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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Polymer in ULTIMER 92LT173TM

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Polymer in ULTIMER 92LT173TM

1. APPLICANT

Nalco Australia Pty Ltd of 2 Anderson Street, Botany NSW 2019 has submitted a limited notification for the assessment of the new polymer in ULTIMER 92LT173TM.

2. IDENTITY OF THE CHEMICAL

The notified chemical is a cationic acrylamide copolymer. The polymer contains a number of hazardous impurities. These are present at levels below the cut-off concentrations necessary to classify the polymer as a hazardous substance according the *Approved Criteria for Classifying Hazardous Substances* (1).

Based on the nature of the chemical and the data provided, the polymer in ULTIMER 92LT173TM is considered to be non-hazardous. Therefore, the chemical name, CAS number, molecular weight, molecular formula and structural formula have been exempted from publication in the Full Public Report and the Summary Report.

Trade name: ULTIMER 92LT173TM

Number-average molecular weight: > 1000

3. PHYSICAL AND CHEMICAL PROPERTIES

The following data were submitted for the product ULTIMER 92LT173TM, containing the major constituents: notified polymer (10-30%), ammonium sulfate (10-30%), sodium sulfate (<10%) and water.

Appearance at 20°C and 101.3 kPa:	White liquid
Melting Point:	-10°C (water)
Boiling Point:	120°C (water)
Specific Gravity:	1.22
Vapour Pressure:	Expected to be that of water
Water Solubility:	Completely soluble in water
Partition Co-efficient (n-octanol/water) log P_{ow}:	Not provided
pH:	3.7 - 4.2
Hydrolysis as a function of pH:	The polymer is expected to hydrolyse under environmental conditions. This was supported by a report on the hydrolysis of a similar polymer.
Adsorption/Desorption:	Not provided

Dissociation Constant
pK_a**:** No data provided. The polymer contains no acidic protons or basic nitrogens.

Flash Point: > 100°C

Flammability Limits: Not flammable

Combustion Products: Ammonia, oxides of sulphur, nitrogen and carbon

Explosive Properties: None

Reactivity/Stability: May react with strong oxidisers and strong alkalis

Comments on Physico-Chemical Properties

The partition coefficient would be difficult to measure but is expected to be low due to the high solubility in water.

As cationic polymers are known to bind to humic acid in water (2), it is likely that the polymer will bind to the organic matter in soils and thus the adsorption is expected to be relatively strong.

The hydrolysis of the ester functions in the polymer is expected to occur under environmental conditions. The hydrolysis data presented for pH 7 shows 47.8, 52.5 and 60.6 % hydrolysis on days 1, 7 and 14 respectively (40°C). The first half-life is quick (approximately 1 day) but subsequent half-lives are much slower. Using the fact that the rate of reaction doubles with every 5°C increase in temperature, then the first half-life at 25°C is expected to be 8 days. Subsequent rates of hydrolysis are expected to be significantly slower.

Hydrolysis of the amides will be very slow under environmental conditions.

4. PURITY OF THE CHEMICAL

Degree of purity: The polymer is manufactured as a 10-30% active aqueous polymer solution. The polymer itself is never isolated.

Hazardous residual monomers:

. **Chemical name:** Acrylamide
CAS No.: 79-06-1
Weight percentage: 0.3%
Toxic properties: Toxic by oral, dermal and inhalational route. Experimental carcinogen and neoplastogen, experimental reproductive effects, eye and skin irritant, mutagen (3).

Listed on *List of Designated Hazardous Substances* (4) with cut-off concentration of 3%.

WSA exposure standard (5): TWA 0.03 mg/m^3;
Sk - absorption through the skin may be a significant source of exposure.

Other hazardous impurities:

. **Generic name:** Aromatic alcohol
Weight percentage: 0.02%
Toxic properties: Toxic by oral route, moderately toxic by inhalation and skin contact, mild skin irritant, severe eye irritant (3).

Listed on *List of Designated Hazardous Substances* (4) with cut-off concentration of 25%.

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

. **Chemical name:** Water
CAS No.: 7732-18-5
Weight percentage: Balance

Maximum content of residual monomers: 0.4%

Additives/Adjuvants:

. **Chemical name:** 3(2H)-Isothioxolone, 2-methyl
Other name: Kathon
CAS No.: 2682-20-4
Weight percentage: <1%

5. INDUSTRIAL USE

The polymer will be imported as a white aqueous solution in 200 L steel drums. The polymer will be used for the flocculation of pollutants in waste water, emulsion breaking and sludge dewatering in industrial waste treatment.

