File No PLC/737

17 December 2007

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

HE Polymer 300

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 and Water Resources.

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

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

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Director
NICNAS

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1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Chevron Phillips Australia Pty Ltd
Suite 409, 685 Bourke Road
CAMBERWELL VIC 3124

NOTIFICATION CATEGORY
Polymer of Low Concern

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication:
Chemical Name, CAS Number, Molecular and Structural Formulae.

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

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
HE Polymer 300, HE 300

MOLECULAR WEIGHT (MW)

Number Average Molecular Weight (Mn)	8 266 000 Da.
Weight Average Molecular Weight (Mw)	10 250 000 Da.
Polydispersity Index (Mw/Mn)	1.24
% of Low MW Species < 1000 Da	0%
% of Low MW Species < 500 Da	0%

MOLECULAR WEIGHT (MW)

Number Average Molecular Weight (Mn)	>10000 Da

Reactive Functional Groups
The notified polymer contains only low concern functional groups.

3. PLC CRITERIA JUSTIFICATION

Criterion	Criterion met
Molecular Weight Requirements	Yes
Functional Group Equivalent Weight (FGEW) Requirements	Yes
Low Charge Density	Yes
Approved Elements Only	Yes
Stable Under Normal Conditions of Use	Yes
Not Water Absorbing	Yes
Not a Hazard Substance or Dangerous Good	Yes

The notified polymer meets the PLC criteria.

4. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20^{o}C and White powder

101.3 kPa	
Melting Point/Glass Transition Temp	Tm = 325°C
Density	1 250 kg/m^3 at 20°C
Water Solubility	1-18 g/L at 20°C in de-ionised water. 3-20 g/L at 20°C in sea water (4.2 g sea salt in 100 mL of deionised water). The notified polymer was added to 100 mL of water (above) and stirred at a constant rate for 20 mins. Cloudiness was observed in concentrations at and above 2.0 g/L for deionised water and 6.0 g/L in seawater. All mixtures were viscous and became non-pourable at 18 g/L and 20 g/L in deionised water and seawater, respectively.
Dissociation Constant	Contains anionic groups which are expected to show typical values (pKa < 1). The notified polymer will remain ionised in the environmental pH range of 4-9.
Particle Size	The notified polymer is imported in solution. The powder form of the notified polymer has the following particle size: Average = 39.6 μm <70 μm = 90.2% <10 μm = 0.9%
Reactivity	Stable under normal environmental conditions.
Degradation Products	None under normal conditions of use.

5. INTRODUCTION AND USE INFORMATION

Maximum Introduction Volume of Notified Chemical (100%) **Over Next 5 Years**

Year	1	2	3	4	5
Tonnes	50	50	50	50	50

Use

The notified polymer is a drilling mud viscosity modifier used in oil and gas drilling operations. The notified polymer will be used at both onshore and offshore drilling sites.

At the drilling site, the polymer bag will be opened and the polymer powder will be added to a hopper that is connected to a pipe, which will transport drilling mud to the centre of the drill shaft. The polymer will mix with the mud and flow to the drill bit. The concentration of the notified polymer in the drilling mud will be ~0.3%. The main role of the mud suspension containing the notified polymer will be to prevent the loss of drilling fluid to the surrounding rock formation and as a high temperature viscosity control in the well. From the drill bit the mud suspension containing the notified polymer will be pushed to the surface of the well. The mud containing the notified polymer will coat the bore of the well, reducing water flow into the well.

Mode of Introduction

The notified polymer will be imported in powder form in 4.44 kg or 9.25 kg polyethylene-lined paper bags. Potential ports of entry will include Adelaide, Darwin, Dampier, Fremantle, Broome, Melbourne and Brisbane. The notified polymer will be transported directly from the port to the oil or gas drilling site by road or rail.

6. HUMAN HEALTH IMPLICATIONS

Hazard Characterisation

No toxicological data were submitted. The notified polymer meets the PLC criteria and therefore is assumed to be of low hazard.

Occupational Health and Safety Risk Assessment

Inhalation, ocular and dermal exposure to the notified polymer may occur during the transfer of the notified polymer to the hopper. Transfer will occur in well-ventilated areas and exposure is expected to be minimised by the use of PPE (eye protection, gloves, apron and a respirator). The MSDS recommends using a respirator to avoid breathing dust.

Following mixing with the drilling mud minimal contact is expected and any exposure from contact with the drilling mud would occur to low concentrations of the notified polymer (~0.3%).

