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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

Dristemp Polymer

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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

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Dristemp Polymer

1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Chevron Phillips Chemicals Australia Pty Ltd (ABN 29 107 015 896) of Suite 409, 685 Burke Rd, 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, Other Names, CAS Number, Molecular and Structural Formulae, Molecular Weight, Polymer Constituents and Residual Monomers/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
USA (1984)
Canada (2003)

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
Dristemp Polymer

MOLECULAR WEIGHT (MW)
Number Average Molecular Weight (Mn) >100,000

REACTIVE FUNCTIONAL GROUPS
The notified polymer contains only low concern functional groups.

3. PLC CRITERIA JUSTIFICATION

Criterion	*Criterion met (yes/no/not applicable)*
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°C and 101.3 kPa	White Powder
Melting Point/Glass Transition Temp	327 °C
Density	1120 kg/m^3 at 20°C
Water Solubility	Stated to be readily soluble in water, which is supported by its high content of anionic functionality.
Dissociation Constant	Contains anionic groups which are expected to show typical acidity, with pKa values of approximately 2 and 4. Will remain ionised in the environmental pH range of 4-9.
Particle Size	Base on microscopic examination of a similar polymer produced with identical technologies the majority of the notified polymer is expected to have a particle size in the range 3mm x 5mm with < 1% with a particle size < 70µm and < 0.1% 3 µm in size.
Reactivity	Although the notified polymer contains hydrolysable groups, these are only expected to hydrolyse under extreme conditions and it is therefore 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	100	100	100	100	100

USE AND MODE OF INTRODUCTION AND DISPOSAL

Mode of Introduction

The notified polymer will be imported (neat) in 12 or 25 kg polyethylene lined paper bags and transported to up to 40 drilling sites by truck.

Reformulation/manufacture processes

No reformulation or manufacture will take place in Australia.

Use

The notified polymer is a drilling mud additive for high temperature viscosity control and fluid loss control.

The notified polymer will be used at both onshore and offshore drilling sites.

At the drilling site, the polymer bag is opened and the polymer powder is added to a hopper connected to a pipe transporting drilling mud to the centre of the drill shaft. The polymer mixes with the mud and flows to the drill bit. The concentration of the notified polymer in the drilling mud is ~ 0.5%. The main role of the mud suspension containing the notified polymer is to prevent the loss of drilling fluid to the surrounding rock formation and high temperature viscosity control in the well. From the drill bit the mud suspension containing the notified polymer is pushed to surface of well. The mud containing the notified polymer coats the bore of the well reduces water flow into the well.

6. HUMAN HEALTH IMPLICATIONS

6.1. Exposure Assessment

OCCUPATIONAL EXPOSURE

Dermal, ocular and inhalation exposure may potentially 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 where adequate ventilation is not available). Inhalation exposure is also expected to be minimised due to the expected low percentage (<1%) of particles in the inhalable range.

Following mixing with the drilling mud minimal contact is expected and any exposure from contact with the drilling mud would be low due to the low concentration of the notified polymer (0.5%).

PUBLIC EXPOSURE

The notified polymer is intended only for use in industry and as such public exposure to the notified chemical is not expected.

6.2. Toxicological Hazard Characterisation

No toxicological data were submitted. The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard. High molecular weight polymers have the potential to cause lung overloading effects. The water solubility of the polymer would aid the clearance from the respiratory tract.

6.3. Human Health Risk Assessment

OCCUPATIONAL HEALTH AND SAFETY

Although exposure to the notified polymer could occur during transfer of the notified polymer the risk to workers is considered to be low due to the intrinsic low hazard of the notified polymer and the controls in place during this process. As no significant inhalation exposure is expected the risk of lung overloading effects is considered to be low.

The level of atmospheric nuisance dust should be maintained as low as possible. The NOHSC exposure standard for atmospheric dust is 10 mg/m^3.

PUBLIC HEALTH

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

7. ENVIRONMENTAL IMPLICATIONS

7.1. Exposure Assessment

ENVIRONMENTAL RELEASE

As the notified polymer will not be manufactured locally, there will be no environmental exposure associated with this process in Australia. Release of the polymer during transport (e.g. due to a ripped bag) is expected to be very limited. Residual notified polymer in empty bags is expected to account for < 1% (maximum 1 tonne) of total import volume and will be disposed of to licensed landfill.

The drilling mud normally contains 0.5% 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. 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.

After the completion of the drilling operation, the drilling mud along with the used notified polymer is discharged into the ocean or into the lined reserve pits for on-shore use. Due to the anionic nature of the polymer at the pH of the ocean, and the high molecular weight, the notified polymer is expected to be tightly adsorbed to the clay and mud residues (> 90% according to Boethling and Nabholz *et al*, 1997). 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 reserve pits for on-shore drilling operations may be treated in several different ways, including, 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.

ENVIRONMENTAL FATE

The notified polymer is expected to remain tightly adhered to the drilling mud, and should degrade slowly through biotic and abiotic processes. While hydrolysis is possible, it is unlikely to occur under environmental conditions.

7.2. Environmental Hazard Characterisation

The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard. This is supported by environmental endpoints observed in testing conducted on an analogue polymer (assessed under PLC/530). 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 be 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
Bivalve Mollusc Toxicity (*Abra alba)*	EC50 447 mg/kg

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

7.3. Environmental Risk Assessment

Less than 1 tonne (based on the maximum import volume) of the notified polymer is expected to be left as residue in empty import bags, which will be disposed of to landfill. 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.

Up to 20 off-shore and 20 on-shore drilling rigs per year are expected to use the notified polymer, which could eventually release up to 100 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.

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. The notified polymer is not expected to be readily biodegradable. 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.

The drill cuttings may contain up to 0.05% of the notified polymer (i.e. 500 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.

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 require data on toxicity tests performed against local marine species and supplementary biodegradation data prior to granting approval for their use (Cobby and Craddock 1999)

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

8. CONCLUSIONS

8.1. Level of Concern for Occupational Health and Safety

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

8.2. Level of Concern for Public Health

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

8.3. Level of Concern for the Environment

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

9. MATERIAL SAFETY DATA SHEET

9.1. Material Safety Data Sheet

The notifier has provided MSDS as part of the notification statement. The accuracy of the information on the MSDS remains the responsibility of the applicant.

10. 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

- All sites and processes in which the notified polymer is used must comply with the State and Territory requirements.

Disposal

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

Emergency procedures

- Spills and/or accidental release of the notified polymer should be handled by physical containment and collecting by shovelling, sweeping or using an industrial vacuum cleaner. Avoid creating dust by moistening the spilled material. Prevent spills from contaminating soil surface water or groundwater. Collect for disposal.

10.1. 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(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.

14. BIBLIOGRAPHY

Boethling R S and Nabholz J V (1997). Environmental assessment of polymer under the US Toxic Substances Control Act. In: Hamilton, Sutcliffe ed. Ecological assessment of polymers, strategies for product stewardship and regulatory programs. New York, Van Nostrand Reinhold, p 187.

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.