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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

BYK-UV 3500

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Director
Chemicals Notification and Assessment

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BYK-UV 3500

1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT
Nuplex Industries (Aust) Pty Ltd (ABN: 25 000 045 572) of 49-61 Stephen Road, Botany, NSW, 2019.

NOTIFICATION CATEGORY
Limited: Polymer with NAMW ≥ 1000 (greater than 1 tonne per year).

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication:
Chemical Identity
Polymer constituents
Molecular weight
Spectral data
Purity and Identity of impurities
Estimated import volume

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
No variation to the schedule of data requirements is claimed.

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
None.

NOTIFICATION IN OTHER COUNTRIES
BYK-UV 3500 has been notified in Europe, USA, Korea, Japan and China.

2. IDENTITY OF CHEMICAL

OTHER NAME
Polyether modified acryl functional polydimethylsiloxane.

MARKETING NAME(S)
BYK-UV 3500

3. COMPOSITION

DEGREE OF PURITY
High

HAZARDOUS IMPURITIES/RESIDUAL MONOMERS
All hazardous impurities or residual monomers are present at below the relevant cut offs for classification of the notified polymer as a hazardous substance on the basis of monomer impurity content.

DEGRADATION PRODUCTS
The polymer is not expected to degrade under normal conditions of use. Under extreme heat conditions e.g. fire, the polymer would degrade to oxides of carbon and silicon.

LOSS OF MONOMERS, OTHER REACTANTS, ADDITIVES, IMPURITIES
The polymer crosslinks with other components in the coatings or printing inks to form a very high molecular weight and stable film. There is expected to be no loss of monomers during the life of the coating or printing ink.

4. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL OVER NEXT 5 YEARS
The notified polymer will not be manufactured in Australia, but will be imported from Germany in the pure form.

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

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

USE
The notified polymer will be used as an ingredient in industrial coatings and UV-Flexo, UV-Offset and UV-Silk screen printing inks to increase the surface slip of the coating or printing ink. The material is cured by radiation. Approximately 90% of the imported product will be sold into the coatings industry, with the remaining 10% being sold into the printing industry.

5. PROCESS AND RELEASE INFORMATION

5.1. Distribution, transport and storage

PORT OF ENTRY
Melbourne and Sydney

IDENTITY OF MANUFACTURER/RECIPIENTS
Coatings and printing inks containing the notified polymer will be formulated by a variety of companies located throughout Australia.

TRANSPORTATION AND PACKAGING
The notified polymer will be transported and stored in steel drums of 200 L capacity. Coatings products are usually supplied in either 200 L steel drums or by road tanker. Finished printing inks are packed in metal cans (0.5-5 kg), in metal or plastic pails (8, 11 and 19 L) or in 114 or 190 L metal or non-permeable fibre drums. The low viscosity inks (e.g. news, flexo or gravure) are usually delivered by tanker directly to the printer. Transport of the notified polymer and products containing the notified polymer is by road or rail.

5.2. Operation description

Coating Formulation
Typically, workers will connect a vacuum hose line to the drums from which the polymer solution is emptied into a blending vessel. Other ingredients are then added to the vessel. Complete mixing is achieved by high speed dispersing and blending in the mixer. Blending generally occurs in a closed automated system with dedicated transfer lines. The blended product containing between 0.05 and 2% notified polymer is sampled for laboratory analysis and quality control.

Occasionally, coatings manufacture may occur in batch mixers where addition of the polymer solution is semi-automated

Printing Ink Formulation
Printing inks are produced either by mixing pre-dispersed pigment concentrates with adjuvants, solvents, oils and compounds and filtering or by mixing dry pigments or resin coated pigments with adjuvants and compounds and then dispersing them using various types of ink mills. Typically the notified polymer is charged using a drum lift. Mixing is done in change-can mixers, or in large agitated tanks, which can hold up to 10,000 kg; these are usually covered. Inks may also be heated to lower their viscosity to facilitate grinding in media mills.

The blended ink containing between 0.05 and 2% of the notified polymer is sampled for laboratory analysis and quality control. A number of quality control tests are conducted on the formulation to test colour strength, hue, tack, rheology, drying rate, stability and product resistance.

Coating Application
At the application sites, the coating will be stirred, pumped into trays and applied either as a spray, by rollers or by dipping. Mixing and spraying is conducted in spray booths where the overspray is collected within the spray booth by its filtering system. After the coating is complete, the spray gun and lines will be emptied and any residual coating will be placed into waste drums for recycling. The spray gun is then cleaned at a recycled solvent wash station.

