File No.: PLC/69

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

POLYMER OF LOW CONCERN

FULL PUBLIC REPORT

Poly(oxy-1,2-ethanediyl), α-octadecyl-ω-hydroxy-, ether with dodecane-1,12-diol, polymer with hexamethylene diisocyanate

Under subsection 38(5) of the *Industrial Chemicals (Notification and Assessment) Act* 1989 (the Act), the Director of Chemicals Notification and Assessment publishes this assessment report by giving a copy of it to:

. the Chief Executive Officer of the National Occupational Health and Safety Commission (Worksafe Australia);

. the Secretary of the Department of the Environment, Sport and Territories;

. the Secretary of the Department of Health and Family Services; and

. the Director of the Department of Occupational Health Safety and Welfare, Western Australia

This assessment report will not be available for inspection by the public.

Director
Chemicals Notification and Assessment

November, 1997

FULL PUBLIC REPORT

Polymer in Borchigel L75N

1. APPLICANT

Bayer Australia Limited of 895 Pacific Highway PYMBLE NSW 2073 has submitted a notification statement accompanying their application for assessment of a synthetic polymer of low concern, polymer in Borchigel L75N

2. IDENTITY OF THE CHEMICAL

Polymer in Borchigel L75N. meets the definition of a Polymer of Low Concern under the Act, and is not considered to be hazardous according to Worksafe Criteria, based on the nature of the polymer and the data provided. Therefore the chemical name, molecular formula, structural formula, molecular weight, spectral data, monomer identity and formulation details have been exempted from publication in the full public report.

Other Name(s):	polymer component of KOK11142
Trade Name(s):	Borchigel L75N (formulation)

3. PHYSICAL AND CHEMICAL PROPERTIES

Since the polymer is not isolated during manufacture, the physical and chemical properties except where noted pertain to the commercial product Borchigel L75N of which the notified polymer forms 25%.

Appearance at 20°C and 101.3 kPa:	yellow to brown odourless liquid
Density:	1.08 x 10^3 kg.m^{-3} at 20°C
Water Solubility:	polymer insoluble but formulation miscible with water (see comments below)
Partition Co-efficient (n-octanol/water):	not supplied
Hydrolysis as a Function of pH:	not supplied

Flammability Limits:	not applicable (water based polymer)
Autoignition Temperature:	not applicable (water based polymer); flashpoint in excess of 200°C
Explosive Properties:	not applicable (water based polymer)
Reactivity:	stable at normal temperatures and pH (see below)

Comments on Physico-Chemical Properties

The data provided are acceptable for a polymer of low concern.

The product containing the notified polymer is a liquid. The boiling point first observed will be that for the water component.

The original notification claims that the product Borchigel L75N is dispersed in or miscible with water but claims that the notified polymer is insoluble. No data or other justification was provided to support this claim. The notifier asserted only that as a function of its use and formulation it must be inherently insoluble. Since the polymer, according to information provided by the notifier, is not isolated during manufacture data specific to the purified polymer was not readily available. However a Gel Permeation Chromatography trace of the polymer alone was available.

The notified polymer, though not identified as such by the notifier, would appear to be a member of a class of rheology modifiers known as hydrophobically modified ethoxylated urethanes (HEUR). These chemicals are designed to self associate in water. In conjunction with surfactants and other chemicals, HEUR form viscosity modifying additives with low foam and low surface tension which are used in water-based paints and adhesives without adversely affecting the properties of the dry film. The surfactants are added not to solubilise the HEUR compounds but to increase the associative bonds between the involved molecules {Glass, 1996}. The literature concerning terminally hydrophobically modified HEUR compounds indicates that structural homologues of the notified polymer are water soluble; see for example {Lundberg, 1994}.

It is also noted that the polymer consists essentially (> 90% by weight) of pre-formed long chain polyethylene glycols linked to a small polyurethane component. It is our experience, supported by the literature {Budavari, 1989}, that the water solubility of these chains increases with increasing ethylene oxide content. While the effect of the polyurethane component, including any cross-linking, on the water solubility is unclear, the predominance of long chain water soluble polyoxyethylene units in the notified polymer could confer considerable water solubility.

These two considerations of evidence for aqueous solubility for this chemical type were not addressed by the notifier in their claim for insolubility. However, since no conclusive measure of solubility for the notified chemical is available, inclusion of the

chemical in the polymer of low concern class has been allowed at this time because the polymer meets all other criteria for inclusion.

