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**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

Polymer in Reagent S-7261 Depressant

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT**Polymer in Reagent S-7261 Depressant****1. APPLICANT**

Cytec Australia Limited of 7-11 Railway St BAULKHAM HILLS NSW 2153 has submitted a limited notification statement in support of their application for an assessment certificate for Polymer in Reagent S-7261 Depressant.

2. IDENTITY OF THE CHEMICAL

The notified polymer is considered not to be hazardous based on the nature of the chemical and the data provided. Therefore the chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data and details of the polymer composition have been exempted from publication in the Full Public Report and the Summary Report.

Trade Name: no specific trade name applies to this polymer;
initially it will be imported as a component of the
polymer solution Reagent S-7261 Depressant

**Number-Average
Molecular Weight:** >1 000

**Maximum Percentage of Low
Molecular Weight Species**

Molecular Weight < 500: < 2%

Molecular Weight < 1 000: < 2%

3. PURITY OF THE CHEMICAL

Purity: high

Additives/Adjuvants: none

4. PHYSICAL AND CHEMICAL PROPERTIES

The physical and chemical properties relate to the imported product, Reagent S-7261 Depressant, containing the notified polymer, unless otherwise stated. The polymer solution contains between 10 and 30% polymer in an aqueous solution with up to 10% isopropanol and 10% sodium metabisulphite.

Appearance at 20°C and 101.3 kPa:	clear, white liquid with an alcohol odour
Boiling Point:	~80°C (estimated for typical water/isopropanol mixtures)
Specific Gravity:	1.14 ± 0.005
Vapour Pressure:	4.9 kPa at 31°C (estimated for typical water/isopropanol mixtures)
Water Solubility:	claimed as completely miscible
Partition Co-efficient (n-octanol/water):	not provided but expected to be low
Hydrolysis as a Function of pH:	not measured, the polymer contains ester and amide groups which may hydrolyse above pH 10 and below pH 2 to give polyacrylate products
Adsorption/Desorption:	not expected to adsorb to organic matter, though may adsorb to clays and silicates.
Dissociation Constant:	not provided
Flash Point:	52°C (Pensky Martens Closed Cup Method)
Flammability Limits: (for 3.8% isopropanol)	Upper Explosive Limit = 12.7 % (isopropanol) Lower Explosive Limit = 2.0 % (isopropanol)
Autoignition Temperature:	not expected to autoignite
Explosive Properties:	not explosive
Reactivity/Stability:	the polymer is stable under ambient conditions but above 90°C and extremes of pH (> 9 and < 4) some hydrolysis may take place

Comments on Physico-Chemical Properties

The claim that the notified polymer is “completely miscible in all proportions” for water solubility was based upon a simple bench method where 1.0 g of the polymer was placed in a beaker with water. Miscibility was recorded for 10, 2 and 1% solution concentrations. These solutions were found to be homogenous with no layering observed. No precipitate developed upon standing. All evidence supports the conclusion that the notified polymer will be completely miscible in water. Polyacrylamides are known to be infinitely soluble in water *ie* no phase separation (1).

The notified polymer is not expected to hydrolyse under normal environmental conditions. However, under extreme pH ($\text{pH} < 2$ & $\text{pH} > 10$) the ester and amide groups of the notified polymer may hydrolyse to give polyacrylate products.

The notifier expects that the notified polymer will have a low partition coefficient due to its high solubility in water and hydrophilic nature. Dissociation in the environmental pH range is not expected.

The notifier claims that the notified polymer is not expected to adsorb to organic matter in soils, but may adsorb to clays and silicates. It is expected that the notified polymer will undergo complexation with metals (especially iron) in clays and silicates.

5. USE, VOLUME AND FORMULATION

The notified polymer will be used as an iron depressant in the refining of zinc ore by the flotation method. The notified polymer will not be manufactured in Australia but will be imported in an already formulated aqueous/isopropanol mixture (up to 10% isopropanol) containing between 10 and 30% of the notified polymer. The import volume of the polymer in suspension is projected to be more than 10 tonnes per annum for the first 5 years.

6. OCCUPATIONAL EXPOSURE

The notified chemical will be imported in 1 tonne Intermediate Bulk Containers and transported from dockside to a contract chemical warehouse in western Sydney for storage. Finally Reagent S-7261 will be transported to a concentrator site in western NSW. Approximately 3 to 6 workers would be involved in the transport and storage of Reagent S-7261 Depressant for 1 to 2 hours/day for 5 to 10 days/year. For these workers exposure to the notified chemical is only expected to occur in the event of an accident.

