File No: LTD/1452

February 2010

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

Polymer 2 in Electroshield 21 resin

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:

Street Address:	334 - 336 Illawarra Road MARRICKVILLE NSW 2204, AUSTRALIA.
Postal Address:	GPO Box 58, SYDNEY NSW 2001, AUSTRALIA.
TEL:	+ 61 2 8577 8800
FAX	+ 61 2 8577 8888
Website:	www.nicnas.gov.au

Director
NICNAS

TABLE OF CONTENTS

FULL PUBLIC REPORT

This notification has been conducted using the cooperative arrangement with the Office of Pollution Prevention and Toxics (OPPT), of the United States Environmental Protection Agency (US EPA). Information pertaining to the assessment of the notified polymer as conducted by the US EPA was provided to NICNAS, and where appropriate, has been used in this assessment report. The other elements of the risk assessment and recommendations on safe use of the notified polymer were carried out by NICNAS.

Polymer 2 in Electroshield 21 resin

1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
DuPont (Australia) Ltd (ABN 59 000 716 469)
7 Eden Park Drive
Macquarie Park NSW 2113

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 names, CAS number, Molecular formula, Structural formula, Molecular weight, Purity, Polymer constituents, Hazardous impurities/residual monomers, Introduction volume, Use details, Identity of recipient.

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
Variation to the schedule of data requirements is claimed as follows: Particle size, Flash point, Flammability limits.

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
None

NOTIFICATION IN OTHER COUNTRIES
USA, Canada

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
Electroshield 21 resin (containing < 30% notified polymer)

MOLECULAR WEIGHT
Mn > 1000 Da

ANALYTICAL DATA
Reference IR and GPC spectra were provided.

3. COMPOSITION

DEGREE OF PURITY > 90%

NON HAZARDOUS IMPURITIES (>1% by weight)
None

ADDITIVES/ADJUVANTS
None

4. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AT 20°C AND 101.3 kPa: Clear to slightly yellow solid.

Property	Value	Data Source/Justification
Boiling Point	> 163°C at 101.3 kPa	Estimated based on characteristics of the imported product.
Density	~ 1114 kg/m^3 at 20°C	Estimated.
Vapour Pressure	< 5 x10^{-9} kPa	Estimated based on the vapour pressure of a monomer of the notified polymer.
Water Solubility	466-942 mg/L at pH 2, 20°C 166-1078 mg/L at pH 9, 20°C; 533-2595 mg/L at pH 7, 37°C	Measured. Difficulties encountered with emulsion formation and filtration. The notifier has indicated that the notified polymer is water soluble in acid conditions between pH 5.0 and 6.5. The notified polymer is at least dispersible in water in acidic conditions and is less dispersible in basic conditions.
Hydrolysis as a Function of pH	Not determined	No readily hydrolysable groups are in the cationic polymer that will hydrolyse between pH 4-9.
Partition Coefficient (n-octanol/water)	P_{ow} = 3.6	Measured. Test report not provided. A low P_{OW} is consistent with the chemical structure of the notified polymer containing a significant amount of hydrophilic terminal moieties.
Adsorption/Desorption	Not determined	Despite the very low P_{OW}, the notified polymer has potential to adsorb to soil or sediment due to the presence of potential cationic functional groups.
Dissociation Constant	Not determined	The notified polymer is expected to be ionised in the environmental pH range of 4-9 based on the presence of potential cationic functional groups.
Particle Size	Not determined	Notified polymer will not be imported as a solid.
Flash Point	Not determined	Notified polymer is a low vapour pressure solid.
Flammability	Not determined	Not expected to be flammable.
Autoignition Temperature	> 532°C	Estimated based on a monomer of the notified polymer.
Explosive Properties	Not expected to be explosive	Contains no structural groups with known explosive properties.

DISCUSSION OF PROPERTIES

Reactivity

The notified polymer is expected to be stable under normal environmental and usage conditions.

Dangerous Goods classification

Based on the submitted physical-chemical data in the above table the notified polymer is not classified as a dangerous good according to the Australian Dangerous Goods Code (NTC, 2007). However the data above does not address all Dangerous Goods endpoints. Therefore consideration of all endpoints should be undertaken before a final decision on the Dangerous Goods classification is made by the introducer of the polymer.

5. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS
The notified polymer will be imported as a < 30% component of a finished product.

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

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	< 500	< 500	< 500	< 500	< 500

PORT OF ENTRY
Melbourne, Adelaide

IDENTITY OF RECIPIENT
DuPont (Australia) Ltd

TRANSPORTATION AND PACKAGING
The notified polymer will be imported in 1040 Litre bulk containers and transported by road to the notifier's depot. The notified polymer will be transferred from the bulk containers to 20,000 Litre steel road tankers via pumps or gravity feed and then delivered to the end user's site.

USE
Component of automotive vehicle undercoats.

OPERATION DESCRIPTION
End-use
After arriving at the end user's site, storemen will transfer the imported solution (containing < 30% notified polymer) from the road tanker to a holding tank. Technicians will then transfer the solution from the holding tank to an electrocoat (e-coat) tank along with other components to form a final e-coat solution containing < 15% notified polymer. Automotive vehicle bodies will be submerged into the e-coat solution and subsequently rinsed in wash tanks. After rinsing, the vehicle body will be placed into an oven for drying and curing, after which the vehicle body will be coated with several layers of topcoats. Quality control staff will conduct daily tests on bath performance and sample quality, and maintenance/servicing will be performed regularly on the coating system and tank filters. Waste water from the e-coating process will be treated and disposed.

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)*
Transport	10	4	40
Storemen	4	1	40
E-coat technicians	4	1	100
Servicing/maintenance	4	1.5	50
Quality Control	2	2	240
Waste treatment/disposal	2	0.5	220

EXPOSURE DETAILS
Transport workers, including those involved in transfer of the notified polymer from import containers to road tankers, are not expected to be exposed to the notified polymer except in the event of an accident. Delivery and container storage areas will be covered and bunded to contain any accidental spills or leakages.

End-use
Exposure to the notified polymer (< 30% concentration) by store workers is not anticipated because of the use of automated pumps and dedicated flexible hose lines for transfer of the solution between the road tanker,

holding tank and e-coat bath. Potential dermal and ocular exposure is expected to be further minimised by measures such as container-venting during pumping to reduce the risk of bubbling and spillage and wearing of personal protective equipment (PPE) such as gloves and overalls.

E-coat technicians may experience dermal and accidental ocular exposure to < 15% notified polymer due to spills or splashes during the electrocoating process; however the level of exposure is expected to be minimised due to the highly automated coating process whereby the vehicle bodies are moved through the e-coat and rinse tanks via conveyors. Exposure will be further reduced by workers wearing PPE such as coveralls, face shields or goggles and gloves.

Quality control workers may experience dermal and accidental ocular exposure during testing; however exposure is likely to be reduced by the use of PPE including gloves and goggles.

Dermal and ocular exposure may occur to workers involved in maintenance, servicing and waste disposal, but the level of exposure is expected to be reduced by the use of PPE (gloves, goggles, coveralls) and dedicated hose lines and valves in the e-coat bath system.

6.1.2. Public exposure

The notifier polymer will not be sold to the general public and therefore no direct public exposure is anticipated. The public is likely to come into contact with surfaces of finished vehicle bodies; however in this form the notified polymer will be cross-linked, incorporated into an inert matrix underneath several topcoat layers and thus will be unavailable for exposure.

6.2. Human health effects assessment

No toxicity data were submitted on the notified polymer.

The human health effects assessment has been conducted based on toxicological study reports submitted by the notifier on a test substance containing a structurally related polymer (at 70% concentration) and an evaluation of human health effects of the notified polymer by the US EPA.

Toxicokinetics and absorption

Based on the relatively high molecular weight (Mn > 1000 Da) and water-octanol solubility (Log P_{ow} = 3.6), the notified polymer is not expected to undergo significant percutaneous absorption through the skin, although it has the potential to be absorbed by the lungs following inhalation exposure. Absorption through the gastrointestinal tract (GIT) by passive diffusion is possible based on the Log P_{ow} and water solubility of the notified polymer.

