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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Polymer in Acrylic Resins HC-12-3791 and HC-99-8373

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Polymer in Acrylic Resins HC-12-3791 and HC-99-8373

1. APPLICANT

PPG Industries Australia Pty Ltd of McNaughton Road, Clayton, Victoria 3169 has submitted a notification statement in support of their application for an assessment certificate for the polymer in Acrylic Resins HC-12-3791 and HC-99-8373.

2. IDENTITY OF THE CHEMICAL

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

The acrylic resin solutions HC-12-3791 and HC-99-8373 both contain the notified polymer, although its molecular weight is slightly different in each case. They share similar physico-chemical properties.

Marketing name:	Acrylic resin HC-12-3791 Acrylic resin HC-99-8373

3. PHYSICAL AND CHEMICAL PROPERTIES

There are very limited data available on the physical and chemical properties of the notified polymer itself due to the polymer not being isolated from the *in situ* manufactured acrylic resin solution which contains the solvents n-butyl acetate and aromatic hydrocarbons. The data presented are for the >60% polymer solutions Acrylic Resin HC-12-3791 and Acrylic Resin HC-99-8373.

Appearance at 20°C and 101.3 kPa:	each acrylic resin solution is a colourless, viscous liquid
Boiling Point:	approximately 126-181°C; see comments below
Specific Gravity:	polymer solution = 1.02 (1.08 calculated for polymer)
Vapour Pressure:	polymer solution = 2kPa (for n-butyl acetate); see comments below

Water Solubility:	estimated to be <1 mg/L; see comments below
Partition Co-efficient (n-octanol/water):	no data presented; see comments below
Hydrolysis as a Function of pH:	no data presented; see comments below
Adsorption/Desorption:	no data presented; see comments below
Dissociation Constant:	no data presented
Particle Size:	not applicable as polymer never isolated from solvent solution
Flash Point:	polymer solution = 23°C
Flammability Limits:	similar to those for the solvent n-butyl acetate (1.7-7.6%); see comments below polymer combustible
Autoignition Temperature:	425°C (based on solvent n-butyl acetate); see comments below
Explosive Properties:	polymer expected to be stable under normal use conditions
Reactivity/Stability:	stable at ambient/room temperatures; will react with oxidising agents

Comments on Physico-Chemical Properties

The notified polymer is never isolated. It is synthesised in solution forming a clear, viscous liquid. The solvents are n-butyl acetate and light aromatic solvent naphtha.

The boiling and melting points of the resin solutions were not determined. By analogy with similar polymers and also considering the high molecular weight, the notified polymer would not be volatile under the conditions of use. The resin solutions are expected to boil in the range of the constituent solvents, n-butyl acetate and light aromatic solvent naphtha (126-181°C).

No vapour pressure data for the polymer were presented. The polymer is expected to have low vapour pressure, by analogy with similar polymers, and exhibit negligible release to the atmosphere. For the acrylic resin solutions, the vapour pressure would be similar to that of the n-butyl acetate solvent (i.e. 2kPa at 25°C).

Water solubility was not determined, however, the notifier refers to published data for similar polymers and estimates that the solubility will be negligible. because it is non-ionic, of high molecular weight and contains a high level of hydrophobic (aliphatic and aromatic) groups.

In addition, the notified polymer is unlikely to be released to the aquatic environment during normal use as it is converted into an inert coating of very high molecular weight during the drying process.

The determination of a partition coefficient could not be undertaken as the notified polymer is expected to be insoluble in water.

No hydrolysis data were available for the notified polymer. As the polymer contains ester groups there is potential for hydrolysis under extreme pH, but this is unlikely at environmental pH (4-9) because of the expected low water solubility.

No adsorption/desorption data were available for the notified polymer. As solvent evaporates from the polymer solution it becomes more viscous and sticky and should readily bind to soil and sediment. Since it is of high molecular weight it is not expected to cross biological membranes and will not bioaccumulate.

Flammability limits, autoignition temperature and explosive properties were not available for the notified polymer. Data presented above correspond to the resin solutions, which were assumed to be similar to those for the solvent n-butyl acetate. The resin solutions are flammable but expected to be stable under normal use conditions.

The polymer contains hydroxyl functional groups, which enable it to cross-link with other polymeric substances in the paint to form a very stable, high molecular weight paint film that adheres firmly to the primer layer to which it is applied. There is no loss of monomers during the life of a coating. These functional groups are not biologically active and biological or UV-degradation of the polymer, whether in solution or as a dry paint film, is likely to be extremely slow.

