File No: NA/458

Date: December 1996

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Polymer in NALMET 8702

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Polymer in NALMET 8702

1. APPLICANT

Nalco Australia Pty Ltd of 2 Anderson Street BOTANY NSW 2109 has submitted a limited notification statement in support of their application for an assessment certificate for Polymer in NALMET 8702.

2. IDENTITY OF THE CHEMICAL

Polymer in NALMET 8702 has been classified as hazardous by Worksafe Australia due to its irritant potential, this is due to the impurity sodium hydroxide which is at the threshold value for classification as a hazardous material of 1%. However for commercial reasons, the chemical identity, chemical composition and spectral data relating to the polymer have been granted exemption from publication in the Full Public Report and Summary Report.

Other Names:	none
Trade Name:	NALMET 8702 (contains notified polymer)
Number-Average Molecular Weight:	> 1 000
Maximum Percentage of Low Molecular Weight Species	
Molecular Weight < 500:	< 1%
Molecular Weight < 1 000:	< 15%

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	hazy, light yellow liquid with a sulphurous odour
Boiling Point:	100°C (at 760 mm Hg)
Density:	1.1-1.3 g/cm (polymer in water solution)

Vapour Pressure:	2.40 kPa at 25°C
Water Solubility:	stated as completely miscible
Partition Co-efficient (n-octanol/water):	see comments
Hydrolysis as a Function of pH:	< 10% hydrolysis after 5 days at pH 4, 7 & 9
Adsorption/Desorption:	see comments
Dissociation Constant:	see comments
Flash Point:	> 61°C
Flammability Limits:	not flammable
Autoignition Temperature:	not determined
Explosive Properties:	not explosive
Reactivity/Stability:	not reactive, stable

Comments on Physico-Chemical Properties

The company has stated that NALMET 8702 (which contains 44% of the notified product) is water miscible in all proportions. This is based on bench experiments, a laboratory report is not available. The notified polymer contains a group which is expected to hydrolyse under acidic conditions. The polymer would be expected to remain stable under the normal environmental pH range. No test for partition co-efficient has been conducted. The notifier expects this to be low due to the high water solubility of the polymer. Due to the expected low partition coefficient and high water solubility, the notified polymer would not be expected to adsorb to organic matter in soils or water. However, because of the anionic form in solution, it may be expected to adsorb to cations in clays and silicates. The polymer would be expected to fully dissociate in water in the environmental pH range.

4. PURITY OF THE CHEMICAL

Degree of Purity:	high
Toxic or Hazardous Impurities:	contains a chemical that is an eye and skin irritant, is harmful by inhalation and is a teratogen (1); however, the concentration of this chemical is well below the threshold for classification as a hazardous substance (harmful) according to Worksafe Australia's *List of Designated Hazardous Substances*

Chemical name:	sodium hydroxide
Synonyms:	caustic soda
	sodium hydrate
CAS No.:	1310-73-2
Weight percentage:	1.0%
Toxic properties:	irritant and corrosive, threshold for classification as a hazardous substance (irritant) is 1.0% according to Worksafe Australia's *List of Designated Hazardous Substances*, on this basis polymer is classified as hazardous; NaOH is a Type III ingredient according to Worksafe Australia's *Control of Workplace Hazardous Substances* (2)

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

Chemical name:	sodium chloride
Synonyms:	salt
Weight percentage:	< 3%
CAS No.:	7647-14-5

Maximum Content of Residual Monomers: see hazardous impurities

Additives/Adjuvants: Formulation, NALMET 8702, consists of water and other ingredients determined not to be hazardous, refer to Material Safety Data Sheet (MSDS)

5. USE, VOLUME AND FORMULATION

An annual importation volume of between 1 and 5 tonnes of the notified polymer is expected over the first five years. It will be imported in 200 L steel drums by sea, and transported to the notifier's site at Botany, New South Wales.

The notified chemical contains metal chelating groups attached to a polymer backbone, making it effective in precipitating heavy metal ions from solution. The product (containing the notified chemical) is expected to be used in industrial waste water treatment, for reduction of heavy metals in wastewater which will then be disposed or to sewer, or reused.

