File No PLC/696

April 2007

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

Polymer in SUPERFLOC® HX-800 Flocculant

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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Polymer in SUPERFLOC® HX-800 Flocculant

1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Cytec Australia Holdings Pty Ltd (ABN 45 081 148 629)
Suite 1, Level 1 Norwest Quay
21 Solent Circuit
Norwest Business Park
Baulkham Hills NSW 2153

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, Residual Monomers/Impurities, Manufacture/Import Volume, Site of Manufacture/Reformulation, Concentration of notified polymer in imported/manufactured products.

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
None

2. IDENTITY OF CHEMICAL

OTHER NAME(S)
Modified polyacrylamide in water

MARKETING NAME(S)
SUPERFLOC® HX-800 Flocculant (<12% notified polymer dispersion in water)

MOLECULAR WEIGHT (MW)
Number Average Molecular Weight (Mn) >10,000

REACTIVE FUNCTIONAL GROUPS
The notified polymer contains a high concern functional group (USEPA). However, the polymer has a high molecular weight (NAMW >10,000). According to the PLC criteria there is no restriction on the number of reactive functional groups in the polymer. As such the notified polymer is unlikely to pose a health hazard. In addition, it is unlikely to be released to the aquatic environment under any conditions.

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 to pale yellow powder
Melting Point/Glass Transition Temp	<0°C
Density	1140 – 1160 kg/m^3 (for the imported < 12% aqueous solution).
Water Solubility	> 200 g/L at 20°C. Solubility limited by viscosity. Test was not conducted.
Dissociation Constant	Not determined. The notified polymer contains anionic groups that are expected to show typical acidity, pKa~2-5.
Reactivity	The polymer contains hydrolysable groups. It is expected to be stable under normal environmental conditions and high pH conditions but may hydrolyse under low pH conditions. To avoid product degradation and equipment corrosion, do not use iron, copper or aluminium containers or equipment.
Degradation Products	None under normal conditions of use. Decomposition products are: carbon monoxide, carbon dioxide, oxides of nitrogen, oxides of sulphur and ammonia.

5. INTRODUCTION AND USE INFORMATION

MAXIMUM INTRODUCTION VOLUME OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	50	100	150	200	300

USE AND MODE OF INTRODUCTION AND DISPOSAL

Mode of Introduction

The notified polymer will be imported in 1000 kg IBCs and/or isotankers as a dispersion in water at a concentration of <12% (SUPERFLOC® HX-800 Flocculant) and will be used without reformulation in Australia. It is envisaged that in future SUPERFLOC® HX-800 Flocculant will be manufactured in Australia. The notified polymer will be transported from the wharf to Cytec Holdings warehouse by truck where it will be stored before being distributed to alumina producing customers.

Reformulation/manufacture processes

Manufacture

It is envisaged that in the future SUPERFLOC® HX-800 Flocculant containing the notified polymer will be manufactured in Australia by a toll manufacturer in Western Australia. This depends on the scale of use in Australia.

The raw materials are manually handled, weighed and added into a sealed stainless steel reaction vessel. On three occasions during the manufacture process, quality control samples are taken from the

reaction vessel via a sampling valve. The samples are tested for pH and solid content, and appearance is graded. Once the manufacturing process is completed the finished product, containing <12% of the notified polymer, is transferred using dedicated pumps and hoses to either 1000 kg IBC and/or isotankers.

End-use

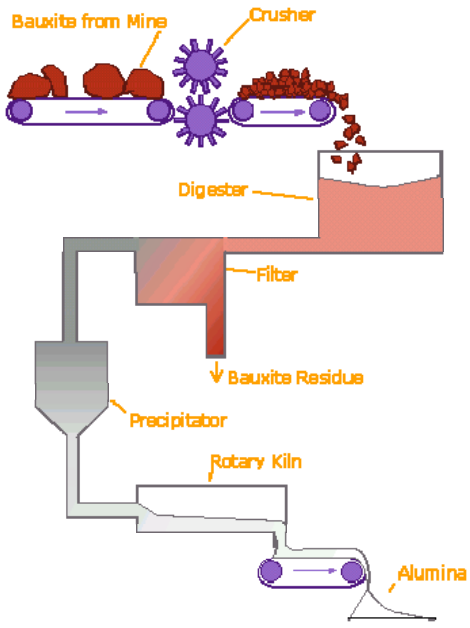
At the end-user site, the SUPERFLOC® HX-800 Flocculant containing the notified polymer at < 12% will be used as a filtering aid in the Bayer Process (see figure below). The Bayer Process is a procedure for obtaining alumina from the aluminium ore, bauxite.

At end-user sites, isotankers or IBCs of SUPERFLOC® HX-800 Flocculant will be transferred from defined chemical storage areas to the Bayer process as required. Operators manually insert an automated pump through a small opening at the bottom of the IBC to enable transfer of SUPERFLOC® HX-800 Flocculant into a holding tank. As required, SUPERFLOC® HX-800 Flocculant is pumped/injected from the holding tank into the Bayer liquor stream via an automated system into a large vessel called a 'Filter'. Alternatively, operators manually attach a hose which is dose automated into the isotanker outlet from which SUPERFLOC® HX-800 Flocculant is added directly into the 'Filter'. This process is carried out with fully automated and computer controlled equipment.