Printing Ink Application
The notifier states that printing ink application in Australia has not been investigated, hence detailed information on the application of the notified polymer in printing ink was not provided. The following information is taken from a NICNAS chemical assessment report for a UV curing ink ingredient (NICNAS, 2000).

Screen printing processes generally include printing and cleaning of the equipment and may include colour mixing. Mixing if required generally occurs in small containers using hand held mixers although mechanical stirrers are used for mixing larger quantities. The inks are applied by spatulas manually on to the ink trays of the machine or silkscreen. When the colour is changed, the leftover ink is scraped off the trays using spatula and returned to the ink storage area.

Lithographic and flexographic printing are largely automated. A typical printing process involves charging the print machine, running the print and distributing the end product. In larger scale operations the inks could be fed to the print machine directly from the bulk containers under some form of controlled pressure. Excess ink is then returned to the same bulk container. Some on-site blending of inks may occur by computer controlled dispensing and metering equipment. The smaller operations may involve hand filling of the print machine reservoir from a small ink container.

5.3. Occupational Exposure

Number and Category of Workers

Category of Worker	*Number*	*Exposure Duration*	*Exposure Frequency per Yr*
(a) Transport and warehousing	10	~3 hours/day	200 days/year
(b) Formulation			
Coatings			
High speed dispersing	40	4 hours/day	30 days/year
Make-up	40	2 hours/day	30 days/year
Quality Control	10	8 hours/day	30 days/year
Filling containers	40	8 hours/day	30 days/year
Printing Ink			
Make-up	10	2 hours/day	30 days/year
Quality Control	3	8 hours/day	30 days/year
Filling containers	10	8 hours/day	30 days/year
(c) Application			
Coatings			
Addition to coater	10	8 hours/day	200 days/year
Spray painting	20	8 hours/day	200 days/year
Cleaning equipment	30	2 hours/day	200 days/year
		8 hours/day	30 days/year
Printing Ink			
Addition to trays	10	8 hours/day	200 days/year

Printing	10	8 hours/day	200 days/year
Cleaning equipment	3	2 hours/day	200 days/year

Exposure Details
Transport and storage
Exposure to the notified polymer is not expected during the importation, warehousing or transportation of the notified polymer or the coating and ink products, except in cases where the packaging is accidentally breached.

Coating and Ink Formulation
Skin contact to up to 2% notified polymer via splashes, drips and spills may occur during charging or during connection and disconnection of transfer hoses. All operations involving transfer are expected to be carried out under exhaust ventilation.

Blending of the polymer solution to finished coatings and inks generally occurs in a closed automated system with dedicated transfer lines, thereby minimising the potential for occupational exposure. Filtration, drum and pail filling are automated and metered processes and worker intervention is not required unless the filling line requires adjustment. The automated and enclosed nature of the process and the presence of exhaust ventilation would reduce worker exposure during normal use and likely exposure will only be due to spillage that may occur during batch adjustment.

Workers involved in formulation typically wear overalls, gloves and safety glasses.

Incidental skin contact to up to 2% notified polymer may occur during sampling and analytical and quality control procedures. A number of quality control tests are required for printing inks. Workers may also be exposed to the polymer via the dermal and ocular routes while cleaning and rinsing process equipment.

Coating Application
Dermal exposure to the notified polymer up to 2% could occur during stirring, transfer to trays or application by dipping or rollers. Additionally, inhalation exposure to aerosols formed during spray application may be possible. The product is stirred and sprayed in booths with an exhaust/filter system, and workers wear air-fed respirator safety glasses, gloves and overalls.

Workers may also be exposed to the polymer via the dermal and ocular routes while cleaning and rinsing spray equipment.

Printing Ink Application
Dermal exposure to the notified polymer up to 2% could occur, when opening and handling ink containers, when mixing the ink (screen printing), when introducing the ink into the print machine (especially in the case of screen printing and small lithographic and flexographic printing operations), from intermittent contact with printing rollers/heads and from cleaning operations and contact with contaminated rags. Suitable gloves are expected to be used in all these operations.

5.4. Release

RELEASE OF CHEMICAL AT SITE
Coating and Ink Formulation:
Estimates by the notifier indicate that due to the cleaning of process equipment, containers and spills, approximately 50 kg per year of the notified polymer will end up as waste. A licensed waste disposal contractor will collect this material and dispose of it in line with state requirements. Generally such disposal is likely to be to landfill but may include incineration.

Residues in empty import drums are expected to account for an additional 50 kg of the notified polymer per annum. These drums will be sent for recycling by licensed drum recyclers. During the recycling the residues containing the notified polymer will either be consigned to landfill or incinerated.

