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

FULL PUBLIC REPORT

Polymer in S-9974

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**Director
Chemicals Notification and Assessment**

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FULL PUBLIC REPORT

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1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT

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

NOTIFICATION CATEGORY

LRCC: Synthetic Polymer of Low Concern

EXEMPT INFORMATION (SECTION 75 OF THE ACT)

Data items and details claimed exempt from publication:

- Chemical name
- Other names
- Molecular formula
- Structural formula
- Means of identification
- Number average molecular weight
- Weight-average molecular weight
- Weight percentage of polymer species with MW < 1000 and MW < 500
- Charge Density
- Polymer Constituents
- Residual Monomers and impurities
- Reactive Functional Groups
- Import Volume
- Site of manufacture and or reformulation
- Purity

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

None

NOTIFICATION IN OTHER COUNTRIES

None

2. IDENTITY OF CHEMICAL

OTHER NAME

Modified Styrene polymer
S-9968

MARKETING NAME
S-9974

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
No Substantial Degradability	Yes
Not Water Absorbing	Yes
Low Concentrations of Residual Monomers	Yes
Not a Hazard Substance or Dangerous Good	Yes

The notified polymer meets the PLC criteria.

4. 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>	< 800	< 800	< 800	< 800	< 800

USE

The notified polymer will be used as an anti-scalant agent.

5. PROCESS AND RELEASE INFORMATION

5.1. Operation Description

The notified chemical will be imported as a component of S-9974 (<30%) in 200 L polypropylene drums and/or IBCs and will be used without reformulation in Australia. It will be transported from the wharf to Cytec Holdings warehouse by truck where it will be stored before being distributed to metal refinery industries (such as Alcoa, Rio Tinto and BlueScope Steel).

At the end-users site, the S-9974 containing the notified polymer will be used as a scale inhibitor in Metal Refinery, for obtaining ore. It is a closed loop system and discharge to the environment is negligible.

The flow in the metal refinery ranges from 500 cubic meters/hr for a small plant to 2500 cubic meters/hr for a large plant. The dose of S-9974 is expected to be in the range of 5-50 ppm (based on real polymer). Therefore, the amount of notified polymer used in metal refinery ranges from 2.5 – 125 kg/hours or 60-3000 kg/day, depending on the size of the plant and the dose.

The S-9974 and ground ore is pumped via an automatic measuring system into a large pressure vessel called a “Digester”. In the digester it is mixed with a hot solution of sodium hydroxide and steam at a temperature in excess of 250 deg C.

During the clarification process the liquor containing the ore is separated from the insoluble impurities. These residues, known as ‘red mud’ sink gradually to the bottom of the tank and are removed. S-9974 is expected to end up in the red mud.

During the precipitation phase, the ore is precipitated or crystallised from the solution as crystals. The

solution is mixed in tall vessels with recycled seed crystals. When completed the solid ore is passed on to the next stage and the remaining liquor, which contains the sodium hydroxide, S-9974 containing the notified polymer and some ore, goes back to the digesters.

In the final stages the ore is washed and then it is heated to about 1050 deg C in special kilns to drive off the water of crystallisation, leaving the ore.

The fate of the notified polymer in the red mud is discussed under section 6.3.1.

6. EXPOSURE INFORMATION

6.1. Summary of Occupational Exposure

<i>Number and Category of Workers</i>			
<i>Category of Worker</i>	<i>Number</i>	<i>Exposure Duration</i>	<i>Exposure Frequency</i>
Storemen	5	8 hrs/day	48 weeks/year
Transport	≤5	2-4 hrs/day	30-60 days/year
Operators	4	1 hrs/day	48 weeks/year

Transport and warehousing

Workers are not expected to be exposed to the imported notified polymer, as they will be handling closed containers. The notified polymer will be supplied in 200 L drums and/or IBCs and transported in secure pallets. Exposure is possible in the event of an accident where the packaging is breached.

