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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

Polymer in MVA 2424 L/50% and MVA 2424 L/50% N.D.

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Director
NICNAS

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1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
BASF Construction Chemicals Australia Pty Ltd (ABN 46 000 450 288)
11 Stanton Rd, Seven Hills NSW 2147

NOTIFICATION CATEGORY
Polymer of Low Concern

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication:
Chemical Name, CAS Number, Molecular and Structural Formulae, Molecular Weight, Polymer Constituents, Residual Monomers/Impurities, and Manufacture/Import Volume.

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
No variation to the schedule of data requirements is claimed.

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
None

NOTIFICATION IN OTHER COUNTRIES
USA EPA (2000)
Environment Canada (2003)
NIER Korea (2004)

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
Polymer in MVA 2424 L/50% and MVA 2424 L/50% N.D.

MOLECULAR WEIGHT (MW)

Number Average Molecular Weight (Mn)	>10,000 g/mol*
% of Low MW Species < 1000	<15%*
% of Low MW Species < 500	<1%

* The high percentage of low molecular weight species is due to the presence of residual macromonomeric species. The Mn value above is representative of the notified polymer only, disregarding the influence of the macromonomeric species on the molecular weight distribution.

REACTIVE FUNCTIONAL GROUPS
The notified polymer contains only low concern functional groups.

3. PLC CRITERIA JUSTIFICATION

Criterion	*Criterion met*
Molecular Weight Requirements	Yes
Functional Group Equivalent Weight (FGEW) Requirements	Yes
Low Charge Density	Yes
Approved Elements Only	Yes
Stable Under Normal Conditions of Use	Yes
Not Water Absorbing	Yes
Not a Hazard Substance or Dangerous Good	Yes

The notified polymer meets the PLC criteria.

4. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa	Turbid to milky turbid, slightly yellowish to yellowish-brownish aqueous solution
Melting Point/Glass Transition Temp	Not determined. The notified polymer is never isolated as a solid.
Density	1,100-1,140 kg/m^3 at 20°C (for a <60% polymer solution)
Water Solubility	>560 g/L (50% aqueous solution)
Partition Coefficient	logP_{ow} < -1.85 at 22°C at pH 5 (shake flask method, OECD TG 107)
Dissociation Constant	pKa = 5.8-6.5 Based on values for equivalent functional groups in similar polymers.
Reactivity	The notified polymer is stable under normal environmental conditions, and it is not anticipated to substantially degrade, depolymerise or decompose. No hydrolysis or other degradation of the notified polymer was observed after 1 day at pH 1.2, or 14 days at pH 4.0-9.0. All tests were carried out at 40°C (test method similar to OECD TG 111).
Degradation Products	None are known, and none are expected under normal conditions of use.

5. INTRODUCTION AND USE INFORMATION

MAXIMUM INTRODUCTION VOLUME OF NOTIFIED POLYMER (100%) OVER NEXT 5 YEARS

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	<30	<30	<30	<50	<50

USE AND MODE OF INTRODUCTION AND DISPOSAL

Mode of Introduction

The notified polymer will be imported as a <60% aqueous solution (in 1,000 L pallecons or in 200 L drums) through Sydney. It will be transported to the notifier's admixture plants by road.

Reformulation/manufacture processes

The notified polymer solution will be delivered to concrete admixture plants, where it will be pumped from the containers into a storage tank. It will be blended with other admixture components to produce a concrete admixture product (<20% notified polymer). Formulation of concrete admixtures will be carried out at several locations in Australia, in NSW, QLD, VIC, SA and WA.

Empty containers, pipelines and hoses will be rinsed with water after production, and the water will be collected for re-use in later production. The admixtures will be repackaged into bulk transport, 1000 L pallecons, 200 L drums or 20 L cubes, and sold to concrete manufacturers. These containers will be transported to customers by road.

