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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Polymer in WR-78-5314

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act* 1989 (the Act) and Regulations. This legislation is an Act of the Commonwealth of Australia. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by the National Occupational Health and Safety Commission which also conducts the occupational health & safety assessment. The assessment of environmental hazard is conducted by the Department of the Environment and the assessment of public health is conducted by the Department of Health and Aged Care.

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Director
Chemicals Notification and Assessment

TABLE OF CONTENTS

FULL PUBLIC REPORT

Polymer in WR-78-5314

1. APPLICANT

PPG Industries Australia Pty Ltd of McNaughton Road, Clayton, Victoria, 3168 (ACN 055 500 939) has submitted a limited notification statement in support of their application for an assessment certificate for the new synthetic polymer in WR-78-5314.

2. IDENTITY OF THE CHEMICAL

The chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data and details of the polymer composition, concentrations and import volume have been exempted from publication in the Full Public Report and the Summary Report.

Marketing Names: WR-78-5314
E6273B

3. PHYSICAL AND CHEMICAL PROPERTIES

The following data relate to the notified polymer or an analogue of the notified polymer at a concentration of 36 % w/w dispersed in water, the notified polymer itself, or an analogue polymer (assessed by NICNAS as NA/886, and differing only in identity of counterion), as indicated. The polymer itself is never isolated from the *in situ* manufactured resin solution.

Appearance at 20°C and 101.3 kPa: light amber, slightly viscous turbid liquid (dispersion)

Boiling Point: not determined

Specific Gravity: 1.037 (dispersion, notified polymer)
1.11 (notified polymer, calculated)

Vapour Pressure: the notified polymer is not volatile

Water Solubility: > 161 g/L at pH 1
> 142 g/L at pH 7
> 116 g/L at pH 10 and 20°C (analogue polymer)

n-octanol Solubility: 92.6 g/L (analogue polymer)

Partition Co-efficient (n-octanol/water): Log P_{ow} = -0.19 (analogue polymer)

Hydrolysis as a Function of pH:	not determined (see comments below)
Adsorption/Desorption:	not determined (see comments below)
Dissociation Constant:	not determined (see comments below)
Particle Size:	not applicable as the polymer is never isolated from solution
Flash Point:	not flammable (dispersion)
Autoignition Temperature	does not autoignite (analogue polymer)
Explosive Properties:	not explosive
Reactivity/Stability:	stable at ambient temperatures

3.1. Comments on Physico-Chemical Properties

The water solubility was determined following the flask method detailed in OECD TG 105 (Springborn Laboratories 1999a and 1999b). The solubility of the analogue polymer was determined at pH 1, pH 7 and pH 10. Polymer solutions (~1 g/mL) were prepared in triplicate in each of the three buffer solutions. A replicate solution at each pH was then shaken for 24, 48 and 72 h after which they were equilibrated for 24 h at 20°C with shaking. An aliquot from each flask was removed and centrifuged and analysed by GPC. This method indicated that the solubility of the structural analogue of the notified polymer at pH 1, 7 and 10 is greater than 161, 142 and 116 g/L, respectively. When the test was repeated with a longer equilibration time (up to 144 h) the solubility of the test substance at pH 1, 7 and 10 was found to be greater than 151, 94.9 and 1.46 g/L, respectively.

The notifier provided a test report which showed that the *n*-octanol solubility of the analogue polymer is 92.6 g/L (Springborn Laboratories 1999c). Based on this value and its water solubility value, the partition coefficient of the analogous polymer has been calculated to be 0.65-1.0.

The notified polymer contains linkages that could be expected to undergo hydrolysis under extreme pH conditions. However, in the environmental pH range of 4 to 9, significant hydrolysis is unlikely to occur.

No adsorption/desorption tests were conducted for this notification. The partition coefficient for the analogue polymer indicates that it may be mobile in soil. However as a consequence of its cationic nature, the notified polymer is expected to eventually associate with the soil matrix and sediments and be immobile in soil.

