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March 1999

**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION  
AND ASSESSMENT SCHEME**

**FULL PUBLIC REPORT**

**Polymer in Polyester Resin HP-16-3471**

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Director  
Chemicals Notification and Assessment

**FULL PUBLIC REPORT****Polymer in Polyester Resin HP-16-3471****1. APPLICANT**

PPG Industries Australia Pty Ltd of McNaughton Rd, CLAYTON, VIC 3169 has submitted a limited notification statement in support of their application for an assessment certificate for Polymer in Polyester Resin HP-16-3471.

**2. IDENTITY OF THE CHEMICAL**

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

**Trade Name:** Polyester Resin HP-16-3471

**Method of Detection and Determination:** The polymer is characterised by GPC and identified by IR spectroscopy. A reference spectrum has been provided.

**3. PHYSICAL AND CHEMICAL PROPERTIES**

The polymer is manufactured as a 90 % (w/w) solution in methyl amyl ketone (MAK) and xylene. It is never isolated. The properties reported below are variously those of the polymer solution and of the notified polymer, as stated.

**Appearance at 20°C and 101.3 kPa:** Colourless viscous liquid

**Boiling Point:** 138-152°C for the solution; the polymer is not expected to be volatile

**Specific Gravity:** 1.02 for the solution; 1.05 (calculated) for the polymer

**Vapour Pressure:** 1.0 kPa at 20°C (for the solvent xylene)

<b>Water Solubility:</b>	< 34 g/L at 25°C
<b>Hydrolysis as a Function of pH:</b>	No groups are expected to be hydrolysed under normal environmental conditions
<b>Partition Co-efficient (n-octanol/water):</b>	Not determined (see below)
<b>Adsorption/Desorption:</b>	Not determined (see below)
<b>Dissociation Constant:</b>	Not determined (see below)
<b>Particle Size:</b>	Not applicable as the polymer is not isolated from solution
<b>Flash Point:</b>	25°C for the solution
<b>Flammability Limits:</b>	Upper Explosive Limit = 7.9 % Lower Explosive Limit = 1 % (for the solvent MAK)
<b>Autoignition Temperature:</b>	393°C for the solution (similar to the solvent MAK)
<b>Explosive Properties:</b>	The polymer is not expected to be explosive
<b>Reactivity/Stability:</b>	The polymer is expected to be stable

### **Comments on Physico-Chemical Properties**

The polymer is not isolated as a defined entity and the data provided was for a 90% polymer solution in the solvent system.

The notifier claims that by analogy with similar polymers, the polymer is not expected to be volatile under the conditions of use. The polymer solution is also expected to boil at the temperature of the solvent, while the vapour pressure of the polymer is predicted to be very low with the value provided being that of the solvent (xylene).

The water solubility was determined to have an upper limit of 3.4% (34 g/L) (during measurement the aqueous phase was slightly turbid at this point). It would appear that this relatively high water solubility reflects polar lower molecular weight oligomers which would cross-link during the curing process.

The polymer contains ester linkages that could be expected to undergo hydrolysis under extreme pH conditions although hydrolysis is unlikely in the environmental pH range of between 4 and 9.

The notified polymer is expected to largely partition into n-octanol rather than water. Due to its high molecular weight, the polymer is expected to become associated with the organic component of soils and sediments.

No dissociation constant data was provided as the notifier claims that the polymer has no units likely to dissociate; it is likely however that a quite large proportion of free carboxylic acid groups will be present at some of the chain terminations. These would be expected to have a  $pK_a$  in the range 4-5.

The polymer would be expected to be combustible, however, the polymer solution is flammable due to the solvent content, and is classified as a Class 3 dangerous good.

#### 4. PURITY OF THE CHEMICAL

**Degree of Purity:** Up to 30 % in pre-prepared paints; resin solution contains 90 % in mixed solvents

**Maximum Content of Residual Monomers:** All residual monomers are present at well below 0.1 %, and all are present at below the cutoff levels for classification of the polymer as hazardous.

**Toxic or Hazardous Impurities:** none

#### Additives/Adjuvants:

*Chemical name:* methyl amyl ketone (MAK)

*CAS No.:* 110-43-0

*Weight percentage:* < 10 %, exact concentration confidential

*Toxic properties:* R22 Harmful if swallowed  
NOHSC exposure standard 50 ppm TWA

*Chemical name:* xylene (mixed isomers)

*CAS No.:* 1330-20-7

*Weight percentage:* < 10 %, exact concentration confidential

*Toxic properties:* R20/21 Harmful by inhalation and in contact with skin  
R38 Irritating to skin  
NOHSC exposure standard 80 ppm TWA, 150 ppm STEL

## 5. USE, VOLUME AND FORMULATION

The notified polymer will initially be imported in pre-prepared paints, and will have a large number of adjuvants such as stabilisers, pigments and solvents.

