File No: LTD/1413

September 2009

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

Polymer in Acrylic Polymer 6285

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act 1989* (Cwlth) (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 Department of Health and Ageing, and conducts the risk assessment for public health and occupational health and safety. The assessment of environmental risk is conducted by the Department of the Environment, Water, Heritage and the Arts.

For the purposes of subsection 78(1) of the Act, this Full Public Report may be inspected at our NICNAS office by appointment only at 334-336 Illawarra Road, Marrickville NSW 2204.

This Full Public Report is also available for viewing and downloading from the NICNAS website or available on request, free of charge, by contacting NICNAS. For requests and enquiries please contact the NICNAS Administration Coordinator at:

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Director
NICNAS

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1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Orica Australia Pty Ltd (ABN 99 004 117 828)
1 Nicholson Street, MELBOURNE VIC 3000

and

Nuplex Industries (Aust) Pty Ltd (ABN 25 000 045 572)
49-61 Stephen Road, BOTANY NSW 2019

NOTIFICATION CATEGORY
Limited: Synthetic polymer with Mn ≥ 1000 Da.

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication:
Chemical Name, Other Name, CAS Number, Molecular Formula, Structural Formula, Polymer Constituents, Molecular Weight, Spectral Data, Concentration and Identity of Impurities, Details of Use, Manufacture Volume and Identity of Manufacturer

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
Variation to the schedule of data requirements is claimed as follows:
Hydrolysis as a Function of pH, Partition Coefficient, Dissociation Constant, Particle Size, Flash Point, Flammability Limits, Autoignition Temperature, Explosive Properties, Reactivity

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
None

NOTIFICATION IN OTHER COUNTRIES
None

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
Acrylic Polymer 6285/1 (Product containing the notifier polymer)
Acrylic Polymer 6285/2 (Product containing the notifier polymer)

MOLECULAR WEIGHT
Mn > 1000 Da

ANALYTICAL DATA
Reference IR and GPC spectra were provided.

3. COMPOSITION

DEGREE OF PURITY > 95%

HAZARDOUS IMPURITIES/RESIDUAL MONOMERS
All hazardous impurities and residual monomers are present at below the relevant cut-offs for classification of the notified polymer solution as a hazardous substance.

LOSS OF MONOMERS, OTHER REACTANTS, ADDITIVES, IMPURITIES
The polymer solution contains a small amount of residual monomer, which may be lost as a vapour.

DEGRADATION PRODUCTS
The hydrolysis of the acrylate units will yield a poly(acrylic acid) and an alcohol.

4. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AT 20°C AND 101.3 kPa: Yellow oily solid (expected)
NB: The solid polymer is never isolated from solution. This solution has a clear yellow appearance.

Property	Value	Data Source/Justification
Glass transition temperature	34.7°C (6285/1) -5.6°C (6285/2)	Calculated
Boiling Point	Not determined	The notified polymer is never isolated from the manufacturing solution.
Density	1228 kg/m^3 at 20°C (6285/1) 1172 kg/m^3 at 20°C (6285/2)	Measured/calculated
Vapour Pressure	Not determined	The notified polymer is never isolated from the manufacturing solution. Based on the high molecular weight of the polymer the vapour pressure is expected to be low.
Water Solubility	< 0.006 g/L at 20°C (6285/1) < 0.0058 g/L at 20°C (6285/2)	Measured
Hydrolysis as a Function of pH	Not determined	The notified polymer is never isolated from the manufacturing solution.
Partition Coefficient (n-octanol/water)	Not determined	The notified polymer is never isolated from the manufacturing solution.
Adsorption/Desorption	Not determined	The notified polymer is never isolated from the manufacturing solution.
Dissociation Constant	Not determined	The notified polymer is never isolated from the manufacturing solution.
Particle Size	Not determined	The polymer is never isolated from solution.
Flash Point	Not determined	The notified polymer is never isolated from the manufacturing solution.
Autoignition Temperature	Not determined	The notified polymer is never isolated from the manufacturing solution. The notified polymer is not expected to autoignite under normal conditions of use.
Explosive Properties	Not determined	Expected to be stable under normal conditions of use. The notified polymer contains no functional groups that would imply explosive properties.

DISCUSSION OF PROPERTIES
The notified polymer is expected to be stable to hydrolysis under environmental conditions, and to have high affinity for soils and sediments because of its low water solubility. It contains weakly acidic functionality (pKa ~ 5) but dissociation is likely to be precluded under environmental conditions by the very low solubility. For full details of tests on physical and chemical properties, please refer to Appendix A.