In the polymer dispersion, the neutralising acid partially protonates the base polymer sufficiently to stabilise it as a micelle. No pK_a data were provided but the amine groups could be expected to behave as typical aliphatic tertiary amines and be appreciably basic.

Consequently the amine groups would be protonated and carry positive charge in the usual environmental pH range. The notified polymer contains no other functional groups which are expected to show pH dependent dissociation under normal environmental conditions.

As the notified polymer is imported and used in aqueous dispersion, it is not expected to be flammable.

4. PURITY OF THE CHEMICAL

Degree of Purity:	> 95 %
Maximum Content of Residual Monomers:	all residual monomers are present at below the cutoff levels for classification of the polymer as hazardous; other reactants used in forming the final polymer dispersion are also below the respective cutoff levels for classification of the polymer as hazardous
Toxic or Hazardous Impurities:	none present apart from residual monomers
Non-hazardous Impurities (> 1% by weight):	none
Additives/Adjuvants:	none are present at above the cutoff levels for classification of the polymer dispersion as hazardous

5. USE, VOLUME AND FORMULATION

The notified polymer will not be manufactured in Australia. It will be imported as part of an aqueous coating resin formulation at less than 5 % (w/v). The formulated product will be diluted by approximately a factor of two prior to end use. The coating resin formulation will be imported mainly in 20000 L isotanks, but 208 L drums or 1041 L tote tanks will be used for around 10 % of the imported volume.

The polymer will be used as a flexibiliser resin in an electrodepositable coating composition used as a primer coating for automobile bodies in an immersion bath. The polymer will only be used in automobile assembly plants.

The import volume within the first five years will be less than 20 tonnes per annum.

6. OCCUPATIONAL EXPOSURE

Transport and Storage

The notified polymer as part of a formulated aqueous coating resin product will be transported from the docks to the notifier's warehouse, where it will be distributed to the customer sites. The notifier expects that 2 - 6 waterside workers and 2 - 4 warehouse workers, along with an unspecified number of transport drivers, will handle the containers of the coating formulation containing the notified polymer, for approximately 6 hours, 50 times a

year. The original containers will not be opened, so it is unlikely that these workers will be exposed, except in the event of an accident involving the rupture of a drum or tank.

Primer Application
The notified polymer is used in a section of the automated production line in automobile assembly plants. The electrodeposition process involves the use of a potentially dangerous electric current in a wet environment, so the plant operators and the bath containing the notified polymer are physically separated during the normal operation of the production line.

The notifier estimates that a total of 8 plant operators, 4 plant technical operators and 4 laboratory workers will be exposed to the notified polymer. The exposure is estimated to be for 2 hours per shift, 250 times per year for plant operators, 4 hours per shift, 250 times per year for plant technical operators and 6 hours per shift, 100 times per year for laboratory workers.

The product containing the notified polymer will be transferred by plant operators from the import tanks to a storage tank using a coupling hose. There is possibility of dermal exposure to drips and spills when the containers are exchanged and the transfer hoses are disconnected and reconnected.

The formulation containing the notified polymer is dispensed into a large water bath from the storage tank via a fixed automated transfer system.

The automobile bodies are lowered into the water bath by the production line conveyor until completely submerged; a negative voltage is then applied and the electrostatically charged paint is deposited onto the body. The conveyor then lifts the automobile body out of the bath and excess polymer solution is washed off back into the bath with water; the concentration of the bath is maintained as the wash water is recirculated from the bath through an ultrafiltration system. The automobile body is then transferred by conveyor to a baking oven, where the crosslinking reaction occurs. After this process, the polymer coating is crosslinked and the notified polymer is no longer separately available for exposure.

There is a need for periodic sampling and testing of the bath contents to ensure that the concentrations of all of the paint components, including the notified polymer, are maintained. Dermal exposure of plant technical operators to the bath contents is possible during sampling. The testing is performed by laboratory personnel. Dermal exposure to small quantities of the bath contents of these workers is also possible.

