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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Polymer in DCA-174

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Polymer in DCA-174

1. APPLICANT

BetzDearborn Australia Pty Limited of 69-77 Williamson Road INGLEBURN NSW 2565 has submitted a notification statement in support of their application for an assessment certificate for 'Polymer in DCA-174'.

2. IDENTITY OF THE CHEMICAL

The data to be exempted from publication in the Full Pubic Report include:

Chemical name;
CAS number;
Molecular weight and formula;
Spectral data;
Weight and residual percentage of ingredients; and
Low molecular weight plymer.

Trade Name:	Acrylate terpolymer, DCA-174 (containing 35% aqueous solution of the notified polymer)

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	white to yellow solid
Melting Point:	not well defined (see comments below)
Specific Gravity:	1 320 kg/m^3
Vapour Pressure:	2.4 kPa at 25°C
Water Solubility:	Extremely soluble (see comments below)
Partition Co-efficient (n-octanol/water):	Log P_{ow} < 0.11 (see comments below)

Hydrolysis as a Function of pH: no data (see comments below)

Adsorption/Desorption: Log K_{OC} < 3.58 (see comments below)

Particle Size: not provided as it is imported in aqueous solution

Dissociation Constant: pK_a = 4.87 (propanoic acid)
pK_a = -1.86 (methanesulfonic acid)

Flash Point: > 93°C

Flammability Limits: not determined

Autoignition Temperature: not determined

Explosive Properties: not expolosive

Reactivity/Stability: stable (see comments below)

Comments on Physico-Chemical Properties

The notified polymer has no well defined melting point, and begins to darken and decompose without melting at temperatures above 200ºC.

The solubility of the notified polymer in water was determined as approximately 45% at ambient temperature, and this is in accord with the high ionic content of the polymer and its intended use as a dispersant in cooling tower water.

The notified polymer is stable under normal environmental conditions - again in accord with its projected use in cooling towers where it needs to be persistent to be effective. A preliminary test conducted at 50ºC, under OECD TG 111, indicated that the polymer is hydrolytically stable with half life > 1 year for environments with pH 1.2, 4.0, 7.0 and 9.0. This polymer can be considered extremely stable to hydrolytic degradation in the usual environmental pH range 4-9.

The notifier provided a test report on the HPLC determination of the n-octanol/water partition coefficient. The result of this study indicated Log P_{OW} < 0.11, and this is in agreement with the high water solubility.

The notifier also provided a test report for the determination of the adsorption coefficient Log K_{oc}. In the study based on the OECD TG 106, five chromatographic peaks were detected for DCA-174, with the adsorption coefficients < 0 and 3.58 for the first and last eluting components, respectively.

4. PURITY OF THE CHEMICAL

Degree of Purity: > 99.8%

Maximum Content of Residual Monomers:

Name	*CAS No.*	*% Weight*
acrylic acid	79-10-7	0.01
3-2(propenyloxy)-2-hydroxypropane-1-sulfonic acid, sodium salt	52556-42-0	< 1.0

Non-Hazardous Impurities:

Name	*CAS No.*	*% Weight*
sodium sulphate	7727-73-3	≤ 1.0

Additives/Adjuvants:
Methylchloroisothiazolinone or methylisothiazolinone is added to the formulation as a biocide.

Name	*CAS No.*	*% Weight*
methylchloroisothiazolinone or methylisothiazolinone	26172-55-4 or 2682-20-4	0.025

5. USE, VOLUME AND FORMULATION

The new polymer will be used as a particulate dispersant and scale inhibitor in cooling water towers.

The new polymer is to be imported as a 35% aqueous solution in 205 L drums and 1 500 L intermediate bulk containers (IBCs). It may be repackaged and relabelled for sale as the 35% solution, or alternatively formulated with other chemicals into other specialty products. The reformulated products will be distributed to customers in 205 L drums and 1 500 L IBCs.

When used in cooling water, the formulations containing the new polymer would be continuously dosed into the circulating water load to maintain a typical polymer concentration of 2 to 12 mg/L, although in some cases this may be as high as 20 mg/L.

The notifier indicated that anticipated annual import quantities of the DCA-174 formulation (35% new polymer) over the next five years are to up to 50 tonnes per year, which is equivalent to annual imports for the polymer of up to 17.5 tonnes.

