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**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME
(NICNAS)**

FULL PUBLIC REPORT

Polyurethane in DynamX

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**Director
Chemicals Notification and Assessment**

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FULL PUBLIC REPORT**Polyurethane in DynamX****1. APPLICANT AND NOTIFICATION DETAILS**

APPLICANT(S)

National Starch and Chemical Pty Ltd, 7 Stanton Road Seven Hills, NSW 2147

EXEMPT INFORMATION (SECTION 75 OF THE ACT)

Data items and details claimed exempt from publication:

- Chemical Name
- Other Names
- CAS Number
- Molecular Formula
- Structural Formula
- Means of Identification
- Number Average Molecular Weight
- Weight Average Molecular Weight
- Weight percentage of Polymer species with MW < 1000 and MW < 500
- Charge Density
- Polymer constituents
- Residual Monomers and Impurities

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

None

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)

Polyurethane in DynamX

3. COMPOSITION

PLC CRITERIA JUSTIFICATION

Molecular Weight	The notified polymer satisfies the molecular weight criteria
Reactive Functional Groups	The notified polymer contains no functional groups of high or moderate concern.
Elemental Criteria	The notified polymer contains only approved elements.
Degradability	The notified polymer is not expected to undergo degradation.
Water Absorbing	The notified polymer is not a water-absorbing polymer.
Residual Monomers	All residual monomers are below the relevant cut-off.
Hazard Category	The notified polymer is not classified as a hazardous substance.

The notified polymer meets the PLC criteria.

4. INTRODUCTION AND USE INFORMATION

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

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
<i>Tonnes</i>	20	20	20	20	20

USE

The notified polymer will be used as a hair fixative agent in hair care products such as pump sprays and hair gel formulations at a concentration of up to 6%.

6. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa	The product DynamX containing the notified polymer is an amber liquid.
Melting Point/Glass Transition Temp	N/A
Density	930 kg/m ³ (DynamX)
Water Solubility	1000 mg/L The water solubility of the notified polymer was determined by visual assessment. The fully neutralised test material (1000 mg) was added to water (1000 mL) and found to produce a clear solution. The notified polymer is imported in an up to 30% aqueous ethanol solution at a concentration of 28% (solids). Based on the monomer composition and the general hydrophobic properties of the polymer class, the un-neutralised notified polymer is unlikely to have significant water solubility. Therefore, the notified polymer is likely to be dispersible in water rather than truly soluble.
Particle Size	Not applicable as the polymer is imported as an aqueous emulsion.
Degradation Products	The polymer is not expected to undergo degradation.
Loss of monomers, other reactants, additives impurities	None expected

OTHER PROPERTIES

Hydrolysis as a Function of pH	The notified polymer contains linkages that could be expected to undergo hydrolysis under extreme pH conditions. However, in the environmental pH range of 4 to 9, significant hydrolysis is unlikely to occur.
Partition Coefficient (n-octanol/water)	The notified polymer's water solubility is indicative of preferential partitioning into the octanol phase.
Adsorption/Desorption	The neutralized notified polymer is expected to have a low affinity for soil and sediment and be mobile in the environment due to its water solubility. However, as the free acid it is likely to be insoluble in water and, as a result, will be immobile in the environment.

Dissociation Constant

The notified polymer contained some carboxylic acid groups that are expected to have typical acidity.

7. HUMAN HEALTH IMPLICATIONS

7.1 Toxicology

9.2.1. Toxicological Investigations

No toxicological data were submitted.

9.2.2. Human Health Hazard Assessment

The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard.

7.2 Occupational Health

7.2.1 Occupational Exposure

The notified polymer will be into Australia in 25 kg pails and 200 L drums at a concentration of 19.6% in a water/ethanol solution, and transported to the notifier's warehouse prior to distribution to customer sites. Exposure of workers involved in transport and storage is unlikely except in the event of an accident where packaging may be breached.