Acute toxicity

The oral LD_{50} in rats for the structurally related polymer was greater than 2000 mg/kg in an acute oral toxicity test; therefore the notified polymer is likely to be of low acute toxicity via the oral route.

Irritation and Sensitisation

No structural alerts for sensitisation were identified. The notified polymer contains a functional group that may have the potential to cause skin, eye and mucous membrane irritation, particularly in light of the significant proportion of low molecular weight species.

Mutagenicity.

The structurally related polymer was not mutagenic to any bacterial strain in a bacterial mutagenicity test and did not induce chromosomal aberrations in human whole blood lymphocytes, either with or without metabolic activation. Based on these studies, the notified polymer is not considered to be mutagenic or genotoxic.

Health hazard classification

Based on the available data the notified chemical cannot be classified as hazardous according to the *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004).

6.3. Human health risk characterisation

6.3.1. Occupational health and safety

The notified polymer is not likely to be dermally absorbed, but the potential for skin and eye irritation cannot

be ruled out. Workers may experience dermal and ocular exposure to the notified polymer during transfer of the imported solution (containing < 30% concentration) and to the e-coat mixture (< 15%) during electrocoating, quality control, maintenance and waste disposal processes. Exposure is expected to be limited due to the highly automated systems and the use of personal protective equipment that covers the eyes (goggles or face shields) and skin (gloves, coveralls).

The notified polymer has the potential to be absorbed by the lungs and GIT, however workers are not likely to experience oral exposure and inhalation of notified polymer vapours is not anticipated due to the low vapour pressure.

Under the proposed occupational setting and control measures, the notified polymer is not considered to pose an unacceptable risk to the health of workers.

6.3.2. Public health

There will be negligible exposure to the public, therefore the notified polymer is not considered to pose an unacceptable risk to public health.

7. ENVIRONMENTAL IMPLICATIONS

7.1. Environmental Exposure & Fate Assessment

7.1.1 Environmental Exposure

RELEASE OF CHEMICAL AT SITE

The notified polymer will be imported as a component of a resin for end use in Australia. Transportation by road tanker of the product containing the notified polymer to the end user's site will occur in Australia. Residues in the imported containers are estimated to be less than 0.02% of the volume and will be rinsed with water. Any rinsings from the containers and pumping equipment will be placed into the road tanker. Empty containers will be sold to a local drum recycler for reuse. The road tanker will be dedicated to carrying the liquid product and will not be washed out between deliveries. No significant release from spillage is expected for these operations.

RELEASE OF CHEMICAL FROM USE

The potential release scenarios of the notified polymer at the car manufacturing plant include:

a) Road tanker delivery to the plant

In the unlikely event of spillage, it will either be contained and disposed to landfill, or it will be drained to the internal waste water treatment plant. No significant release is expected.

b) Electrocoat (e-coat) immersion tank

As the automotive bodies and parts are passed through the electrocoat tank by conveyer, it is likely the majority of excess coating will drip back into the tank and any small amount that does not will be recycled into the e-coat tank. As the e-coat tank is replenished with additional coating from an automated pump, there is potential for a small amount to overflow. Most of the overflow is expected to be recycled. The e-coat tank contents will be filtered. The filters will be rinsed and the residues directed to the internal waste water treatment plant. It is expected the filters will eventually be dried and disposed to landfill. At no time are the contents of the tank removed for tank cleaning or rinsing. No significant release of the notified polymer is expected at this stage.

c) E-Coat wash water tanks

Rinsing of the metal surface after deposition is conducted by a closed loop process, with successive rinses, each feeding back to the previous rinse. Rinse material is obtained from the paint itself by ultrafiltration. The final rinse drainings containing a very small amount of the notified polymer will be directed to the internal waste water treatment plant. The filters will be cleaned and the residues in the waste water will be sent to the internal waste water treatment plant.

The rinsings and residues at the internal waste water treatment plant will be treated with sodium hydroxide and alum to aid in the precipitation and coagulation of any suspended or dissolved solids to form a sludge. This sludge will be then separated from volatile content through a filtration process for disposal to landfill.