End-use operations

The application process requires very little operator activity. Drums or IBCs of the liquid containing the notified polymer will be transferred from defined chemical storage areas to the metal refinery area as required. Operators will manually insert an automated pump through a small opening at the top of the 200L drum to enable transfer of the S-9974 into a holding tank. As required the S-9974 is pumped/injected from the holding tank via an automated system into the digester during the metal refinery.

Alternatively, operators manually attach a hose, which is dose-automated into the IBCs outlet from which the S-9974 is added directly into the digester. The system is closed and the liquid containing the notified polymer is delivered via automated pumps to the digester. This process is carried out in fully automated and computer controlled equipment.

Operators are only exposed to notified polymer when replacing the empty drum with new drum when transferring the S-9974 to holding tanks or when attaching a hose into the IBCs. Any residue remaining in drum or IBCs are poured into the next drum to be used. Lids are replaced on drums when emptied. This activity occurs daily and takes approximately 5-10 minutes under normal conditions. Dermal and ocular exposure may occur during this activity, as a result of spills and drips. Workers involved in the process will wear gloves, overalls and safety glasses.

Cleaning and maintenance work

Cleaning of pump and transfer lines and maintenance work on the equipment used to dispense the liquid containing the notified polymer is rarely required. Personnel undertaking maintenance tasks are required to wear gloves, overalls, safety glasses and a respirator if necessary.

6.2. Summary of 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.

6.3. Summary of Environmental Exposure

6.3.1. Environmental Release

RELEASE OF CHEMICAL AT SITE

Release of the polymer in the environment is only expected in the event of accidental spills/leaks and during transfer of 200 L drums and IBCs into the digester. Spills will be limited to the capacity of the drums and the IBCs. It is estimated that a maximum of 2% of the notified chemical (~ 6000 kg per annum) would be lost during spillage (based on import levels of 300,000 kg per annum). 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.

Residues remaining in the drums and IBCs will be reused. The empty 200L drums and 450L IBCs will be rinsed with suitable solvent. The residue and empty 200L containers will be collected by licensed waste contractors. The containers will be disposed of to landfill. Empty IBCs will be cleaned with suitable solvents and sent back to manufacturers. The rinsate from cleaning the IBCs will be collected in a container and collected by a licensed waste contractor for disposal. The total residues in the containers are expected to account for up to ~ 1584 kg/year of the notified polymer based on 300,000 kg/year imported volume. The table below provides an estimate of the residue of the notified substance in the empty containers.

Proportion of import volume imported in these containers	Residue product in container (%)	Residue of notified chemical in container (kg)	Volume of residue per year (kg)	Disposal method
200 kg Drums (70%)	3	1.32*	1386**	Landfill
450 IBC (30%)	1	0.99*	198**	Reused
	4.5			

*200 kg x 3% x 22% or x 1% x 22%; ** 300,000 kg x 70% x 3% x 22% or x 30% x 1% x 22%

RELEASE OF CHEMICAL FROM USE

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

The flow in the Metal Refinery ranges from 500 cubic meters/hr for a small plant to 2500 cubic meters/hr for a large plant. The dose of S-9974 is expected to be in the range of 5-50 ppm (based on real polymer). Therefore, the amount of notified polymer used in the metal refinery ranges from 2.5 – 125 kg/hours or 60-3000 kg/day, depending on the size of the plant and the dose.

During the metal refinery, 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 metal refinery to be used as wash water to the mud washers, as hose water and as cooling water. The recycled water will be contained in the refinery and no direct release to natural receiving water will occur.

Alternatively, there is a new technique in place by companies involved with the production of ore, which involves the storage of ore residue thereby reducing environmental effects, requiring less land, and making the metal-refining by-product accessible for alternative uses and surface reclamation. This technique is known as "Dry Stacking". Dry stacking involves taking residues 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.

6.3.2. Environmental Fate

The following study was carried out on the product S-9974, which contains <30% of the notified polymer.