RELEASE OF CHEMICAL FROM USE

Coating Application
The use of the coatings will be restricted to industrial situations where it will be applied through spray application, roller coating or using dip baths. It should be noted that out of the proposed application methods, spray painting has the highest loss rate. The transfer efficiency for spraying can be as low as 60%. The remaining 40% will be captured as overspray in the spray booth. The other application methods will have a loss rate less than this but all loss will be contained in the application booths. The waste material generated by application will be disposed of by licensed waste disposal contractors, generally to landfill. The notifier estimates that between 2.5 and 5 tonnes per year of the notified polymer will be disposed of across Australia due to application (assuming as a worst case that 100% is applied by spraying). Application through roller coating and using dip baths are far more efficient processes with excess coating being trapped and recycled for reuse. Hence, the volume of waste generated using these application methods is likely to be small.

A small amount of the coating will remain in the empty containers (< 1 kg). These will either be disposed of to landfill or collected by licensed drum recyclers who will clean the drums prior to incineration. It is estimated that up to 90 kg of the notified polymer will be lost in this way.

Ink Application
Cleaning of application and mixing equipment in printing will generate 1% waste, which will be collected and recycled. Waste arising from this source will account for less than 15 kg of the notified polymer. It is anticipated that spills during application may account for up to additional 5 kg per annum of the notified polymer.

5.5. Disposal

Approximately 100 kg of waste notified polymer will be generated annually during the manufacture of the coatings and inks. This is likely to be to disposed of to landfill but may be incinerated.

Due to the application of coating, up to 5 tonnes of notified polymer will go to landfill across Australia. Residues in coating containers will account for up to a further 90 kg which will either be disposed of to landfill or incinerated in container recycling.

Waste generated during the application of printing inks containing the notified polymer will be small (<15 kg per annum) and are likely to be disposed of either via incineration or consigned to landfill.

The majority of the notified polymer will be disposed of with the surfaces to which it has been applied (as a cured coating or ink), at the end of the surfaces useful lifetime. As such, the polymer will be either incinerated or consigned to landfill with the surface to which it is bound.

5.6. Public exposure

Coatings and printing inks are applied under controlled conditions in industrial plants. Public exposure to the notified polymer is only likely after the coating or ink applied to the articles has fully dried. The notified polymer forms a hard durable film on the coated or printed article and is unavailable for exposure.

6. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa Brown liquid

Boiling Point >100°C

Remarks Data taken from MSDS. Study report not provided

Density 1040 kg/m^3 at 20°C

METHOD DIN EN ISO 2811-3.
Remarks Data taken from MSDS. Study report not provided

Vapour Pressure Not determined

Remarks BYK-UV 3500 is a high molecular weight polymer. The notifier reports a calculated vapour pressure of <0.1kPa at 20ºC in the MSDS.

Water Solubility Insoluble

Remarks The notifier has indicated that the notified polymer is a hydrophobic polydimethylsiloxane (PDMS) derivative and is highly unlikely that such a molecule would be water soluble. The notifier has included a list of PDMS properties (Kirk-Othmer 1997) and given the structural similarities between PDMS and the notified polymer. The notifier indicates that the solubility of notified polymer is expected to be <1 ppm. While the polymer does contain some functionality likely to increase solubility, the manufacturer has found in working with the polymer that it is poorly soluble in water.

Hydrolysis as a Function of pH Not determined

Remarks The notified polymer is not expected to hydrolyse in water given its water insolubility. In soil prolonged contact with soil moisture may result in hydrolysis. Lehman et al (1998) reported that when PDMS enters the soil environment it hydrolyses to yield the monomeric dimethylsilanediol (DMSD). The hydrolysis reaction is reported to be abiotic, because it is much faster as the soil dries. Hydrolysis rates are controlled by soil moisture and to a lesser extent by soil type. The by-products of hydrolysis eventually biodegrade or evaporate (Singh 2000).

TEST FACILITY

Partition Coefficient (n-octanol/water) Not determined

Remarks The notified polymer‘s low water solubility and its hydrophobic nature are indicative of partitioning into the octanol phase (log K_{ow} estimated >3, Kirk-Othmer 1997).

Adsorption/Desorption Not determined
– screening test

Remarks The notifier has indicated that because of the hydrophobic nature of the notified polymer, silicones entering the aquatic environment should be significantly absorbed by sediment or migrate to the air-water interface. This is consistent with the large body of evidence available for hydrophobic organic compounds. In bench-scale activated sludge reactors, silicones were found to absorb to solid material (Watts *et al* 1999).