At the concrete production plant, the admixtures will be pumped from the containers into a storage tank. From there, it will be dosed automatically into a concrete mixer along with other ingredients (eg Portland cement, sand, gravel and water) to produce concrete. Final concrete will contain <0.1% notified polymer, and will be poured or fed primarily into ready-mix concrete trucks for transport to construction sites, but potentially also into pre-cast concrete moulds.

Use
The notified polymer is proposed to be used as a raw material in the preparation of concrete admixtures, which will, in turn, be used in concrete production for predominantly ready-mix concrete, but also for pre-cast moulded concrete. Final concrete will contain <0.1% notified polymer. In concrete and cement-based materials, the notified polymer acts as a "superplasticiser", to improve plasticity and reduce water content, such that improved concrete strength and durability are achieved.

6. HUMAN HEALTH IMPLICATIONS

6.1. Exposure Assessment

OCCUPATIONAL EXPOSURE
Concrete admixture formulation
Dermal and ocular exposure to the notified polymer may potentially occur during concrete admixture formulation, which is estimated to take place for 40 days each year. Exposure may occur from the imported solution or from the concrete admixture product (<60% or <20% notified polymer, respectively). The stages of production where exposure to the notified polymer could occur are the pumping steps (to and from the mixing vessel) and the rinsing steps (empty containers and tanks/hoses). However, the potential for exposure to significant amounts of the notified polymer is limited because of the contained process used (little direct handling) and because of the personal protective equipment (PPE) that is expected to be worn by workers, including goggles and gloves.

Concrete manufacturing
Dermal and ocular exposure to the notified polymer may potentially occur during concrete manufacturing, on ~220 days of each year. Exposure may occur from the concrete admixture or from the prepared concrete (<20% or <0.1% notified polymer, respectively). The stages of production where exposure could occur are during pumping from the admixture container to the storage tank, and during the cleaning of equipment with water (eg the concrete mixer). Exposure to significant amounts of the notified polymer is unlikely during these processes, because of the low concentration of notified polymer, the lack of direct handling (through pumps) and/or the PPE that is expected to be worn by workers, including goggles and gloves.

Construction workers
Construction workers may experience frequent dermal exposure to concrete mixtures containing the <0.1% notified polymer, during construction with concrete. However, exposure to the notified polymer would be limited due to its low concentration in concrete and the likely use of gloves by the workers. Construction workers would also experience extensive exposure to solidified concrete or cement. However, in this state the notified polymer will be bound within the hardened matrix of the concrete, and will be unavailable to cause exposure.

PUBLIC EXPOSURE
The notified polymer is intended only for use in industry and will not be sold to the public. As such, exposure of the public to the imported polymer solution or to concrete admixtures is not expected.
Extensive public exposure to solidified concrete or cement containing <0.1% notified polymer is likely. However, the notified polymer will be bound within the hardened matrix of concrete, and will be unavailable to cause exposure to members of the public. Leaching of the notified polymer from concrete is not expected.

6.2. Toxicological Hazard Characterisation

The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard. This is supported by toxicological endpoints observed in testing conducted on the notified polymer.

Endpoint	*Result*	*Classified?*	*Effects Observed?*	*Test Guideline*
Rat, acute oral	LD50 >2,000 mg/kg bw	no	yes	OECD TG 423
Rabbit, skin irritation	non-irritating	no	yes	OECD TG 404
Skin sensitisation - adjuvant test	no evidence of sensitisation.	no	no	OECD TG 406 (Maximisation test)
Genotoxicity - bacterial reverse mutation	non mutagenic	no	no	OECD TG 471
Phototoxicity to Balb/c 3T3 cells	not phototoxic	no	no	EC Directive 2000/33/EC B.41

All results were indicative of low hazard. All observed effects were mild and were only associated with high-level dosing:

- *Rat, acute oral toxicity:* Hunched posture was observed in all female animals during the day of dosing, but no adverse effects were observed in male animals (2,000 mg/kg bw).
- *Rabbit, skin irritation:* Very slight erythema was observed at the test site in all animals at 1 hour after removal of the dressing. No skin reactions were observed in any animal at 24, 48 or 72 hours.