6. OCCUPATIONAL EXPOSURE

The notified polymer is a fine powder. However, DCA-174, the imported product containing 35% of the notified polymer, is formulated as a liquid. Thus, skin contamination, rather than respiratory contamination, is expected to be the main route of occupational exposure.

Transport and Storage
The notified polymer is to be imported as a 35% aqueous solution in 205 L drums and 1 500 L IBCs. Workers will receive the products at the waterside and transport them to the notifier's site. The products will be stored in a chemical warehouse in a bunded area prior to being reformulated on site or despatched to customers. Reformulated products will be distributed to customers in 205 L drums and 1 500 L IBCs.

There will be 3-6 waterside and transport workers and 2-3 warehouse workers. They will handle the products containing the notified polymer for 2-3 hours per day and 1 day per year.

It is anticipated that waterside workers, transport drivers and warehouse workers would only be exposed to the notified polymer in the event of an accident where the packaging was breached.

Reformulation
DCA-174 may be reformulated into specialty blended products on site using 5 000 L or 10 000 L mixing tanks with appropriate engineering controls and bunding. DCA-174 is transferred from drums to the mixing tanks by metered dose pumps. All processes involved in the reformulation are automated. Formulated products containing the notified chemical will be filled into 205 L drums or 1 500 L IBCs.

There will be 6-10 workers at the reformulation site. They may handle the notified polymer for 8 hours per day and 100 days per year. Occupational exposure may occur during the connection and disconnection of the pumps. Local and general ventilation are used to extract any fugitive vapours or mists. Workers will wear impervious gloves, overalls and chemical splash goggles to prevent skin and eye contact.

End use
Plant operators will handle products containing up to 35% of the notified polymer during water treatment. The expected duration of exposure will be 0.5 to 1 hour/day, 100 days/year. Operators may be contaminated with the notified polymer during handling IBCs, removing bungs and connecting pumping equipment to the storage containers. The notified polymer will be automatically pumped from the containers directly into the process stream using a purpose built feed system. The notified polymer will be fed either neat or pre-diluted; the final maximum concentration in the cooling tower is 20 mg/L.

Typically, plant operators are required to wear impervious gloves, overalls and eye protection during connection and disconnection of containers to transfer lines and during cleaning and maintenance of the equipment used in water treatment.

7. PUBLIC EXPOSURE

No public exposure is expected to occur from transport, storage, reformulation, or plant operation except in the case of accidental spills.

The notified polymer will not be sold to the general public and will only be used in industrial applications. Public contact from transport, storage, reformulation or plant operation is expected to be minimal. Physical contact i.e. dermal, inhalation, and ocular exposure, to

cooling tower drift at concentrations of notified polymer of up to 20 ppm (typically 2 to 12 ppm), suggests a potentially widespread, but low level of exposure to the public.

8. ENVIRONMENTAL EXPOSURE

Release

The notifier indicates that around 1% of the polymer formulation is likely to remain in the containers after emptying, and this amounts to an annual residual of up to 150 kg of the new polymer. This would be washed out of containers either used at the BetzDearborn facility or returned to the site for disposal. A further 1% (150 kg of polymer) may be released as a consequence of accidental spills and leaks during repackaging and formulation activities. The notifier states that all on-site residue will be contained by bunding and tanks, and transferred to the Lidcomb Aqueous Waste Treatment Plant for final treatment and disposal. It is expected that the polymer would be recovered into sludge at this facility, and either incinerated or placed into landfill. If placed into landfill, it is probable that the polymer would eventually leach from these facilities and be released into the wider water compartment, due to the very high water solubility of the polymer.

The new polymer will be exclusively used for treatment of cooling water. Discharge from these systems is more or less continuous as a consequence of operational blowdown (i.e. continuous or semi continuous bleeding of the system). The majority of the material will be released to the environment, primarily through release into metropolitan sewers. Since the new polymer will be used in cooling water towers throughout Australia, release will be widespread and diffuse.