Dissociation Constant Not determined

Remarks No data available. The notified polymer is not expected to dissociate due to its poor solubility in water. The notified polymer does not contain functional groups, which could potentially dissociate.

Particle Size Not determined

Remarks Not applicable as notified polymer is a liquid.

Flash Point >100ºC

METHOD DIN EN 22719, ISO 2719
Remarks Data taken form MSDS. Study report not provided.

Flammability Limits Not determined.

Remarks The polymer does not form flammable vapours.

Autoignition Temperature Not determined

Remarks The notified polymer is not expected to autoignite.

Explosive Properties Not determined

Remarks From examination of the structure, there are no chemical groups that would infer explosive properties, therefore the notified polymer is regarded as non-explosive.

Reactivity

Remarks The notified polymer is stable under ambient conditions. Based on its structure, the notified polymer is expected to react with oxidising agents.

7. TOXICOLOGICAL INVESTIGATIONS

No toxicological data were submitted.

8. ENVIRONMENT

8.1. Environmental fate

No environmental fate data were submitted

8.2. Ecotoxicological investigations

No ecotoxicity data were submitted

9. RISK ASSESSMENT

9.1. Environment

9.1.1. Environment – exposure assessment

Based on the release information in Section 5.4, the majority of the introduced notified polymer will be disposed of to landfill or be incinerated. The notified polymer is incorporated with other coating components to form very high molecular weight and stable coating film that firmly adheres to the primer layer to which it is applied. Disposal of the notified polymer to landfill is unlikely to present a hazard to the environment, as it is not water soluble and thus will not be mobile in either terrestrial or aquatic environment. The notified polymer in waste from application equipment will be disposed of by incineration.

Fate

The notified polymer is a high molecular weight polymer and is considered to be non-volatile. Therefore, the loss to the atmosphere of the notified polymer is unlikely to be significant. In view of the high molecular weight, the bioaccumulation potential of the notified polymer is considered to be low (Connell 1990). Leaching in landfill is unlikely to occur as the notified polymer is likely to be strongly adsorbed to soils. The notified polymer is considered structurally related to polydimethylsiloxane. Wastewater treatment plants studies have confirmed that polydimethylsiloxanes which enter treatment plants are largely removed by sorption to sludge (Watts *et al* 1995). Experiments in several soils and under different test conditions demonstrated that polydimethylsiloxanes will degrade in soil. (Lehmann *et al* 1998, 2000; Singh *et al* 2000).

9.1.2. Environment – effects assessment

No ecotoxicological data were provided. Nonionic polymers with a number average molecular weight in excess of 1000 are generally of low concern for ecotoxicity because they often have negligible water solubility (Boethling and Nabholz 1997).

9.1.3. Environment – risk characterisation

Although the disposal quantity of the notified polymer to landfill is considered relatively large (up to 5 tonnes), it is expected to occur in a dispersed manner, thereby minimising the hazard associated with this means of disposal. In landfill, it is expected that the notified polymer will be immobile (due to its low water solubility) and will slowly degrade through abiotic means.

The main aquatic hazard would arise through spillage in transport accidents that may release quantities of the notified polymer to drains or waterways. However, the notified polymer is not expected to be toxic to aquatic organisms and is expected to sink to sediments and remain immobile pending collection and disposal to landfill, due to the expected low solubility of the substance. The MSDS contains adequate directions for dealing with spills. Should a spill occur it is imperative that all efforts are directed at avoiding the spill entering the waterway.

9.2. Human health

9.2.1. Occupational health and safety – exposure assessment

Transport and Storage

Exposure to transport and warehouse workers is expected to be negligible, except in the event of an accidental spill.

Coating and Ink Formulation

The main potential for exposure to the notified polymer is during transfer of the neat notified polymer to the blending vessel. Dermal exposure to splashes drips and spills is the most likely route of exposure. A greater potential for exposure is expected at sites where the polymer is charged manually or semi-automatically, rather than at sites where transfer hoses are used. Exposure would be limited by the use of personal protective equipment (PPE). Due to the automated nature of the blending and filling process, exposure to the notified polymer is expected to be negligible except in the case of a machine malfunction.

Exposure to quality control chemists during sampling and analysis is expected to be low due to

low concentration (up to 2%) and the expected small samples involved. Exposure would also be limited by the use of PPE.

Exposure during cleaning processes is expected to be low due to the low concentration (up to 2%) and the expected use of PPE.

Coating Application
Although there is the potential for dermal and inhalation exposure during application of coatings containing the notified polymer, exposure is expected to be low due to the low concentration (up to 2%) and the use of engineering controls and PPE.