6. OCCUPATIONAL EXPOSURE

The notified polymer will be imported in a formulation, NALMET 8702, containing the polymer, in 200 L steel drums. These drums will be transported to the notifier's warehouse for decanting, repackaging and quality assurance testing. Occupational exposure during transport and warehousing is unlikely and will only occur in the event of accidental release. The formulation is classified under the *Australian Dangerous Goods Code* (3) as a corrosive liquid with the Hazchem code 2R.

Decanting into smaller containers will be undertaken with automatic pumping equipment in well ventilated areas. This task and sampling for quality control will be performed by four operators for periods of 2-5 hours/day for 30 days/year. Three quality control chemists will analyse the formulation, the chemists will potentially be exposed to the notified chemical for 4-8 hours/day for 30 days/year.

The group with the highest level of exposure to the notified chemical will be those associated with the end use of the product as a water treatment chemical. Many sales staff will be involved in distribution and implementation of the treatment system. The latter involves setting up the feed equipment and verifying the required dosage levels. These staff will potentially be exposed for periods of 4-8 hours/day for 200 days/year. The water treatment plant operators will maintain the feed systems by setting and testing the dosage levels. The notified chemical will be diluted to 10-40 ppm in the dosed wastewater. The treatment plant operators will potentially be exposed for periods of 1-2 hours/day for 340 days/year.

The treatment dosage equipment is automated however, there will be potential for occupational exposure during maintenance and filling of the equipment. The low volatility of the formulation will limit inhalational exposure. The main routes of exposure will be dermal and ocular. The caustic nature of the formulation indicates that exposure via these routes should be minimised, the most appropriate methods include the use of appropriate personnel protective equipment.

7. PUBLIC EXPOSURE

No public exposure is expected to occur during storage, decanting or distribution of the notified polymer.

Only industrial use of the notified polymer is anticipated as the product, NALMET 8702, will not be sold to the public. Although, some operator exposure is expected to occur, it is unlikely that the public would be exposed to the notified polymer during its industrial use.

It has been estimated that approximately 95 to 99% of the notified polymer will absorb onto metal/solids during treatment of the wastewater. Such metals/solids will be removed from wastewater and then disposed of to landfill. In addition, it has been estimated that wastewater released to sewer may contain approximately

0.1 to 2 ppm of the notified polymer. Overall, public exposure to the notified polymer will be minimal.

8. ENVIRONMENTAL EXPOSURE

Release

Upon arrival at the notifier's Botany site, the product will, in most cases, be repackaged into other containers. Generally, it will be transferred to the notifiers purpose designed containers, or smaller pails. This repackaging will be carried out either by automatic pumping or gravity feed. Any residue remaining in empty drums will be washed with water and disposed of to a liquid waste treatment facility. Generally, the purpose designed containers will not require washing before re-filling as they are product dedicated. The notifier has estimated release from repacking operations to be 1% (up to 50 kg annually) of the product. Repacking is expected to occur on 30 days of the year, giving a daily release of around 1.7 kg.

Dilution of the imported product occurs when waste water treatment facilities are dosed. Typically, the concentration of NALMET 8702 in the dose system is less than 0.1%

The major release of the notified product will occur on discharge from treatment plants. Discharge from treatment plants will depend on the size of the operation, and is estimated to be between 3 and 30 KL a day. A typical treatment plant will have a 'balance tank' to maintain a constant discharge rate to sewer.

In the presence of water containing heavy metals or suspended solids, the notifier has indicated that between 95 to 99% of the polymer is expected to absorb onto the metals/solids and be removed from the water phase. Based on the assumption that 95% of the polymer is released in this manner through end use, and that release from industry occurs over 200 days of the year, the following release figures are derived:

Operation	Volume	% release	Release/year	Days/ year	Release/day
Repack	5000 kg	1	50 kg	30	1.67 kg
END USE					
Removal from water phase (landfill)	4950 kg	95	4702 kg	200	23.5 kg
Release to sewer	4950 kg	5	248 kg	200	1.24 kg

The estimated releases due to end use will be spread over a number of sites around Australia.