Reactivity
The polymer is stable under normal environmental and operating conditions.

5. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS

The notified polymer will be manufactured as 30-60% solution in water or water/polyethylene glycol.

MAXIMUM INTRODUCTION VOLUME OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	3-10	3-10	30-100	30-100	30-100

PORT OF ENTRY
The notified polymer will not be imported.

IDENTITY OF MANUFACTURER
Nuplex Industries (Aust) Pty Ltd

TRANSPORTATION AND PACKAGING
The solution containing the notified polymer will be stored in 200 L steel drums or 1100 L intermediate bulk containers (IBC's) and transported by road freight.

USE
Component of aqueous latex for coatings. The notified polymer will be used as an additive in the manufacture of waterborne latex at < 5%. The concentration of latex in waterborne paint is typically 30-50%.

OPERATION DESCRIPTION
Overview of processes involved:

Polymer manufacture ► Filling & reactor cleaning

► Transport to latex manufacturer ► Use in latex preparation

(a) Manufacture of Acrylic Polymer 6285

The reactants are charged to a batch reactor and heated in order to manufacture the notified polymer. The raw materials are added as solids or pumped in as liquids from 200 L drums. All raw materials are added to the reactor under local exhaust ventilation via a hatch cover located at the top of the reactor. The reactor is equipped with an agitator and a chilled water condenser. Temperature control is achieved by application of steam or chilled water to a jacket surrounding the reactor. This process will produce Acrylic Polymer 6285 30-60% solution in water or water/polyethylene glycol.

(b) Filling and reactor cleaning

Once the reaction is complete the polymer solution is cooled and 200 L steel drums or 1100 L intermediate bulk containers (IBC's) are filled at a filling station. Workers connect a hose from the reactor, open valves and supervise filling of drums/IBC's. Once packed in drums/IBC's the polymer solution is transported to the site of latex manufacture. The time taken from the start of the process to the end of the filling step is approximately 10 hours.

The reactor is then cleaned by washing the reactor walls with sodium hydroxide solution. These washings, along with any accidental spillages on site, will pass through interceptor pits and are contained prior to discharge to sewer as trade waste.

(c) Latex manufacture

In a typical procedure a 5000 L batch reactor will be used for the manufacture of the latex via emulsion polymerisation at approximately 80°C. Acrylic Polymer 6285 will be included as an additive at up to 5% in the latex manufacturing process. Once the latex has been made the notified polymer will have become irreversibly incorporated into the polymer latex. However the functional groups of the notified polymer will be present in the latex at low concentrations.

(d) Paint manufacture and use

The polymer latex will be used to manufacture paints for professional and public use.

6. HUMAN HEALTH IMPLICATIONS

6.1 Exposure assessment

6.1.1 Occupational exposure

NUMBER AND CATEGORY OF WORKERS

Category of Worker	*Number*	*Exposure Duration (hours/day)*	*Exposure Frequency (days/year)*
Manufacture:			
Reactor operator	1	8 hours/day	20 days/year
Maintenance personnel	1	1-2 hours/day	20 days/year
Laboratory personnel	1	2 hours/day	20 days/year
Transport personnel	2	5 hours/day	20 days/year
Use in latex manufacture:			
Reactor operator	1	1 hour/day	20 days/year
Paint manufacture and use:			
Paint formulator	100	8 hours/day	200 days/year
End user of latex	1000	8 hours/day	200 days/year

EXPOSURE DETAILS

Dermal and ocular exposure to the notified polymer may potentially occur during certain processes involving the notified polymer, including sampling and analysis, reactor cleaning and manufacture of latex. However, exposure to significant amounts of the notified polymer will be limited due to the engineering controls (local exhaust ventilation) used and personal protective equipment (gloves, coveralls and safety glasses) worn by workers. Inhalation exposure is unlikely due to the low volatility of the notified polymer.

All hazardous impurities and residual monomers are present at below the relevant cut-offs for classification of the notified polymer solution as a hazardous substance.

The latex will be used to make paints, which will be applied to surfaces by professional painters. The polymer itself will not be present as it is chemically bonded into the latex. The functional groups of the notified polymer will only be present at a low concentration in latex and paint, therefore worker exposure will be low.

6.1.2. Public exposure

Public exposure to the polymer as a result of transportation within Australia is unlikely unless there is an accident. The material safety data sheets (MSDS) supplied for the products containing the notified polymer have adequate instructions for clean-up and disposal of any accidental spills and therefore public exposure as a result of a transport accident is likely to be negligible.

The latex will be used to make paints, which the public will use potentially without PPE. The functional groups of the notified polymer will be present in the paint at a low concentration only therefore public exposure via the use is expected to be low.