The notified polymer will initially be imported as a component in an automotive refinish coating at up to 30 % (w/w). It will be imported at a volume of 1 to 10 tonnes of polymer in the first year. The polymer solution, HP-16-3471, containing 90 % (w/w) notified polymer will later be imported for local reformulation into coatings. The polymer solution may also be manufactured locally at some later date. After the first year, the import or manufacture volume is expected to be in the range of 100 – 500 tonnes per annum.

## 6. OCCUPATIONAL EXPOSURE

Pre-prepared paints containing the notified polymer will be imported in 1, 3.5 and 20 L tins. The notifier has provided no detail on the type of packaging for the overall shipment of imported individual containers or the handling involved in breaking up the shipment into individual containers for dispatch to the customer sites. The individual product containers are not expected to be opened before arrival at the end use site and the likelihood of a spill is low.

The polymer solution, HP-16-3471, will initially be imported in 200 L steel drums. At a later date, this polymer solution may be locally manufactured then transferred for reformulation in 200 L steel drums.

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.

The laboratory development, polymer manufacture and reformulation into coatings, along with the warehouse storage, will all be carried out at a single site within Australia.

### *Laboratory Development*

The notifier indicated that 3 laboratory workers would be involved in trials for the manufacture of the polymer and the manufacture and testing of paint. The potential exposure would be for up to 8 hours per day, for up to 20 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.

### *Polymer Manufacture*

The polymer manufacture, when commenced, will involve 9 workers for up to 8 hours per day, 10 days per year. The reactants and solvents will be added to an enclosed reactor, and the resultant polymer solution will be filtered and filled into 200 L steel drums. During the filling process, there is potential for dermal exposure to the polymer solution in the form of

drips and spills. As the polymer solution will be viscous, the formation of aerosols is unlikely.

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

#### *Reformulation (Paint Manufacture)*

The reformulation of polymer solution into paint components, when commenced, will involve 9 workers for up to 8 hours per day, 30 days per year. Three groups of workers will be involved in the process; in paint mixing, quality control and drum or can 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 the solvents. Workers will wear impervious gloves, coveralls and goggles, with additional personal protective equipment being used as required.

#### *End Use*

The notifier estimates that as many as 6000 spray painters in up to 3000 establishments across Australia could be exposed to the notified polymer. The exposure is estimated to be for up to 4 hours per day, for up to 220 days per year.

The spray painters who will be exposed to the notified chemical will be fully TAFE trained. Typically the spray painter will measure the appropriate amounts of the different components required in a particular formulation into an open container and pour this mixture into a spray gun. 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. Several possible booth designs may be used. In a dry floor booth, the overspray will be collected in filters contained in the floor of the booth; any unremoved particulates will reach the exhaust stack with the solvent vapours. In a wet floor 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* and AS/NZS/4114.1:1995 *Spray Painting Booths – Selection, Installation and Maintenance*. After application of the paint, the automobile may be heated to cure the coating.

Residual paint mixture will be washed from the equipment manually, using recycled paint solvent, and the washings will be disposed of by solvent recyclers.

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.

Spray painters will wear appropriate personal protective equipment at all times; impervious gloves and anti-static flame retardant overalls while mixing the paint, and, in addition, a full face shield and respirator conforming to AS/NZS1715 and AS/1716 while inside the spray booth.

## **7. PUBLIC EXPOSURE**

There is little potential for public exposure to the notified polymer arising from manufacture, transport, occupational use and disposal. In the event of an accidental spill, the polymer will remain part of the paint, which the notifier states should be scraped up and placed in suitable containers for disposal. The polymer would not be expected to partition into the aqueous compartment, but rather to associate with the sediments, as detailed below. Waste from the industrial use of the polymer will be disposed of through a licensed waste disposal contractor in approved landfill. The polymer in the form of uncured paint will therefore remain within the industrial domain, and public exposure due to the environmental spread of the polymer is unlikely.

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**

### **Release**

There is potential for release during the polymer manufacture, the coating formulation and the coating application. The manufacturing and formulation processes (when commenced) will take place at the notifier's plant and any spills that occur will be contained by the plant bunding. The paint is applied to motor vehicles with approximately 30% efficiency in a spray booth with control measures, such as a filtering system and masking materials, in place. Cleaning of the spray gun and mixing equipment will generate waste that will be collected and disposed of in the same manner as wastewater from the spray booth.

During the manufacturing and formulation processes, the notifier estimates that up to 10 tonnes per year of waste polymer would be generated at the manufacturer's plant. During coating application it is expected that 7 tonnes of polymer waste during the first year and 70 tonnes of waste during subsequent years will be produced.

Some residue (an estimated 2 % of the container contents) will also remain in the ‘empty’ containers after use. Up to 200 kg in the first year and 2000 kg annually in the subsequent years will remain as residue in the containers.

### **Fate**

The polymer, as part of an inert, fully cured automotive surface coating, will share the fate of the vehicle panel, potentially being recycled as scrap. Incineration of the coating would emit noxious fumes including oxides of carbon.