Fate

The notified chemical is to be used in wastewater treatment plants to scavenge heavy metals generated in the electroplating and metal finishing industry. As such, the majority of the polymer will be removed from the water phase through absorption onto the metals/solids, and the sludge disposed of to landfill where it would be expected to remain associated with the metals or clay particles due to ionic bonding, or sent to have the metals reclaimed.

A proportion of the chemical will not be bound to metals/solids within the wastewater treatment plant, but will be released to sewer. The notifier estimates that water released to sewer will contain the polymer at less than 2 ppm. This polymer could be expected to further bind to cations within the sewage treatment plant, and be landfilled. A small proportion may be discharged to receiving waters where it could be expected to remain associated with clay or silicates.

No ready biodegradation test was provided. Biochemical Oxygen Demand (BOD) values were provided as BOD (20 days) = 100 mg/L; and BOD (5 days) greater than 50 mg/L. While this indicates some degradation, it is not certain whether the notified polymer itself is degrading, or other structures within the test system, such as low molecular weight material.

Bioaccumulation of the polymer is not expected because of its high water solubility and high molecular weight which is likely to inhibit membrane permeability and prevent uptake during exposure.

The company has submitted a label and an MSDS for the notified polymer which has adequate recommendations for disposal and handling accidental spillage.

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological data are required for polymers of NAMW greater than 1 000 according to the *Act* and none are available for either the polymer in isolation or as a component of the formulation NALMET 8702.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data are required for polymers of NAMW greater than 1 000 according to the *Act*. However, several ecotoxicity test results were provided by the notifier and are summarised as follows: (S = static; NC = nominal concentration).

Species	Test (Conditions)	Result (mg/L)
Fathead minnow (*Pimephales promelas*)	96 hour (S; NC)	LC_{50} > 1 000
Sheepshead minnow (*Cyprinodon variegatus*)	96 hour (S; NC)	LC_{50} > 1 000
Silverside (*Menidia beryllina*)	96 hour (S; NC)	LC_{50} > 1 000
Rainbow trout (*Oncorhynchus mykiss*)	96 hour (S; NC)	LC_{50} = 20
Mysid shrimp (*Mysidopsis bahia*)	96 hour (S; NC)	LC_{50} = 140
Water flea (*Daphnia magna*)	48 hour (S; NC)	LC_{50} = 11

LC_{50} values for Fathead minnow can be considered questionable. Like Rainbow trout, this is a freshwater fish, and was tested in carbon filtered, dechlorinated tap water. The definitive test was carried out at one concentration only, 1 000 mg/L (ppm), and no deaths were recorded. This is despite two screening tests where all test fish had died between 10 mg/L and 100 mg/L. Why the definitive test was conducted at such a high concentration is unclear given the results of the screening tests. An explanation for the lack of toxicity at higher concentrations may be due to the nature of the polymer. It is an anionic polymer which would be expected to exhibit flocculant characteristics. At 1000 ppm, high turbidity of the test solution was observed, which could be due to flocculation of the chemical, thereby reducing its content in solution and thus its bioavailability. Turbidity of water was not observed at lower concentrations (< 30 ppm) in other tests, meaning more chemical could be in solution, and therefore exhibit increased toxicity.

A further anomaly is found in the Sheepshead minnow toxicity test. Again, the definitive test was only conducted at 1 000 ppm, even though the screening test showed 0% survival at 10 ppm (and 100% survival at 100 ppm).

Both Sheepshead minnow and Silverside are saltwater species, and were tested in natural seawater. This may provide an explanation for the increased tolerance of these species to the polymer. Being natural seawater, as opposed to clean laboratory water, there would be present a number of impurities such as dissolved organic carbon (DOC) which has been shown by a number of authors to reduce the apparent toxicity of polyelectrolyte flocculants (4). Although no fish deaths were reported during testing of silverside, a LOEC = 1 000 mg/L was found, as almost half the fish in the treated groups were surfacing at 24 hours.

