were seen in any other organs. The effects in the male reproductive tract were reported to correlate with the degree of body weight loss. The No Observed Adverse Effect Level (NOAEL) is determined at 3% (15.8 mg/kg).

Phase 2 – Rats and Rabbits (investigation into reproductive tract effects observed above)
Rabbits – similar male reproductive tract findings as observed in phase 1. Testicular atrophy was evident in a gross reduction in size and weight of the testes and in a reduced testes to bodyweight ratio. In the epididymides, reduction or absence of spermatozoa was consistent with the testicular effects. Some reversibility of testicular effects occurred during recovery. However the duration of the recovery period was considered insufficient to determine if reversibility was complete.

Rats – no reproductive tract effects reported.

Comment:
Hewstone (1994) comments that the reproductive tract effects observed in rabbits are generic to this class of compound. Furthermore, these effects appear to be species specific being demonstrated only in the rabbit. Hewstone (1994) makes reference to investigations where rabbit male reproductive effects may be physiological, a result of reduced food consumption and body weight loss and not as a result of a direct toxic effect.

9.2.2 Inhalation Developmental Study - (TOXLINE, 2000)

The following is taken from the TOXLINE abstract. The original data were not available for assessment.

Test Substance	Analogue B
Species	Rat, Charles River CD (SD) BR (mated)
Concentration and Dosing Schedule:	0, 5.8, 51 and 214 mg/m^3 6 hours/day on days 6-15 of gestation. Number of animals per dose was not provided.

Findings:
Three dams at 214 mg/m^3 died on gestation days 15 to 17. At 5.8 and 51 mg/m^3, clinical signs of maternal toxicity were red staining and encrustation of face and forelimbs. In addition, dams at 214 mg/m^3 showed urinary staining, matted fur, vaginal discharge, piloerection, hunched posture, hypoactivity and breathing difficulties. Body weight and weight gain were unaffected in dams at 5.8 mg/m^3. Significant body weight decreases occurred on gestation day 10, 13, 16, and 21 in dams at 51 mg/m^3 and on gestation day 10, 13, and 16 at 214 mg/m^3, relative to control group animals. Significant decreases in weight change were reported on gestation days 6 to 16 in dams at 214 mg/m^3.
Post mortem findings in treated and control dams were comparable. Mean implants, corpora lutea, and preimplantation loss in treated groups were comparable to controls. Uterine weights were not reported.

Total number of foetuses, live foetuses, and mean foetal weight (both males and females) decreased significantly while the number of early resorptions, post implantation loses and total number with malformations were increased in animals at 214 mg/m^3. Treatment related malformations at 214 mg/m^3 (included undescended testes, bent scapulae and/or limb bones and ribs). Foetal variations were similar in treated and control groups.

Comment:
Based on the summary data provided the lowest observed effect level (LOEL) for maternal toxicity is determined at 5.8 mg/m^3 and the NOAEL for developmental effects is 51 mg/m^3.

9.3 Genotoxicity

Test Substance	*Mutagenicity*	*Reference*
Analogue C	Mutagenic in *Salmonella* strains TA1535 and TA100 in the presence or absence of S9.	HSDB, 2000
Analogue D	Non mutagenic in any strain of *Salmonella* in the presence or absence of S9.	HSDB, 2000
Analogue G	Non mutagenic to *Salmonella* strains TA1535, TA1537, TA1538, TA98, TA100, at 12.5 to 1 000 µg/plate in the presence or absence of S9. No increased cell transformations in mammalian (BHK21/Cl-13) cells at 500 to 4 000 µg/mL in the presence or absence of S9.	Brooks et al, 1983

9.4 Overall Assessment of Toxicological Data

In the absence of data on the notified chemical, the notifier provided data on Analogue A. In addition, data on other structurally related analogues (Analogues B-G) were also provided. Full study data were only provided for Analogue A. Data on Analogues B-G are taken, without assessment, from literature abstracts or papers.

Analogue A and Analogues B-G have low acute oral toxicity, typically an oral LD_{50} of greater than 2 000 mg/kg (range: 694 mg/kg to 18 100 mg/kg). Analogue A is closely related to the notified chemical and it is expected that the oral toxicity of the notified chemical would be similar to that of Analogue A. Analogue F was of moderate acute dermal toxicity; the rabbit dermal LD_{50} is reported at 1 250 mg/kg. Analogue B and Analogue C had moderate acute inhalation toxicity, LC_{50} (4hr) of 1 700 and 1 640 mg/m^3 respectively. It is expected that the acute dermal and inhalation toxicity profile of the notified chemical would be similar to that observed with the analogues.