In the 'Filter', SUPERFLOC® HX-800 Flocculant is used to flocculate bauxite residue and sometimes also the alumina hydrate product. Flocculants aggregate fine particles by bridging or sticking the particles together to form larger clumps or aggregates, speeding up solid-liquid separation.

The solution containing alumina is separated from insoluble impurities ('red mud') that gradually sink to the bottom of the tank and are removed. Some notified polymer is expected to end up in the red mud. Alumina is precipitated or crystallised from the solution as alumina trihydrate. The remaining solution, which contains some notified polymer, goes back to the 'Filter'.

The Bayer Process



Use

SUPERFLOC® HX-800 Flocculant is used as an alumina trihydrate flocculant in the Bayer process (used to obtain alumina from bauxite), acting as a filtering aid and hydrate stabiliser.

6. HUMAN HEALTH IMPLICATIONS

6.1. Exposure Assessment

OCCUPATIONAL EXPOSURE

Transport and warehousing

Workers are unlikely to be exposed to the imported and/or manufactured forms of the notified polymer. The notified polymer will be in closed containers and will be transported in secure pallets. Exposure is possible in the event of an accident where the packaging is breached. It is estimated that 6 workers will be involved in such operations for approximately 2 hours/day, 48 weeks/year.

Manufacture

Dermal exposure to the notified polymer may occur as a result of drips and spills during the QC sampling process and during the connection/disconnection of hoses. Manufacturing areas are equipped with general and local exhaust ventilation. Manufacturing workers (2 workers, exposed for 8 hours/day, 25 days/year) will wear overalls, chemical resistant gloves, safety glasses/face shield and safety shoes. Laboratory staff undertaking the QC activities (1 worker, exposed for 45min/day, 25 days/year) wear laboratory coats, chemical resistant gloves and safety glasses.

End-use

End use operations require minimal operator activity. Dermal and ocular exposure of workers to the notified polymer may occur as a result of spills and drips when operators replace empty IBCs with new IBCs, when transferring the notified polymer to holding tanks, when attaching a hose into the Isotankers, or when pouring residues from IBCs or Isotankers into the next IBC. Exposure will be minimised by the wearing of gloves, overalls and safety glasses. These activities occur daily and take approximately 5-10 minutes under normal conditions.

Dermal and ocular exposure of workers to the notified polymer may occur during cleaning of pump and transfer lines and maintenance work on the equipment used to dispense the notified polymer. Such operations are rarely required and personnel must wear gloves, overalls, safety glasses and a respirator, if necessary.

PUBLIC EXPOSURE

The notified polymer is intended only for use in industry. The public is unlikely to be exposed to the notified polymer during transport, storage, and manufacture except in the event of an accidental spillage.

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.

6.3. Human Health Risk Assessment

OCCUPATIONAL HEALTH AND SAFETY

The OHS risk presented by the notified polymer is expected to be low, based on the minimal exposure to workers, the low intrinsic hazard of the polymer, and the fact that the polymer meets the PLC criteria.

The polymer contains a high concern functional group, which is listed by the USEPA as they are considered to be potential carcinogens, heritable mutagens, reproductive and developmental toxicants, and potential neurotoxins. However, the polymer has a high molecular weight (NAMW > 10,000), which is likely to mitigate the hazard.

It should be noted that SUPERFLOC® HX-800 Flocculant is synthesised/manufactured using constituents that are classified as hazardous. Given that residuals of these constituents are present at concentrations much lower than the cut off classification levels, together with limited exposure, the risk to workers is expected to be low. However, care should be taken by workers to prevent exposure to what may potentially be high concentrations of residual monomers/constituents, incidentally produced during manufacture, by the use of appropriate engineering controls and PPE.

PUBLIC HEALTH

As there will be negligible exposure of the public to the notified polymer, the risk to the public from exposure to the notified polymer is considered to be low.

7. ENVIRONMENTAL IMPLICATIONS

7.1. Exposure Assessment

ENVIRONMENTAL RELEASE

Release From Site

Currently, no manufacture occurs in Australia and the polymer is imported. However, if the scale of use justifies manufacture within Australia then it is expected to be produced by a toll manufacturer in Western Australia.

Release of imported SUPERFLOC® HX-800 Flocculant

At Cytec Holdings warehouse, release of the polymer is only expected in the event of accidental spills/leaks and during transfer of 1000 kg IBCs and Isotankers. Spills will be limited to the capacity of the IBCs and the Isotankers. It is estimated that a maximum of 0.5% of the notified polymer (< 1500 kg per annum) would be lost during spillage. Spill kits are in place in the storage and production areas. Spills are collected with inert absorbent material and disposed of through a licensed waste disposal contractor. Spilled material will be collected with inert absorbent material and only trace amounts of material will remain. Flushing with water or with detergent will clean the area of spill and the waste material will go to a drain in the floor where it is collected in a pit. The pit is cleaned periodically and waste collected is sent off site for disposal by landfill by a licensed waste contractor.