4. PURITY OF THE CHEMICAL

The notified polymer is dissolved in the solvents n-butyl acetate and light aromatic solvent naphtha at a concentration of greater than 60% by weight. Any impurities, including the residual monomers, are at low concentrations.

Toxic or Hazardous Impurities:

Chemical name:	n-butyl acetate
CAS No.:	123-86-4
Weight percentage:	<30%, exact concentration confidential
Hazardous properties:	NOHSC time weighted average exposure standard of 150 ppm (713 mg/m^3); short term exposure limit of 200 ppm (950 mg/m^3) based on eye, nose and throat irritation reported in humans (ACGIH 1991)

Chemical name:	solvent naphtha, petroleum, light aromatic
CAS No.:	64742-95-6
Weight percentage:	<10%, exact concentration confidential
Hazardous properties:	NOHSC 1999 *List of Designated Hazardous Substances:* Harmful: may cause lung damage if swallowed (R65)

5. USE, VOLUME AND FORMULATION

The notified polymer is to be used as a resin in automotive refinish coatings. In the first two years it will be imported as a component of paint solutions, but it is expected that after two years the polymer will either be imported or manufactured locally (i.e. at the PPG Australia resin plant) for reformulation into paint. During manufacture, the polymer is synthesised in solution forming a clear, viscous liquid.

The acrylic resin solutions are reformulated into paints containing polymer at concentrations of up to 35% by weight.

The estimated import volume (combined) is 1-10 tonnes for the first year and 100-500 tonnes for each of the next four years. Resin solutions and reformulated paint products will be stored at the PPG warehouse, before distribution to customers. Resin solutions will be stored in 200 litre steel drums and paints will be stored in tinplate paint cans and pails of 1, 3.5, 5 and 20 litre capacities. Transportation of paint cans to distributors throughout Australia will be via road.

Paints containing the polymer will also be exported during the first five years. Export of up to 80% of the polymer as paint is anticipated after year 2.

6. OCCUPATIONAL EXPOSURE

According to the notifier, four main groups of workers will be exposed to the polymer, those involved in :

1. laboratory development;
2. resin manufacture;
3. paint manufacture; and
4. paint application .

For each group, the most likely means of exposure to the polymer and its solutions will be skin contact. Inhalation of the polymer (in aerosol form) is unlikely due to the viscous nature of the polymer solution and the expected low vapour pressure of the resin.

Laboratory development
Group 1 workers (approximately 6) will be involved in small scale manufacturing of polymer

and paint, as well as product testing. The maximum extent of exposure for an individual is expected to be 8 hours per day for 10-20 days each year.

Paint testing is to be performed in a ventilated spray booth equipped with a fume extraction system. Spills may occur during the mixing, gun filling and spraying stages. The minimum protective clothing issued to workers involved in the handling of polymer solution and paint, includes impervious gloves, coveralls and goggles.

Polymer manufacture
Group 2 workers (approximately 9) will be involved in sampling and testing of polymer from the reaction vessel, as well as the filling of polymer drums, post synthesis. The maximum extent of exposure for an individual is expected to be 8 hours per day for 10 days each year.

Reformulation (Paint manufacture)
Group 3 workers (approximately 9) will be involved in paint preparation, QC testing and the filling of paint drums. The maximum extent of exposure for an individual is expected to be 8 hours per day for 30 days each year.

At the PPG facility there are procedures for controlling the exposure of workers (Groups 2 and 3) to the polymer and solutions. For the resin synthesis, reactants and solvents are charged to a closed reactor system. Paint manufacture employs high speed mixers fitted with exhaust ventilation to capture volatiles at the source. Both polymer solution and paint are filled into containers under local exhaust ventilation that captures vapours. A regular maintenance program is carried out and includes measurement of air flows at determined intervals. Any spills that occur during the blending, batching and filling are contained to the plant through existing bunding. Spills are absorbed with sand, soil or a suitable inert absorbent and workers wear protective equipment for eye, skin and respiratory protection. The absorbed material is collected and sealed in properly labelled containers and disposed of according to local waste management regulations.

Paint application
Group 4 workers (approximately 6 000) will be involved in the activation, thinning and application of the paint products and cleaning of spray equipment. The maximum extent of exposure for an individual is expected to be 4 hours per day for 220 days each year. Training courses are run for end users on the correct way to handle, apply and dispose of coating chemicals.

Prevention of exposure during paint application is achieved through a combination of engineering controls, personnel protective equipment and training courses. When handling open cans of paint, operators must be protected by anti-static flame retardant overalls, anti-static footware, impervious gloves and eye protection conforming to Australian Standard AS/NZS 2161.2 and AS/NZS 1337 respectively. (Standards Australia/Standards New Zealand, 1998, Standards Australia//Standards New Zealand, 1992). Paint mixing and spraying is performed in a well ventilated, down draft spray booth with a minimum volume of four air changes per minute.