The notifier indicates that data for the end user's internal waste water treatment plant is not useful for calculation purposes as there are waste streams from other areas of the plant mixed with the e-coat process. Data were therefore used for a large automotive plant. This data can be assumed to be an estimate of a worst case scenario for the release of notified polymer from use in Australia. Assuming 8.889 kg/day of the notified

polymer is released to the internal water treatment processing plant and the e-coat process functions for 340 days per year, the release of the notified polymer to the treatment plant is 3022.26 kg per annum (= 8.889 kg/day × 340 days/year). Assuming the coagulation method produces 96% precipitation/coagulation of the notified polymer, the release of the notified polymer with the effluent to the local sewerage treatment plant is 120 kg per annum (3022.26 kg/year x 4%).

RELEASE OF CHEMICAL FROM DISPOSAL
At the end of the car's useful life, the coated metal articles will enter metal recycling or be disposed to landfill.

7.1.2 Environmental fate

The notified polymer was found not to be readily biodegradable. For the details of the environmental fate studies, refer to Appendix B. Based on the high molecular weight, a low P_{ow} and/or cross-linked structure after the curing application, the notified polymer is not expected to be bioavailable or bioaccumulative to aquatic organisms.

A small amount of the notified polymer will be disposed to sewage. In the water compartment, the notified polymer is expected to adsorb to the sludge based on its cationic characteristics and will be collected for disposal to landfill. Most of the notified polymer will be cured into an inert, cross-linked polymer network with another polymer component, when the electrocoated automotive parts are autoclaved after e-coating. The notified polymer will share the fate of the automotive parts, which will involve eventual disposal to landfill or thermal decomposition during metal recycling. In landfill, the notified polymer is not expected to leach due to its high molecular weight and cross-linked structure, and will undergo slow biotic or abiotic degradation processes. In both cases for landfill and thermal decomposition, the notified polymer is expected to degrade to water and oxides of carbon and nitrogen.

7.1.3 Predicted Environmental Concentration (PEC)

Based on the data for a large automotive plant, the estimated release of the notified polymer in effluent from the end user's waste water treatment plant to the local sewerage treatment plant is 120 kg/year. Assuming a flow of 85 ML/day for the individual local sewerage treatment plant, 340 days per annum, and none of the solid removed during the sewage treatment, which is the worst case scenario, the PEC can be calculated as 4.15 µg/L (120 kg/year ÷ 340 days/year÷85 ML/day) for release to a river.

7.2. Environmental effects assessment

The results from ecotoxicological investigations conducted on a product containing 70% analogue polymer in 2-butoxyethanol are summarised in the table below. Details of these studies can be found in Appendix B. Based on the information provided by the notifier, the test substance is considered structurally similar to the notified polymer despite the different counter ion. Therefore the data from the analogue is considered acceptable to use in the assessment of the notified polymer.

Endpoint	*Result*	*Assessment Conclusion*
Fish Toxicity	96 h LC50 = 3.5 mg/L	Toxic
Daphnia Toxicity	48 h EC50 = 6.0 mg/L	Toxic
Algal Toxicity	72 h E_rC50 = 1.1 mg/L	Toxic

Given the fact that the notified polymer has a higher charge density with respect to functional groups of high concern compared to the analogue polymer, and considering the test substance for this study is not the pure form of the analogue polymer, the notified polymer is likely to be at least as toxic as the test substance. Considering the endpoint for algae is very close to the threshold of the GHS classification of toxic/very toxic rating (United Nations, 2009), the notified polymer is conservatively rated to be very toxic to aquatic life.

7.2.1 Predicted No-Effect Concentration

Predicted No-Effect Concentration (PNEC) for the Aquatic Compartment		
Alga	1.1	mg/L

Assessment Factor	500	
PNEC:	2.2	µg/L

A PNEC has been calculated by using the endpoint of E_rC50 = 1.1 mg/L for the most sensitive species algae. Even though studies for three aquatic trophic levels are available, a safety factor of 500 was used due to the following considerations which have made the test results less reliable. The ecotoxicity studies were based on a product containing 70% of an analogue polymer and this polymer has a lower charge density with respect to functional groups of higher concern compared to the notified polymer.

