

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

**POLYMER OF LOW CONCERN PUBLIC REPORT**

**Polymer in Hostadrill 4706**

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act 1989* (Cwlth) (the Act) and Regulations. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by the Australian Government Department of Health, and conducts the risk assessment for public health and occupational health and safety. The assessment of environmental risk is conducted by the Australian Government Department of the Environment.

For the purposes of subsection 78(1) of the Act, this Public Report may be inspected at our NICNAS office by appointment only at Level 7, 260 Elizabeth Street, Surry Hills NSW 2010.

This 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: Level 7, 260 Elizabeth Street, SURRY HILLS NSW 2010, 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](http://www.nicnas.gov.au)

**Director  
NICNAS**

**April 2014**

**Table of Contents**

SUMMARY .....	2
CONCLUSIONS AND REGULATORY OBLIGATIONS.....	2
ASSESSMENT DETAILS.....	3
1. APPLICANT AND NOTIFICATION DETAILS.....	3
2. IDENTITY OF POLYMER .....	4
3. PLC CRITERIA JUSTIFICATION .....	4
4. PHYSICAL AND CHEMICAL PROPERTIES.....	4
5. INTRODUCTION AND USE INFORMATION .....	4
6. HUMAN HEALTH RISK ASSESSMENT.....	5
7. ENVIRONMENTAL RISK ASSESSMENT .....	5
BIBLIOGRAPHY .....	9

## SUMMARY

The following details will be published in the NICNAS *Chemical Gazette*:

ASSESSMENT REFERENCE	APPLICANT(S)	CHEMICAL OR TRADE NAME	HAZARDOUS SUBSTANCE	INTRODUCTION VOLUME	USE
PLC/1170	Clariant (Australia) Pty Ltd	Polymer in Hostadrill 4706	No	< 100 tonnes per annum	Additive in water based drilling fluids

## CONCLUSIONS AND REGULATORY OBLIGATIONS

### **Human Health Risk Assessment**

Based on the assumed low hazard and the assessed use pattern, the notified polymer is not considered to pose an unreasonable risk to the health of workers and the public.

### **Environmental Risk Assessment**

Based on the PEC/PNEC ratio, low hazard and the assessed use pattern, the notified polymer is not considered to pose an unreasonable risk to the environment.

### **Health and Safety Recommendations**

- A person conducting a business or undertaking at a workplace should implement the following engineering controls to minimise occupational exposure to the notified polymer when in the powder form:
  - Use in a well-ventilated area
- A person conducting a business or undertaking at a workplace should implement the following safe work practices to minimise occupational exposure during handling of the notified polymer in powder form:
  - Use of low-dust handling techniques
  - Avoid contact with skin, eyes, and clothing
- A person conducting a business or undertaking at a workplace should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified polymer if the potential for significant inhalation exposure of the powder is expected:
  - Respiratory protection

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 precautions should be observed for use of the notified polymer as introduced in powder form:
  - The level of atmospheric nuisance dust should be maintained as low as possible. The Safe Work Australia exposure standard for atmospheric dust is 10 mg/m<sup>3</sup>.
- A copy of the (M)SDS should be easily accessible to employees.
- If products and mixtures containing the notified polymer are classified as hazardous to health in accordance with the *Globally Harmonised System for the Classification and Labelling of Chemicals (GHS)*, as adopted for industrial chemicals in Australia, workplace practices and

control procedures consistent with provisions of State and Territory hazardous substances legislation should be in operation.

**Disposal**

- The notified polymer should be disposed to landfill.

**Emergency Procedures**

- Spills and/or accidental release of the notified polymer should be handled by physical containment, collection and subsequent safe disposal.

**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 polymer 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 polymer, have post-assessment regulatory obligations to notify NICNAS when any of these circumstances change. These obligations apply even when the notified polymer 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 notified polymer has changed from additive in water based drilling fluids, or is likely to change significantly;
  - the amount of notified polymer being introduced has increased, or is likely to increase, significantly;
  - the notified polymer has begun to be manufactured in Australia;
  - additional information has become available to the person as to an adverse effect of the notified polymer 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 (M)SDS of the product containing the notified polymer was provided by the applicant. The accuracy of the information on the (M)SDS remains the responsibility of the applicant.