Turbidity of the test water was a common observation for all tests. With the exception of water fleas and rainbow trout, this turbidity was observed at higher concentrations, around 1000 ppm. During preliminary testing of Rainbow trout and Daphnia, cloudiness was observed at 30 to 300 ppm concentration in test waters. Rainbow trout effected during testing were lethargic and darker in colour than control fish. No other sub-lethal effects were observed.

The definitive test was conducted at five concentrations: 13, 22, 36, 60 and 100 mg/L. After 96 hours, 100% survival was observed in the 13 mg/L concentration, with 20% survival in the 22 mg/L concentration. No survival was observed in the other test concentrations.

The 96 hour NOEC for mysid shrimp was found to be 100 mg/L as one of the ten mysids was swimming erratically at 72 hours.

Screen testing of water fleas showed no sub-lethal effects. All ten animals were dead at 48 hours in both the 100 and 1000 mg/L solutions, with 80% dead at 10 mg/L.

The results indicate that the notified substance is slightly to moderately toxic to water fleas, moderately to practically non-toxic to fish depending on test conditions, and practically non-toxic to shrimp.

No tests were carried out on algae. Polyanionic polymers (the notified polymer is in this class) which are water soluble, and have a MW greater than 1 000 are of concern for aquatic toxicity (5). Algae could be of concern because of anionic polymer's ability to chelate nutrient elements needed by algae for growth. No results appear to be available for this class of anionic polymer in the literature.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The notifier has estimated discharge from treatment plants to be between 3 000 and 30 000 litres per day, depending on the size of the operation. As a worst case scenario, we have assumed in the following calculations, that the largest estimated daily discharge occurs to a country sewer, and 3 of the largest estimated daily discharges occur to a city sewer.

A predicted environmental concentration (PEC) has been derived as follows:

	City	Country
Daily discharge from treatment plant (L)	90 000	30 000
Dosing rate	40 ppm	40 ppm
% removed through chelation with metal ions	Nil	Nil
Total quantity released to sewer	3.6 kg	1.2 kg
Daily output from Sewage Treatment Plant (STP)	200 ML	5 ML
Concentration in STP	18 ppb	0.24 ppm

The PEC has been derived assuming none of the notified chemical is removed through association with heavy metals/solids in wastewater treatment plants, the total treatment plant volume is released to the sewer each day.

Australian and New Zealand Environment and Conservation Council (ANZECC) (6) water quality guidelines recommend, that to obtain 'safe' levels in water when only acute toxicity data are available, the application factor for a persistent chemical is derived by 0.01 x LC_{50}. The lowest observed LC_{50} = 11 ppm for daphnia. Therefore, according to these guidelines, the 'safe' level of this polymer in water is 0.11 ppm.

It can be seen that the PEC in a country sewer is 0.24 ppm. Assuming dilution of 2 to 1 in receiving waters, the PEC is 0.12, which is very similar to that derived using the ANZECC guidelines.

These figures do indicate caution is required when discharging the notified polymer to sewer. However, it should be remembered that the PEC's were obtained assuming no removal in the water treatment plant through association with metal and solids and no removal in the sewage treatment plant through association with cations and suspended solids. Additionally, when released to receiving waters, this chemical would be expected to further bind to clays and silicates, and toxicity would be further mitigated due to dissolved organic carbon available in receiving waters.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The notified polymer has a NAMW of greater than 1 000 and is therefore not expected to traverse biological membranes and constitute a toxicological hazard. The notified polymer contains low levels of residual monomers/hazardous impurities including a proprietary ingredient, sodium hydroxide (1.0%) and low molecular weight species (< 15% with NAMW < 1 000). The sodium hydroxide concentration is equivalent to the threshold for classification as hazardous according to the *List of Designated Hazardous Substances* (1), on this basis the polymer is classified as hazardous. However, the hazardous impurities will be present at extremely low levels in treated wastewater and therefore are not expected to present a toxicological threat during use in water treatment systems. The imported formulation NALMET 8702 is caustic/corrosive (pH 11.5-13) and is classified as hazardous according to the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (3). On this basis the formulation would also be classified as hazardous according to the Worksafe Australia criteria (7) even though the levels of hazardous impurities in the formulation are below the threshold values requiring hazardous classification according to Worksafe Australia's, *List of Designated Hazardous Substances* (1).

