File No PLC/1315

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

POLYMER OF LOW CONCERN PUBLIC REPORT

Polymer in BDF-637

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act 1989* (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.

This Public Report is 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

February 2016

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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/1315	Halliburton Australia Pty Ltd	Polymer in BDF-637	No	≤ 1000 tonnes per annum	Component of 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 assumed 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

- 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 (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 of 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

- Where reuse or recycling are not appropriate, dispose of the notified polymer in an environmentally sound manner in accordance with relevant Commonwealth, state, territory and local government legislation.

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 a component of 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 a 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
Halliburton Australia Pty Ltd (ABN: 73 009 000 775)
Level 17, 444 Queen Street
BRISBANE QLD 4000

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, spectral data, use details, polymer constituents, residual monomers/impurities and import volume.

2. IDENTITY OF POLYMER

Marketing Name
BDF-637 (contains the notified polymer at 60-100% concentration)

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

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

* While the notified polymer is water absorbing (water-swellable), it is also water dispersible. Water dispersible polymers are not considered to be water absorbing polymers according to the PLC criteria.

The notified polymer meets the PLC criteria.

4. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20 °C and 101.3 kPa	White/beige solid
Glass Transition Temp	62.84 °C
Density	150-200 kg/m^3 at 25 °C ((M)SDS)
Water Solubility	Insoluble
Dissociation Constant	Not determined. The notified polymer is a salt and is expected to be ionised under environmental conditions (pH 4-9).
Particle Size	d10 = 0.992 µm d50 = 3.10 µm d90 = 13.1 µm
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	100-1000	100-1000	100-1000	100-1000	100-1000

Use
The notified polymer will not be manufactured or reformulated in Australia. The notified polymer will be used as a component of drilling fluids where it will act as a fluid loss additive and viscosifier.

6. HUMAN HEALTH RISK ASSESSMENT

The notified polymer is of high molecular weight (> 70,000 Da) and the particle size of the notified polymer indicates that a substantial portion will be respirable (< 10 µm). As powdered notified polymer will be handled by workers at well drilling sites, inhalation exposure is possible. Inhalation of polymers with molecular weights > 70,000 Da has been linked with irreversible lung damage due to lung overloading. However, the notified polymer is water dispersible. Water dispersible polymers are expected to be readily cleared from the lungs by normal mucociliary mechanisms after inhalation. Therefore lung overloading effects from inhalation exposure are not expected for the notified polymer. Furthermore, transfer, blending and handling operations are expected to occur in well-ventilated environments and workers are expected to wear appropriate personal protective equipment (PPE) that should limit inhalation exposure.

The notified polymer will be used in industrial settings only; hence public exposure to the notified polymer is not expected.

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

7. ENVIRONMENTAL RISK ASSESSMENT

The results from ecotoxicological investigations conducted on the product containing the notified polymer (at 60-100% concentration) are summarised in the table below. The data is obtained with standard US EPA methods which may differ from the OECD aquatic toxicity methods. The Daphnia and fish testing methods have used freshwater organisms, with shorter duration than the test methods typically used to understand marine toxicity. The shrimp test method uses a "suspended particulate phase" of seawater that has equilibrated with a hypothetical "drilling fluid"; the "drilling fluid" contains the notified polymer in a concentration that would be typical of a discharged drilling fluid.

Endpoint	*Result*
Fish Toxicity (*P. promelas*, freshwater)	LC50 (48 h) = 435 mg/L
Daphnia Toxicity (*D. magna*, fresh water)	LC50 (48 h) = 707 mg/L
Shrimp (bahia, marine)	EC50 (96 h) = 650 mg/L

The ecotoxicity of anionic polymers derives from their potential to chelate metal ions, making the metallic nutrients unavailable to algae (US EPA, 2009). However, the highly crosslinked nature of the notified polymer would likely to prevent the formation of geometries capable of metal chelation.