Polymer may be released in this manner at the maximum concentration of 20 mg/L, but would be rapidly diluted by mixture with waters in the sewer. The notifier indicated that a small facility operating one cooling water tower would typically have a blowdown of 500 L per hour, or 4.5ML/year. Assuming a typical and use maximum concentration of 12 mg/L for the new polymer in the cooling water, this amounts to an annual release of 54 kg . A larger plant may have a blowdown of up to 21 tonne of water per hour, amounting to an annual release of about 2.2 tonnes of the new polymer. If the plant or facility is equipped with an on-site sewage treatment facility, the notifier indicates that the concentration of the polymer in the effluent would be reduced from a maximum of 20 mg/L to approximately 2 mg/L.

Fate

The new polymer is not readily biodegradable. A Closed Bottle Test for biodegradation according to OECD TG 301 D, indicated 30% degradation over the 28 day test period. However, the polymer may be inherently biodegradable, as is supported by the presence of biocides in the imported formulation. When released to the environment, the high water solubility dictates that the polymer will remain in the water compartment, and will not be removed by association with soils or sediments. However, as the material may be inherently biodegradable, it is expected to be slowly degraded to water, carbon dioxide and sulfate, while some may be assimilated into microbiological biomass. The polymer is stable to hydrolytic degradation, so decomposition by this mechanism is unlikely to be important in the environment.

The high water solubility and high molecular weight preclude bioconcentration of the polymer.

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological studies were included in the notification. The material safety data sheet (MSDS) for DCA-174 indicates that the imported product may be a moderate skin, eye, gastrointestinal and respiratory irritant.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The notifier supplied test reports for the following ecotoxicity data. The tests were performed according to United States Environment Protection Agency Test Guidelines, and complied with the protocols of good laboratory practice.

Test	*Species*	*Results (Nominal)*
Acute Toxicity EPA/600/4-90/027F	Fathead Minnow *Pimephales promelas*	LC_{50} (96 h) >5 000 mg/L
Acute Toxicity EPA/600/4-90/027F	Invertebrates *Daphnia Magna*	LC_{50} (48 h) = 4 790 mg/L NOEC = 3 250 mg/L LOEC = 7 692 mg/L
Algal Growth Inhibition SOP SL 3005.1.0	Green Algae *Selenastrum capricornutum*	NOEC > 10 000 mg/L
Inhibition of Bacterial Respiration SOP SL 3005.0.0	Activated Sludge Bacteria	IC_{50} estimated as around 1 000 mg/L

The fish test was conducted using a static procedure at 20 ± 1°C. The fish were exposed to water containing nominal concentrations of the test substance of 10, 100, 500, 1 000 and 5 000 mg/L, and ten fish were used for each test concentration. The pH of the solutions remained between 6.2 and 7.6, while the dissolved oxygen concentrations were between 7.9 and 8.9 mg/L. No mortality of the fish occurred over the 96 hour test period, and no

behavioural aberrations were noted. Accordingly the new polymer is regarded as practically non toxic to this species.

The tests on daphnia were conducted using a static procedure at 20±1ºC. The daphnia were exposed to water containing seven nominal concentrations of the test substance between 890 and 11 800 mg/L, together with one control, with ten daphnia used for each test concentration. The pH of the solutions remained between 6.2 and 7.6, while dissolved oxygen concentrations were between 7.8 and 8.9 mg/L. No mortality of the daphnia occurred at test concentrations below or equal to 3 250 mg/L over the 48 hour test period, while 100% mortality was observed at 7 692 mg/L. Although the polymer caused death in the daphnia at very high concentrations, it can still be regarded as practically non toxic to this species.

The effect of the polymer on algal growth was assessed by measuring the rate of uptake of C^{14} by algae exposed to water containing the polymer and C^{14} labelled sodium bicarbonate. The results indicated no inhibition to growth of algal biomass for exposure concentrations up to 10 000 mg/L. In contrast, a reference toxicant, methylene bis(thiocyanate) present at 5 mg/L, was reported to caused significant inhibition of growth which validated the test results. However, this data was not included in the test report.

A screening test on inhibition of bacterial respiration was also conducted using methods based on assimilation of C^{14}. This test indicated 55% inhibition of bacterial activity after 2 hours incubation at 37ºC in the presence of the test material at 1 000 mg/L. There was less inhibition at lower test concentrations, so the IC_{50} was estimated to be approximately 1 000 mg/L.