The MSDS states airborne dust concentrations above 20 mg/L may create a dust explosion hazard.
Handling of the notified polymer may cause electrostatic charge build up. Precautions to avoid electrostatic charge accumulation or the creation of a flammable atmosphere should be taken.

The level of atmospheric nuisance dust should be maintained as low as possible. The exposure standard for atmospheric dust is 10 mg/m^3 but ACGIH recommends 3mg/m^3 for airborne respirable particulates (not otherwise regulated).

Public Health Risk Assessment

As there will be no exposure of the public to the notified polymer the risk to the public from exposure to the notified polymer is considered to be negligible.

7. ENVIRONMENTAL IMPLICATIONS

The notified polymer meets the PLC criteria and can therefore be assumed to be of low hazard. This is supported by environmental endpoints observed in testing conducted on an analogue polymer. Although the notified polymer may show greater toxicity than the analogue polymer when partially hydrolysed, the polymer is unlikely to hydrolyse under environmental conditions.

According to the ecotoxicological test results below, the analogue polymer is very slightly toxic to marine invertebrates, which may be in part due to physical effects caused by the viscosity of the test substance at high test concentrations. The test substance also shows some toxicity to marine algae and *Abra alba* below the maximum tested levels, but was practically non-toxic to other marine organisms. While the analogue polymer is not readily biodegradable, it has a relatively low potential for bioaccumulation in exposed organisms based on its high water solubility and the polymer being unlikely to cross biological membranes based on its high molecular weight.

Endpoint	*Result and Conclusion*
Ready Biodegradability	Not readily biodegradable
Bioaccumulation	Not bioaccumulative
Fish Toxicity (*Scophtalmus maximus*)	EC50 >1800 mg/L
Amphipod Toxicity (*Corophium volutator*)	LC50 >10000 mg/kg
Amphipod Toxicity (*Corophium volutator*)	NOEC 5500 mg/kg (average)
Mysid Toxicity (*Mysidopsis bahia*)	LC50 12800 ppm
Copepod Toxicity (*Acartia tonsa*)	LC50 599 mg/L
Algal Toxicity (*Skeletonema costatum*)	EC50 2859 mg/L
Abra alba	EC50 447 mg/kg

(refer to PLC/530 for assessment of the studies on the analogue polymer)

Environmental Risk Assessment

The notified polymer will be imported as the finished product and will not be reformulated in Australia. Therefore no environmental release is expected from manufacture or reformulation in Australia. Release from residue in bags is expected to be minimal (0.1%; 50 kg per annum) as it is a dry powder. Empty bags are expected to be disposed of to landfill.

Currently, 15 off-shore and on-shore drilling rigs are expected to use the notified polymer, which could eventually release up to 50 tonne of the notified polymer per year. When used in an off-shore situation, the solid cuttings containing the notified polymer are likely to form piles on the sea floor under the drilling platform. During the operational life of the platform, the discharged cuttings may remain in a mound directly under the platform, relatively shielded by the platform itself from the dispersive effects of marine storms and currents. However, this protection can be expected to be removed once the platform is decommissioned allowing the mounds of cuttings and the notified polymer to disperse in a much wider area of the sea floor.

The main environmental exposure is expected to result from the notified polymer remaining in cuttings discharged overboard at off-shore drilling rigs. Effectively all notified polymer used on off-shore drilling operations is expected to be discharged to the ocean at the completion of drilling. Effectively all notified

polymer used in on-shore drilling operations is expected to be contained and treated by either being allowed to dry by evaporation, being picked up by vacuum trucks and transferred to disposal well sites for discharge, or simply covered with top soil and remediated.

The drilling mud normally contains 0.3% w/w of the notified polymer. During drilling operations, the mud is pumped down the drill shaft and functions as a combination of lubricant for the drill bit, carrier for the solid cuttings, and sealant to minimise drilling fluid loss into the formations during deep well drilling. The drilling mud is pushed out of the well and transferred to the surface for solids processing. This involves a sifting along with low speed centrifugation in order to remove the drill cuttings. The drilling mud containing the notified polymer is recovered and then replenished with additional mud containing more notified polymer and is transferred back down into the well. The drill cuttings that represent about five to ten percent of the material transferred to the surface contain some trapped notified polymer. After separation the notifier indicates that the drill cuttings will contain approximately 5% entrained drilling mud. This is consistent with the literature value of 15% for a worst case and 5% for modern practices (The International Association of Oil & Gas Producers 2003). Although it is possible for cuttings to be re-injected into the well or collected for on-shore disposal or re-use as general fill, it would appear that this is not generally practiced in Australia. Consequently in the case of off-shore drilling, the cuttings are discharged into the ocean. In the case of on-shore drilling, these are discharged into lined reserve pits for later treatment.