Typically, 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* (Standards Australia/Standards New Zealand, 1995). After application of the paint, the automobile will be heated to cure the coating.

Solvent in the ventilation system is vented via a stack to the atmosphere. Overspray is trapped in the spray booth or on masking materials such as kraft and newspaper. The spray painter wears an air-fed breathing mask conforming to AS/NZS 1715 and AS/NZS 1716 (Standards Australia/Standards New Zealand, 1994a, b), in addition to the clothing specified above.

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

The notified polymer in acrylic resins HC-12-3791 and HC-99-8373 will only be used in automobile coatings. Paint containing the polymer (up to 35% by weight) will only be applied by professional spray painters. Although members of the public will make dermal contact with automobiles coated with paints containing the notified polymer, exposure will be negligible because of high molecular weight (>1000) and the cured state of the polymer in the coatings.

8. ENVIRONMENTAL EXPOSURE

Release

There is potential for release during the polymer manufacture and paint formulation and application. The manufacturing and formulation processes will take place at the PPG 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 PPG plant. During coating application it is expected that 7 tonnes of polymer waste during the first year and 70 tonnes of waste per year during subsequent years will be produced.

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

Fate

Once applied to the metal panels of vehicles the notified polymer will be incorporated in a hard, durable, inert film and will not present a significant hazard. Any fragments, chips or 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. In steel recycling, the polymer will be destroyed in the blast furnaces and converted to water vapour and oxides of carbon.

The solid waste generated in the manufacture, formulation and application of the coating will be disposed of to landfill (although incineration is an option). It is assumed that the polymer is recovered as an insoluble solid from the cleaning wastewater 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 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 should not bioaccumulate (Connell, 1989).

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological data were provided for the notified polymer. This is acceptable for polymers of NAMW greater than 1 000.

MSDS for Acrylic Resin HC-12-3791 and Acrylic Resin HC-99-8373, were included in the notification dossier. Toxicological and health hazard information on the solvents, n-butyl acetate and light aromatic solvent naphtha and each resin solution were provided. It is likely that these are solvents would be the principal toxic agents in the resin solutions.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided. This acceptable for polymers of NAMW greater than 1000.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The polymer cross-links with other paint 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 is part of the surface coating and will share the fate of the vehicle panel. The paint will slowly deteriorate under the action of UV light, but deteriorisation would be negligible over the life of the motor vehicle. When the vehicle panel is recycled, the polymer will 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 the 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 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 of the notified polymer are 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.

The notified polymer itself is unlikely to be a hazardous substance under the National Occupational Health and Safety Commission *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999b). It is unlikely to cause systemic toxicity because it is essentially unable to traverse biological membranes because of the high molecular weight. In addition, the concentration of residual monomers is low and they are unlikely to cause health effects.

The acrylic resin solutions HC-12-3791 and HC-99-8373 are both Class 3 (flammable) dangerous goods. The solutions are not hazardous substances, however the MSDS list a number of health effects, including toxic and irritant effects that are believed to relate to the organic solvents (n-butyl acetate and light aromatic solvent naphtha), rather than the polymer itself.

The types and prevalence of injuries and diseases relating to workers exposed to the notified polymer and its corresponding solutions were not available. No adverse health effects (symptoms) are known for the polymer itself. When part of an inert fully cured paint film, the notified polymer will not be available for exposure or absorption and, therefore, is not considered to be a risk to human health.

Occupational Health and Safety

There is little potential for exposure to the notified polymer in the transport and storage of the paint components. There will be exposure during the manufacture and reformulation of the polymer and during the local production of the paint components (when commenced), as well as 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 polymer is expected to have low vapour pressure. The paints and polymer solutions will be viscous, and 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 and the concentration of residual monomers is low. Protective measures used to prevent exposure to the hazardous solvents should provide sufficient protection against the notified polymer.

The greatest occupational exposure associated with the notified polymer will come from the use and disposal of the paints containing the polymers. The presence of hazardous substances, including solvents, pigments and other paint resin, in such 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 any paint containing Acrylic Resins HC-12-3791 and HC-99-8373 should be in accordance with the National Occupational Health and Safety Commission *Draft National Code of Practice for Spray Painting* (NOHSC, 1991).

The notifier has indicated that all paint applications will occur in a well ventilated, down draft spray booth, with a minimum four air changes per minute. Paint over-spray will be trapped onto spraybooth masking materials and solvent will be ventilated via a stack into the atmosphere. Given these measures, standard personal protective equipment will provide an adequate level of protection from the notified polymer, which is likely to be less intrinsically toxic than most of the other substances involved.