The polymer is claimed to be stable, being used in a watery medium, with no hydrolysis, thermal degradation, photodegradation or depolymerisation expected (under normal conditions of use). However, the presence of the carbamate functionality is noted which are known to be hydrolytically unstable. Therefore, hydrolysis could be expected, albeit very slowly in the anticipated environmental pH range and conditions.

4. PURITY OF THE CHEMICAL

The notified polymer is never isolated during manufacture but is produced as the final product Borchigel L75N. The weight-percentage of residual monomers in the formulation is 0 percent. A Gel permeation chromatography test report identified a very low level of low molecular weight species with a number-average molecular weight greater than 10 000. The polydispersity (weight-average/number-average molecular weight) of the polymer is 1.16, indicating a tight molecular weight distribution.

5. USE, VOLUME AND FORMULATION

For a number of years in the USA and Europe, industry has developed formulations of aqeuous paint and adhesive formulations to replace organic-solvent based products. The HEUR class of compounds have been developed as rheological modifiers (viscosity modifiers), of aqueous coating formulations used in this replacement strategy {Wetzel, 1997}. This product will be supplied by the notifier to paint and adhesive manufacturers.but will not be available to the general public.

Expected import volumes of the notified polymer are as follows:

Year	1	2	3	4	5
Import Volume (tonnes)	2	4	6	8	10

During coating and adhesive production, the product is mixed with the other components in a mixing vessel by batch process. The resultant formulations, containing the notified polymer at concentrations less than 0.25%, are then packaged into either 20 kg containers in the case of the adhesives, or 200 L containers in the case of coatings.

6. OCCUPATIONAL EXPOSURE

The product Borchigel L75N will be not be manufactured in Australia, but will be imported in polyethylene barrels with a net weight of 120 kg, in a closed system with sealed packaging. Borchigel L75N is formulated as a thickening agent which is to be mixed with other polymers and additives, and formulated into waterborne paints and adhesives. The potential for worker exposure during import and transport could only occur as a result of accidental spillage.

At industrial sites where aqueous coatings and adhesives are manufactured, Borchigel L75N will be incorporated into formulations by batch processing in mixing vessels, blended, and repacked in 20 kg containers (in the case of adhesives) or 200L containers (in the case of coatings). Exposure of workers involved in storage and batch processing to the notified polymer in the industrial manufatcuring setting will be negligible in normal circumstances.

Borchigel L75N, which contains the notified chemical at 25%, is blended according to information suppplied by the notifier, in the water-based coating product at rates of less than 1% (v/v) polymer in the final product. Accordingly, after blending the notified chemical will be present at 0.25% or less in the final product. Worker exposure at this concentration will therefore be insignificant in the final coating product..

7. PUBLIC EXPOSURE

There is little potential forpublic exposureto the notified polymer during import, storage, transport, formulation or use of the end-products. Minor public exposure to the notified chemical may remit from accidental spillage during transport. If spillage occurs as a result of a transport accident, the material will be contained and absorbed with an inert absorbent material and placed in a sealable container for disposal by incineration.

These products are expected to be initially used at automotive plants, where coatings are applied by spray; adhesives are usually applied in a semi-automated process, although some brush application is possible. There is little potential for public exposure to the notified polymer arising from these processes.

Release of the notified polymer to the general environment as a result of its use in application of automotive coatings is likely to be minimal. The chemical will finally be immobilised as part of an inert, hardened paint or adhesive film, but there may be significant public contact with the notified chemical in this form.

8. ENVIRONMENTAL EXPOSURE

. Release

The notifier claims that the manufacturing processes produce approximately 2% waste, which is mainly from residues left in the mixer. This waste may either be processed to remove solids which are then disposed of to landfill, or be sent to an approved waste treatment facility. Factories using the product are required by law to be adequately bunded, preventing any release to waterways and sewage systems in the event of an accidental spill. Empty product containers will be disposed of to drum recycling companies.

The notifier claims that it is not possible to estimate the total amount of waste generated through the two applications. An estimated waste of 10-20% of the notified polymer has been supplied. It is noted that up to 70% of the paint may be

lost through overspray and 'bounce-back' {Environment Protection Authority, 1992} {Randall, 1992}. However, any waste overspray generated will be collected through the spray booths' filtering system (dry booth) or water traps and coagulated (wet booth). The sludge will be disposed of to an approved landfill.

