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October 1999

**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

RC0888 Polymer

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT**RC0888 Polymer****1. APPLICANT**

Courtaulds (Australia) Pty Ltd of 51 M^cIntyre Road SUNSHINE VIC 3020 has submitted a limited notification statement in support of their application for an assessment certificate for RC0888 Polymer.

2. IDENTITY OF THE CHEMICAL

The following requests for exempt information were accepted: chemical name, CAS No., molecular and structural formulae, constituents, exact use and import volume.

Other Names: Acrylic RC0888

Trade Name: the polymer will be manufactured as a 37% (w/w) solution in aromatic hydrocarbon solvent 100, n-butanol, n-butyl acetate (15:15:1); this solution is labelled Acrylic Resin RC0888

Method of Detection and Determination: gel permeation chromatography (GPC) and infrared (IR) spectroscopy

Spectral Data: an IR spectrum for the polymer was provided

3. PHYSICAL AND CHEMICAL PROPERTIES

The notifier stated that the polymer would be a hard, brittle amber resin at room temperature. However, it is manufactured as a solvent solution which is a clear viscous amber liquid under ambient conditions. The physico-chemical properties below refer to the solvent solution unless otherwise specified.

Appearance at 20°C and 101.3 kPa: the polymer solution as manufactured is a clear, amber, viscous solution

Boiling Point: 117.5°C (n-butanol)

Specific Gravity: 0.936 at 20°C

Vapour Pressure:	1.7 kPa at 38°C (aromatic hydrocarbon solvent 100); 0.67 kPa at 20°C (n-butanol)
Water Solubility:	not determined (see comments below)
Partition Co-efficient (n-octanol/water):	not determined (see comments below)
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; the notified polymer is a solution polymer
Flash Point:	not applicable to polymer
Flammability:	not applicable to polymer
Autoignition Temperature:	not applicable to polymer
Explosive Properties:	not applicable to polymer
Reactivity:	the notifier states that under normal conditions of use the polymer does not break down but is cross-linked into an inert surface coating film at a temperature of 232°C; under ambient storage conditions the polymer solution is completely stable

Comments on Physico-Chemical Properties

The notified polymer is soluble in a range of organic solvents and is a 37% w/ w solution of polymer in an aromatic hydrocarbon/ n-butanol/ n-butyl acetate (ratio 15:15:1). The notifier stated that water solubility could not be measured because the polymer is produced in solution and removing the solvents would remove some residual monomers and low molecular weight fractions, thus changing the solubility. The notifier claims that this class of polymer is insoluble in water. Also, the hydrophobic structure indicates the water solubility would be extremely low.

The polymer contains a large proportion of ester functionality, but hydrolysis in the environmental pH range (4-9) is not expected due to the low water solubility.

Partition coefficient and adsorption/ desorption have not been measured due to the

low water solubility of the polymer. The partition coefficient is expected to be high and the polymer can be expected to bind strongly to, or be associated with, soil and sediment. The polymer contains a small amount of free carboxylic acid groups expected to have typical acidity.

The notifier stated that severe hydrolysis, severe thermal conditions (>300 °C) and severe oxidation and pyrolysis will cause degradation, decomposition or depolymerisation yielding individual monomers and/ or oligomers of these monomers and produce oxides of carbon.

4. PURITY OF THE CHEMICAL

Degree of Purity: > 96%

Toxic or Hazardous Impurities: residual monomers, but below concentrations which would render the polymer hazardous according to NOHSC *Approved Criteria for Classifying Hazardous Substances* (National Occupational Health and Safety Commission, 1994a)

Non-hazardous Impurities (> 1% by weight): none

Maximum Content of Residual Monomers: 0.35%

Additives/Adjuvants: none

5. USE, VOLUME AND FORMULATION

The notified polymer will be used as an ingredient in a paint for coil coating. It is to be manufactured as a solvent solution, with the formulation of the solution as follows:

<i>Chemical Name</i>	<i>CAS No.</i>	<i>Weight %</i>
RC0888 Polymer		37%
aromatic hydrocarbon solvent 100	64742-95-6	30.5%
n-butanol	71-36-3	30.5%
n-butyl acetate	123-86-4	2%

The notified polymer will be formulated into paint at a concentration of 3.1% (w/w).

The manufacture volume of polymer is anticipated to be 50 - 200 tonnes per year for the first 5 years.

6. OCCUPATIONAL EXPOSURE

The notified polymer is to be manufactured at a single site in New South Wales as a resin solution and mixed into paint at a single site in Victoria. The finished paint is then to be transported to New South Wales to a single site to be used in coil coating.