If manufacturing occurs within Australia, then the process is expected to occur in enclosed reaction vessels. The site will be bunded and the release pattern is expected to be similar to that of the release pattern from the warehouse.

Release of manufactured SUPERFLOC® HX- 800 Flocculant

During the manufacturing process, water used to flush the equipment, pipes and pump is reused as part of the finished batch. After transfer of the final product to storage containers, the tank is flushed with water, and all trade wastes are sent to the on-site trade waste treatment plant. A rotary vacuum drum filter removes solids from the trade waste. Clarified and pH neutral water is discharged to sewer under a trade waste agreement with the Water Authority. The effluent is sampled every 8 days by an independent contractor and analysed at a NATA certified laboratory.

No notified polymer enters the sewer system.

Release From Use

Minimal release of the notified polymer is anticipated once it is delivered into the Bayer Process, as this process is a closed loop system and discharge to the environment is expected to be minimal.

The flow in a Bayer Plant ranges from 500 cubic meters/hour for a small plant to 2500 cubic meters/hour for a large plant. Assuming that the product is dosed at 5 ppm, equivalent to 0.6 ppm polymer, the amount of notified polymer used is ~ 7 kg to 36 kg/day, depending on the size of the plant and the dose.

During the Bayer Process, approximately 5000 tonnes of caustic red mud and sand are produced daily. To handle the vast quantities of red mud and manufacturing wastes, two large on-site tailing dams have been constructed with a multi-layered base of compacted clay and PVC membrane with a further inner layer of yellow sand housing the underdrain system, which collects the water. This multi-layered base prevents leaching of the dilute caustic liquor containing the notified polymer into groundwater, which is very close to the surface in this area.

The caustic sand and mud waste are sent to the first disposal dam for treatment to separate the solids and recycle the water for further use. After thickening, the mud slurry is pumped to drying beds, distributed over the surface to a depth of less than one metre and sun dried to at least 65 to 70% solids before distribution of the next mud layer. The remaining supernatant in the settling dam is sent

to a second dam where it is returned to the bauxite refinery to be used as wash water to the mud washers, as hose water and as cooling water.

There is a new technique in place by companies involved with the production of alumina, which involves the storage of bauxite residue thereby reducing environmental effects, requiring less land, and making the alumina-refining by-product accessible for alternative uses and surface reclamation. This technique is known as "Dry Stacking". Dry stacking involves taking bauxite residue from refineries; reducing the water content through thickening and spreading the material in 0.5 metre layers for further drying via evaporation and drainage. The residue's final density is about 30% higher than that achieved in the previously used wet disposal areas. The higher density and lower water content in the deposit means less risk of seepage and groundwater contamination. This technique also enables residue recovery for reuse and rapid rehabilitation for alternative land uses.

The empty 1000 kg IBCs and Isotankers will be rinsed with suitable solvent. The total residues in the containers are expected to account for up to ~ 2000 kg/year and will be disposed of to landfill. Empty IBCs and isotankers will be re-used after cleaning.

ENVIRONMENTAL FATE

Based on the polymer structure, water solubility and NAMW, a Publicly Owned Treatment Works (POTW) removal of 90% has been estimated for the notified polymer. The notified polymer has a very high NAMW and will not volatilize from water to any appreciable extent. In soil, migration to ground water will be negligible. The notified polymer is estimated to biodegrade very slowly in the environment. Due to the size of the polymer, it is not expected to bio-concentrate in exposed organisms and the BCF is estimated as low.

7.2. Environmental Hazard Characterisation

No ecotoxicological data were submitted. The polymer contains a high concern functional group, which is listed due to potential aquatic toxicity. However, the polymer has a high molecular weight (NAMW > 10 000), which is likely to mitigate the hazard. Further, anionic polymers are known to be moderately toxic to algae. The mode of toxic action is overchelation of nutrient elements needed by algae for growth. The highest toxicity is when the acid is on alternating carbons of the polymer backbone. This could apply to the notified polymer. However, the toxicity to algae is likely to be reduced due to the presence of calcium ions, which will bind to the functional groups.

7.3. Environmental Risk Assessment

The notified polymer is not expected to enter the sewer system during manufacture, and minimal release of the notified polymer is anticipated once it is delivered into the Bayer Process, as this process is a closed loop system. Release will be to large, properly constructed tailings dams. Therefore, discharge to the environment is expected to be minimal. The notified polymer has a NAMW of greater than 1000 and it is unlikely to cross biological membranes and cause toxicity or bioaccumulate. Based on the exposure levels and use pattern, the notified polymer is unlikely to pose an unacceptable risk to 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

Disposal

- The notified polymer should be disposed of by authorised incineration or thermal treatment.

Emergency procedures

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