Printing Ink Application
The greatest potential for dermal exposure is during introduction of the ink to the print machine especially in the case of screen printing and small lithographic and flexographic operations where this process is expected to be completed manually or during the mixing of screen printing inks. However, the notified polymer is only present at a maximum concentration of 2% in the printing ink and exposure would be further limited by the wearing of gloves.

9.2.2. Public health – exposure assessment

Public exposure to the notified polymer is only likely after the coating or ink applied to the articles has fully dried. The notified polymer is bound within an inert matrix and is unavailable for exposure. As such, public exposure is expected to be negligible.

9.2.3. Human health - effects assessment

No toxicological data have been provided for the notified polymer and therefore the substance cannot be classified in accordance with the NOHSC Approved Criteria for Classifying Hazardous Substances (NOHSC, 2002).

The notified polymer contains acrylate functional groups, which may infer irritant and/or sensitising properties. The notified polymer is of a high molecular weight (>1000 daltons), and is unlikely to cross biological membranes and thus it is expected to have a low order of toxicity. However, as low molecular weight species are present, the risk of irritancy/sensitisation cannot be ruled out.

The notifier states that there are no known instances of work-related injuries or diseases to any workers exposed to BYK-UV 3500.

9.2.4. Occupational health and safety – risk characterisation

The notified polymer is expected to have a low order of toxicity, however, the risk of irritant and sensitising properties cannot be ruled out due to the presence of low molecular weight species.

Coating and Printing Ink Formulation
Exposure and hence the risk of irritation and/or sensitisation is most likely during the initial transfer of the notified polymer to the blending vessel, especially at sites where the polymer is charged manually or semi-automatically. However the risk to workers is expected to be low if the following personal protective equipment is worn during formulation: Protective eyewear, chemical resistant industrial clothing (coveralls) and impermeable gloves.

Following formulation, the risk of adverse effects from exposure to the coating or ink is expected to be low due to the low concentration of the notified polymer (up to 2%).

Coating Application
The risk to workers is expected to be low due to the use of engineering controls and PPE, the low concentration (up to 2%) and the expected low toxicity at this concentration.

Printing Ink Application
Although exposure to the notified polymer could occur when introducing the ink to the print

machine or when mixing screen printing inks, the risk to workers is expected to be low due to the low concentration (up to 2%) and the expected low toxicity at this concentration.

9.2.5. Public health – risk characterisation

Public exposure to the notified polymer is expected to be negligible and therefore the risk to public health is also expected to be negligible.

10. CONCLUSIONS – ASSESSMENT LEVEL OF CONCERN FOR THE ENVIRONMENT AND HUMANS

10.1. Hazard classification

No toxicological data have been provided for the notified polymer and therefore the substance cannot be classified in accordance with the NOHSC Approved Criteria for Classifying Hazardous Substances (NOHSC, 2002).

10.2. Environmental risk assessment

The chemical is not considered to pose a risk to the environment based on its reported use pattern.

10.3. Human health risk assessment

10.3.1. Occupational health and safety

There is Low Concern to occupational health and safety under the conditions of the occupational settings described.

10.3.2. Public health

There is Negligible Concern to public health when used in the proposed manner.

11. MATERIAL SAFETY DATA SHEET

11.1. Material Safety Data Sheet

The MSDS of the notified polymer provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 2003). It is published here as a matter of public record. The accuracy of the information on the MSDS remains the responsibility of the applicant.

11.2. Label

The label for the notified polymer provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Labelling of Workplace Substances* (NOHSC, 1994). The accuracy of the information on the label remains the responsibility of the applicant.

12. RECOMMENDATIONS

REGULATORY CONTROLS

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 introduced:
  - 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 introduced:
  - Protective eyewear, chemical resistant industrial clothing and impermeable gloves;

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 NOHSC *Approved Criteria for Classifying Hazardous Substances*, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Environment

- Do not allow material or contaminated packaging to enter drains, sewers or water courses.

Disposal

- The notified polymer should be disposed of to landfill or be incinerated

Emergency procedures

- Spills/release of the notified polymer should be handled by soaking up with inert absorbent material and follow state or local regulation for the disposal of the waste.

12.1. Secondary notification

The Director of Chemicals Notification and Assessment must be notified in writing within 28 days by the notifier, other importer or manufacturer:

(1) Under subsection 64(2) of the Act:
  - if any of the circumstances listed in the subsection arise.

The Director will then decide whether secondary notification is required.

No additional secondary notification conditions are stipulated.

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