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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Acrylic Polymer in Polyurethane-Acrylic Dispersion Resin WR-76-5472

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

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1. APPLICANT

PPG Industries Australia Pty Ltd of McNaughton Rd, CLAYTON, VIC 3169 (ACN 055 500 939) has submitted a limited notification statement in support of their application for an assessment certificate for Acrylic Polymer in Polyurethane-Acrylic Dispersion Resin WR-76-5472.

2. IDENTITY OF THE CHEMICAL

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

Marketing Name:	Polyurethane-Acrylic Dispersion Resin WR-76-5472
Method of Detection and Determination:	infrared spectroscopy

The notified polymer forms part of a core-shell polymer structure. The polyurethane polymer, subject of a concurrent notification PLC/177, forms the shell, and the acrylic polymer is formed in situ within this shell. The polyurethane soap is manufactured first, and the acrylic monomers are then added and polymerised while intimately mixed with the polyurethane. No bonds between the acrylic and polyurethane sections are formed, but the two sections of the polymer will be physically interlinked so that they form a single entity. Both components of the core-shell polymer will be crosslinked, so physical interlinking of polymer rings can occur.

3. PHYSICAL AND CHEMICAL PROPERTIES

The polymer is manufactured as an aqueous dispersion and is never isolated. Due to the physical inseparability of the notified acrylic polymer from the polyurethane shell, the measured results are for the entire core-shell structure comprising approximately 25 % (w/v) of the polymer dispersion. The properties reported below are variously those of the polymer dispersion and of the core-shell polymer (notified polymer and polyurethane polymer subject of PLC/177 in a ratio of 40:60), as stated.

Appearance at 20°C	milky white low viscosity liquid with little odour

and 101.3 kPa:

Boiling Point:	100°C (polymer dispersion, based on water)
Specific Gravity:	1136 kg/m^3 (calculated, notified polymer) 1038 kg/m^3 (dispersion)
Water Solubility:	not determined
Particle size:	not applicable; notified polymer is never isolated from dispersion
Partition Co-efficient (n-octanol/water):	not determined
Hydrolysis as a Function of pH:	not determined
Adsorption/Desorption:	not determined
Dissociation Constant:	not determined
Flash Point:	91°C (polymer dispersion, based on a minor solvent component)
Flammability Limits:	not flammable
Autoignition Temperature:	not determined
Explosive Properties:	not explosive
Reactivity/Stability:	stable under normal environmental conditions

3.1. Comments on Physico-Chemical Properties

A water solubility study was not submitted. The notified polymer itself is not expected to be soluble in water, due to the absence of hydrophilic groups attached to the acrylic backbone. The notifier claims that the core-shell polymer is not soluble but is dipersible in water. The amine is used to provide an anionic charge to the polymer surface and as water is added to the polymer salt it coils into a tight particle bearing the surface charge. This charge provides the dispersion stability. As the concentration of water increases, it is claimed the amine prefers to partition to the water and the polymer becomes more water insoluble. The notifier has provided a literature reference (Eisenberg, 1977) that supports this case for the insolubility of the final emulsion polymer.

The polymer contains ester linkages that could be expected to undergo hydrolysis under extreme pH conditions. However, due to the low exposure of the acrylic core of the core-shell polymer to water, this is unlikely in the environmental pH range of between 4 and 9.

The determination of partition coefficient and adsorption/desorption could not be undertaken as the notified polymer is expected to be insoluble in water and will largely partition into n-octanol rather than water, and as the notified polymer is not isolated as a separate entity. Due to its low water solubility, the core-shell polymer is expected to readily bind to soils and sediments as it will become becomes viscous and sticky as the water evaporates.

No dissociation constant data was provided. The notified acrylic polymer contains no functional groups which are likely to dissociate.

4. PURITY OF THE CHEMICAL

Degree of Purity:	40 % on basis of core-shell polymer solids
Maximum Content of Residual Monomers:	residual monomer identities and concentrations have been exempted from publication; concentrations of residual monomers are all below the relevant cutoffs for the notified polymer to be classified as hazardous

5. USE, VOLUME AND FORMULATION

The notified polymer will be used as a component of a waterborne automotive coating for Original Equipment Manufacture (OEM). The coating will be applied by robot or hand spraying prior to the final assembly of the vehicles.

The notified polymer will be imported as part of a core-shell polymer in an aqueous resin dispersion, WR-76-5472, containing 25 % (w/w) core-shell polymer (10 % notified polymer). The resin dispersion will be reformulated at one site in Australia to produce the paint component, containing up to 20 % (w/w) core-shell polymer (8 % notified polymer). The resin dispersion will be imported in 200 L drums. The finished paint will be stored and transported in 200 L drums.