Polymer Production

The notified polymer will be manufactured from the constituent monomers in an enclosed reactor. The monomers are added to solvent in the reactor and polymerised. The polymer solution is then adjusted to 37% (w/w) prior to filling into 200 L drums or bulk holding containers via a closed filling system. The monomers and solvents are transferred from bulk storage, drums and bags into the reaction vessel. The reaction vessels have local exhaust ventilation at access points when loading the reactor or when sampling to test for progress of the reaction. Each batch of polymer solution requires 2 days to produce and there is one batch per month. On each of the 2 days operators are potentially exposed for 12 hours per day. The notifier states that up to 20 reactor operators may be exposed in any one year. Cleanup of the reactor vessels is by solvent wash although it is stated that this is minimised by the routine production of compatible resin solutions. Exposure of reactor operators is unlikely due to the high level containment required for manufacturing polymers of this type.

Up to two maintenance personnel may be exposed for up to 2 days per month, 8 hours per day. Maintenance workers perform emergency and routine maintenance on vessels, pumps, pipelines and valves. The notifier states that they have extensive procedures and work practices for ensuring their personal safety and in minimisation of spills and leaks. The notifier states that all have personal protective equipment and operate on a Work Permit system authorised by the plant manager and a Personal Lockout system. These systems are stated to ensure physical and procedural barriers to exposure, to notify other operators in the vicinity and protect the maintenance workers. Therefore, exposure should be controlled.

Up to 14 laboratory technicians/chemists/development personnel are involved in polymer manufacture (although the notifier gave this number for the workers involved in both polymer manufacture and paint production). These workers are supplied with samples from the reactor in sealed containers. The laboratories are stated to be fitted with local fumehood extraction and facilities for the safe storage of samples and removal of waste. Some dermal exposure to the polymer can be expected although this can be expected to be infrequent.

Paint Production

Up to 20 operators are involved in the production of 15 paint batches per month, 1 batch per day with a shift of 12 hours per day per operator.

The polymer solution from the manufacturing plant is poured directly from 200 L drums through a bung and tap arrangement. Generally, the main opportunities for exposure to the notified polymer will be during sampling for testing and during actual testing. Exposure will mainly be dermal with the possibility of secondary transfer from hand to eye and a limited possibility of inhalation exposure to aerosols. The polymer is at a concentration of 3.1% (w/w) in the final paint, so after transfer to the mixing vessel and mixing with other ingredients exposure of reactor operators, maintenance personnel and laboratory technicians to the chemical should be minimal even if contamination occurs. The notifier provided the

same description for maintenance work and quality control testing for polymer manufacture and paint production. In general the potential for exposure to paint is somewhat greater than for polymer solution as the level of containment is not as great in the former case.

Paint Coating

Approximately 12 coating operators are potentially exposed for 8 hours/day, 26 days/year. The drums of paint are transported to the coating room and the lid removed. An air stirrer is fitted and the paint stirred until consistent. A small sample is taken and checked for viscosity and the viscosity modified by the manual addition of solvent (i.e., the paint is thinned). The paint is then mixed and a recirculating pump is inserted to feed the paint into the coating heads (which feed the paint into a paint tray) and collect and feed unused paint back into the drum. Some exposure of workers is possible at this stage, although, given that the polymer present in paint at a low level, exposure is minimal. The coating company states that the coating room, where the paint is applied by roller coating to a continuous coil of flat strip, is enclosed and fitted with fume extraction and the control panel is removed from the room. Local exhaust ventilation is used during set-up, application and baking of the paint and workers are supplied with gloves and safety glasses.

7. PUBLIC EXPOSURE

Minimal public exposure is anticipated through the synthesis, transfer, or disposal of the notified polymer at the manufacture, reformulation or application sites.

Public exposure to the notified polymer is expected through handling of household domestic appliances to which paint containing the notified polymer has been applied. However, the notified polymer will not be bioavailable due to the curing process, which renders the polymer inert.

8. ENVIRONMENTAL EXPOSURE

Release

Roller coating is a very efficient process. At the polymer and paint manufacturing sites waste from accidental spills and residues accumulating on filters are disposed of to landfill. Wash solvent residues produced in the solvent recovery unit contain other resin residues and are also disposed of to landfill. The empty drums are cleaned by licensed drum reconditioners who would dispose of the residues by approved methods. Test samples of polymer solution are discarded in a highly diluted form through authorised waste disposal contractors. The company claims that all waste waters originating from the process areas are passed through a treatment tank prior to discharge to the sewer. The notifier estimates the maximum amount of waste polymer from all these sources to be 0.35% per annum.