The applicant will import > 1 tonne of polymer per annum.

6. OCCUPATIONAL EXPOSURE

The notified polymer will constitute 10-30% of an imported liquid product. Product will arrive in sealed 200L steel drums and be transported by road to Nalco's plant in NSW. Transport workers (6 truck drivers) will handle packaged product only, and should therefore only be exposed to the chemical in the event of accidental spills. The product will be onsold to approximately 50 customers Australia-wide for addition to their treatment systems. In some cases repacking into returnable bulk shipping containers may occur at the Botany plant prior to selling.

Activities conducted at Nalco's plant will include storage, sampling for quality control and decanting imported product into alternate containers. Decanting procedures will be either direct or via a decanting vessel. Receiving clerks (two) and forklift drivers (four) will handle sealed drums only and should therefore only be exposed to the chemical in the event of accidental spills. Laboratory chemists (three) will be exposed for approximately 4-5 hours per annum during analysis of imported product and repacked products. Chemical operators (four) will be exposed for approximately 30-50 hours per annum during sampling for QC (10 minutes per sampling) and repacking/decanting (2-4 hours per batch). Maintenance workers at the Nalco plant are not expected to be exposed to the chemical under normal situations, as the vessels and equipment are flushed with water before maintenance work is commenced.

At the customer sites, product will be diluted (to a concentration of of 0.1-1.5% of product) and fed directly into the treatment systems using continuous feed dosing. For some treatment applications, undiluted product will be used. Approximately 100 personnel (2 per site) are expected to be involved in dosing, testing and calibrating feed equipment. The applicant states that exposure during these operations will be for a few minutes at a time only. Nalco salespeople (fifteen) may be exposed to the chemical when visiting customer sites and verifying dose levels.

Maintenance personnel and workers involved in spill recovery will be exposed for longer periods. Maintenance personnel will be potentially exposed to residual chemical in the feed equipment (10-30%) as well as in the application system (< 0.45%) - exposure time will depend on the repairs required. Clean-up personnel will be potentially exposed for > 1 hour.

Exposure to chemical liquid, aerosols, mists or vapours will be limited by the use of engineering controls and automated equipment. Decanting vessels at the Nalco plant will be linked to a negative pressure extraction system. At the customer sites, worker exposure should be minimal as the chemical "will be dosed by continuous feed dosing equipment directly into the treatment system".

Workers will be instructed to wear chemical goggles or safety glasses and impermeable gloves during decanting operations, while setting up feeding equipment and during laboratory analysis. During maintenance and emergency clean-ups respirators will be worn if aerosols, mists, vapours etc are generated. If personnel are required to enter tanks, vessels or enclosed spaces with limited ventilation, workers will be required to use self-contained breathing apparatus. Safety footwear will be worn when handling containers.

7. PUBLIC EXPOSURE

At the customer sites, the product containing the notified polymer will be used neat for emulsion breaking applications or diluted to approximately 0.1-1.5% for water clarification. The notifier has indicated that the polymer is expected to be completely retained by the waste water sludge, which is typically landfilled. A worse case scenario would be 5% of the product remaining in the waste water phase. This concentration would enter the receiving water, invariably municipal sewerage treatment plants and undergo further dilution of many orders of magnitude. The treatment water is not intended for human consumption, as the polymer is not approved for the treatment of potable water. The notifier has stated that the likelihood of public exposure to the treated water would be the same as for treated municipal sewerage water.

Disposal is via landfill, incineration or aqueous water treatment in accordance with local regulations. The applicant states that the liquid product should be solidified with stabilising agents so that no free liquid remains before disposal to an industrial waste landfill.

8. ENVIRONMENTAL EXPOSURE

. Release

The polymer is expected to be released to the environment via treatment works. The polymer is used to treat effluent water from industrial sites etc., with the supernatant discharged to the sewer. The majority of the polymer will be in the solids, which are dewatered before disposal by either incineration or landfill.

Other possible releases of the polymer could occur during repacking, sampling or during dosing. These operations are done on industrial sites using appropriate equipment designed to reduce possible spills etc. This together with the instructions on the clean up of spills in the Material Safety Data Sheet (MSDS) should limit the possibility of environmental release to a minimum.

