

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

**POLYMER OF LOW CONCERN PUBLIC REPORT**

**Nanoshield**

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 and Energy.

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**

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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/1399	Baker Hughes Australia Pty Ltd	Nanoshield	No	≤ 100 tonnes per annum	Additive for onshore and offshore oil and gas drilling operations and coal seam gas (CSG) operations in the Surat Basin, Queensland

## 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.

- 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 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.

### **Environmental Recommendations**

- The product containing the notified polymer (hereafter, the product) must be used and disposed of in accordance with the relevant State, Territory and Federal regulations and certificate conditions.
- Terrestrial waste disposal must be through an appropriate licensed waste disposal facility. The product must not be disposed of directly to surface or ground waters.

**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**

- Prevent from entering into soil, ditches, sewers, waterways and/or groundwater.
- 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.
  - additional information has become available to the person as to the environmental fate or environmental release of the notified polymer.
  - the notified polymer is to be used in coal seam gas (CSG) operations outside of the Surat Basin, Queensland

or

- (2) Under Section 64(2) of the Act; if
  - the function or use of the notified polymer has changed from an additive for onshore and offshore oil and gas drilling operations and CSG operations in the Surat Basin, Queensland, 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.

**Safety Data Sheet**

The SDS of the notified polymer was provided by the applicant. The accuracy of the information on the SDS remains the responsibility of the applicant.

## ASSESSMENT DETAILS

### 1. APPLICANT AND NOTIFICATION DETAILS

**Applicants**

Baker Hughes Australia Pty Ltd (ABN: 20 004 752 007)  
5 Walker Street  
BRAESIDE VIC 3195

**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.

### 2. IDENTITY OF POLYMER

**Marketing Name(s)**

Nanoshield

**Molecular Weight**

Number Average Molecular Weight (Mn) is > 1,000 Da

### 3. PLC CRITERIA JUSTIFICATION

<i>Criterion</i>	<i>Criterion met</i>
Molecular Weight Requirements	Yes
Functional Group Equivalent Weight (FGEW) Requirements	Not applicable
Low Charge Density	Not applicable
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	Solid
Melting Point/Glass Transition Temp	234 °C
Density	1.05 kg/m <sup>3</sup> at 20 °C
Water Solubility	Not determined. The notified polymer is not expected to be water soluble based on the predominantly hydrophobic chemical structure.
Dissociation Constant	Not applicable
Particle Size	2.4 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	≤ 100	≤ 100	≤ 100	≤ 100

#### Use

The notified polymer will be used in oil and gas drilling operations, including use in coal seam gas (CSG) operations. The notified polymer will not be manufactured in Australia. The notified polymer will be imported in powder form (at 100% concentration) into Australia in 11 kg (25 lb) sacks. The notified polymer will be reformulated on site (on-shore and/or off-shore) into drilling fluid (closed system) for use with the drilling rig.

## 6. HUMAN HEALTH RISK ASSESSMENT

No toxicological data were submitted. The notified polymer is expected to be water insoluble and will be introduced as a powder at up to 100% concentration. The notifier has indicated that the average particle size is 2.4 µm and hence it is in the respirable particle range (< 10 µm). If inhaled at low levels and/or infrequently during adding into drilling fluid it is assumed that the notified polymer will be cleared from the lungs. High level and/or frequent exposure may result in lung overloading effects, although the level of exposure in humans that would result in any adverse effects, as well as the severity of the effect(s), are uncertain. However, exposure during reformulation and drilling is expected to be mitigated due to use of closed systems.

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 of 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.

### Occupational Health and Safety Risk Assessment

The notified polymer is for industrial use only. Workers may come into contact with the notified polymer in its pure form when adding it to the drilling fluid (water based mud) or at 7.3 g/L in the event of accidental rupture or leakage at the end of the drilling process. The principal route of exposure will be by inhalation, while dermal, oral and ocular exposure is also possible.

Workers are expected to use PPE (impervious rubber gloves, coveralls, gumboots, safety glasses with side-shields or goggles) and good safe work practices (including operating in a well-ventilated area) and hygiene practices are expected to be in place.

Based on the assumed low hazard of the notified polymer and the expected use pattern, the risk to workers is not considered unreasonable.

### Public Health and Safety Risk Assessment

The notified polymer and products containing it will not be available to the public and hence the risk to the public is not considered to be unreasonable.

## 7. ENVIRONMENTAL RISK ASSESSMENT

The results from ecotoxicological investigations conducted on the product containing the notified polymer are summarised in the table below.

<i>Endpoint</i>	<i>Result</i>	<i>Assessment Conclusion</i>
<u>Fish Toxicity</u>		
<i>Scophthalmus maximus</i> (96 hours)	EC50 > 378 mg/L (limit test)	Not harmful
<u>Daphnia Toxicity</u>		
<i>Arcatia tonsa</i> (48 hours)	LC50 > 800 mg/L (WAF*)	Not harmful
<u>Algal Toxicity</u>		
<i>Skeletonema costatum</i> (72 hours)	EL50 = 377 mg/L (WAF*)	Not harmful
<u>Sediment Dwelling Organism Toxicity</u>		
<i>Corophium volutator</i> (10 days)	LC50 = 4998 mg/kg (dry wt)	Not harmful
<i>Corophium volutator</i> (10 days)	NOEC = 1015 mg/kg (dry wt)	Not harmful

\* WAF: Water Accommodated Fraction

Based on the above endpoints, the notified polymer is not considered to be harmful to marine fish, daphnids, and algae up to the limit of its water solubility. The notified polymer is also not harmful to sediment dwelling organisms. Based on the toxicity to aquatic biota, the notified polymer is not classified under the Globally Harmonised System of Classification and Labelling of Chemicals (GHS; United Nations, 2009) for acute and chronic toxicity effects.