Exposure may also occur during bath cleaning. The process is continuous with topping up of the electrocoat concentration through the automated system, but bath cleaning will occur every one to two years. The notifier states that the bath contents will be pumped into a storage tank through fixed piping, along with water used to rinse the walls of the tank. Residual washings and sludge will be removed by waste disposal contractors who may have dermal exposure to low concentrations of the notified polymer.

The bath containing the notified polymer is enclosed and local exhaust ventilation is used to remove any solvent vapours which may be present. The baking oven will be vented to the atmosphere through an afterburner, which will remove any oven fumes.

Workers in the electrocoat sections of the car plants would be expected to wear gloves,

protective eyewear and clothes, and other personal protective equipment as required.

7. PUBLIC EXPOSURE

Members of the public may be exposed to the imported paste formulation containing the notified polymer following transport accidents. Such accidents are unlikely. The regulated disposal of any waste containing the notified polymer means that environmental contact with the notified polymer is also unlikely. The products containing the notified polymer are not available to the public. The notified polymer is a bound component of the primary coating of vehicle metal body work and is not accessible to public contact. The primary coating is covered by several other coats of paint and contact with the notified polymer is further prevented. The potential for exposure of the public to the notified polymer is negligible.

8. ENVIRONMENTAL EXPOSURE

8.1. Release

During coatings production, the notifier estimates that up to 105 kg per annum of waste containing the notified polymer will be generated from cleaning up minor spills and quality control testing. The notifier further estimates that up to 100 kg per annum of the notified polymer will be disposed of during coating application and equipment cleaning and up to 30 kg of the notified polymer will be disposed of during drum cleaning.

8.2. Fate

The majority of the notified polymer will be combined with other coating components to form a very high molecular weight and stable coating. Therefore, once incorporated into the coating formulation, the notified polymer is expected to be immobile in the environment. As the coating degrades over time, any fragments, chips and flakes of the coating will be of little concern as they are expected to be inert. The metal panels and car bodies coated with the polymer are likely to be either recycled for steel reclamation or placed into landfill at the end of their useful life. During recycling, the polymer would be destroyed in furnaces and converted to water vapour and oxides of carbon and nitrogen.

A biodegradation study was conducted on the analogue polymer (subject of NA/886) according to OECD TG 301B; Determination of Biodegradability by the CO_2 Evolution Modified Sturm Test (Springborn Laboratories 1999d). The inoculum was obtained from the Wareham Wastewater Treatment Plant in Wareham, Massachusetts. A stock solution of the test substance was prepared by adding the polymer (~4 g) to a flask containing medium (22 mL) The biodegradation of the test substance was compared against sodium benzoate. The biodegradation of sodium benzoate was 81 % after 28 days, indicating the test conditions were valid. After 28 days at 21°C, the mean biodegradation of the test substance based on titration measurements was determined to be –22 %. This suggests that the test substance exhibits a slight inhibitory effect on the inoculum. Based on the analogue data, the notified polymer is not expected to be readily biodegradable.

The notified polymer in waste from spills, equipment cleaning and drum recycling will be

collected by licensed waste disposal contractors and treated by flocculation, filtration and centrifugation. The resulting solid containing the notified polymer will be dried followed by disposal into landfill while the water will be tested prior to release into the sewer. Some of the wastes generated, particularly from drum recycling, may also be incinerated.

The notified polymer is water soluble and is therefore expected to be mobile in both the terrestrial and aquatic compartments. However as a consequence of its cationic nature, the notified polymer is expected to eventually associate with the soil matrix and sediments. The notified polymer is not expected to cross biological membranes due to its high molecular weight and is therefore not expected to bioaccumulate (Connell 1990).

9. EVALUATION OF TOXICOLOGICAL DATA

Toxicity data are available for the analogue polymer subject of NICNAS notification NA/886. No other toxicity data are available.

9.1 Acute Toxicity

9.2.1 Acute Oral Toxicity (WIL, 1999)

TEST SUBSTANCE	Analogue of notified polymer, subject of NA/886 (as 36 % aqueous dispersion; doses corrected for concentration of polymer).
METHOD	OECD 401 Acute Oral Toxicity – Limit Test.
Species/Strain	Rat/ Crl:CD®(SD)IGS BR
Vehicle	As supplied.
Remarks - Method	No significant protocol deviations.