## **ASSESSMENT DETAILS**

### **1. APPLICANT AND NOTIFICATION DETAILS**

**Applicants**

Clariant (Australia) Pty Ltd (ABN: 30 069 435 552)  
Brandon Office Park, Building 5, L2, 530-540 Springvale Road,  
Glen Waverley VIC 3150

**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, residual monomers/impurities, and import volume.

**2. IDENTITY OF POLYMER****Marketing Name(s)**

Hostadrill 4706 (contains the notified polymer at > 90% concentration)

**Molecular Weight**

Number Average Molecular Weight (Mn) is > 10,000 Da

**3. PLC CRITERIA JUSTIFICATION**

<i>Criterion</i>	<i>Criterion met</i>
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 to brownish powder
Glass Transition Temp	Approximately 240 °C
Density	Approximately 250 kg/m <sup>3</sup> at 20°C (bulk)
Water Solubility	> 400 g/L (Clariant, 2013a)
Dissociation Constant	Not determined. The notified polymer is a salt and will be ionised under environmental conditions (pH 4-9).
Particle Size	Range: 0.20-300 µm, Mean: 2.23 µm
Reactivity	Stable under normal environmental conditions but may undergo side-chain hydrolysis under the harsh use conditions of a drilling mud.
Degradation Products	None under normal conditions of use. Under harsh conditions, the side chains of the notified polymer may hydrolyse to form low molecular weight organic compounds.

**5. 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>
Tonnes	1-10	10-100	10-100	10-100	10-100

**Use**

The notified polymer will be imported at > 90% concentration for use as a component of fluids for oil drilling and geothermal wells, both onshore and offshore. The dosage rate of polymer to the drilling fluid is 0.5 to 3% by weight. The drilling fluid is either produced in a formulation plant and taken by

road to the drill site, or is made on site by emptying bags of the powdered polymer into the drilling mud via hoppers.

## 6. HUMAN HEALTH RISK ASSESSMENT

The notified polymer meets the PLC criteria and is therefore assumed to be of low hazard. This is supported by tests submitted on the following toxicological endpoints.

<i>Endpoint</i>	<i>Result</i>	<i>Classified?</i>	<i>Effects Observed?</i>	<i>Test Guideline (Choose one or add new method)</i>
Rat, acute oral	LD50 > 2000 mg/kg bw; low toxicity	no	yes	OECD TG 401
Rabbit, skin irritation	non-irritating	no	no	OECD TG 404
Rabbit, eye irritation	non-irritating	no	yes	OECD TG 405

Animals in the acute oral toxicity test showed sporadically stilted gait and flanks drawn in between 1 and 8 hours after administration. From day 2 until the end of the study no findings were observed.

In the primary eye irritation study in rabbits, the animals' conjunctivae showed reddening, swelling and serous eye discharge one hour after administration. Definitely injected blood vessels of the conjunctivae were observed in one animal up to 48 hours after administration. All signs of irritation had disappeared 72 hours after administration.

Although not considered in this risk assessment, NICNAS notes that the notified polymer contains residual monomers that are classified as hazardous according to the *Globally Harmonised System for the Classification and Labelling of Chemicals (GHS)*, as adopted for industrial chemicals in Australia. These are not present above the cut off concentrations for classification in the notified polymer as introduced.

The particle size of the notified polymer indicates that a substantial proportion will be respirable (< 10 µm). The notified polymer is water soluble and therefore if inhaled at low levels is likely to be cleared from the upper respiratory tract readily through mucociliary action. Small proportions of the notified polymer may reach the lower respiratory tract, but it should still be readily cleared from the lungs unless high levels are inhaled. When high concentrations of the notified polymer are inhaled, it is likely to be cleared from the lungs, but this may be slower and temporary respiratory impairment is possible. The expected use of dust masks by workers handling the notified polymer in powder form should reduce inhalation exposure levels and hence lower any risk of temporary lung overloading.

The notified polymer will be used under industrial conditions only, and no exposure of the public is expected.

The risk of the notified polymer to occupational and public health is not considered to be unreasonable given the assumed low hazard and the assessed use pattern.

## 7. ENVIRONMENTAL RISK ASSESSMENT

The results from ecotoxicological investigations conducted on the notified polymer are summarised in the table below. The actual concentrations of the notified polymer in the test media were not determined and the results were based on the nominal concentrations. The results are considered reliable as the validity criteria for all of the tests were satisfied.

<i>Endpoint</i>	<i>Results</i>	<i>Assessment Conclusion</i>	<i>References</i>
Fish Toxicity			
Brachydanio rerio	96 hours LC50 > 100 mg/L;	Not harmful to fish	NLFAB (2001)
Scophthalmus maximus	96 hours LC50 = 1010 mg/L		RFM (2001a)

Daphnia Toxicity		Not harmful to aquatic	
Arcatia tonsa	48 hours EC50 = 400 mg/L	invertebrates	RFM (2001b)
Algal Toxicity			
Skeletonema costatum	72 hours ErC50 = 640 mg/L	Not harmful to algae	RFM (2001b)
Amphipod Toxicity			
Corophium volutator	10 days LC50 > 2860 mg/kg	Not Classified	RFM (2001b)