Analogues A and B are moderate skin irritants. Analogue C was a mild skin irritant, while Analogues F and G are severe skin irritants. Analogues A, B, C, F and G are severe eye irritants. Analogue D was found to be a moderate eye irritant. Repeated contact results in severe skin damage characterised by fissuring and exfoliation. By analogy, the notified chemical will share the same degree of skin and eye irritancy.

A 28 day repeat dermal dose study on Analogue G revealed significant systemic effects (aspermatogenesis and tubular hypoplasia) in males at 5% and 25% but not at 1% or 3%. There were reportedly no effects in other organs but experimental details were not provided. Application at 5% and 25% also resulted in skin damage and bodyweight loss. The effects in

the male reproductive tract appeared to correlate with the degree of bodyweight loss and may be species dependent as in subsequent investigations in rabbits and rats, reproductive effects were only observed in rabbits. This data is insufficient to determine a repeat dose health effect classification for the chemical.

Teratogenicity was evaluated in rats exposed by inhalation to 5.8, 51 and 214 mg/m^3 Analogue B on days 6 to 15 of gestation. The LOEL for maternal toxicity is determined at 5.8 mg/m^3. Treatment related malformations were observed in foetuses at 214 mg/m^3. The NOAEL for developmental effects was 51 mg/m^3.

Analogue C was found to be mutagenic to bacteria, but not Analogue D. Blends of Analogue G did not show evidence of genotoxic activity in a bacterial mutation assay or in a mammalian cell transformation assay. In the absence of data no determination can be made on the clastogenic potential of the class of compounds represented by Analogues A - G.

Hazard Classification
In the absence of specific data, analogue data with 45% of active chemical, and lack of study reports for assessment this is a conservative health effects classification. Classification of the health hazards of the notified chemical is made by analogy with Analogue A and Analogues B-G. The analogue chemicals meet the criteria for classification as Harmful (Xn) under the *Approved Criteria for Classifying Hazardous Substances* (NOHSC 1999). Based on the findings of significant skin and eye irritation scores, Analogue A meets the criteria for classification as a severe eye irritant (R41 - Risk of Serious Damage to Eyes), and skin irritant (R38 - Irritating to skin). Analogue F is classified as acutely toxic by the dermal route (R21 – Harmful in Contact with Skin) based on the reported acute dermal LD_{50}, and Analogue B and Analogue C are moderately acute by the inhalation route (R20 – Harmful by Inhalation).

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The notifier provided the following ecotoxicity data for Analogue A. The data are acceptable since any acute toxic effects will be due to the organic anion. Tests were performed using OECD test protocols and are summarised in the following table:

Test	*Species*	*Test concentrations (nominal) mg/L*	*Results mg/L*
Acute Toxicity (Static Test) (OECD TG 203)	Zebra Barbel *(Brachydanio rerio)*	500	96 hour LC_{50} > 500
Respiration Inhibition	Aerobic Waste Water Bacteria	-	3 hour EC_{50} = 650

10.1 Acute Toxicity Fish (Pharma Research Toxicology and Pathology, 1987b)

The Acute Toxicity fish test was performed in compliance with OECD/EEC Test Methods and according to OECD Principles of Good Laboratory Practices.

The acute toxicity of the chemical to Zebra Barbel was determined in a 96 hour static test at a single nominal concentration of 500 mg/L. The notifier states that there were no mortalities during the trial period and that no changes in the appearance and behaviour of the fish were observed when compared with the control group. The 96 hour LC_{50} of the notified chemical was determined by the notifier to be >500 mg/L and the highest concentration tested without toxic effects was 500 mg/L. Measured concentrations of the test samples were not determined.

10.2 Microorganisms (Hoechst 1986)

The notifier supplied a very brief summary of two unspecified 24 hour waste water biological tests (said to be a Fermentation and a Consumption Inhibition test) carried out on the notified chemical. Nominal test concentration ranges were not supplied and measured concentrations of the test samples were not determined. The 24 hour EC_{50} values of the chemical are claimed by the notifier to be 650 and 1500 mg/L, respectively.