The notified polymer has been in large-scale commercial use overseas for some years without adverse human health effects reported.

Discussion of the degree of hazard presented by the residual macromonomer and related species:
The lower molecular weight polymeric residual macromonomer and its related products (Mn ~1,000 Da) should also be considered for any potential health hazards for the solution of the notified polymer, as they are present in considerable concentration (<16%, combined). These species are considered to have a higher probable hazard than the notified polymer, due to their lower molecular weight and the presence of reactive groups. Toxicology data for similar low-molecular weight species exhibit low oral toxicity and eye irritation potential, but may induce mild dermal irritation.

Presumably, the residual macromonomeric species were present in the polymer solution that underwent the toxicological examinations described above for the notified polymer. In the acute oral toxicity test, some rats treated with the solution of the notified polymer displayed hunched posture, suggesting that systemic absorption or perhaps gastro-oesophageal irritation had occurred. Both of these effects would more probably be induced by these lower molecular weight macromonomeric species than by the notified polymer, but could equally be caused by the volume of the dose causing gastrointestinal distension. The transient, mild skin irritation that occurred following the treatment of rabbits with a solution of the notified polymer could also result from the presence of the residual macromonomer. However, none of the observed effects demonstrated a significant hazard.

Overall, the notified polymer, as well as its residual macromonomer and derived species, can be considered to be of low hazard.

6.3. Human Health Risk Assessment

OCCUPATIONAL HEALTH AND SAFETY

Although low-level exposure to the notified polymer could occur during the formulation of concrete admixtures or during the manufacturing of concrete, the risk to these workers is considered to be low due to the intrinsic low hazard presented by the notified polymer. The risk of the notified polymer to construction workers handling solidified concrete is considered to be negligible.

PUBLIC HEALTH

The notified polymer will not be available to the public. Members of the public may make dermal contact with concrete containing the notified polymer. However, the risk to public health will be negligible because the notified polymer is of low hazard, and because it is present at low concentrations, bound within the concrete matrix and resistant to degradation.

7. ENVIRONMENTAL IMPLICATIONS

7.1. Exposure Assessment

ENVIRONMENTAL RELEASE

The notified polymer will not be manufactured in Australia, but will be reformulated at polymer admixture plants located around Australia. The notified polymer is intended to be mixed with water before use. Consequently, all import drums and residues from equipment cleaning and maintenance may be thoroughly rinsed with water for charging to the batch. Release from reformulation plants from spills and other sources is expected to be less than <0.1% of the import volume (30 kg per annum). This is expected to be flushed to sewer.

At concrete production plants, the reformulated product is expected to be pumped and then rinsed into the storage facilities for later addition to concrete. The dosing to the concrete mixer is expected to be automated with no release except from cleaning of equipment. The mixed concrete will be transferred to concrete trucks for use. Concrete trucks are usually rinsed at the end of the day after several batches. Approximately 1-4%* of the concrete adheres to the inside of the drums. If four batches are assumed between rinses then the amount of notified polymer in the excess concrete and water amounts to less than 1% (<300 kg per annum). These washings from delivery trucks on return to batch plant are expected to be contained in a wash water system, most of which is recycled for future concrete manufacture. Some of the wastewater may be associated with the waste concrete and be allowed to evaporate as the concrete cures, with the notified polymer becoming associated with the waste concrete. Any excess concrete is expected to be transferred to dumpsters where the concrete is allowed to cure with subsequent disposal in authorised landfill.

* S. Abdol Chini and William J. Mbwambo, *Environmentally Friendly Solutions for the Disposal of Concrete Wash Water from Ready Mixed Concrete Operations*, CIB W89 Beijing International Conference, 21-24 October, 1996.

ENVIRONMENTAL FATE

The vast majority of the notified polymer will be bound in the concrete matrix and will not be released to the environment in any significant quantity. At the end of the concrete's useful life, it is likely to be landfilled or used as low-grade construction material such as road base. The notified polymer showed 18% degradation in a ready biodegradability test (OECD Guidelines 301B). It is therefore expected that the notified polymer will eventually degrade by biotic and abiotic processes to oxides of carbon, water vapour and sodium salts.