. Fate

The polymer is expected to undergo hydrolysis under environmental conditions to yield the polymer backbone (copolymer of acrylamide and acrylic acid) and another hydrolysis product. The other hydrolysis product released is expected to undergo further degradation (6).

The final fate of the water soluble backbone polymer is unknown but it is likely to slowly degrade (hydrolyse) further.

9. EVALUATION OF TOXICOLOGICAL DATA

Toxicological data are not required for polymers of number-average molecular weight (NAMW) > 1000 according to the *Industrial Chemicals (Notification and Assessment) Act, 1989* and no data were submitted for the notified polymer.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The ecotoxicity of the polymer was calculated by the company using US EPA methods for cationic polymers (7), based on clean water.

96 hr Fish LC_{50}	3.2 ppm
48 hr Daphnia LC_{50}	13 ppm
96 hr Algal EC_{50}	0.53 ppm

An ecotoxicity test for fish was presented by the applicant using a similar polymer product, ULTIMER 92LT175. ULTIMER 92LT175 contains the major constituents: cationic acrylamide copolymer (10-30%), ammonium sulfate (10-30%) and water.

LC_{50} (freshwater, 48 hr)	3.8 ppm
LC_{50} (seawater, 48 hr)	2,000 ppm

The above information shows that the polymer is potentially highly toxic to algae, moderately toxic to freshwater fish and slightly toxic to daphnids. As the polymer has <3.3% amine nitrogen, these effects are not mitigated by binding to dissolved organic carbon in natural waters (2).

Anionic polymers are normally toxic to algae due to chelation of nutrient elements (2), with the toxicity [EC_{50}] in the range of 1-100 ppm. However, initial hydrolysis of the polymer to give the backbone polymer (copolymer of acrylamide and acrylic acid) gives an anionic polymer that is of lower concern because the free acids in the copolymer are not positioned correctly to readily chelate nutrient elements.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

Most of the polymer will be disposed of with the solids (sludge) by landfill or incineration. The remaining polymer in the supernatant will normally be disposed of in the municipal sewer.

Incineration of the polymer will produce water together with the oxides of carbon and nitrogen and is unlikely to present an environmental hazard. The polymer disposed of in landfills is expected to undergo hydrolysis to give the backbone polymer and another hydrolysis product. The backbone polymer is expected to remain in the landfill, while the other product should further degrade and/or sorb strongly to particles within the landfill. The environmental hazard from disposal of the polymer by incineration or landfill is expected to be low.

It is not possible to determine the concentration in the supernatant for all cases as this will vary with the different sludges involved. The applicant states that typically >95% of the applied product remains with the sludge. At the maximum dose rate <2.5 ppm of the polymer will be in the supernatant.

Assuming an industrial site produces 10,000 L of liquid waste on a given day at 1% solids, ie 100 kg of solid waste, then after flocculation/dewatering there will be approximately 10,000 L of supernatant discharged to the sewer. Assuming the sewage treatment works do not remove any of the polymer, then:

Concentration of polymer entering sewer (worst case)	2.5 ppm
Dilution in city sewer, 250 ML	0.1 ppb
Concentration in receiving waters (ocean, 10:1 dilution)	0.01 ppb
For a regional based site, Dilution in country sewer, 5 ML	5 ppb
Concentration in receiving waters (river, 2:1 dilution)	2.5 ppb

The calculations show that the concentration in the regional receiving waters is >2 orders of magnitude below the calculated EC_{50} of the most sensitive organisms, algae. This will be further mitigated by removal of the polymer to the sludge in the alkaline sewage treatment works together with the expected hydrolysis.

The only other sources of environmental contamination is from accidental spills etc. during transport. The MSDS is adequate to limit the environmental exposure and therefore limit the environmental hazard.

Overall the environmental hazard can be rated as low.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

No toxicological data were submitted for the new polymer. However, as the notified chemical is a high molecular weight polymer (NAMW >1000), it is unlikely to pass biological membranes and cause systemic effects. The polymer contains a number of hazardous impurities. These are present at levels well below the cut-off concentrations necessary to classify the polymer as hazardous (1) and are therefore not expected to cause any significant toxicological concerns.

The notified chemical will arrive in Australia as a 10-30% aqueous solution. The imported product is stable, non-flammable and has a vapour pressure equal to that of water. As the product is non-volatile, exposure to the notified chemical via the inhalational route should be unlikely during normal use.