7.3. Environmental risk assessment

A Risk Quotient (Q = PEC/PNEC) for river water has been calculated to be 4.15/2.2 = 1.89 (Q > 1). The Q value for ocean water is expected to be 0.19 (Q < 1), suggesting that the notified polymer is not expected to pose an unacceptable risk to the ocean life from the reported use pattern in Australia. Release of the notified polymer to river water is not expected due to the location of the user site.

8. CONCLUSIONS AND REGULATORY OBLIGATIONS

Hazard classification

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

As a comparison only, the classification of the notified polymer using the Globally Harmonised System for the Classification and Labelling of Chemicals (GHS) (United Nations 2003) is presented below. This system is not mandated in Australia and carries no legal status but is presented for information purposes.

	Hazard category	***Hazard statement***
Environment	Acute Category 1 Chronic Category 1	Very toxic to aquatic life with long lasting effects

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 is not considered to pose an unacceptable risk to public health.

Environmental risk assessment

On the basis of the PEC/PNEC ratio and the reported use pattern, the notified polymer is not expected 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 imported at concentrations < 30%:
  - Avoid contact with eyes and skin.

- Employers should ensure that the following PPE is used by workers to minimise occupational exposure to the notified polymer as imported at concentrations < 30%:
  - Gloves
  - Safety glasses
  - Protective clothing

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

- If products and mixtures containing the notified chemical 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 chemical should be disposed of to landfill.

Emergency procedures

- Spills or accidental release of the notified chemical should be handled by physical 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(1) of the Act; if
  - the polymer has a number-average molecular weight of less than 1000;

or

(2) Under Section 64(2) of the Act; if
  - the function or use of the chemical has changed from a component of automotive coatings, or is likely to change significantly;
  - the amount of chemical being introduced has increased from 500 tonnes, or is likely to increase, significantly;
  - the chemical has begun to be manufactured in Australia;
  - 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.

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

APPENDIX A: PHYSICAL AND CHEMICAL PROPERTIES

Water Solubility 466-942 mg/L at pH 2, 20 ºC;
166-1078 mg/L at pH 9, 20ºC;
533-2595 mg/L at pH 7, 37ºC

Method OECD TG 120: Solubility/Extraction Behaviour of Polymer in Water

Remarks 2.5 g and 0.25 g of the notified polymer were separately mixed to 250 mL of water and kept at 20˚C or 37˚C and pH of 2 and 9 for 24 hours. Emulsions were formed, and the emulsified polymer particles could not be separated from water by centrifugation. The mixtures were filtered through a 0.45 µm PTFE syringe filter for TOC analyses. Filtration was difficult and presumably is one reason for the high variability in some of the TOC results. A calibration factor of 1.49 was used for calculation of the water solubility/extractability. The calibration factor accounts for the fact that the notified polymer contains elements other than carbon and was the average of 2 measurements. The notified polymer showed a variety of solubility/extractability values depending on the pH and temperature as described in the following table.

Water solubility/extractability of the notified polymer

pH	Nominal concentration (g/250 mL)	Temperature (ºC)	Solubility/extractability	
			mg/L	% of starting material
2	2.5	20	942±259	9.3±2.6
	0.25	20	466±214	46.3±24.8
7	2.5	37	2595±2017	23.9±18.1
	0.25	37	533±100	50.7±9.31
9	2.5	20	1078±690	11.0±7.9
	0.25	20	166±44	13.4±3.2

Test Facility DuPont (2010)

Partition Coefficient (n-octanol/water) P_{OW} = 3.6

Method Test report not provided.

Remarks A P_{OW} of 3.6 is stated by the notifier. The notified polymer is considered soluble in acidic conditions or is at least dispersible according to the above summarized test report. Therefore, a low P_{OW} is expected and corresponds to the presence of hydrophilic terminal functional groups in the notified polymer.