The notified polymer is a highly cross-linked, water insoluble polymer and is not expected to be readily biodegradable. Based on its very high molecular weight it is not expected to bioaccumulate. The water insoluble notified polymer is expected to remain closely associated with the mineral components of the drilling mud and cuttings, which will deposit in piles of waste material on the ocean

floor beneath the discharge point. In this matrix, degradation due to abiotic and biotic processes can be expected to be very slow considering the conditions in the piles of drill cuttings and mud, including low temperatures and low density of bacteria. In landfill 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 in solid form, and will not be reformulated in Australia. Therefore, no environmental release is expected from manufacture or reformulation in Australia. Any import container residue or spills of the notified polymer will be contained and disposed to landfill in accordance with local regulations.

The 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.

After drilling operations are complete, approximately 16% of the drilling fluid containing the notified polymer will remain in the well. Approximately 35% of the fluid containing the notified polymer is expected to be brought back up from the well and re-used. The remaining 49% of fluid containing the notified polymer that cannot be re-used will be disposed of in accordance with local regulations.

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. For offshore application, it is assumed that drilling fluid is released 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). However, water based PEC was not calculated as majority of the discharged mass of the notified polymer is expected to remain associated with the insoluble minerals and other solids discharged overboard. The notified polymer is therefore expected to deposit on the sea floor beneath the discharge point along with the mud and cuttings. The concentration of the notified polymer in sediment ($PEC_{sediment}$) is therefore of potential significance.

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 an equilibrium between the high short-term levels of chemicals in the water column arising from batch-wise release of muds and the levels of these chemicals 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. However, an estimate of the $PEC_{sediment}$ can be made in accordance with the CHARM model assuming that the greatest effect of the notified polymer will occur within a radius (r) of 500 m from the discharge line. In this case, the total volume of sediment affected is $\pi r^2 d$. If the depth of sediment (d) is taken to be 5 cm (= 0.05 m), the resulting volume of affected sediment is 39,250 m^3 (= 3.14 × 500 m × 500 m × 0.05 m). If the density of the sediment is approximately 1,200 kg/m^3 (default value), then the mass of affected sediment is 47,100 tonnes (= 39,250 m^3 × 1,200 kg/m^3 × 10^{-3}). It is further assumed that the discharged mass of the notified polymer is < 3,000 kg per well. Using the upper bound as the amount of polymer in a batch of used mud deposited in the sediment, then the PECsediment for the notified polymer in the benthic system is estimated to be, at most, 64 mg/kg per well (= 3,000 kg ÷ 47,100 tonnes x 10^3).

A Predicted No-Effect Concentration (PNEC) for the aquatic compartment has not been calculated since the US EPA measured data suggests that the notified polymer is not expected to be harmful to aquatic organisms up to the limit of its water solubility.

The Risk Quotient (RQ = PEC/PNEC) has not been calculated since the PNEC has not been calculated. The notified polymer will be used as a component of drilling fluids at both on- and off-shore sites in northern Australia. The main route for exposure of the environment to the notified polymer is through the discharge of drill cuttings and used drilling muds overboard at off-shore drilling sites. Effectively, the notified polymer used in off-shore drilling operations is expected to be discharged to the ocean at the completion of drilling.

The deposition of the notified polymer in sediments on the ocean floor beneath the discharge point following a single batch-wise discharge of used mud is expected to produce concentrations of up to 64 mg/kg of the notified polymer in the top 5 cm of sediment in a worst case scenario. Hence, the relatively low levels of the notified polymer disseminated through the top layer of sediment beneath the discharge points of off-shore drilling sites are not expected to have chronic toxic effects on benthic invertebrates. Therefore, based on its assumed low hazard, the notified polymer is not considered to pose an unreasonable risk to the environment.

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US EPA, Office of Pollution Prevention and Toxics, Risk Assessment Division. 2009. Technical Reference Manual for the ECOSAR Class Program. 45p., September.

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