Reformulation of the polymer solution into hair fixative products takes place on customer sites and involves the pumping of the polymer solution into a blending vessel, together with other ingredients. Exposure may occur during the formulation process when opening drums and pails and *via* drips from hoses and cam-lock fittings during pumping and connection to pumps. Exposure to the notified polymer may also occur during quality control sampling and testing which follows formulation.

Following quality control procedures, the formulation containing the notified polymer is packaged into consumer sized packaging. Exposure to the notified polymer is not expected during this highly automated process except in the event of leaking or malfunctioning filling equipment or transfer lines.

Retail workers involved in the shelf filling and sale of the final consumer product are not expected to be exposed to the notified polymer except in cases of an accident where the packaging may be breached.

Occupational exposure may occur in salons during application of the products to customers' hair. Dermal exposure is expected to be the most likely route of exposure during hairdressing, however limited ocular exposure is possible and inhalation exposure may also occur during use of spray products.

7.2.2 Exposure Assessment

The most significant scenario for occupational exposure occurs in hair salons where workers may apply the product containing the notified polymer several times each working day.

Dermal and ocular exposure can occur during certain formulation processes and quality control. However, exposure to significant amounts of the notified polymer is limited because of the engineering controls and personal protective equipment worn by workers.

During transport and storage, workers are unlikely to be exposed to the notified polymer except when packaging is accidentally breached. Likewise, retail workers are unlikely to be exposed to the notified polymer unless the consumer packaging is damaged.

7.3 Public Health

7.3.1 Public Exposure

The notified polymer is reformulated into hair fixative products available to the public through various retail outlets, and as such, public exposure will occur.

7.3.2 Exposure Assessment

The notified polymer is present in the final product at a concentration of up to 6%. Those consumers using the product are expected to use approximately 5 g of the product 1-2 times per day (EU, 1996) and are therefore potentially exposed to up to 0.6 g of notified polymer per day through application to hair.

8. ENVIRONMENTAL IMPLICATIONS

8.1 Ecotoxicology

8.1.1 Ecotoxicological Investigations

No toxicological data were submitted.

8.1.2 Environmental Hazard Assessment

The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard.

8.2 Environmental Contamination

8.2.1 Environmental Exposure

Manufacture:

During cosmetics formulation, the notifier estimates that up to 800 kg per annum of notified polymer waste will be generated. This will be derived from the spills (100 kg per annum) and equipment cleaning (600 kg per annum). Formulation equipment will be cleaned with water and the resulting wastes will be treated prior to disposal. The notifier indicates that solid wastes (560 kg/annum, assuming 80% removal) will be disposed to landfill and the treated liquid wastes containing the remaining 140 kg/annum will be released to sewer. It is expected that empty import drums and any residual notified polymer they contain will be disposed of to landfill. This will result in up to a further 100 kg per annum of the notified polymer may be disposed of to landfill.

End-Use:

The notified polymer will be used in hair care products and, as such, this will result in the eventual release of close to the entire import volume to the environment.

8.2.2 Exposure Assessment

The notified polymer is miscible in water and as such is likely to be mobile in both aquatic and terrestrial compartments. When released to sewer and in landfill, the notified polymer is expected to slowly associate with soil and sediment and degraded through the abiotic and biotic processes to water and oxides of carbon and nitrogen.

The notifier has provided a summary of a literature reference (Martin 1996) in which the level of removal of a polyacrylate polymer from wastewater treatment plants was investigated. The summary refers to studies carried out on a polymer used in the production of nappy products and showed its extensive removal from the aqueous compartment through the use of horizontal flow tanks containing sand beds. It is difficult to assess the relevance of this information in determining the extent to which the notified polymer will be removed during treatment in sewerage treatment plants in the absence of a structure and physico-chemical data on the test substance referred to in the article. However, it is likely to be completely different from the notified polymer. Therefore, the exposure assessment below has been conducted using a worst-case release of 20000 kg per annum.

Based on annual releases of 20000 kg per annum to sewer and no removal during sewage treatment processes, the daily release on a nationwide basis to receiving waters is estimated to be 54.8 kg/day. Assuming a national population of 19,500,000 and that each person contributes an average 200 L/day to overall sewage flows, the predicted concentration in sewage effluent on a nationwide basis when released to ocean and inland river are estimated to be 0.28 and 2.81 µg/L. However, removal processes such as adsorption to sludge would reduce this value further.