7.2. Environmental Hazard Characterisation

The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard. This is supported by environmental endpoints observed in testing conducted on the notified or analogue polymer.

Endpoint	*Result*	*Effects Observed?*	*Test Guideline*
Daphnia Toxicity	EC50 > 100 mg/L	no	OECD TG 202

The result is indicative of low hazard.

However, anionic polymers are known to be moderately toxic to algae. The mode of toxic action is overchelation of nutrient elements needed by algae for growth, however the functional groups of the notified polymer do not predict a high degree of toxicity. The notified polymer's toxicity to algae is also likely to be reduced due to the presence of calcium ions, which will bind to the functional groups*.

* Nabholz JV, Miller P and Zeeman M (1993). Environmental Risk Assessment of New Chemicals Under the Toxic Substances Control Act (TSCA) Section Five. In: Landis WG, Hughes JS & Lewis MA ed *Environmental Toxicology and Risk Assessment*, ASTM STP 1179, American Society for Testing and Materials, Philadelphia, PA.

7.3. Environmental Risk Assessment

Small amounts of the notified polymer (<30 kg per annum) may be released to sewer from polymer admixture plants. This will result in a worst-case predicted environmental concentration (PEC) of 0.028 µg/L at sewage outfall. (30 kg per annum ÷ (20.5 million persons × 200 L per day per person × 260 working days).

A predicted no effect concentration (PNEC) cannot be calculated, as no end-point was reached in the ecotoxicity test. However, it can be stated that the PNEC is > 100 µg/L, based on the ecotoxicity test and applying a safety factor of 1,000. (The safety factor of 1,000 is used, as test data only exist for one trophic level.) A risk quotient may then be derived by dividing the PEC by the PNEC. This can be stated to be < 0.01.

Although the notified polymer may show moderate toxicity to algae, the majority of it will be used in environments where calcium ions will be present in vast excess. During use, it is expected to bond strongly to these calcium ions. It is therefore unlikely that it will chelate further calcium ions in the environment, thus greatly reducing the risk to the aquatic environment. Furthermore, the notified polymer is unlikely to be released from the matrix of set concrete. Accordingly, exposure of the notified polymer to the aquatic environment is expected to be minimal. The notified polymer is unlikely to pose an unacceptable risk to the environment.

8. CONCLUSIONS

8.1. Level of Concern for Occupational Health and Safety

The notified polymer poses no significant risk to occupational health and safety under the conditions of the occupational settings described.

8.2. Level of Concern for Public Health

There is negligible risk to public health when used in the proposed manner.

8.3. Level of Concern for the Environment

The notified polymer is not considered to pose a risk to the environment based on its reported use pattern.

9. MATERIAL SAFETY DATA SHEET

9.1. Material Safety Data Sheet

The notifier has provided MSDS as part of the notification statement. The accuracy of the information on the MSDS remains the responsibility of the applicant.

10. RECOMMENDATIONS

CONTROL MEASURES
Occupational Health and Safety

- No specific engineering controls, work practices or personal protective equipment are required for the safe use of the notified polymer itself, however, these should be selected on the basis of all ingredients in the formulation.

- Guidance in selection of personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

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

- If products and mixtures containing the notified polymer are classified as hazardous to health in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances*, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Disposal

- The notified polymer should be disposed of by authorised landfill.

Emergency procedures

- Spills and/or accidental release of the notified polymer should be handled by absorption with inert material and disposal to landfill. Residues may be flushed to sewer in accordance with Federal State and local regulations.

10.1. Secondary Notification

The Director of Chemicals Notification and Assessment must be notified in writing within 28 days by the notifier, other importer or manufacturer:

(1) Under subsection 64(1) of the Act; if
  - the notified polymer is introduced in a chemical form that does not meet the PLC criteria.

or

(2) Under subsection 64(2) of the Act:
  - if any of the circumstances listed in the subsection arise.

The Director will then decide whether secondary notification is required.