

File No PLC/642

1 September 2006

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

**FULL PUBLIC REPORT**

**Polymer in Superfloc TF 8000 Flocculant**

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**Director  
NICNAS**

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**FULL PUBLIC REPORT****Polymer in Superfloc TF 8000 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, Purity, Import Volume, Site of Manufacture/Reformulation, Customer,

## 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**

## MARKETING NAME(S)

Superfloc TF 8000 (<10% notified polymer dispersion in water)

## MOLECULAR WEIGHT (MW)

Number Average Molecular Weight (Mn) >10000

## REACTIVE FUNCTIONAL GROUPS

The notified polymer contains only low concern functional groups.

**3. PLC CRITERIA JUSTIFICATION**

<i>Criterion</i>	<i>Criterion met (yes/no/not applicable)</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**

Off white to light yellow liquid with suspended solids.

**Melting Point/Glass Transition Temp**

Not determined

**Density**

1000-1100 kg/m<sup>3</sup> for solution of notified polymer (conc <10%).

**Water Solubility**

<10% Dispersion in water. Claimed to have very low solubility as low viscosity indicates very limited polymer has dissolved. The MSDS also claims that the solubility is limited by viscosity.

**Dissociation Constant**

Not determined. The notified polymer contains anionic groups that are expected to show typical acidity, pKa~2-5 (the pKa for aliphatic carboxylic acids is 3-5 and the pKa for derivatives of the hydroxyl aluminium ion is 2-4).

**Reactivity**

Stable under normal conditions of use. Hazardous polymerisation does not occur.

**Degradation Products**

Carbon monoxide, oxides of nitrogen, oxides of sulphur (includes sulphur dioxides and sulfur trioxides), ammonia and carbon dioxide.

#### 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>
<i>Tonnes</i>	10-30	10-30	10-30	10-30	10-30

USE AND MODE OF INTRODUCTION AND DISPOSAL

**Mode of Introduction**

The notified polymer will be imported in isotankers as a dispersion in water at a concentration of <10% and will be used without reformulation in Australia. It is envisaged that in future Superfloc TF-8000 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

The raw materials are received at the manufacturing site in various forms of packaging. All material is stored in a banded, dedicated Dangerous Goods area. The raw materials are either pumped or manually 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 is transferred using dedicated pumps and hoses to isotankers.

End-use

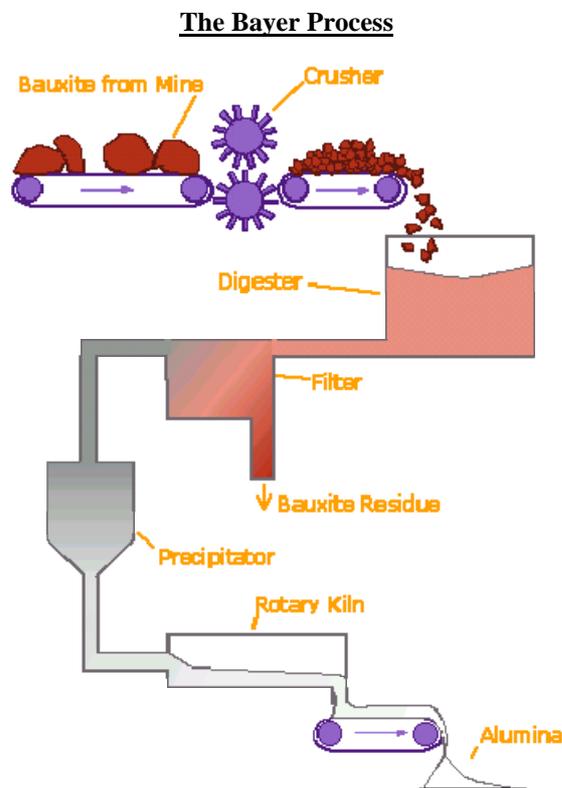
At end-user sites isotankers or IBCs of the liquid containing the notified polymer will be transferred from defined chemical storage areas to the Bayer process as required. Operators manually insert an

automated pump through a small opening at the bottom of the IBC to enable transfer of the notified polymer into a holding tank. As required, the notified polymer 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 the notified polymer is added directly into the 'Filter'. The system is closed and the liquid containing the notified polymer is delivered via automated pumps to the 'Filter'. This process is carried out with fully automated and computer controlled equipment.