At the paint coating plant minor spills are collected into the empty drums. These drums are taken away by a licensed waste disposal agent where the residual liquid waste is collected and the drum discarded to landfill. The liquid waste is distilled,

the solvent is recovered and the residue containing the polymer is incinerated. At this stage some polymer is also lost as coating on rejected metal. The rejected metal is recycled by melting at high temperature, during which the polymer is destroyed. It is estimated that up to 0.75% of the polymer would be lost per annum as waste at the paint coating plant.

The total waste from both the manufacturing and paint coating sites would be approximately 1.1% of the manufacture volume. The coils containing an external coating of polymer will gain nation-wide distribution.

Fate

The fate of the bulk of the polymer will be tied to the fate of the heat cured external coil coating. Most cured coating products will go through metal recycling, where the high temperatures will destroy the polymer, producing oxides of carbon and water vapour.

Some of the metal products and part of the waste generated during manufacture and application of the polymer will be disposed of to landfill sites in a very dispersive manner. Due to the low solubility and the highly cross linked nature of the polymer, it will not leach but remain associated with soil and sediment. It will undergo slow abiotic and biotic degradation processes operative in landfills. Once the notified polymer is applied as part of an external coating it will be incorporated in an inert film and would not present a significant hazard.

Any fragments, chips or flakes of the coating will be of little concern as they are expected to be inert. The painted appliances coated with the polymer are likely to be either recycled for steel reclamation or be placed into landfill at the end of their useful life. When recycled, the polymer would be destroyed in the blast furnaces and converted to water vapour and oxides of carbon. Incineration will destroy the polymer.

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological data were provided.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The polymer is unlikely to present a hazard to the environment when handled, used and disposed of as proposed. Disposal of waste polymer, discarded appliances or metals coated with the polymer to landfill will not pose a hazard to the environment

due to high molecular weight and the low solubility. Any fragments, chips or flakes of the coating will be of little concern as they are expected to be inert. The painted appliances coated with the polymer are likely to be either recycled for steel reclamation or be placed into landfill at the end of their useful life. During metal recycling, the polymer would be destroyed in the blast furnaces and converted to water vapour and oxides of carbon. Incineration will also break down the polymer into oxides of carbon and water vapour. The US EPA considers polynonionic polymers with NAMW greater than 1 000 and low water solubility to be of low concern (Nabholz et al., 1993). The environmental hazard from the notified polymer can be rated as low.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The notified polymer has a NAMW greater than 1 000 which should limit potential systemic effects by minimising absorption across biological membranes. The levels of residual monomers would not result in the polymer being classified as hazardous according to NOHSC *Approved Criteria for Classifying Hazardous Substances* (National Occupational Health and Safety Commission, 1994a). In addition there is a very low level of low molecular weight species (0.6% with NAMW less than 1 000).

Transport and storage workers are unlikely to be exposed to the notified polymer except in the event of an accident.

Occupational Health and Safety

Exposure to the polymer following manufacture is likely to be limited to spillage during maintenance work and sampling the small volumes for quality control and testing, since resin solution manufacture and drumming off are performed using a closed system. As these operations involve small volumes, exposure is expected to be limited. However, skin exposure could be prolonged if resin solution is allowed to adhere to unprotected areas. The notifier states that personal protective equipment such as protective clothing, gloves, goggles and respirators is used. Maintenance workers also rely on personal protective equipment to limit exposure. The use of engineering controls and protective equipment is necessary to prevent exposure to solvent components in the polymer solution.

Exposure scenarios are similar for polymer solution manufacture and paint manufacture although the final concentration of polymer is 37% (w/w) in the former case and approximately 3% (w/w) in the latter. During paint manufacture some exposure to drips and spills may occur when transferring resin solution to the paint mixing vessel. However, the transfer methods should limit spills and the stated use of personal protective equipment should prevent any exposure.

End use of the paint in coil coating will not lead to significant exposure of workers to the notified polymer. Again the polymer is present at a low percentage in the paint and there is limited opportunity for exposure during paint stirring and thinning with solvent. Again, personal protective equipment will be employed further reducing the likelihood of exposure. The coating process is controlled from a remote location and is not expected to result in

worker exposure.

There is virtually no risk of adverse health effects from exposure to the notified polymer during its manufacture, mixing into paint or use in coil coating, because the polymer unlikely to be a hazardous substance, and given the control mechanisms described above, there is limited opportunity for worker exposure.