Due to its high molecular weight (>>1000 MW), the notified polymer is not expected to bioaccumulate.

9. RISK ASSESSMENT

9.1. Environment

The notified polymer will be used in hair care products and, as such, this will result in the eventual widespread and diffuse release of the entire import to the environment from use. When released to sewer and in landfill, the notified polymer is expected to associate with soil and sediment and degraded through the abiotic and biotic processes to water and oxides of carbon and nitrogen.

An assessment of the available literature indicates that the toxicity exhibited by polyaliphatic acids towards fish and daphnia are consistently low (Boethling and Nabholz 1996). However, this class of polymer is known to exhibit indirect toxicity to algae through their capacity to remove cationic metals from solution and that this toxicity is dependant on the distance between the pendant carboxylic acid groups on the polymer backbone. Polymers containing pendant carboxylic acid groups separated by one atom (carbon, nitrogen, oxygen etc.) on the backbone tend to be the most toxic (eg. MW 3000, LC50 of 7.5 mg/L). In contrast, if the acids are moved closer or farther apart the algal toxicity exhibited decreases. In the case of the notified polymer, the separation of the pendant carboxylic acid groups is large enough (10 atoms) to suggest that it is unlikely to exhibit any appreciable toxicity towards algae and that its toxicity is unlikely to exceed the PEC calculated above.

The notified polymer is not likely to present a hazard to the environment when it is stored, transported and used in the proposed manner.

9.2 Occupational health and safety

The OHS risk presented by the notified polymer during transport, storage, and reformulation is expected to be low due to its expected low hazard and low potential for worker exposure.

Hair salon workers will be regularly exposed to the notified polymer through application of hair gels and sprays to clientele, however, due to the low amount of notified polymer used with each application and the low hazard associated with the notified polymer, the risk to the workers is considered low.

The polymer will be imported in an ethanol containing solution and is a class 3 (flammable) Dangerous Good. It should be transported and stored according to the Dangerous Goods Code and regulations (FORS, 1998).

9.3 Public health

The product containing the notified polymer will be used by the general public applying the products themselves, and also by those having products applied during professional hairdressing. The notified polymer has a MW > 1000, and thus will be unable to cross biological membranes. Despite the potential widespread use, the risk to public health is considered low due to the non-hazardous nature of the notified polymer.

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

10.2. Environmental risk assessment

The polymer 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 no 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 intended manner.

12. RECOMMENDATIONS

CONTROL MEASURES

Occupational Health and Safety

- No specific engineering controls, work practices or personal protective equipment are required for the safe use of the notified polymer itself, however, these should be selected on the basis of all ingredients in the formulation.
 - 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

Disposal

- Wastes containing the notified polymer should be disposed of to landfill.

Transport and Packaging

- The notified polymer will be imported in an ethanol containing solution and is a Class 3 (flammable) Dangerous Good. Transport and packaging of the product 'Dynam X' should be in accordance with the requirements of the *Australian Dangerous Goods Code* (FORS, 1998) and Regulations.

Storage

- The product 'DynamX' should be stored in accordance with *AS 1940-1993: The storage and handling of flammable and combustible liquids* (Standards Australia, 1993).
- The following precautions should be taken regarding storage of the notified polymer:
 - Store on a wooden pallet
 - Store between 5-30 C.
 - Store in a cool, dry area away from heat, sparks or fire.
 - Open drums in ventilated area.

Emergency procedures

- Spills/release of the notified polymer should be handled by dam and recover. Prevent entry into drainage systems, rivers and waterways. Collect with absorbant material such as sand, earth or appropriate commercial absorbent. Shovel up with non sparking tools and then place in suitable containers.

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(1) of the Act; if
 - the notified polymer is introduced in a chemical form that does not meet the PLC criteria.
- or
- (2) 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.

13. BIBLIOGRAPHY

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