Test	Duration	Result
Ready Biodegradability: CO2 Evolution (Modified Sturm Test) (OECD 301B)	28 day	19.4%

The product S-9974 was not readily biodegradable within a 28-day test period when exposed to microorganisms maintained in an aerobic, aqueous mineralised environment. The mean cumulative biodegradation of the test substance was 19.4% after 28 days.

Cumulative biodegradation of the reference substance was 66.8% by Day 14 meeting the test criteria for acceptability.

The notified polymer is not expected to cross biological membranes due to its high molecular weight, and as such should not bioaccumulate.

7. ESTABLISHMENT OF LOW PHYSICAL AND CHEMICAL HAZARD

Appearance at 20°C and 101.3 kPa	Colourless to amber liquid with mild odour.
Melting Point/Glass Transition Temp	Not determined: Expected to be similar to water.
Density	1.0-1.05
Water Solubility	100% soluble in water
Dissociation Constant	Not determined.
Reactivity	Stable under normal conditions and will not polymerisation will not occur. Avoid contact with acids and strong oxidizing agents.
Degradation Products	Hazardous decomposition products are oxides of carbon and nitrogen and ammonia.

7.1. Comments

The dissociation constant was not determined, but consideration of the functional groups present indicates that the polymer will be anionic under environmental conditions.

8. ESTABLISHMENT OF LOW HUMAN HAZARD

8.1. Toxicology

The following toxicological studies were submitted for the product S-9974 containing <30% notified polymer.

<i>Endpoint</i>	<i>Result</i>	<i>Classified?</i>	<i>Effects Observed?</i>
1. Rat, acute oral	LD50 > 5000 mg/kg bw	no	no
2. Rabbits, acute dermal	LD50 > 2000 mg/kg bw	no	no
4. Rabbit, skin irritation	non-irritating	no	no*
5. Rabbit, eye irritation	non-irritating	no	no
8. Genotoxicity – Ames <i>Salmonella</i> Assay	non mutagenic	no	no

*PII = 0

All results were indicative of low hazard.

8.2. Human Health Hazard Assessment

The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard. This is supported by the low acute oral and dermal toxicity, non-irritation to skin and eyes and lack of mutagenicity in the Ames *Salmonella* Assay.

9. ENVIRONMENTAL HAZARDS

9.1. Ecotoxicology

The following ecotoxicological studies were submitted for the product S-9974 containing <30% notified polymer.

<i>Endpoint</i>	<i>Result</i>	<i>Effects Observed?</i>
Fish Toxicity	EC50 > 100 mg wm/L	no
Daphnia Toxicity	EC50 770 mg wm/L	no
Fresh water Green Alga Toxicity	E _b C ₅₀ 150 mg wm/L	no

9.1.1 Discussion of Observed Effects

A static freshwater toxicity test was conducted on rainbow trout (*Oncorhynchus mykiss*) in accordance with the OECD test guideline 203. Mortality of rainbow trout exposed for 96 h was 0% in the control and in the single 100 mg wm/L test concentration. The 96 h LC₅₀ could not be calculated because of lack of mortality during the exposure period and can be stated to be >100 mg wm/L.

A static freshwater toxicity test was conducted on *Daphnia magna* accordance with the OECD test guideline 202. Mortality of *Daphnia magna* exposed for 48 h was 65% in the 1000 mg wm/L test concentration. The 48 h LC₅₀ was calculated to be 770 mg wm/L with 95% confidence limits of 590-1000 mg wm/L. The 48 h NOEC was calculated to be 250 mg wm/L due to lack of significant mortality at this test concentration.

A static test was conducted on the freshwater green algae (*Selenastrum capricornutum*) in accordance with the OECD test guideline 201. After 72 h of exposure the % inhibition of cell growth compared to the control ranged from – 16% at 50 mg wm/L to 55% at 100 mg wm/L. The 72 h E_bC₅₀ was calculated to be 150 mg wm/L with 95% confidence limits of 120 and 210 mg wm/L. The E_bC₅₀ (24 and 48 h) could not be calculated. The E_rC₅₀ (24-72 h) could not be calculated due to insufficient reduction in growth rates during the exposure period. The 72 h NOEC was 50 mg wm/L based on a lack of significant reduction in growth (cell density) at this testing concentration compared to the control.