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

In the event of a spill of resin solution or paint the notified polymer will remain part of the resin or paint and become attached to a solid absorbent (e.g. soil, sand or other inert material). The material can be collected and sealed in a suitable vessel for disposal. The MSDS explains the recommended clean-up procedures. All ignition sources (e.g. earthing leads) should be extinguished.

There is an NOHSC exposure standard for n-butyl acetate (NOHSC, 1995). The employer is responsible for ensuring that this exposure standard, and exposure standards pertaining to other final paint mix additives, are not exceeded in the workplace.

Public Health

As part of a fully cured paint film, the notified polymer is of negligible risk to humans. Based on the intended use pattern and its physico-chemical properties, the notified polymer in acrylic resins HC-12-3791 and HC-99-8373 does not appear to pose a significant hazard to public health.

13. RECOMMENDATIONS

To minimise occupational exposure to the polymer in Acrylic Resins HC-12-3791 and HC-99-8373, the following guidelines and precautions should be observed:

- Safety goggles should be selected and fitted in accordance with Australian Standard AS 1336 (Standards Australia, 1994) to comply with Australian/New Zealand Standard AS/NZS 1337 (Standards Australia/Standards New Zealand, 1992);

- Industrial clothing should conform to the specifications detailed in AS 2919 (Standards Australia, 1987) and AS 3765.1 (Standards Australia, 1990);

- Impermeable gloves should conform to AS/NZS 2161.2 (Standards Australia/Standards New Zealand, 1998);
- All occupational footwear should conform to AS/NZS 2210 (Standards Australia/Standards New Zealand, 1994c);
- Respirators should conform to AS 1715 and AS 1716 (Standards Australia/Standards New Zealand, 1994a,b);
- Spray booths should conform to AS/NZS 4114 (Standards Australia/Standards New Zealand, 1995);
- The NOHSC exposure standard for n-butyl acetate should not be exceeded in the workplace;
- Spillage of the notified chemical should be avoided; spillages should be cleaned up promptly with absorbents which should be put into containers for disposal;
- Good personal hygiene should be practised to minimise the potential for ingestion;
- A copy of the appropriate MSDS should be easily accessible to employees .

14. MATERIAL SAFETY DATA SHEET

The MSDS for Acrylic Resin HC-12-3791 and Acrylic Resin HC-99-8373 were provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 1994c).

The MSDS were provided by the applicant as part of the notification statement. They are reproduced here as a matter of public record. The accuracy of the 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

ACGIH (1991) Documentation of the Threshold Limit Values and Biological Exposure Indices, 6th ed (1997 Supplement). Cincinnati, American Conference of Governmental Industrial Hygienists (ACGIH).

Commonwealth of Australia (7th April, 1998) *Chemical Gazette* **No. C4**, 36-59.

Connell DW (1989) General characteristics of organic compounds which exhibit bioaccumulation. In Connell DW (ed.), *Bioaccumulation of Xenobiotic Compounds*. CRC Press, Boca Raton, USA.

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

National Occupational Health and Safety Commission (NOHSC, 1999a) *List of Designated Hazardous Substances* [NOHSC:10005(1999)]. Australian Government Publishing Service, Canberra. (in press)

National Occupational Health and Safety Commission (NOHSC, 1999b) *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(1999)]. Canberra, Australian Government Publishing Service. (in press)

National Occupational Health and Safety Commission (NOHSC, 1995) Adopted National exposure Standards for Atmospheric Contaminants in the Occupational Environment, [NOHSC:1003(1995)]. In Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards, Canberra Australian Government Publishing Service.

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

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

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

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

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

Standards Australia/Standards New Zealand (1994a) Australian/New Zealand Standard 1715-1994, Australian/New Zealand Standards for the Selection, Use and Maintenance of Respiratory Protective Devices. Sydney/Wellington, Standards Australia and Standards New Zealand.

Standards Australia/Standards New Zealand (1994b) Australian/New Zealand Standard 1716-1994, Australian/New Zealand Standard Respiratory Protective Devices. Sydney/Wellington, Standards Australia and Standards New Zealand.

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

Standards Australia/Standards New Zealand (1995) Australian/New Zealand Standard 4114-1995, *Spray Painting Booths*. Sydney/Wellington, Standards Australia and Standards New Zealand.

Standards Australia/Standards New Zealand (1998) Australian/New Zealand Standard 2161.2-1998, Australian/New Zealand Standard Occupational Protective Gloves Part 2: General Requirements. Sydney/Wellington, Standards Australia and Standards New Zealand.