The notifier estimates that the import volume will be up to 6 tonnes notified polymer per annum in the first five years of importation, equivalent to 15 tonnes per annum core-shell polymer.

6. OCCUPATIONAL EXPOSURE

Transport and Storage
Waterfront, transport and warehouse workers are not expected to be exposed to the notified polymer except in the case of an accident involving spillage of the paint or resin solution. Unloading containers will involve 4 – 6 workers for 6 hours per day, 10 days per year. Transport to the reformulation site will involve 4 workers for 4 hours per day, 10 days per year.

Laboratory Development
The notifier indicated that three laboratory workers would be involved in the manufacture and testing of paint. The potential exposure would be for up to 8 hours per day, for up to 80

days per year. Exposure would be by skin contact during the handling of small quantities of the polymer solution and paint. The use of appropriate laboratory ventilation facilities and personal protective equipment such as a laboratory coat and safety glasses would be expected.

Reformulation (Paint Manufacture)
The reformulation of polymer solution into paint components will involve 24 workers for up to 4 hours per day on a daily basis. Three groups of workers will be involved in the process; in paint mixing, quality control and drum filling. The mixers used for preparing the paint will be enclosed and fitted with local exhaust ventilation. Dermal exposure to the polymer will be possible at several points throughout the process; charging the polymer solution into the mixer, removal and testing of quality control samples, and drips and spills during the paint filtration and filling. The formation of aerosols during the high speed mixing will be unlikely because of the viscosity of the mixture.

The mixing and filling will be carried out under local exhaust ventilation to prevent exposure to solvents. Workers will wear impervious gloves, coveralls and goggles, with additional personal protective equipment being used as required.

End Use
The notified polymer will be used at two vehicle manufacturing sites in Australia. The paint will be predominantly applied using a robotic system, but manual touchups will be necessary. The notifier indicates that 6 workers will be involved in adding paint to the circulation tank of the robot spraying system (2 hour per day), and 20 workers will apply the paint by hand spray (8 hours per day). A further 6 workers are expected to be involved in cleaning the spray equipment (2 hours per day). All exposures will be on a daily basis.

The paint containing the notified polymer will be transferred by drum pump from the 200 L drum to a 400 L circulation tank, and then pumped through an enclosed 350 L pipework circulation system. The paint lines will supply both the robotic sprayers and also the manual spray equipment. Robotic spraying will be carried out in a downdraft spray booth, and no worker exposure is expected during the spraying procedure. There is potential for dermal exposure to the notified polymer for workers installing the drum pumps for transfer to the circulation tank.

Paint mixing will be carried out in a ventilated paint kitchen. Workers will wear impervious gloves, anti-static coveralls, anti-static footwear and eye protection. The spraying of the automobile will be carried out in a laminar flow downdraft spray booth which is designed to rapidly remove aerosol particles and solvent vapour from the atmosphere. Workers will wear nylon overalls, calico hoods, nylon gloves and cartridge type respirators while inside the spray booth. Overspray will collect in a pool of water below the grill floor or in a wet scrubber in the exhaust and will be removed with a filter. The residual solids will be disposed of to secure landfill. The spray booths are subject to AS/NZS/4114.1:1995 *Spray Painting Booths – Design, Construction and Testing* (Standards Australia/Standards New Zealand, 1995a) and AS/NZS/4114.1:1995 *Spray Painting Booths – Selection, Installation and Maintenance* (Standards Australia/Standards New Zealand, 1995b). After application of the paint, the automobile will be heated to cure the coating.

Residual paint mixture will be washed from the equipment manually.

Once residual final paint mixture has dried, the notified polymer will be irreversibly bound within the cured matrix and not separately available for either exposure to workers, or for dermal absorption.

7. PUBLIC EXPOSURE

There is little potential for public exposure to the notified polymer arising from paint manufacture, transport, occupational use and disposal. The polymer in the form of uncured paint will remain within the industrial domain.

The notified polymer will enter the public domain only in the form of cured paint films on automobiles. This paint film will contain the polymer in a crosslinked unreactive form which will not be bioavailable.

8. ENVIRONMENTAL EXPOSURE

8.1. Release

There is potential for release of the notified chemical during the paint formulation process at the notifier's plant. The notifier estimates that the total waste produced from spills, drum residues and equipment cleaning will be 4.5 % of the import volume (up to 270 kg per annum). This waste will be collected by licensed waste disposal contractors and incinerated.