Adhesives are generally applied in a semi-automated process that the notifier claims generate minimal waste. However, some brush application is possible. If the new product was used in this process expected losses arising would be greater, i.e. due to splashes and drips, but would be localised. Wastes would also be generated through brush washings. The polymer in the adhesive may be precipitated with sodium chloride which will cause co-precipitation of the polymer product for suitable disposal.

. Fate

The majority of the notified polymer is not expected to be released to the environment until it has been fully cured into a solid polymer matrix, either as a paint coating, adhesive product or waste (e.g. overspray). The vast majority of the coating and adhesive containing the crosslinked polymer will share the fate of the automotive panels and articles to which it is applied.

Any chips or flakes of the cured paint that occur (due to stone chips, accidents, wear and tear, etc) will be inert, diffuse and form part of the sediments. Once the adhesive product has dried, it is expected that the polymer is permanently entrapped by the curing/hardening process, becoming inert. As part of a polymerised paint coating or dried adhesive, no hydrolysis, movement or biodegradation of the polymer is expected in landfill. Biological membranes are not permeable to polymers of very large molecular size and therefore bioaccumulation of the notified polymer, even before curing, is not expected {Anliker, 1988} {Gobas, 1986}.

Incineration of the notified polymer is expected to produce water and oxides of nitrogen and carbon.

9. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided which is acceptable for polymers of low concern with a NAMW > 1000 according to the *Industrial Chemicals (Notification and Assessment) Act.*

10. ASSESSMENT OF ENVIRONMENTAL HAZARD

The main environmental exposure of the notified polymer arises from the landfill disposal of recovered dry waste paint from the application process. It is estimated that up to 3 200 kg per year of the polymer may be consigned to landfill at maximum projected import volumes (20% overspray in application, 10% wastage through cleaning and 2% residues in paint cans). However, such material will be cured or bound to soil, and remain immobile in the environment. The environmental hazard from such disposal is expected to be low.

Losses during application of the adhesive are difficult to quantify and will vary depending upon the method of application. However, these losses are expected to be localised within the manufacturing plant. Any spillages will be cleaned up with an absorbent material or left to dry to a hardened form, and then sent to landfill. Here the polymer can be expected to persist but remain immobile in the hardened form.

The main environmental hazard would arise through spillage in a transport accident, releasing quantities of the uncured polymer to drains and waterways. Due to the size of the imported product containers, spillages could potentially release large quantities of the notified polymer into the aquatic environment. However, larger spillages of the polymer should result in negligible hazard as the MSDS states that spilt polymer product can be covered with a chemical binder or dry sand, thus preventing further environmental exposure and possible movement into waterways. Should the polymer enter the aquatic compartment, it will disperse to a dilute concentration eventually adsorbing to sediment. The molecular size of the notified polymer indicates that it should not bioaccumulate.

The low environmental exposure of the notified polymer as a result of the proposed uses indicates that the overall environmental hazard should be low.

11. ASSESSMENT OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY EFFECTS

Workers exposed to the notified polymer are at minimal risk of adverse health effects. The polymer is of low polydispersity, high molecular weight and does not contain reactive side chains or aromatic moieties. Given the automated nature of the blending processes and the physico-chemical parameters of the notified polymer, it is considered unlikely to present a significant occupational risk when imported at 25% concentration. Borchigel L75N is transhipped to industrial surface manufacturers where it is diluted at least 100 fold in surface coating formulations. The final concentartion in paints and adhesives of less than 0.25% will therefore extinguish any possible hazard. In the finished products the notified polymer will be bound into the coating matrix and thus unavailable for contact.

12. RECOMMENDATIONS

To minimise occupational exposureto the polymer in Borchigel L75N, the following guidelines and precautions should be observed:

- Industrial clothing should conform to the specifications detailed in AS 2919 {Standards Australia, 1987};
- Spillage of the notified chemical should be avoided, spillages should be cleaned up promptly which should then be put into containers for disposal or recycling;
- Good personal hygiene should be practised to minimise the potential for ingestion;

- A copy of the relevant Material Safety Data Sheets (MSDS) should be easily accessible to employees.

13. MATERIAL SAFETY DATA SHEET

The MSDS for the notified polymer was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* {National Occupational Health and Safety Commission, 1994d}.

This MSDS was provided by the notifier as part of the notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of the notifer.

14. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Act secondary notification of the polymer in Borchigel L75N shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

15. REFERENCES