The notified polymer will be imported into Australia in a powder form. The notified polymer is expected to be reformulated in automated enclosed systems. Therefore, significant environmental releases are not expected from reformulation in Australia. Any empty sacks residue or spills of the notified polymer will be contained and disposed through an approved third party chemical disposal company.

The notified polymer is expected to have very low water solubility but the product as a whole is expected to have dispersive properties. The average particle size of the notified polymer is 2.4 µm. The notified polymer is not expected to be readily biodegradable (27% in 28 days). It is also not expected to cross biological membranes due to its high molecular weight and low water solubility, and is therefore not expected to bioaccumulate. The organic components of the notified polymer are expected to be eventually degraded in water or landfill, via abiotic and biotic pathways, forming water, inorganic salts and oxides of carbon and nitrogen.

### *Drilling Applications*

The notified polymer will be used as an additive in synthetic-based drilling muds for both offshore (80% of the total import volume) and onshore applications (20% of the total import volume). A single drilling operation is expected to last 30 – 60 days. At the drilling sites, drilling fluids containing the notified polymer will be added into wells and recirculated constantly during the drilling operation. After drilling operations are complete, the notified polymer is not expected to be consumed during drilling operations and is not expected to remain in the borehole. The notified polymer that cannot be re-used will be disposed of in accordance with local regulations.

In offshore operations, the produced waters will be treated and released to the ocean, in accordance with an environmental assessment plan approved by relevant State and Territory Environmental regulations. Under the worst case scenario, it is assumed that the entire import volume will be used for off-shore applications and consequently, most of the used notified polymer remaining in the retrieved fluids is expected to be disposed of to the ocean. A small amount of the notified polymer collected from spills or leaks may be disposed of to landfill. However, as the notified polymer is not expected to be water soluble, the quantities of notified polymer expected to be present in produced waters from drilling operations is expected to be negligible.

For onshore applications, spent notified polymer is expected to be efficiently removed by adsorption to sludge during onsite effluent and wastewater treatment processes. Furthermore, when the notified polymer is used in accordance with State, Territory and Federal regulations and certificate conditions, adequate engineering controls will be in place to minimise release of the notified polymer to 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. It is expected that proper controls will be implemented at drilling sites to prevent emission of the notified polymer to surface waters and ground waters.

For off shore application, it is assumed that drilling fluid is released directly to the ocean. The resulting PEC from offshore applications can be 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 ( $PEC_{\text{sediment}}$ ) is therefore of potential significance.

The  $PEC_{\text{sediment}}$  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  $PEC_{\text{sediment}}$  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, based on the notifier's information, significant release of the notified polymer is not expected (approximately 3.6 – 7.3 g/L of mud). Thus, a  $PEC_{\text{sediment}}$  has not been calculated.

#### *CSG applications*

The products containing the notified polymer will be used in CSG operations in the Surat Basin, Queensland. It is anticipated by the notifier that up to 2,500 kg of the notified polymer will be used per CSG exploration well.

It is expected that large quantities of waste water containing ~ 3000 mg/L total dissolved salts (TDS) will be produced from CSG operations compared to conventional operations. As the notified polymer is expected to be insoluble, the notified polymer is not expected to be present in significant quantities in produced waters. Thus, the PEC has not been calculated, since significant release of the notified polymer to the aquatic environment is not expected.

Users of the product containing the notified polymer are expected to comply with the Underground Water Impact Report for the Surat Cumulative Management Area which includes disposal of waste and waste water containing high TDS (Queensland Government, 2016).

It is expected that the CSG sites in the Surat Basin have high salinity averaging 3,000 mg/L (Queensland Government, 2016). Therefore, the marine toxicity studies provided above are relevant for assessing the risk of the notified polymer in these environments. The polymer is not expected to be harmful to aquatic organisms.

Residues containing the notified polymer are expected to be disposed of in accordance with local regulations.

#### *Environmental Risk Assessment*

A Predicted No-Effect Concentration (PNEC) for the aquatic compartment has not been calculated since the notified polymer is not harmful to aquatic organisms up to the limit of its water solubility.

The Risk Quotient ( $RQ = PEC/PNEC$ ) has not been calculated since the PEC and PNEC have not been calculated. The notified polymer is not harmful up to the limit of its water solubility and no significant release to the aquatic compartment is anticipated.

Therefore, based on its assumed low hazard, the notified polymer is not considered to pose an unreasonable risk to the environment.

#### *Conclusions*

On the basis of the assessed use pattern and the currently available information, the notified polymer is not considered to directly pose an unreasonable risk to the environment. Users of the product containing the notified polymer for CSG operations are expected to comply with the Underground Water Impact Report for the Surat Cumulative Management Area (Queensland Government, 2016). The product containing the notified polymer must be used and disposed of in accordance with the relevant State, Territory and Federal regulations and certificate conditions.



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