RESULTS

Group	*Number & Sex of Animals*	*Dose mg/kg bw*	*Mortality*
I	5 per sex	2000	0/10

LD50	> 2000 mg/kg bw
Signs of Toxicity	For seven animals, various discoloured areas due to discharges (wet or dried red or yellow, around the eyes, nose, hind limbs, base of tail, anogenital or urogenital areas) were observed. Abnormal defecation (mucoid faeces, soft faeces or decreased defecation) was observed for five animals. No other clinical signs of toxicity were observed during the study.
Effects in Organs	There were no gross pathological changes observed.
Remarks - Results	One female lost weight during the second week of the study.
CONCLUSION	The notified polymer is of low toxicity via the oral route.
TEST FACILITY	WIL Research Laboratories, Inc.

9.2 Overall Assessment of Toxicological Data

The acute oral toxicity of the analogue polymer is very low. No studies of dermal or inhalation toxicity or skin irritation or sensitisation were provided by the notifier, and the notified polymer cannot be classified for these health effects.

Polymers of high molecular weight do not readily cross the skin or other biological membranes, and the overall toxicity is expected to be low. The notified polymer will have surfactant properties and is a possible skin and eye irritant due to its defatting properties.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The following ecotoxicity data are available for the analogue polymer subject of NICNAS notification NA/886.

Test	*Species*	*Results (nominal)*
acute toxicity (static) [OECD TG 203]	rainbow trout (*Oncorhynchus mykiss*)	96 hr LC_{50} = 1 mg/L NOEC = 0.27 mg/L
acute immobilisation (static) [OECD TG 202]	*Daphnia magna*	48 hr EC_{50} = 42 mg/L NOEC = 8.2 mg/L

LC_{50} : the concentration of the test substance in dilution water which causes mortality of 50 % in the exposed test population after a fixed period of time.
EC_{50} : the concentration of the test substance in dilution water which causes immobilisation of 50 % in the exposed test population after a fixed period of time.
NOEC : No Observed Effect Concentration

The tests on fish were performed using a static methodology (Springborn Laboratories Ltd 1999e). Observations were performed at 0, 2, 24, 48, 72 and 96 hours. The test was performed using ten specimen fish per loading rate at a temperature of 14ºC. The tests were conducted using test substance made up at nominal concentrations of 0.055, 0.12, 0.27, 0.61, 1.4 and 3 mg/L. While analysis of the test solutions was not conducted, the notifier indicates that all test solutions were clear and colourless. The results of the definitive study showed that after 96 h, no mortalities were experienced at test concentration below 0.61 mg/L. However, fish at test substance concentration of 0.61 mg/L exhibited lethargy, while at a test substance concentration of 1.4 mg/L, fish experienced loss of equilibrium. Mortalities of 90 and 100 % were observed at test concentrations of 1.4 and 3 mg/L, respectively. The 96-hour LC_{50} to *Oncorhynchus mykiss* is 1.0 mg/L as estimated by non-linear interpolation.

The immobilisation tests with *Daphnia magna* were performed under static conditions with observations performed at 24 and 48 hours (Springborn Laboratories Ltd 1999f). The test was performed in quadruplicate using 5 daphnids per flask at a temperature of 20ºC. The tests were conducted using the test substance made up at nominal concentrations of 1.7, 3.7, 8.2, 18, 41, 90 and 200 mg/L. While analysis of the test solutions was not conducted, the notifier indicates that all solutions were clear and colourless. After 48 h, vessels containing test substance concentrations of 1.7, 3.7, 8.2, 18, 41, 90 and 200 mg/L exhibited 5, 10, 5, 20, 60, 70 and 90 % immobilisation, respectively. The 48-hour EC_{50} to *Daphnia magna* is 42 mg/L as calculated by moving average analysis.