6.2. Human health effects assessment

No toxicological data have been provided for the notified polymer.

The notified polymer contains a high concern functional group, which is structurally related to a functional group that is a structural alert for sensitisation (Barratt, 1994). The notified polymer has a molecular weight > 1000 Da and only a small percentage of low molecular weight species, which would reduce the possibility of its being absorbed across biological membranes, and therefore the hazard is expected to be low. Systemic toxicity is also unlikely based on the expected low absorption, however slight skin and eye irritation cannot be ruled out.

The notified polymer contains residual monomers that are classified as sensitisers or irritants, however, these are present at less than the cut-off concentration in the mixture introduced.

The polymer has the potential to decompose under certain conditions (such as processing temperatures above 90^{o}C), with the formation of toxic gases that could cause adverse health effects.

Health hazard classification
Based on the available data the notified polymer cannot be classified as hazardous under the *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004).

6.3. Human health risk characterisation

6.3.1. Occupational health and safety
Information on the health effects of the notified polymer is not available. A functional group in the polymer is potentially sensitising, based on its similarity to another functional group. The polymer has a high molecular weight and is unlikely to cross biological membranes, but does contain some low molecular weight species.

Dermal and ocular exposure to the notified polymer (up to 60%) may potentially occur during the processes of manufacture of the notified polymer and latex, including reactor charging and reactor cleaning. However, exposure will be limited by the engineering controls (local exhaust ventilation) used and personal protective equipment (PPE) (gloves, coveralls and safety glasses) worn by workers. The polymer is non volatile and unlikely to be inhaled unless aerosols of the latex are formed. The polymer should be used in well ventilated areas and if the potential for inhalation exists, local exhaust ventilation or the wearing of an organic vapour respirator would be needed to reduce risk.

Worker exposure and risk during the formulation of paints is expected to be low as engineering and PPE controls would be in place. The application of coatings containing the notified polymer may be carried out by workers without PPE however the risk is considered to be acceptable due to the high molecular weight of the polymer, the expected low concentrations of the notified polymer in the coating (< 2.5%) and the incidental nature of any exposure from drips etc.

Adverse health effects could potentially occur if the polymer broke down to release toxic gases. The notifier advised that no release of toxic gases is expected in the processes used during the polymer or latex manufacture.

The occupational health and safety risk for the handling and use of this polymer is therefore considered to be acceptable.

6.3.2. Public health
The public may use latex-based paints derived from the notified polymer. Other exposure to the notified polymer is not expected. As the functional group of concern will be present at a low concentration in high molecular weight polymer, the risk to the public from use of paints is considered low.

Overall the risk to the public is not considered unacceptable.

7. ENVIRONMENTAL IMPLICATIONS

7.1. Environmental Exposure & Fate Assessment

7.1.1 Environmental Exposure

RELEASE OF CHEMICAL AT SITE
The reactor in which the notified polymer is made and the containers used to transport it will be washed with sodium hydroxide solution. These washings, along with any accidental spillage on site, will pass through interceptor pits and are contained prior to discharge to sewer as trade waste.

RELEASE OF CHEMICAL FROM USE
During its use as an additive in latex manufacture, the notified polymer will be handled by personnel experienced with dealing with a range of chemicals. As such, no or minimal release is expected during use. Once the latex has been made there will be none of the polymer remaining as it will have become irreversibly incorporated into the polymer latex.

RELEASE OF CHEMICAL FROM DISPOSAL
After the notified polymer has been used for the preparation of waterborne latex, the empty containers with residual polymer will be sealed and passed on to a licensed waste contractor for disposal (such as by incineration).

7.1.2 Environmental fate

No environmental fate data were submitted. Based on its structure, the notified polymer is not expected to be readily biodegradable, or to cross biological membranes. The notified polymer is expected to slowly degrade *in situ* following landfill disposal.

7.1.3 Predicted Environmental Concentration (PEC)

It is neither necessary nor meaningful to calculate the PEC, as the notified polymer will become irreversibly incorporated into the latex during paint manufacture, with no aquatic release expected.

7.2. Environmental effects assessment

No ecotoxicity data were submitted.

7.2.1 Predicted No-Effect Concentration

The PNEC cannot be calculated as no ecotoxicity data are available.

7.3. Environmental risk assessment
A risk quotient cannot be calculated. The notified polymer is not considered to pose a risk to the environment, as it will become irreversibly incorporated into the latex during paint manufacture, with no aquatic release expected.