The major sources of worker exposure will be during direct decanting methods at the Nalco plant, during maintenance of dosing equipment and treatment systems at the customer sites, as well as during emergency clean-ups. During direct decanting processes splashing and spillages may result in skin and eye contact. The use of personal protective equipment, such as goggles, impervious gloves and protective clothing, will minimise contact during these operations. During maintenance work and emergency clean-up operations, aerosols or mists may form, and inhalational exposure may result. The use of an approved respirator, in addition to eye and skin protection, should reduce exposure during these operations.

Personnel entering poorly ventilated enclosed spaces will be required to use self-contained breathing apparatus. With the appropriate personal protective equipment exposure to the notified chemical will be minimal.

In the case of accidental spillage during transport, the public may be exposed to the notified polymer. This is minimised by the recommended practices for storage and transportation. Emergency procedures for the containment and clean up of accidental spills are available and should be followed. Public exposure to the notified chemical is therefore expected to be very low.

13. RECOMMENDATIONS

To minimise occupational exposure to the polymer in ULTIMER 92LT173TM the following guidelines and precautions should be observed:

- when using the notified chemical the following protective equipment should be worn:
  - impervious gloves conforming to Australian Standards (AS) AS 2161 (8),
  - protective eye goggles conforming to AS 1336 (9),
  - protective clothing conforming to AS 3765.2 (10), and
  - protective footwear conforming to AS/NZS 2210 (11).
- if mist, vapour or aerosols are generated, and engineering controls are not sufficient to control exposure, the following protective equipment should also be worn:
  - respiratory protection conforming to AS/NZS 1715 (12).

- the NOHSC exposure standard for acrylamide should be observed:

  - TWA 0.03 mg/m^3 (5).

- when entering poorly ventilated enclosed spaces, tanks or vessels the following protective equipment should be worn:

  - self-contained breathing apparatus conforming to AS/NZS 1715 (12).

- good work practices should be implemented to prevent splashing and spillages.

- good personal hygiene practices should be observed.

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

14. MATERIAL SAFETY DATA SHEET

The MSDS for ULTIMER 92LT173TM (containing 10-30% notified polymer) was provided in Worksafe Australia format.

This MSDS was provided by Nalco Australia Pty Ltd as part of their notification statement. The accuracy of this information remains the responsibility of Nalco Australia Pty Ltd.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989*, secondary notification of the polymer in ULTIMER 92LT173TM shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

1. National Occupational Health and Safety Commission, Approved Criteria for Classifying Hazardous Substances. Australian Government Publishing Service, Canberra, 1994.

2. J. V. Nabholz, P. Miller and M. Zeeman, "Environmental Risk Assessment of New Chemicals Under the Toxic Substances Control Act TSCA Section Five", in *Environmental Toxicology and Risk Assessment*, W. G. Landis, J. S. Hughes and M. A. Lewis (Eds), pp 40-55, 1993.

3. N. I. Sax and R. J. Lewis, *Dangerous Properties of Industrial Materials*, Van Nostrand Reinhold, New York, 1989.

4. National Occupational Health and Safety Commission, *List of Designated Hazardous Substances*. Australian Government Publishing Service, Canberra, 1994.

5. National Occupational Health and Safety Commission, *Exposure Standards for Atmospheric Contaminants in the Occupational Environment.* Australian Government Publishing Service Publ., Canberra, 1995.

6. J. C. Cooper, *Review of the Environmental Toxicity of Quaternary Ammonium Halides* Ecotoxicology and Environmental Safety, **16**, 65-71 (1988).

7. Estimating Toxicity of Industrial Chemicals to Aquatic Organisms Using Structure Activity Relationships, EPA-56016-80-001, Vol 1, 1988.

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

9. Australian Standard 1336-1982, Eye protection in the Industrial Environment. Standards Association of Australia Publ., Sydney, 1982.

10. Australian Standard 3765.2-1990, Clothing for Protection against Hazardous Chemicals Part 2 Limited protection against specific chemicals. Standards Association of Australia Publ., Sydney, 1990.

11. Australian/New Zealand Standard 2210-1994, Occupational Protective Footwear. Standards Association of Australia, Standards Association of New Zealand, 1994.

12. Australian/New Zealand Standard 1715-1994, Selection, Use and Maintenance of Respiratory Protective Devices. Standards Association of Australia, Standards Association of New Zealand, 1994.

13. National Occupational Health and Safety Commission, Guidance Note for the Completion of a Material Safety Data Sheet, 3rd edition. Australian Government Publishing Service Publ., Canberra, 1991.