Test Facility EPA (1996)

APPENDIX B: ENVIRONMENTAL FATE AND ECOTOXICOLOGICAL INVESTIGATIONS

B.1 Environmental Fate

B.1.1 Ready biodegradability

TEST SUBSTANCE	Analogue polymer
METHOD	AEM SOP MI051-P "Ready biodegradability: Closed Bottle Test". OECD TG 301 D Ready Biodegradability: Closed Bottle Test.
Inoculum	Wilmington POTW treatment works
Exposure Period	28 days
Auxiliary Solvent	None
Analytical Monitoring	Biodegradation was measured as the loss of dissolved oxygen within the closed bottle.
Remarks - Method	A series of test substances were used in the study. Based on the information provided by the notifier, one of the test substances is considered structurally similar to the notified polymer including the fact that it has a different counter ion. Therefore it was considered acceptable as an analogue to the notified polymer.

RESULTS

Test substance		*Sodium Acetate*	
Day	*% Degradation*	*Day*	*% Degradation*
7	2	7	63
28	9	14	77

Remarks - Results	The reference substance achieved > 60% degradation after 7 days. The test analogue degraded 9% after 28 days, indicating the test substance is not readily biodegradable. In addition, considering the counter ion substance is readily biodegradable, this detected degradation may partly derive from the counter ion substance. Therefore, the notified polymer is not expected to be readily biodegradable.
CONCLUSION	The test substance and by inference, the notified polymer, are not readily biodegradable.
TEST FACILITY	E. I. du Pont de Nemours and Company (1996)

B.1.2 Bioaccumulation

TEST SUBSTANCE	Notified polymer
METHOD	Not determined
CONCLUSION	The notified polymer is not expected to be readily biodegradable. However, it is not considered to be bioaccumulative in aquatic organisms based on its high molecular weight (> 1000) and low P_{ow}.

B.2. Ecotoxicological Investigations

B.2.1 Acute toxicity to fish

TEST SUBSTANCE	Analogue polymer in 2-Butoxyethanol
METHOD	OECD TG 203 Fish, Acute Toxicity Test – static; United States EPA – 40CFR 797.1400 Fish acute toxicity test 96 hr – static

Species	Fathead Minnows (*Pimephalas promelas*)
Exposure Period	96 hours
Auxiliary Solvent	None
Water Hardness	84 mg $CaCO_3$/L
Analytical Monitoring	Not measured
Remarks – Method	Following a range-finding test, fish were exposed to the test substance at nominal concentrations of 0.31, 0.63, 1.3, 2.5, 5.0, 10 and 20 mg/L in comparison with a blank control. All test levels were conducted in duplicates and 10 fish were used for each replicate, and the conditions were controlled at 7.4-8.1 pH, 7.9-8.9 mg/L oxygen concentration and 20.4-21.8˚C temperature. Statistical analyses of the endpoints used the Moving Average-Angle Method.

RESULTS

Concentration mg/L	*Number of Fish*	*Mortality*				
Nominal		*1 h*	*24 h*	*48 h*	*72 h*	*96 h*
0	20	0	0	0	0	0
0.31	20	0	0	0	0	0
0.63	20	0	0	0	0	0
1.3	20	0	0	0	0	0
2.5	20	0	0	0	0	0
5.0	20	15	20	20	20	20
10	20	20	20	20	20	20
20	20	20	20	20	20	20

LC50	3.5 mg/L at 96 hours (with 95% confidence limits of 2.9-4.2 mg/L)
NOEC	0.63 mg/L at 96 hours
Remarks – Results	The test results indicate that the test substance is toxic to fish *Pimephalas promelas*. Considering the test substance contains ~30% solvent, and the notified polymer has a higher charge density of cationic moieties, which are functional groups of high concern, than the analogue polymer, the notified polymer is considered to be at least as toxic as the test substance.

CONCLUSION The test substance, and by inference, the notified polymer, are toxic to fish.

TEST FACILITY E. I. du Pont de Nemours and Company (1993a)

B.2.2 Acute toxicity to aquatic invertebrates

TEST SUBSTANCE Analogue polymer in 2-Butoxyethanol

METHOD OECD TG 202 *Daphnia* sp. Acute Immobilisation Test and Reproduction Test – unaerated static.
EC Directive 92/69/EEC C.2 Acute Toxicity for *Daphnia* – unaerated static.