Five to 10 plant operators at the concentrator site will be potentially exposed to the notified polymer for 0.5 to 1 hour/day from 150 to 200 days/year. The notified chemical constitutes approximately 10 to 30% of Reagent S-7261 which is added manually at the rate of 50g/tonne of ore. All reagents for the zinc concentration process are stored and mixed in a mixing room. Plant operators are trained in the handling of hazardous chemicals and are required to wear half-face respirators, impervious gloves, chemical splash goggles, coveralls, safety boots and a hard hat.

while handling reagents. Local exhaust ventilation is positioned over the mixing tanks.

The notified polymer has a high molecular weight indicating that it will be poorly absorbed across biological membranes and tissues. The notified polymer has a low level of monomers. Skin exposure is unlikely to occur to Reagent S-7261 Depressant because of the liquid dispensing and mixing systems and the safety equipment used. Since acrylamide, an accumulative toxin and potential carcinogen, will be present at low concentration (equal to or below 0.09%) workers should be notified of the possible dangers considering the large amount being mixed (more than 10 tonnes/year). All monomers are present at concentrations below the threshold requiring classification according to Worksafe Australia's *Approved Criteria for Classifying Hazardous Substances* (Approved Criteria) (2).

7. PUBLIC EXPOSURE

Public exposure to the notified chemical is unlikely. The finished product is used only in the mining industry and initial imports will be used solely by a single customer. The notified chemical is added to ore for processing. Subsequent to use, approximately 70% of the added product will be disposed of underground together with depleted ore in a cement mix. The remainder will be disposed of with water to a tailings dam from which all water is recycled for use within the processing plant. Public exposure to the notified chemical is unlikely except in the event of a transport accident where the main hazard will be the products flammability. Potential for public exposure to the polymer during transport and disposal of process waste and clean-up waste after a spill is very minor. In this event the spill will be contained in sand or vermiculite and disposed of according to local state requirements. If the conditions of use are varied, greater exposure may occur. In such circumstances, further information would be required to assess the hazards to public health.

8. ENVIRONMENTAL EXPOSURE

Release

Almost all the volume of notified polymer imported into Australia will be released to the environment at the mining site in western NSW.

The majority of notified polymer will be associated with the depleted ore from the concentrator circuits, which will be pumped into either tailing dams or underground. The notifier expects that 70% of the polymer will be disposed of underground with depleted ore in a cement mixture. The remaining 30% will be pumped into a tailings dam. It is claimed that negligible amounts of the notified polymer will remain in the zinc concentrate.

It is a condition of the mining lease that process water must be recycled and not leave the site. Therefore, the notified polymer should not enter the environment outside of the western NSW mining site.

Fate

Any notified chemical in depleted ore that is pumped underground will be mixed with cement. The notified polymer will become immobile when the cement mixture hardens. This hardened mixture is used as mine support.

In the tailings dam, the ester groups of the notified polymer are likely to undergo hydrolysis, as the pH of the dam is approximately 9.5. The amide groups are not likely to hydrolyse. Hydrolysis of the ester will form ethylene glycol which will undergo further degradation (through to CO₂). The remaining product, a polyacrylic polymer, contains approximately 90:10 amide and acid sidechains on the polymer backbone. This product will remain as an inert organic material, possibly bound to the surface of clays and other clay like particles in the tailings dam.

Any notified polymer retained in the zinc concentrate will be destroyed in the smelting process. Combustion of the polymer will produce water, and oxides of carbon and nitrogen.

Biological membranes are not permeable to polymers of very large molecular size (MW > 1 000) and therefore bioaccumulation of the notified polymer is not expected (3,4). Also, its expected low P_{OW} and high water solubility will limit its bioavailability and hence bioaccumulation potential (5).

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicology data were provided, which is acceptable for polymers of Number Average Molecular Weight (NAMW) of more than 1 000 according to the Act. A NAMW of more than 1 000 for the polymer will restrict transfer across biological membranes.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicology data were provided, which is acceptable for polymers of NAMW greater than 1 000 according to the Act.

The hydrolysis product containing a majority of amide and fewer acid sidechains, is not likely to exhibit significant environmental toxicological effects due to the limited chelation expected (6).

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The majority of the polymer (~70%) will be sent underground. Here the polymer will be immobile in the cement mixture.

Approximately 30% of the polymer will be sent to the tailings dam. Therefore, with a use rate of more than 10 tonnes per year, with 30% going to the tailings dam, the concentration of the notified polymer in the tailings will be ~2.4 ppb. It is likely that the polymer will hydrolyse over time, forming a polyacrylic polymer, that will become immobile in the clay slurries, and CO₂, and therefore should not accumulate.