The solid waste generated in the manufacturing, formulation and application of the coating will be disposed of to landfill (although incineration is an option). It is likely that the polymer is recovered as an insoluble solid from the wastewater used for cleaning and also disposed of to landfill. The containers and their residue will also be disposed of in this manner. Leaching of the polymer from landfill from these sites is unlikely, given the low solubility of the substance.

The polymer is not expected to cross biological membranes, due to the low solubility and high molecular weight, and as such should not bioaccumulate (Connell, 1989).

## **9. EVALUATION OF TOXICOLOGICAL DATA**

No toxicology data were submitted, which is acceptable for a limited notification of a polymer with NAMW > 1000. The polymer is stable with low volatility. Polymers of high molecular weight and low water solubility do not readily cross biological membranes. The notifier states that no occupational or public health issues have been reported for polymers of similar composition in Australia.

## **10. ASSESSMENT OF ENVIRONMENTAL EFFECTS**

No ecotoxicological data were provided, which is acceptable for a limited notification of a polymer with NAMW > 1000.

## **11. ASSESSMENT OF ENVIRONMENTAL HAZARD**

Despite the relatively high proportion of low molecular weight species, the polymer should not present a high environmental hazard. The polymer cross-links with other coating components to form a very high molecular weight and stable film that adheres firmly to the primer layer to which it is applied. The polymer, as part of this surface coating, will therefore share the fate of the vehicle panel. The coating will slowly deteriorate under the action of UV light, but this is negligible over the life of the motor vehicle. When the vehicle panel is recycled, the polymer would be destroyed through incineration.

The majority of notified polymer associated with waste from the application of the coating to the automotive surface should not enter the environment until it is disposed of to landfill. Movement of the polymer by leaching from landfill sites is not expected because of its lack of mobility due to either its low water solubility and high binding affinity to soil or cross-linking in the cured coating.

In the event of accidental spillage of the polymer solution into waterways, the polymer is not expected to disperse into the water, but settle out onto sediments. If the polymer is spilt on land, either during usage or transport, it is expected that the polymer would 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.

## **12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS**

On the information available, the notified polymer cannot be classified as a hazardous substance according to the NOHSC *Approved Criteria for Classifying Hazardous Substances* (National Occupational Health and Safety Commission, 1994b). However, the polymer solution HP-16-3471 is a Class 3 dangerous good (flammable liquid) because of the solvent content (MAK and xylene). The MSDS for the polymer solution HP-16-3471 lists a number of potential health effects, namely nausea, vomiting, skin, eye and respiratory irritation, central nervous system depression and chronic central nervous system disorders. These relate mainly to the solvent, xylene, and to a lesser extent MAK, 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 manufacture and reformulation of the polymer and during the local production of the paint components (when commenced), and in the use and disposal of the paints.

During the manufacture and reformulation processes, the main exposure route for the notified polymer will be dermal. The paints and polymer solutions will be viscous, and ready formation of aerosols is not expected. The polymer is not expected to be hazardous by dermal exposure as the high molecular weight will preclude absorption through the skin. The notified polymer does, however, contain a relatively high proportion of low molecular weight species that could potentially be absorbed. Protective measures used to prevent exposure to the hazardous solvents should provide sufficient protection against the notified polymer.

The final paint mix, including the pre-prepared paint containing the notified polymer, could contain a wide variety of additional ingredients once fully mixed. This is likely to introduce

human health hazards because, apart from a range of potentially toxic solvents, there may be components containing resins with pendant isocyanate groups. 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 *Draft National Code of Practice for Spray Painting* (National Occupational Health and Safety Commission, 1991). 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.

There are NOHSC exposure standards for xylene and methyl amyl ketone, identified as ingredients in the polymer solution HP-16-3471. The employer is responsible for ensuring that these exposure standards, and exposure standards pertaining to other final paint mix additives, are not exceeded in the workplace.

The paint components containing the notified polymer are flammable due to their solvent content. Precautions must be taken to avoid sources of ignition, e.g. use of earthing leads. Operators should wear antistatic overalls and footwear.

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.

#### *Public Health*

There is negligible potential for public exposure to the notified polymer arising from use in paints. There may be public contact with the notified polymer on the painted surfaces of motor vehicles, but its adhesion to the substrate and the physico-chemical properties of the cured paint will be sufficient to preclude absorption across the skin or other biological membranes. Therefore, based on its use pattern and physico-chemical characteristics, the notified polymer will not pose a significant hazard to public health.

### **13. RECOMMENDATIONS**

To minimise occupational exposure to HP-16-3471 the following guidelines and precautions should be observed:

- 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 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 3765.2 (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, 1994a).

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

Connell D. W. (1989) General characteristics of organic compounds which exhibit bioaccumulation. In Connell D. W., (Ed) Bioaccumulation of Xenobiotic Compounds. CRC Press, Boca Raton, USA.

National Occupational Health and Safety Commission (1991) Draft National Code of Practice for Spray Painting. Australian Government Publishing Service, Canberra.

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National Occupational Health and Safety Commission (1994b) Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1994)]. Australian Government Publishing Service, Canberra.

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

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

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