In the 'Filter' the notified polymer 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'.

Approximately 0.25 ppm notified polymer will be used in the Bayer process, that is 3 kg to 15 kg/day, depending on the size of the plant.



#### Use

The notified polymer will be used as a flocculant in the Bayer Process (a procedure for obtaining alumina from the aluminium ore, bauxite).

## 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

The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard. This is supported by toxicological endpoints observed in testing conducted on the notified polymer.

	<i>Endpoint</i>	<i>Result</i>	<i>Classified?</i>	<i>Effects Observed?</i>	<i>Test Guideline</i>
1.	Rat, acute oral	LD50>5000mg/kg bw	no	yes	Similar to OECD TG 401
2.	Rabbit, acute dermal	LD50>2000mg/kg bw	no	yes	Similar to OECD TG 402
3.	Rabbit, skin irritation	non-irritating	no	no	Similar to OECD TG 404
4.	Rabbit, eye irritation	slightly irritating	no	yes	Similar to OECD TG 405
5.	Genotoxicity - bacterial reverse mutation	non mutagenic	no	no	Similar to OECD TG 471

All results were indicative of low hazard.

In the single dose oral toxicity study in rats, instances of wetness and soiling of the anogenital area and few faeces were noted in one animal (out of five) within 24 hours of dosing.

In the acute dermal toxicity study in rabbits, the left eye of one animal appeared abnormal after 24 hours. All other animals were normal. Dermal effects ranged from slight to moderate on Day 1 and moderate to severe on Day 7. Body weight changes were normal.

In the primary ocular irritation study in rabbits, there was no corneal opacity or iritis noted at any observation period. Conjunctival irritation, noted in 3/3 eyes, cleared by 72 hours. No abnormal physical signs were noted during the observation period.

### **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 and the low intrinsic hazard of the polymer, as demonstrated by the toxicological data and the fact that the polymer meets the PLC criteria. It should be noted that Superfloc TF 8000 Flocculant contains a hazardous impurity (residual monomer). Given that the impurity is present in Superfloc TF 8000 Flocculant at concentrations <1%, the risk of irritation or skin sensitisation should be minimal, and the product will not be classified as an irritant or sensitiser. The notifier has indicated that the notified polymer is not isolated during the manufacturing process. However, care should be taken by workers to prevent exposure to what may potentially be high concentrations of the notified polymer, incidentally produced during manufacture, by the use of appropriate engineering controls and PPE.

#### **PUBLIC HEALTH**

As there will be no 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 OF CHEMICAL AT SITE

###### Release of Imported SUPERFLOC TF 8000 Flocculant

At Cytec Holdings warehouse release of the polymer is only expected in the event of accidental spills/leaks and during transfer of Isotankers. Spills will be limited to the capacity of the Isotankers. It is estimated that a maximum of 2% of the notified polymer (~ 400 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.

###### Release of manufactured SUPERFLOC TF 8000 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 OF CHEMICAL FROM USE

Minimum 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/hr for a small plant to 2500 cubic meters/hr for a large plant. Therefore, the amount of notified polymer used in the Bayer Process ranges from 3 kg to 15 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.

Or

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 Isotankers will be rinsed with suitable solvent. The residue will be disposed of to landfill. The total residues in the containers are expected to account for up to ~ 400 kg/year

#### 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 bioconcentrate in exposed organisms and the BCF is estimated as low.

### 7.2. Environmental Hazard Characterisation

No ecotoxicological data were submitted. 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. Whether this applies to the notified polymer is unclear. 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

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. 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 incineration or to landfill.

**Storage**

- The following precautions should be taken regarding storage of the notified polymer:
  - Store at temperatures <24°C.

**Emergency procedures**

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