The test concentrations reported for the above tests are based on the nominal concentrations as whole material and all test substance was in solution.

9.2. Environmental Hazard Assessment

The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard. This is supported by the low toxicity observed in the studies with fish, daphnia and fresh water green alga.

10. RISK ASSESSMENT

10.1. Environment

The notified polymer is a component in an imported ready to use anti-scalant in the Metal Refinery Industry. Application of the anti-scalant in metal refinery takes place in an automated enclosed system and hence, environmental release of liquid containing the notified polymer is expected to be minimal during the manufacture of ore. It is estimated that approximately 6000 kg per annum of waste polymer will be generated from accidental spills and ~1584 kg per annum as residues in empty containers. The notified polymer will be released to disposal dam and or collected in dry stacking process. The notified polymer would likely be associated with the mud, which will be left to dry and may be rehabilitated at a later date. Abiotic or slow biotic processes will be largely responsible for the degradation of the notified polymer under these conditions as it is not readily biodegradable. The rate of use and presumably the release will be up to 3000 kg/day. Since there is no direct release to natural receiving waters the risk to the environment from the notified polymer will be negligible.

10.2. Occupational health and safety

The OHS risk presented by the notified polymer is expected to be low. The notified polymer is present in formulation containing hazardous ingredients such as sodium hydroxide and toluene, but these are below the cut off levels to be classified as being hazardous.

Worker exposure may occur when 200 L drums are emptied into holding tanks and when IBCs are attached via a hose to the digester. Dermal and ocular exposure may occur as a result of drips and spills during the transfer of S-9974 from 200L drums into holding tanks and the transfer of residue in used drums to new drums. Dermal and ocular exposure may also occur during the installation of IBCs in to the digester. Exposure may occur during the maintenance and cleaning of the manufacture equipment.

Worker exposure will be minimised by use of the appropriate personal protection equipment. When installing the drum and IBCs and during maintenance work workers will wear eye protection, impermeable gloves and overalls, as required. Metal refinery will occur in well-ventilated areas, where local ventilation will be used.

Worker exposure during the transport, storage, and distribution of the imported notified polymer is unlikely to occur unless there is an accidental spillage or packaging breach.

10.3. 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 low.

11. CONCLUSIONS – ASSESSMENT LEVEL OF CONCERN FOR THE ENVIRONMENT AND HUMANS

11.1. Environmental risk assessment

The notified polymer is not considered to pose a risk to the environment based on its reported use pattern.

11.2. Human health risk assessment

11.2.1. Occupational health and safety

There is No Concern to occupational health and safety under the conditions of the occupational settings described.

11.2.2. Public health

There is Negligible Concern to public health when used as an anti-scalant agent.

12. MATERIAL SAFETY DATA SHEET

12.1. Material Safety Data Sheet

The notifier has provided MSDS in accordance with the schedule item B 12 of the *ICNA Act*. The accuracy of the information on the MSDS remains the responsibility of the applicant.

13. RECOMMENDATIONS

CONTROL MEASURES

Occupational Health and Safety

- Engineering control procedures such as local exhaust ventilation should be used.
- Personnel should wear a two-piece PVC suit with hood or PVC overalls with hood and ensure adequate ventilation is present during the metal refinery when transferring the S-9974 containing the notified polymer and during routine maintenance and repairs.

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.

Disposal

- The notified polymer should be disposed of to landfill or incinerated according to State and local government regulations.

Emergency procedures

- Spills of the notified polymer should be handled by covering spills with some inert absorbent and sweeping material up into containers for disposal to landfill. Flush spill area with water.

13.1. 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.

No additional secondary notification conditions are stipulated.