The environmental hazard from the use of the notified polymer is rated as negligible. None of the polymer should enter the environment outside of the western NSW mining site.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The notified polymer will be used as an iron depressant in the refining of zinc ore by the flotation method. It will be imported as a solution, Reagent S-7621 Depressant, containing no more than 30% of the notified polymer and is expected to be used at one mine site in western NSW. Apart from the rare event of an accidental spill, the most significant exposure is likely to occur during the zinc concentration processes. The main route of exposure during dispensing and mixing would be via the skin and inhalation.

The large molecular weight and other physico-chemical properties, which suggest low absorption and high stability under normal ambient conditions, support the notifier's claim of expected low toxicity for the notified polymer. The polymer is not expected to expose a safety risk to workers involved in the transport, storage or ore processing aspects of Reagent S-7621 Depressant. The polymer is not classified as hazardous according to Worksafe Australia Approved Criteria (2).

The notified polymer has a low level of residual monomers, which are known to cause skin and eye irritation. Acrylamide, one of the residual monomers, has cumulative toxic properties and is identified as a possible carcinogen. Good practice would suggest that acrylamide be monitored periodically to ensure that levels do not exceed the exposure standard for acrylamide in the work environment (0.03mg/m³ Time Weighted Average).

Irritation and sensitisation may occur with exposure to other components of the polymer solution. Sodium metabisulphite and isopropanol each constitute up to 10% of Reagent S-7261. These chemicals have the potential to cause irritation of the skin and eyes. Sodium metabisulphite can cause skin sensitisation in some individuals and causes bronchoconstriction in responsive individuals, especially asthma sufferers (7,8). The recommended occupational exposure limit for sodium metabisulphite is 5 mg/m³ Time Weighted Average. The low concentration of the reagent with the ore mixture will minimise exposure risks. The hazardous low molecular weight species and residual monomers are present in Reagent S-7261 at concentrations below the threshold requiring classification according to Worksafe Australia's Approved Criteria (2).

The risks associated with exposure to the notified polymer, in particular to the low molecular weight species, will be minimised by the control and safety measure

employed at the plant. Workers exposed to the chemical are trained in handling hazardous substances and wear protective clothing including half-face respirators during exposure. Local exhaust ventilation is positioned over the mixing tanks to minimise atmospheric buildup in the work environment. Adverse effects from exposure to high concentrations are noted on the Material Safety Data Sheet (MSDS) for the polymer solution.

Public exposure to the notified chemical is unlikely except in the event of a transport accident where the main hazard will be the products flammability. Potential for public exposure to the polymer during transport and disposal of process waste and clean-up waste after a spill is very minor. The notified polymer in Reagent S-7261 Depressant is unlikely to pose a significant risk to public health under the conditions of importation, transport and final use at the zinc concentrating plant.

13. RECOMMENDATIONS

To minimise occupational exposure to Polymer in Reagent S-7261 Depressant, the following guidelines and precautions should be observed:

- Safe practices for handling any chemical formulation, should be adhered to and include:
 - minimising spills and splashes:
 - practising good personal hygiene; and
 - practising good house keeping and maintenance including bunding of large spills which should be cleaned up promptly with absorbents and put into containers for disposal.
- It is expected that in the industrial environment, protective clothing conforming to and used in accordance with Australian Standard (AS)2919 (9) and protective footwear conforming to Australian/New Zealand Standard (AS/NZS) 2210 (10) should be worn as a matter of course. In addition it is advisable when handling the polymer solution to wear chemical-type goggles (selected and fitted) according to AS 1336 (11) and meeting requirements of AS/NZS 1337 (12), impermeable gloves AS 2161-1978 (13) and respiratory protection (selected and fitted) according AS/NZS 1715 (14) meeting the requirements of AS/NZS 1716 (15), to protect against any unforeseen circumstances.
- A copy of the MSDS should be easily accessible to employees.

In addition, The Worksafe Australia document *Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards* (16) should be used as a guide in the control of acrylamide and sodium metabisulphite vapours or mists generated during mixing of the notified polymer. Workplace monitoring for these components should be carried out on a regular basis.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the notified chemical was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (17).

This MSDS was provided by the applicant as part of the notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of the applicant.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Act, secondary notification of the notified chemical shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. Because of the essentially site specific nature of the environmental effects, use of the polymer at an other site with different water retention practices will require secondary notification.

16. REFERENCES

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