The drill cuttings may contain up to 0.015% (0.3% × 5%) of the notified polymer (i.e. 150 mg/kg). The amphipod toxicity test result of the analogue polymer is NOEC ~5500 mg/kg dry weight of sediment. Even with a conservative safety factor of 10 to allow for the notified polymer being more toxic than the analogue polymer, the notified polymer is unlikely to pose a significant risk to benthic organisms at the level it is present in the piles of cuttings. However, it should be also noted that the physical chemical and biological processes that occur in these cutting deposits are not well understood.

Most of the polymer that is discharged at the end of the drilling operation is expected to become associated with benthic sediments with minimal aquatic release. Because of this adsorption to the drilling mud, the notified polymer will be distributed with the mud, which is expected to be localised around the area of drilling operation, unless strong currents prevail. The notified polymer is not readily biodegradable. While hydrolysis is possible, it is unlikely to occur under environmental conditions. Further, degradation due to abiotic and biotic processes can be expected to be very slow considering the conditions in the piles of drill cuttings, including low temperatures and low density of bacteria.

Considering the large quantities of the notified polymer that will be discarded on to the sea floor and the uncertainties regarding the environmental consequences, it is appropriate that the final NICNAS report should be drawn to the attention of the relevant state and territory authorities.

In particular, the WA Department of Industry and Resources should be notified, as they conduct their own assessments on formulated drilling fluids and requires data on toxicity tests performed against local marine species and supplementary biodegradation data prior to granting approval for their use (Cobby and Craddock 1999).

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

8. CONCLUSIONS AND RECOMMENDATIONS

Human health risk assessment
Under the conditions of the occupational settings described, the risk to workers is considered to be acceptable.

When used in the proposed manner the risk to the public is considered to be acceptable.

Environmental risk assessment
Based on the relatively low toxicity and the suggested use patterns, the notified polymer is not expected to pose an unacceptable risk upon the environment.

Considering the large quantities of the notified polymer that will be discarded on to the sea floor and the uncertainties regarding the environmental consequences, a copy of the full public report will be made available to the relevant state authority.

Recommendations

CONTROL MEASURES
Occupational Health and Safety

- Employers should implement the following engineering controls to minimise occupational exposure to the notified polymer in powder form:
    - Use of Local Exhaust Ventilation when handling the notified polymer in powder form.

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified polymer during certain processes where dust may be generated:
    - Use of respirator when handling notified polymer in powder form.

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

- In the interest of occupational health and safety, the following guidelines and precautions should be observed for use of the notified polymer as introduced in powder form
    - The risk of dust explosion exists for airborne dust concentrations above 20 g/m^3. Therefore airborne dust concentrations should be kept below this level. A flammable atmosphere and accumulation of electrostatic charge should also be avoided to prevent risk of a dust explosion.
    - For health concerns, the level of atmospheric nuisance dust should be maintained as low as possible. The ASCC exposure standard for atmospheric dust is 10 mg/m^3 but a recommended exposure limit of 3 mg/m^3 has been suggested by the American Conference of Governmental Industrial Hygienists (ACGIH) for "respirable (insoluble) particulates (not otherwise regulated)".

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

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

Environment

Disposal

- The notified polymer should be disposed of by authorised landfill.

Storage

- Store in a cool, dry place with adequate ventilation away from oxidizing materials, heat, sparks or open flames.

Emergency procedures

- Spills and/or accidental release of the notified polymer should be handled by moistening with water to prevent dust, followed by physical collection (e.g. shovelling, sweeping or use of industrial vacuum cleaner).

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 notified polymer is introduced in a chemical form that does not meet the PLC criteria;

or

(2) Under Section 64(2) of the Act; if
- the function or use of the chemical has changed from a drilling mud viscosity modifier used in oil and gas drilling operations or is likely to change significantly;
- the amount of chemical being introduced has increased from 50 tonnes, or is likely to increase, significantly;
- if 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 products containing the notified chemical provided by the notifier were reviewed by NICNAS. The accuracy of the information on the MSDS remains the responsibility of the applicant.

References
Cobby GL and Craddock RJ (1999) Western Australian Government Decision Making Criteria Involved in the Regulation of Drilling Fluids Offshore. Australian Petroleum Production & Exploration Association 39(1), pp 600-605.

International Association of Oil & Gas Producers, Environmental Aspects of the Use and Disposal of Non Aqueous Drilling Fluids Associated with Offshore Oil & Gas Operations Report No. 342 May 2003, pp 24. (http://www.ogp.org.uk/)