10.3 Algae

No test for inhibition of algal growth was submitted. However, little of the chemical is likely to be released to natural waterways, and considering that algae are unlikely to live under the harsh conditions prevailing in tailings dams at base metal mines, where ambient concentrations of dissolved copper (up to 200 mg/L) are not unusual, this data gap is accepted. However, it may be relevant that QSAR estimated toxicity (see below) of the parent acid indicates it may be toxic to algae.

10.4 QSAR Toxicity Estimates on Parent Acid

The notifier supplied toxicity data calculated using QSAR data (ACD software) for the parent acid of the notified compound. This data is not appropriate for the notified chemical in ionised form, but indicates that the neutral acid form of the compound may be at least moderately toxic to freshwater fish (96 h LC50 = 7.5 mg/L), daphnia (48 h LC50 = 8.9 mg/L) and green algae (96 h EC50 = 6.1 mg/L).

The ASTER Ecotoxicity Profile (US EPA, 2000) estimates lower acute toxicity of 96 h LC50 = 1.8 mg/L for rainbow trout and the 48 h LC50 for daphnia = 2.9 mg/L. The estimated chronic Maximum Allowable Toxic Concentration against daphnia was 0.67 mg/L.

10.5 Conclusions

The ecotoxicity data supplied by the notifier for the notified substance indicates that the notified chemical is practically non-toxic to fish and sewage microorganisms.

However, the ecotoxicity data profiles obtained from QSAR estimates for the free parent acid of the notified chemical indicates that this compound is at least moderately toxic to aquatic organisms.

Overall, the data indicate that Analogue A has significantly lower toxicity to aquatic organisms when compared to the free parent acid.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The environmental hazard of the notified chemical is considered low provided the material is used as a industrial surface active agent as described. The notified chemical will be used at a limited number of mine sites within Australia, and there is no anticipated release to the general aquatic compartment.

Most of the compound will become associated with the surface of mineral particles in metal concentrates and will be destroyed during smelting of these concentrates. The compound would decompose to water vapour and oxides of carbon and sulphur.

The remainder of the reagent is expected to be released with the mine tailings and confined within specialised tailings dams. Based on an annual maximum import volume of 100 tonnes of CAL 610, it is expected that approximately 600-1000 kg of the notified chemical will be released to tailings dams per annum. The notifier claims that the proposed mine produces approximately 2400000 tonnes of tailings per year, and since the tailings are approximately 50% solids in water around 1200 ML of water will be consigned to tailings dams each year. Assuming that 600-1000 kg of the notified chemical is released to tailings dams, the final concentration of the notified chemical in the process effluent would be 0.5-0.8 mg/L.

However, the acidity of tailings dams is often below pH 2 and since the compound is probably susceptible to degradation under acidic conditions, the concentration of the chemical in the tailings water is likely to be significantly lower than 0.5-0.8 mg/L.

Analogue A has demonstrated no toxicity against the one fish species for which data was submitted, although QSAR data indicate that the free parent acid of the notified chemical may be at least moderately toxic to representative species of all three trophic levels. Assuming a maximum concentration of the chemical in the tailings dams of 0.5-0.8 mg/L the environmental safety margin for exposure of the fish species tested would be at least 820. The QSAR estimates given significantly lower environmental safety margins for exposure of aquatic organisms to the free parent acid, with that for the most sensitive aquatic organism, Rainbow trout with QSAR estimated 96 h LC_{50} of 2.5 mg/L, equal to between 3-10.

However due to probable hydrolysis it is unlikely that the notified chemical will have prolonged existence as the free parent acid within the acidic tailings dam water. In any case large scale release of tailings dam water to the external environment is unlikely except in the case of exceptional flood events or dam failure, and the resulting environmental consequences would be orders of magnitude larger than that connected with any concomitant loss of the new compound in the water. Also, release of the chemical to natural waters (eg. rivers and streams) is unlikely except in the case of a transport accident, and even in such circumstances release of the parent acid form is unlikely since the pKa of the acid is expected to be below 3 and under environmental conditions, pH 4-9, it would remain in ionised form. The material safety data sheet (MSDS) supplied indicates that spills should be prevented from entering drains or water courses and that the material should be cleaned up with absorbent material and disposed of to landfill. This assessment finds incineration to be a preferable disposal option.

The notified chemical is not readily biodegradable but is slowly degraded by bacteria under aerobic conditions. Due to its high water solubility, the notified chemical is not expected to

bioaccumulate.