The overall results from the ecotoxicity tests demonstrated that the new polymer is practically non toxic to aquatic organisms.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

It is probable that all the polymer will be released thorough the sewer system, but as this is on a nationwide basis, release will be diffuse. Based on a nationwide release to sewer where each individual in Australia (18 000 000 population) contributes on average 150 L per day, and assuming maximum annual import (and release) quantities of 50 tonnes, gives a Predicted Environmental Concentration (PEC) of the polymer in the sewer system of 0.05 mg/L. The PEC would be further reduced on discharge of the sewer plant effluent to receiving waters. Although most new polymer is expected to be released into the water compartment in this manner, the material is practically non toxic to aquatic organisms and unlikely to be deleterious to aquatic species, as the PEC is several orders of magnitude below toxic levels.

The polymer is highly water soluble and expected to remain in the water compartment after release. Although the polymer is not susceptible to abiotic hydrolysis or readily biodegradable, it is inherently biodegradable and will slowly decompose to water, carbon dioxide and sodium sulfate. When used as a dispersant and scale inhibitor for cooling water in the manner indicated in the notification, the new polymer is not considered a hazard to the environment.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

No toxicological data on the notified polymer has been submitted. According to the notifier, no injuries or diseases related to exposure to the notified polymer, and no occupational hazards are known. Due to its high molecular weight, the notified polymer is unlikely to traverse biological membranes. However, the MSDS indicates that DCA-174, the aqueous product containing 35% of the notified polymer, may cause moderate eye and skin irritation, and the mists or aerosols may cause irritation of upper respiratory tract.

Transport and Storage
Waterside workers, transport drivers and warehouse workers have negligible health risk when handling containers of the notified polymer. As the polymer solution may be a moderate irritant, these workers should use skin and eye protection when cleaning up spills or handling contaminated containers.

Reformulation
Reformulation of water treatment products is largely automated and enclosed, so exposure is negligible during the bulk of the process. Skin, and may be eye, contamination may occur during connection and disconnection of transfer lines to pumps and containers, so skin and eye irritation is possible during these operations. Workers should wear overalls, impervious gloves and chemical splash goggles to prevent contact. Local exhaust ventilation is required to prevent exposure to mists.

End use
The end users will handle the products containing up to 35% of the notified polymer. As skin contamination may occur during connection and disconnection of containers to transfer lines to pumps and containers, and during cleaning and maintenance of equipment, end users should wear impervious gloves, coveralls and eye protection to prevent skin and eye irritation.

The MSDS recommends a particular glove type, namely neoprene gloves for those handling the 35% aqueous product DCA-174.

Public Health
Considering the physicochemical characteristics and use pattern, the notified polymer is unlikely to pose a significant hazard to public health.

13. RECOMMENDATIONS

To minimise occupational exposure to 'Polymer in DCA-174' the following guidelines and precautions should be observed:

- Safety goggles should be selected and fitted in accordance with Australian Standard (AS) 1336 (Standards Australia, 1994) to comply with Australian/New Zealand Standard (AS/NZS) 1337 (Standards Australia/Standards New Zealand, 1992);
- Industrial clothing should conform to the specifications detailed in AS 2919 (Standards Australia, 1987) and AS 3765.1 (Standards Australia, 1990);
- Impermeable gloves or mittens should conform to AS 2161 (Standards Australia/Standards New Zealand, 1998);
- All occupational footwear should conform to AS/NZS 2210 (Standards Australia/Standards New Zealand, 1994);
- 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 notified chemical was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (National Occupational Health and Safety Commission, 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, 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

National Occupational Health and Safety Commission (1994) National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]. Canberra, Australian Government Publishing Service.

Standards Australia (1987) Australian Standard 2919-1987, Industrial Clothing. Sydney, Standards Association of Australia.

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

Standards Australia (1994) Australian Standard 1336-1994, Eye Protection in the Industrial Environment. Sydney, Standards Association of Australia.

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

Standards Australia/Standards New Zealand (1994) Australian/New Zealand Standard 2210-1994, Occupational Protective Footwear. Sydney/Wellington, Standards Association of Australia/Standards Association of New Zealand.

Standards Australia/Standards New Zealand (1998) AS/NZS 2161.2:1998 Occupational protective gloves, Part 2: General requirements, Standards Australia/Standards New Zealand.