The paint is applied to automotive surfaces with approximately 75 % efficiency in spray booths with control measures, such as a filtering system and masking materials, in place. This will result in a release of 25 % (up to 1.5 tonnes per annum) of the polymer as overspray which will also be disposed of by licensed waste disposal contractors and incinerated.

Cleaning of the spray gun and mixing equipment will generate approximately 300 kg per annum of waste that will be collected and disposed of in the same manner as wastewater from the spray booth.

Some residue will also remain in the 'empty' containers after use. It is estimated that 300 kg per annum of the notified polymer, 5 % of the container contents, will remain as residue in the 'empty' import containers.

8.2. Fate

The waste polymer produced during the reformulation process should be destroyed by incineration after collection by licensed waste disposal contractors. However, if any of the polymer was disposed of to landfill it should not be leached out of the soil due to the low water solubility and high molecular weight. It is viscous and sticky when not in the presence of water and excess amine, and should bind to the soils and sediments of the landfill.

In the event of an accidental spillage of the polymer dispersion into the waterways, the polymer will remain suspended in the water fraction until such time as the amine partitions to

the water and the polymer gradually becomes insoluble and drops out of solution due to its high molecular weight. It will eventually become associated with the sediments in the rivers and creek beds or ocean floor.

Once applied to the metal panels of heavy vehicles the notified polymer will be incorporated in a hard, durable, inert film and will not present a significant hazard. Any fragments, chips and flakes of the lacquer will be of little concern as they are expected to be inert. The metal panels 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 steel reclamation, the polymer would be incinerated in the blast furnaces and converted to water vapour and oxides of carbon and nitrogen.

The solid waste generated in the application of the coating will be disposed of by incineration. The 'empty' containers and their residues, which are expected to dry out to a hard inert substance, will also be disposed in this manner. If any of the paint is disposed to landfill, leaching is unlikely, given the expected low solubility of the substance and very high molecular weight. Under these conditions the notified chemical waste would be very slowly degraded to gases such as carbon dioxide through the agency of abiotic and bacteriological processes.

Mixing containers and spray equipment will be washed with solvent that is collected and sent for incineration.

The polymer is not expected to cross biological membranes, due to the anticipated low solubility and high molecular weight, and should not bioaccumulate (Connell, 1990).

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicology data were submitted. Polymers of low reactivity and high molecular weight do not readily cross skin or other biological membranes, and the toxicity of the notified polymer is therefore expected to be low.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were submitted.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The notified polymer crosslinks with other paint components to form a very high molecular weight stable film that adheres firmly to the primer layer to which it is applied. The notified polymer, as part of this surface coating, will share the fate of the vehicle panel. The paint will slowly deteriorate under the action of UV light, but this is not expected to release the polymer over the useful life of the vehicle surfaces. When the vehicle panel is recycled, the notified polymer would be destroyed through incineration.

Overspray will be captured and disposed of by incineration as will paint residues in empty cans and equipment residues. The notifier estimates that a total of approximately 270

kg/annum of the notified polymer will be released to the environment due to the reformulation process and up to 2.1 tonnes/annum from the application process. The paint film will contain the notified polymer as part of a crosslinked polymer matrix. The final fate of the notified polymer will be the same as the final fate of the vehicle. That is either to landfill or to recycling where the polymer will be incinerated to water vapour and oxides of carbon and nitrogen.

In the event of an accidental spillage of the polymer dispersion into the waterways, the polymer will remain suspended in the water fraction until such time as the amine partitions to the water and the polymer gradually becomes insoluble and drops out of solution due to its high molecular weight. It will eventually become associated with the sediments in the rivers and creek beds or ocean floor.

Polymer spilt on land, either during usage or transport, is expected to become immobilised in the soil layer. Contaminated soil can then be collected and disposed of to landfill.

Given the above, environmental exposure and the overall environmental hazard is expected to be low. The notified polymer is not likely to present a hazard to the environment when it is stored, transported and used in the typical manner.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The notified polymer will not be introduced in isolation, but always as a component of a core-shell polymer, including a polyurethane component which is the subject of a concurrent notification, PLC/177. The polyurethane and acrylic polymers will not be chemically connected, but will be physically interlinked and therefore inseparable.

No toxicological information has been provided for the notified polymer and therefore the substance cannot be assessed against the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999b). The polymer dispersion WR-76-5472 is not a hazardous substance. The Material Safety Data Sheet (MSDS) for the polymer solution WR-76-5472 lists a number of potential health effects, namely nausea, vomiting and skin, eye and respiratory irritation. These relate mainly to the co-solvents, 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 paint components containing this polymer. There will be exposure during the local production of the paint components, and in the use and disposal of the paints.