Given that the notified chemical will be used at a small number of mine sites, in essentially closed systems, the environmental hazard from use of the new chemical is assessed as low.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

No toxicology studies on the notified chemical or the product CAL 610 were submitted. Analogues of the notified chemical were of low acute oral toxicity and moderate dermal and inhalation toxicity. Analogues are severe eye irritants and mild to severe skin irritants in rabbits. Data on skin sensitisation were not submitted. In a limited summary of a repeat dose 28 day dermal exposure study in rabbits, an analogue caused severe skin effects, bodyweight loss and effects on the male reproductive tract in males only. The reproductive tract effects were correlated with the degree of bodyweight loss. An inhalation developmental study on another analogue in rats caused developmental effects at maternally toxic doses. One cited study indicated that a related compound was mutagenic to bacteria, however, this finding was not reported in studies on other related compounds.

In the absence of toxicological data on the notified chemical, classification of the health hazards of the notified chemical is made by analogy. The overall hazard classification is Harmful (Xn) with risk phrases: R20/21 Harmful by Inhalation and in Contact with Skin; R41 – Risk of Serious Damage to Eyes; and R38 – Irritating to Skin.

Occupational Health and Safety
In the occupational environment skin and eye irritancy and systemic toxicity are the hazards of concern for the notified chemical. Transport and storage of the 200 L import containers should not result in worker exposure except in the event of accidental spillage.

Worker exposure during normal use of the notified chemical is most likely to occur from drips and spills when connecting or disconnecting lines or cleaning pumps and ancillary equipment. The notifier states that plant workers involved in transferring the notified chemical during the processing phase are required to wear safety gloves, safety goggles, safety boots, helmet and overalls. It is critical that employers ensure that workers wear the protective clothing as specified, to minimise the potential for exposure to the 60-100% solution of chemical and the adverse effects of irritancy and harmful by skin and inhalation exposure. At the commencement of the processing phase, the notified chemical is contained within an automated process at an initial concentration of less than 0.1%. The subsequent processes require little worker intervention. Chemical incorporated during process operations is ultimately destroyed during subsequent off-site metal processing.

Public Health
As the notified chemical will be used in the mining industry and not available to the public, there will be minimal public exposure. Based on the information provided, the notified chemical is unlikely to pose a significant public health risk when used in the proposed manner due to limited potential for exposure.

13. RECOMMENDATIONS

Occupational Health and Safety
To minimise occupational exposure to CAL 610 the following guidelines and precautions should be observed:

- Development and implementation of a skin and eye exposure management system: the workplace, equipment and work tasks should be structured to minimise skin and eye exposure and any resultant damage to health;

- Workers should be advised of the potential for skin and eye effects upon contact with CAL 610 and to promptly report any adverse effects to the occupational health and safety officer at their workplace. If an adverse effect occurs, the employer should review work practices and opportunities for contact with the substance and instigate preventive measures to ensure other workers do not develop the same condition;

- Personal protective equipment should be used where exposure to CAL 610 occurs. Workers should be trained in the proper fit, correct use and maintenance of their protective gear. Guidance in the selection, personal fit and maintenance of personal protective equipment can be obtained from:

Protective eyewear:	AS 1336 ([SAA, 1994 #24])
	AS/NZS 1337 ([SAA/SANZ, 1992 #25]).
Chemical impermeable clothing:	AS 3765.2 ([SAA, 1990 #23]).
Impermeable gloves:	AS 2161.2 ([SAA/SANZ, 1998 #27]).
Occupational footwear:	AS/NZS 2210 ([SAA/SANZ, 1994 #26])

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

- Workplace practices and control procedures consistent with provisions of State, Territory and Commonwealth legislation based on the *National Model Regulations for the Control of Workplace Hazardous Substances* ([NOHSC, 1994 #29]) must be in operation if products containing the notified chemical are determined to be hazardous;

- Good personal hygiene should be practised to minimise the potential for ingestion;

- A copy of the MSDS should be easily accessible to employees.

14. MATERIAL SAFETY DATA SHEET

The MSDS for CAL 610 was provided in a format consistent with the *National Code of*

Practice for the Preparation of Material Safety Data Sheets (NOHSC 1994).

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

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Attachment 1

The Draize Scale (Draize, 1959) 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 (Draize *et al*., 1944) 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.
		Swelling with lids half-closed	3 mod.	Discharge with moistening of lids and hairs and considerable area around eye	3 severe
Diffuse beefy red	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

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MSDS