The notified polymer was measured to attain 1% biodegradation over 28 days (Clariant, 2001) and 3% biodegradation over 28 days (RFM, 2001b), indicating that the notified polymer is not readily biodegradable. The results are considered reliable as the validity criteria were satisfied for both tests. However, the notified polymer contains functionalities that may undergo side-chain hydrolysis under the harsh use conditions of a drilling mud although it is expected to be hydrolytically stable under environmental conditions (Clariant, 2013b). Based on its high water solubility and molecular weight, the notified polymer is not expected to bioaccumulate. In landfill and water, the notified polymer is expected to ultimately degrade via biotic or abiotic pathways to form water, oxides of carbon, nitrogen and sulphur.

The notified polymer will be imported as a component of a finished end-use product and will not be manufactured or reformulated in Australia. Therefore, no environmental release is expected from these activities. Empty containers are expected to be disposed of to landfill and release from residues in empty containers is expected to be minimal.

The imported notified polymer will be used as an additive in water-based drilling fluids in oil and geothermal wells for both onshore (80% of the total import volume) and offshore applications (20% of the total import volume). At the drilling sites, drilling fluids containing the notified polymer will be added into wells and recirculated constantly during the drilling operation. Spills and wastewater are expected to be captured by onsite effluent pits where treated notified polymer contained is expected to predominately partition to sludge due to its high molecular weight and ionic properties. Sludge containing the notified polymer is expected to be disposed of in accordance with local regulations.

After the completion of drilling operations, drilling mud is expected to be eventually be pushed out of the well and transferred to the surface separation systems. After separation, the drilling cuttings are expected to be removed from the drilling fluid and be disposed of to landfill for the on-shore applications and to the ocean for the off-shore applications. The drilling mud is valuable and most often will be collected for reconditioning in a drilling fluid plant for re-use. Spent notified polymer has potential to be released to aqueous compartments as the notified polymer is highly water soluble.

For onshore applications, spent notified polymer is expected to be efficiently removed by adsorption to sludge during onsite effluent and wastewater treatment processes. Furthermore, this industrial sector is expected to have adequate engineering controls in place to minimise release of the notified polymer in the environment. Therefore, the release of the notified polymer to surface waters is expected to be limited and the Predicted Environment Concentration (PEC) from onshore applications has not been calculated. However, for the worst case scenario, it is assumed that drilling fluid is dispersed directly to the ocean from offshore applications. The resulting PEC from offshore applications has been calculated based on the CHARM model (Thatcher et al., 2005).

It was indicated by the notifier that up to 20% of the total import volume of the notified polymer will be used offshore in 1 to 2 oil wells. Each drilling operation is expected to last 5 to 7 days. The highest concentrations of drilling polymer from water-based mud that occur in the vicinity of off-shore oil and gas production facilities arise from the batch-wise discharge of drilling mud. In the CHARM model (Thatcher et al., 2005, p. 23), the PEC for drilling polymer in seawater resulting from batch-wise discharge of water-based mud ( $PEC_{\text{water, batch}} / \text{mg/L}^{-1}$ ) is calculated using equation (1):

$$PEC_{water, batch} = \frac{M}{V_m} \times D_{batch} \times 10^3 \quad (1)$$

In this relationship,

$PEC_{water, batch}$  =  $PEC_{water}$  for batchwise discharges (mg/L);

$M$  = Amount of the notified polymer discharged (kg);

$V_m$  = Volume of mud discharged for the specific section drilled ( $m^3$ );

$D_{batch}$  = Dilution factor for batch-wise discharges;

$10^3$  = Conversion constant to express PEC as mg/L.

The notifier indicated that the section drilled was 8½inches, approximately 1100-1250 meters in length. Hence, the default values for  $V_m$  (280  $m^3$  for a 1,000 m drill length) and  $D_{batch}$  ( $7.7 \times 10^{-5}$ ) as specified in the CHARM model for the batch-wise discharge scenario have been used for this calculation (Thatcher et al., 2005, p. 46).