8. CONCLUSIONS AND REGULATORY OBLIGATIONS

Hazard classification
Based on the available data the notified polymer cannot be classified as hazardous under the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(2004)].

and

Classification of notified polymer using the Globally Harmonised System for the Classification and Labelling of Chemicals (GHS) (United Nations 2003) cannot be undertaken as no toxicological or ecotoxicological data were available. This system is not mandated in Australia and carries no legal status but is presented for information purposes.

Human health risk assessment
Under the conditions of the occupational settings described, the notified polymer is not considered to pose an unacceptable risk to the health of workers.

When used in the proposed manner, the notified polymer not considered to pose an unacceptable risk to public health.

Environmental risk assessment
On the basis of the reported use pattern, the notified polymer is not considered to pose a risk to the environment.

Recommendations

CONTROL MEASURES
Occupational Health and Safety

- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified polymer as manufactured:
  - Avoid skin and eye contact

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified polymer as manufactured:
  - Chemical resistant gloves
  - Protective clothing
  - Safety goggles

- Precautions (such as maintaining process temperature below 90^{o}C) should be taken to avoid formation of toxic gases during manufacture and handling processes involving the notified polymer.

  Guidance in selection of personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

- A copy of the MSDS should be easily accessible to employees.

- If products and mixtures containing the notified polymer are classified as hazardous to health in accordance with the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(2004)] workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Disposal

- The notified polymer should be disposed of to landfill.

Emergency procedures

- Spills or accidental release of the notified polymer should be handled by containment, collection and subsequent safe disposal.

Regulatory Obligations

Secondary Notification
This risk assessment is based on the information available at the time of notification. The Director may call for the reassessment of the chemical under secondary notification provisions based on changes in certain circumstances. Under Section 64 of the *Industrial Chemicals (Notification and Assessment) Act (1989)* the notifier, as well as any other importer or manufacturer of the notified chemical, have post-assessment regulatory obligations to notify NICNAS when any of these circumstances change. These obligations apply even when the notified chemical is listed on the Australian Inventory of Chemical Substances (AICS).

Therefore, the Director of NICNAS must be notified in writing within 28 days by the notifier, other importer or manufacturer:

(1) Under Section 64(2) of the Act; if
- the function or use of the chemical has changed from component of aqueous latex for coatings, or is likely to change significantly;
- the amount of chemical being introduced has increased from 100 tonne per year, or is likely to increase, significantly;
- the method of manufacture of the chemical in Australia has changed, or is likely to change, in a way that may result in an increased risk of an adverse effect of the chemical on occupational health and safety, public health, or the environment;
- additional information has become available to the person as to an adverse effect of the chemical on occupational health and safety, public health, or the environment.

The Director will then decide whether a reassessment (i.e. a secondary notification and assessment) is required.

No additional secondary notification conditions are stipulated.

Material Safety Data Sheet
The MSDS of the product containing the notified polymer provided by the notifier was reviewed by NICNAS. The accuracy of the information on the MSDS remains the responsibility of the applicant.

APPENDIX A: PHYSICAL AND CHEMICAL PROPERTIES

Glass transition temperature 34.7°C (6285/1)
-5.6°C (6285/2)

Method It was calculated using the Fox-Flory equation.

Density 1228 kg/m^3 at 20°C (6285/1)
1172 kg/m^3 at 20°C (6285/2)

Method A specific gravity flask was used to obtain the weight of a known volume (23.889 mL at 20.2°C) of 30-60% solution in water or water/polyethylene glycol. Based on the density of propylene glycol and water the density of the neat polymer was then calculated.

Water Solubility < 0.006 g/L at 20°C (6285/1)
< 0.0058 g/L at 20°C (6285/2)

Method In-house method was used.
Remarks 6285/1: 30 mg of 30-60% solution in a mixture of polyethylene glycol and water was added to 2 L water. After 4 days stirring insoluble material was still present.
6285/2: 34.9 mg of 30-60% solution in a mixture of polyethylene glycol and water was added to 3 L water. After 4 days stirring insoluble material was still present.

Hydrolysis as a Function of pH

Hydrolysis was not tested, as the notified polymer is never isolated from the manufacturing solution, has low water solubility and is expected to be hydrolytically stable.

Partition Coefficient (n-octanol/water)

The partition coefficient was not measured, as the notified polymer is never isolated from the manufacturing solution. The notified polymer would be expected to partition to the organic phase because of its low water solubility, or to the phase boundary between water and octanol.

Adsorption/Desorption

Adsorption/desorption was not measured, as the notified polymer is never isolated from the manufacturing solution. The notified polymer would be expected to partition to soils because of its low water solubility.

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