During the reformulation processes, the main exposure route for the notified polymer will be dermal. The polymer is not expected to be hazardous by dermal exposure as the high molecular weight will preclude absorption through the skin. Standard protective measures used during reformulation and end use should provide sufficient protection against the notified polymer.

The final paint mix, including the pre-prepared paint containing the notified polymer at up to 8 %, could contain a wide variety of additional ingredients, which may have human health

implications, once fully mixed. The spraying procedure also produces a dense aerosol of paint particles which would adversely affect human health even in the absence of additional hazardous components. It is also probable that professionals involved in the spray painting industry will use a number of different paint formulations.

For these reasons, the notified polymer must be assessed for the contribution it makes to the hazards associated with use of the spray paints. The presence of many potential and actual hazardous substances in the formulations requires the use of stringent engineering controls, such as a correctly constructed and maintained spray booth, and of a high level of personal protective equipment, such as impermeable overalls and gloves and a full face shield and respirator. The use of the paint containing the notified polymer should be in accordance with the NOHSC *National Guidance Material for Spray Painting* (NOHSC, 1999c). The level of protection from exposure afforded by the standard protective measures will provide adequate protection from the notified polymer, which is likely to be less intrinsically toxic than most of the solvents, pigments and other paint resins.

Once the applied final paint mix has hardened, the polymer will not be separately available for exposure or absorption.

Similar considerations apply in the disposal of the polymer. The wastes containing the notified polymer may be hazardous substances on the basis of the solvent and other resin content, and the precautions used on the basis of these additional materials should be adequate for protection from the notified polymer. In addition, much of the polymer will be crosslinked, hardened and immobilised by the time of disposal.

The notified polymer presents a low hazard to human health, and the control measures required due to the more hazardous components of the products containing the notified polymer will ensure sufficient protection against the notified polymer itself.

Public Health
The public will come into contact with the notified polymer after it has been applied to and becomes an integral part of a hard durable coating on motor vehicles. This coating is formed by the reaction of the notified polymer and others in the paint with a cross-linking resin under the action of heat to form a very high molecular weight stable paint film. Therefore the risk to the public induced by the notified polymer is considered to be low.

Based on the above information, it is considered that Acrylic Polymer in Polyurethane-Acrylic Dispersion Resin WR-76-5472 will not pose a significant hazard to public health when used in the proposed manner.

13. RECOMMENDATIONS

To minimise occupational exposure to Acrylic Polymer in Polyurethane-Acrylic Dispersion Resin WR-76-5472 the following guidelines and precautions should be observed:

- Use of the paint containing the notified polymer by spray application should be in accordance with the NOHSC *National Guidance Material for Spray Painting* (NOHSC, 1999c);

- Employers should ensure that NOHSC exposure standards for all of the components of the final paint mix are not exceeded in the workplace;

- Safety goggles, chemical resistant industrial clothing and footwear and impermeable gloves should be used during occupational use of the products containing the notified polymer; where engineering controls and work practices do not reduce vapour and particulate exposure to safe levels, an air fed respirator should also be used;

- 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.

If products containing the notified chemical are hazardous to health in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999b), workplace practices and control procedures consistent with State and territory hazardous substances regulations must be in operation.

Guidance in selection of goggles may be obtained from Australian Standard (AS) 1336 (Standards Australia, 1994) and Australian/New Zealand Standard (AS/NZS) 1337 (Standards Australia/Standards New Zealand, 1992); for industrial clothing, guidance may be found in AS 3765.2 (Standards Australia, 1990); for impermeable gloves or mittens, in AS 2161.2 (Standards Australia/ Standards New Zealand, 1998); for occupational footwear, in AS/NZS 2210 (Standards Australia/ Standards New Zealand, 1994a); for respirators, in AS/NZS 1715 (Standards Australia/ Standards New Zealand, 1994b) and AS/NZS 1716 (Standards Australia/ Standards New Zealand, 1994c).

14. MATERIAL SAFETY DATA SHEET

The MSDS for the notified chemical was provided in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 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, the director must be informed if any of the circumstances stipulated under subsection 64(2) of the Act arise, and secondary notification of the notified chemical may be required. Secondary notification may also be required if the notified polymer is introduced in a form other than the core-shell polymer including the polymer assessed as PLC/177. No other specific conditions are prescribed.

16. REFERENCES

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