A number of ingredients in the resin solution or the paint containing the notified polymer may present health hazards to workers. These are listed in the following table together with NOHSC exposure standards (National Occupational Health and Safety Commission, 1995) and concentration cut-offs as found in NOHSC *List of Designated Hazardous Substances* (National Occupational Health and Safety Commission, 1994b):

<i>Ingredient</i>	<i>CAS No.</i>	<i>NOHSC Exposure Standard (ppm)</i>		<i>Concentration in formulation</i>	<i>cut-off</i>	<i>Risk Phrases^c</i>
		TWA	STEL			
<i>Resin Solution</i>						
hydrocarbon 100	64742-95-6			30.5%		
n-butanol	71-36-3	50 ^{a,b}		30.5%	25% (harmful)	10, 20
n-butyl acetate ^d	123-86-4	150	200	2%		
<i>Paint</i>						
titanium dioxide	13463-67-7	10 mg/m ₃				
strontium chromate	7789-06-2	0.001 mg/m ₃			0.1% (toxic)	22, 45(2)
hydrocarbon 100	64742-95-6				0.1% (toxic)	45(2), 65
butyl cellosolve	111-76-2	25 ^a			12.5% (harmful) 20% (irritant)	20/21/22 37
n-butanol	71-36-3	50 ^{a,b}			25% (harmful)	
isophorone	78-59-1	5 ^{a,b}			25% (irritant)	36/37/38
aromatic HC 150	64742-94-5				10% (harmful)	65

^a absorption through the skin may be a significant source of exposure;

^b peak level to which workers can be exposed;

^c risk phrases: R10: flammable; R20/21/22: harmful by inhalation, in contact with skin and if swallowed; R45(2): may cause cancer; R36/37/38: irritating to eyes, respiratory system and skin; R65: harmful (may cause lung damage if swallowed)

^d although not included in NOHSC *List of Designated Hazardous Substances*, Sax and Lewis (1996) has the following description of the hazard: mild toxicity via inhalation and ingestion, experimental teratogen, skin and severe eye irritant, human systemic effects by inhalation, conjunctiva irritation, unspecified nasal and respiratory system effects, mild allergen, high concentrations irritating to eyes and respiratory tract and causes narcosis

From the above table, the polymer solution is flammable (dangerous goods class 3) and harmful by inhalation. Therefore, employers should ensure that a respirator is used when the exposure standard for n-butanol is likely to be exceeded.

The paint can be considered a category 3 carcinogen as a result of the strontium chromate content stated by the notifier. The coating room should be equipped with adequate air extraction. In any case the employer must ensure that a respirator is used if any aerosols are likely to be formed during mixing, thinning or application of the paint and impervious gloves, goggles and protective clothing also should be worn. The manufacturer of the paint must ensure that the label adequately identifies ingredients present at levels above the concentration cut-offs in accordance with NOHSC *National Code of Practice for Labelling Workplace Substances* (National Occupational Health and Safety Commission, 1994c) and that the appropriate risk phrases appear on the label. Similar considerations apply to the MSDS for the paint.

For both the polymer solution and paint, employers are responsible for ensuring that the NOHSC exposure standards are not exceeded in the workplace.

Public Health

Under normal conditions of transport, handling and industrial use, the likelihood of public exposure to the notified polymer is very low. Exposure of the public to paint containing the notified polymer in an inert, cured form will occur during handling of household domestic appliances. Based on the use pattern and physicochemical characteristics of the notified polymer, the public health risk from transport, storage, industrial or domestic use or waste disposal of the notified polymer is considered to be low.

13. RECOMMENDATIONS

To minimise occupational exposure to the notified polymer the following guidelines and precautions should be observed:

- Employers should ensure that NOHSC exposure standards for all of the components of the polymer solution and 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);
- 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, 1994);

- Spillage of the notified polymer should be avoided. Spillage 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 MSDS should be easily accessible to employees.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the resin solution containing the notified polymer was provided in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (National Occupational Health and Safety Commission, 1994d).

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

Nabholz JV, Miller P & Zeeman M (1993) Environmental Risk Assessment of New Substances under the Toxic Substances Control Act Section Five. In: W. G. Landis, J. S. Hughes and M. A. Lewis ed. Environmental Toxicology and Risk Assessment, American Society for Testing and Materials. ASTM STP 1179, Philadelphia, pp 40-55.

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National Occupational Health and Safety Commission (1994b) List of Designated Hazardous Substances [NOHSC:10005(1994)]. Australian Government Publishing Service, Canberra.

National Occupational Health and Safety Commission (1994c) National Code of Practice for the Labelling of Workplace Substances [NOHSC:2012(1994)]. Australian Government Publishing Service, Canberra.

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

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

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

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

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.

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

Standards Australia/Standards New Zealand (1998) Australian/New Zealand Standard 2161.2-1998, Occupational protective gloves, Part 2: General requirements. Standards Association of Australia, Sydney.