The amount of the notified polymer discharged ( $M$ , kg) can be calculated using equation (2):

$$M = W_t \times V_m \times \rho_m \quad (2)$$

In which,

$W_t$  = Weight percentage of the notified polymer in the mud;

$\rho_m$  = Density of the discharged mud ( $kg/m^3$ )

The weight percentage of the notified polymer in the mud ( $W_t$ ) was indicated to be  $\leq 1.14\%$  by the notifier. The default values for  $\rho_m$  (1600  $kg/m^3$  for a 1,000 m drill length) as specified in the CHARM model for the batch-wise discharge scenario have been used for this calculation (Thatcher et al., 2005, p. 46). Therefore, the amount of the notified polymer discharged in a single batch of used mud is calculated to be:

$$M = W_t \times V_m \times \rho_m = 1.14\% \times 280 \times 1600 = 5107 kg$$

Based on the worst case discharge of 5107 kg of notified polymer in a single batch of used mud, the  $PEC_{water, batch}$  for the notified polymer is calculated using equation 1:

$$PEC_{water, batch} = \frac{M}{V_m} \times D_{batch} \times 10^3 = \frac{5107}{280} \times 7.7 \times 10^{-5} \times 10^3 = 1.40 \text{ mg/L} = 1400 \text{ } \mu\text{g/L}$$

The  $PEC_{sediment}$  for a batch-wise discharge scenario is not calculated in the CHARM model because there is assumed to be insufficient time to allow the establishment of equilibrium between the high short-term levels of polymer in the water column arising from batch-wise release of mud and the levels of the polymer in sediments near the discharge point. Thus, in the CHARM model, the calculation of  $PEC_{sediment}$  is based on a continuous discharge scenario (Thatcher et al., 2005, p.48). This scenario cannot be evaluated for Australia as the specific model parameters are not available and the default values for some key parameters are specific to drilling operations in the North Sea. Furthermore, as the notified polymer is highly water soluble and is expected to readily disperse in the aqueous compartment, it is not expected to reach ecotoxicologically significant concentrations in the sediment compartment. Therefore, the  $PEC_{sediment}$  has not been calculated for this assessment.

Although the ecotoxicological investigations indicate that the most sensitive aquatic species is fish, the main release of the notified polymer is expected to be in the ocean from offshore applications. Therefore, the Predicted No-Effect Concentration (PNEC) for the notified polymer has been calculated based on the endpoint of the most sensitive marine species for the notified polymer (*A. tonsa*, 48 hours

EC50 = 400 mg/L) and an assessment factor of 100. An assessment factor of 100 has been used as acute toxicity endpoints for three trophic levels are available.

Predicted No-Effect Concentration (PNEC) for the Aquatic Compartment		
EC50 (aquatic invertebrates).	400	mg/L
Assessment Factor	100	
PNEC:	4000	µg/L

The risk quotient ( $Q = \text{PEC}/\text{PNEC}$ ) for the ocean environment has been calculated and presented in the table below:

Risk Assessment	PEC <sub>water, batch</sub> µg/L	PNEC µg/L	Q
Q - Ocean:	1400	4000	0.35

The risk quotient ( $Q = \text{PEC}/\text{PNEC}$ ) for ocean environments was calculated to be  $< 1$ . Therefore, on the basis of PEC/PNEC ratio, low hazard and the assessed use pattern, the notified polymer is not considered to pose an unreasonable risk to the aquatic environment.



### **BIBLIOGRAPHY**

- Clariant (2001) Hostadrill V 4706: Ready Biodegradability in the OECD 301B “CO<sub>2</sub> Evolution Test (Modified Sturm Test)” (Study No. F771-2, March, 2001). Frankfurt, Germany, Clariant GmbH (Unpublished report submitted by the notifier).
- Clariant (2013a) Hostadrill V 4706: Water Solubility (Project No. 13-145006, June, 2013). Frankfurt, Germany, Clariant Produkte GmbH (Unpublished report submitted by the notifier).
- Clariant (2013b) Hostadrill 4706: Hydrolysis as a function of pH (Project No. 13-160707, December, 2013). Frankfurt, Germany, Clariant Produkte GmbH (Unpublished report submitted by the notifier).
- NLFAB (2001) Fish (Zebra fish), Acute Toxicity Test, Static, Limit Test, 96 h (Study No. FAZ778841, March, 2001). Sarstedt, Germany, Dr. U. Noack-Laboratorium Für Angewandte Biologie (Unpublished report submitted by the notifier).
- RFM (2001a) Hostadrill V 4706: Toxicity Test with the Marine Fish *Scophthalmus maximus* (Study No., RF-2001/279, November, 2001). Stavanger, Norway, RF-Miljølab (Unpublished report submitted by the notifier).
- RFM (2001b) Hostadrill V 4706: Ecotoxicological Tests for Marine Algae: *Skeletonema costatum*, Marine Herbivore: *Acartia tonsa*, Marine Amphipode: *Corophium volutator*, biodegradation and bioaccumulation potential (Study No., RF-2001/237, October, 2001). Stavanger, Norway, RF-Miljølab (Unpublished report submitted by the notifier).
- Thatcher M., Robson M., Henriquez L.R., Karman C.C., and Graham Payne (2005) A user guide for the evaluation of Chemicals used and discharged offshore, Version 1.4. Charm Implementation Network – CIN.