Occupational exposure to the notified polymer is unlikely to occur during transport and warehousing. Exposure may occur during repackaging when the imported formulation is decanted into smaller containers. Exposure may also occur during sampling and analysis for quality assurance. These processes will occur in well ventilated situations and the procedures involved will limit occupational exposure. Occupational exposure will be greatest during end use of the formulation where it will be dosed into water treatment systems. The groups with greatest potential for exposure are the sales representatives and water treatment plant operators. Exposure will potentially be dermal or ocular. The caustic nature of the formulation indicates that this should be avoided. When handling the formulation the appropriate personnel protective equipment should be used.

It is not anticipated that the public would be exposed to the notified polymer. If public contact with the notified polymer were to occur, the high NAMW for the

polymer suggests that absorption is unlikely, and therefore there is negligible risk to public safety. Public exposure to the formulation, NALMET 8702 is also unlikely.

13. RECOMMENDATIONS

To minimise occupational exposure to Polymer in NALMET 8702 the following guidelines and precautions should be observed:

- Safety goggles should be selected and fitted in accordance with Australian Standard (AS) 1336 (8) to comply with Australian/New Zealand Standard (AS/NZS) 1337 (9);
- Industrial clothing should conform to the specifications detailed in AS 2919 (10) and AS 3765.1 (11);
- Impermeable gloves or mittens should conform to AS 2161 (12);
- All occupational footwear should conform to AS/NZS 2210 (13);
- 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 MSDS should be easily accessible to employees.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the formulation containing the notified chemical was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (14).

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. A secondary notification will be required if the annual import volume exceeds 10 tonnes per annum, or if the use of this product leads to an increased exposure to the aquatic compartment than the uses in this assessment.

16. REFERENCES

1. National Occupational Health and Safety Commission 1994, *List of Designated Hazardous Substances* [NOHSC:10005(1994)], Australian Government Publishing Service Publ., Canberra.

2. National Occupational Health and Safety Commission 1994, *Control of Workplace Hazardous Substances* [NOHSC:1005(1994), 2007(1994)], Australian Government Publishing Service, Canberra, Australia.

3. Federal Office for Road Safety 1992, *Australian Code for the Transport of Dangerous Goods by Road and Rail,* 5th Edition, Australian Government Publishing Service Publ., Canberra.

4. Lamberton C. J. 1995, *Acute Toxicity and Management of Polyelectrolyte Flocculants in Australian Aquatic Ecosystems*. Master of Applied Science (Environmental Toxicology) Thesis, University of Technology, Sydney, 1995.

5. Nabholz J.V., Miller P., Zeeman M. 1993, *Environmental Risk Assessment of New Chemicals Under the Toxic Substances Control Act (TSCA) Section Five*. In "Environmental Toxicology and Risk Assessment." ASTM STP 1179. G. Landis, J.S. Hughes, M.A. Lewis (eds). American Society for Testing and Materials, Philadelphia. pp 40-45.

6. ANZECC (Australian and New Zealand Environment and Conservation Council), November 1992, National Water Quality Management Strategy. *Australian Water Quality Guidelines for Fresh and Marine Waters*.

7. National Occupational Health and Safety Commission 1994, *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(1994)], Australian Government Publishing Service, Canberra.

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9. Standards Australia/Standards New Zealand 1992, *Australian/New Zealand Standard 1337-1992, Eye Protectors for Industrial Applications*, Standards Association of Australia Publ., Sydney, Standards Association of New Zealand Publ, Wellington.

10. Standards Australia 1987, *Australian Standard 2919-1987, Industrial Clothing,* Standards Association of Australian Publ., Sydney.

11. Standards Australia 1990, *Australian Standard 3765.1-1990, Clothing for Protection against Hazardous Chemicals Part 1 Protection against General or Specific Chemicals,* Standards Association of Australia Publ., Sydney.

12. Standards Australia 1978, *Australian Standard 2161-1978, Industrial Safety Gloves and Mittens (excluding electrical and medical gloves),* Standards Association of Australia Publ., Sydney.

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