Species	*Daphnia magna*
Exposure Period	48 hours
Auxiliary Solvent	None
Water Hardness	76 mg $CaCO_3$/L
Analytical Monitoring	Test concentrations not measured
Remarks - Method	Following a range-finding test, daphnids were exposed to the test substance at nominal concentrations of 0.061, 0.15, 0.38, 0.96, 2.4, 6.0 and 15 mg/L at 20.0-20.6˚C, pH 7.8-8.2 and dissolved oxygen level of 8.4-8.7 mg/L. Four replicates were performed for each test level including the blank control and five animals were used for each replicate. The end points were statistically analysed by the Moving Average-Angle method.

RESULTS

Concentration mg/L Nominal	*Number of D. magna*	*Number Immobilised*	
		24 h	*48 h*
0	20	0	0
0.061	20	0	0
0.15	20	0	0
0.38	20	0	0
0.96	20	0	0
2.4	20	0	0
6.0	20	3	10
15	20	5	20

EC50	6.0 mg/L at 48 hours (with 95% confidence limits of 5.0-7.2)
NOEC	2.4 mg/L at 48 hours
Remarks - Results	The test results indicate that the test substance is toxic to daphnids. The same considerations with respect to the lower charge density of the analogue polymer & the presence of solvent, as discussed in the above fish test, apply to this test.
CONCLUSION	The test substance, and by inference, the notified polymer, are toxic to daphnids.
TEST FACILITY	E. I. du Pont de Nemours and Company (1993b)

B.2.3 Algal growth inhibition test

TEST SUBSTANCE	Analogue polymer in 2-Butoxyethanol
METHOD	TCSA 40 CFR 792 bearing similarity to OECD TG 201 Alga, Growth Inhibition Test.
Species	*Selenastrum capricornutum*
Exposure Period	96 hours
Concentration Range	Nominal: 0.5, 1.0, 2.0, 4.0 and 8.0 mg/L
Auxiliary Solvent	None
Water Hardness	Not provided
Analytical Monitoring	Data on cells determined visually by microscopic examination with a haemocytometer.
Remarks - Method	Following a range-finding test, *Selenastrum capricornutum* was exposed to the test substance at five different levels at 24±1˚C, pH 7.0 (at start). Three replicates were performed for each test level including the blank control and algae of 1×10^4 cells/mL were used for the test. The probit method was used to determine 72 and 96 hour E_rC50 and the 95% confidence limits.

RESULTS

Growth			
E_rC50 mg/L at 72 h	*NOEC mg/L at 72 h*	*E_rC50 mg/L at 96 h*	*NOEC mg/L at 96 h*
1.1 (95% confidence limits 0.5-2.5 mg/L)	0.5	1.2 (95% confidence limits 0.6-2.0 mg/L)	0.5

Remarks - Results	The slope of the 96 h dose response curve was 3.5. The test results indicate that the test substance is toxic to algae. Based on the same considerations with respect to the lower charge density of the analogue polymer & the presence of solvent, as discussed in the above fish test,

	and also considering the E_rC 50 of 1.1 mg/L is very close to the threshold (1.0 mg/L) for the toxic/very toxic rating, the notified polymer is conservatively rated to be very toxic.
CONCLUSION	The test substance is toxic and the notified polymer is expected to be very toxic to algae.
TEST FACILITY	E. I. du Pont de Nemours and Company (1993c)

BIBLIOGRAPHY

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

NOHSC (2003) National Code of Practice for the Preparation of Material Safety Data Sheets, 2nd edition [NOHSC:2011(2003)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.

NOHSC (2004) Approved Criteria for Classifying Hazardous Substances, 3rd edition [NOHSC:1008(2004)]. National Occupational Health and Safety Commission, Canberra, AusInfo.

NTC (National Transport Commission) 2007 Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG code), 7th Edition, Commonwealth of Australia

United Nations (2009) Globally Harmonised System of Classification and Labelling of Chemicals (GHS), 3rd revised edition. United Nations Economic Commission for Europe (UN/ECE), <http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html >.