The ecotoxicity data indicates the analogue polymer is moderately toxic to fish and slightly toxic to daphnia based on nominal concentrations.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The majority of the notified polymer will be combined with other coating components to form a very high molecular weight and stable coating. Therefore, once incorporated into the coating formulation, the notified polymer is expected to be immobile and pose minimal risk to the environment.

The notified polymer in waste from spills, equipment cleaning and drum recycling will be treated by flocculation, filtration and centrifugation. The resulting solid containing the notified polymer will be dried followed by disposal into landfill while the water will be tested prior to release into the sewer. Ecotoxicity data for a close analogue polymer suggests that the notified polymer may be moderately toxic to fish and slightly toxic to daphnia. According to Nabholz, polymers containing quaternary amine functionalities are of particular concern and are known to be around 6 times more toxic to algae than fish (Nabholz *et al.* 1993). This indicates an EC_{50} to algae of around 0.2 ppm. However, exposure to the aquatic compartment is expected to be low, and any release to this compartment is highly unlikely to result in concentrations approaching this level.

As a consequence of its cationic nature, the notified polymer is expected to eventually associate with the soil matrix and sediments. The notified polymer is not expected to cross biological membranes due to its high molecular weight and is therefore not expected to bioaccumulate (Connell 1990).

The notified polymer is not likely to present a hazard to the environment when it is stored, transported and used in the proposed manner.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Little toxicological data has been provided and the notified polymer cannot be assessed against the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999b). The notified polymer is of very low oral toxicity. Polymers of high molecular weight do not readily cross the skin or other biological membranes, and the overall toxicity is expected to be low. The polymer has surfactant properties and could be a skin and eye irritant due to defatting properties. The Material Safety Data Sheet (MSDS) for the imported product E6273B Electrocoat indicates that this is a possible skin and eye irritant. The MSDS for the imported product lists a number of potential health effects due to inhalation, namely nausea, headaches, dizziness, mucous membrane and respiratory irritation and central nervous system depression, and that the product is harmful if swallowed and in contact with the skin. The health effects relate mainly to the solvents and other ingredients present in the product rather than the notified polymer.

Occupational Health and Safety
There is little potential for significant occupational exposure to the notified polymer in the

transport and storage of the primer components containing this polymer.

The system by which the primer component is dispensed and used is enclosed, and exposure to the notified polymer is only likely when containers are coupled and uncoupled from the production line, when samples of the electrodeposition bath are removed for testing to allow the concentration of polymer in the bath to be maintained, and during electrodeposition bath cleaning. In normal operation, the electrodeposition bath containing the notified polymer will be completely enclosed due to the electrocution hazard associated with the electrodeposition process.

Plant operators and laboratory staff who may come into contact with the notified polymer should take adequate precautions, including the wearing of protective clothing, eyewear and gloves to prevent dermal or ocular exposure.

After the car bodies coated with the primers including the notified polymer have been baked and overcoated with additional paint layers, the notified polymer will not be available for exposure.

Public Health
Public exposure to the notified polymer will most likely be limited to exposure occurring following transport accidents or to contact with it as an environmental contaminant. Such accidents are not likely and the closely regulated nature of waste disposal from assembly plants will mean that environmental contact is also not very likely. The notified polymer is not volatile. Any exposure that does occur is likely to be dermal and of an infrequent and transient nature. The low likelihood of exposure to the notified polymer and its toxicological profile suggest that it will not pose a significant hazard to public health when used in the proposed manner.

13. RECOMMENDATIONS

Control Measures

Occupational Health and Safety

- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified polymer in the product E6273B:
  - NOHSC exposure standards for all of the components of the final paint mix should not be exceeded in the workplace

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified polymer in the product E6273B:
  - Safety goggles, chemical resistant industrial clothing and footwear and impermeable gloves should be used; where engineering controls and work practices do not reduce vapour and particulate exposure to safe levels, an air fed respirator should also be used

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.

13.1 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 Section 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.

No additional secondary notification conditions are stipulated.

14. MATERIAL SAFETY DATA SHEET

The MSDS for a product containing the notified polymer was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 1994).

The MSDS for E6273B Electrocoat 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. REFERENCES

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