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**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

Polymer in Reagent S-7260

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT**Polymer in Reagent S-7260****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-7260.

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: Reagent S-7260 Depressant

**Number-Average
Molecular Weight (NAMW):** >10 000

**Maximum Percentage of Low
Molecular Weight Species**

Molecular Weight < 500: none

Molecular Weight < 1 000: none

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-7260 Depressant, containing the notified polymer, unless otherwise stated. The polymer solution contains between 30 to 60% polymer in an aqueous solution with up to 10% isopropanol and 10% sodium metabisulphite.

Appearance at 20°C and 101.3 kPa:	clear, pale yellow viscous liquid with an ammonia odour.
Boiling Point:	~80°C (estimated for typical water/isopropanol mixtures)
Specific Gravity:	1.113 ± 0.001 at 21.8°C
Vapour Pressure:	4.9 kPa at 30°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; see comments below
Hydrolysis as a Function of pH:	not provided; see comments below
Adsorption/Desorption:	not provided
Dissociation Constant:	not provided
Flash Point:	37°C (Pensky Martens Closed Cup Method)
Flammability Limits: (for 9.23% 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 (>> 10 and << 4) some hydrolysis may take place

Comments on Physico-Chemical Properties

The notifier claims that the product containing the notified polymer is “completely water miscible in all proportions”. The notified polymer will be highly soluble due to the high proportion of polyacrylamide units, which are known to be infinitely soluble in water, ie no phase separation (1,2).

The notified polymer is not expected to hydrolyse under normal environmental conditions. However, under extreme pH (pH 2 & pH 12) and/or extreme temperature (175 - 300°C), the rate of hydrolysis of the polyacrylamide will increase forming polyacrylic acid and ammonium (2). The thiourea is also hydrolysable, but this is expected to be slow under environmental conditions. However, hydrolysis of this group maybe more rapid under the extreme conditions as described above.

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 nickel sulphide depressant in the refining of nickel 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 30 and 60% of the notified polymer. The import volume of the notified polymer in suspension is projected to be approximately 15 to 30 tonnes per annum in the first year, rising to 315 tonnes per annum by the fifth year.

6. OCCUPATIONAL EXPOSURE

The notified polymer will initially be imported in 200 L plastic lined drums and later to be imported in intermediate bulk containers (IBC). It will be transported from dockside to a contract chemical warehouse at Chester Hill, NSW. Finally the notified polymer will be transported to a concentrator site. Approximately 3 to 6 workers would be involved in the transport and storage of Polymer in Reagent S-7260 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.

Six to twelve plant operators at the concentrator site will be potentially exposed to the notified polymer for 12 hours/day for 240 days/year. The notified chemical constitutes approximately 60 to 30% of Reagent S-7260 Depressant which is pumped from the drums (or IBC) together with other reagents into a storage tank. A ring system equipped with automatic control devices is used to regulate flow, mix reagents and deliver the reagent mix containing the Reagent S-7260 Depressant at the rate of 50 to 100 g/tonne of ore. All reagents for the nickel concentration process are stored and mixed in a mixing room. Local exhaust ventilation is positioned over the mixing tanks. Skin exposure is unlikely to occur to Reagent S-7260 because of the type of liquid dispensing and mixing systems and the safety equipment used.

7. PUBLIC EXPOSURE

The notified polymer will not be available to the general public. The finished product is used only in the mining industry.

Minor public exposure may result from disposal of unused polymer, or accidental spillage of the notified polymer during transport and storage. However, adequate measures are described in the Material Safety Data Sheet (MSDS) to minimise the risk of public exposure during formulation, disposal, or in the event of accidental spillage.

8. ENVIRONMENTAL EXPOSURE

Release

Almost all the volume of notified polymer imported into Australia will be released to the environment at the smelter site located in southern, WA.

The majority of notified polymer (estimated by the notifier at 95%) will be absorbed to the metal sulphide surfaces, which will be sent to the smelter. Therefore, at maximum import volumes approximately 300 tonnes of the polymer per year will be incinerated in the smelting process. The remaining 5% (approximately 15 tonnes/year), which will be either absorbed to depleted ore or remain unabsorbed in the process water, which will be pumped to the tailings dam.

The notifier claims that no process water will leave the mining site. Process water is recycled to the flotation circuits. Therefore, the notified polymer should not enter the environment outside of the mining site.

Fate

The majority of notified polymer that is retained in the metal concentrate will be destroyed in the smelting process. Combustion of the polymer will produce water, and oxides of carbon, sulphur and nitrogen.

In the tailings dam, the notifier claims that the amide and thiourea groups of the notified polymer may undergo hydrolysis. The notifier also claims that any polymer adhering to depleted ore will be degraded both biologically and thermally in the dam. Otherwise, the polymer will be recycled with the process water to the flotation circuits.

Biological membranes are not permeable to polymers of very large molecular size (molecular weight (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 NAMW greater than 1 000 according to the Act.

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 products of the polyacrylamide and thiourea groups will ultimately form polyacrylic acid. It is unclear which group will hydrolyse first. The polyacrylic acid is not expected to exhibit significant toxicological effects, ie through the chelation of minerals, due to the excess of minerals available in the tailings dam (6).

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The majority of the polymer (95%) will be sent to the smelter with the nickel concentrate and subsequently destroyed. Approximately 50 tonnes of sulphur may be incinerated yearly (at maximum import rates), having the potential to release approximately 100 tonnes of sulphur dioxide (SO_2) to the atmosphere. However, a Sulphuric Acid Plant installed at the smelter site in southern WA converts approximately 90% of sulphur dioxide emissions to sulphuric acid, which is subsequently sold to other markets within Australia and overseas (7). Therefore, it is expected that the releases of SO_2 , due to

the use of the notified polymer, will be insignificant when compared to the total amount of SO₂ released due to the metal smelting of sulphide ores in southern WA. The carbon and nitrogen products of incineration are not likely to present a significant hazard in the environment.

Approximately 5% of the polymer will be sent to the tailings dam¹. Therefore, with a maximum use rate of 315 tonnes per year (approximately 865 kg/day), with 5% going to the tailings dam, the potential concentration of the notified polymer in the effluent going into the tailings dam will be approximately 3 ppm. The tailings dam volume is quoted as 240 million tonnes. 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. However, the liquid in the tailings dam may be recycled with the process water, resulting in a smaller amount of notified polymer remaining in the tailings dam.

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

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Due to the high molecular weight of the polymer it will be poorly absorbed across biological membranes and tissues. These factors and the 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 notified polymer will be used as a nickel sulphide depressant in the refining of nickel ore by the flotation method. It will be imported as a solution, Reagent S-7620 Depressant, containing no more than 30% of the notified polymer. Apart from the rare event of an accidental spill, the most significant exposure is likely to occur during the nickel concentration processes. The main routes of exposure during dispensing and mixing would be via the skin and by inhalation.

The polymer is not expected to pose a significant safety risk to workers involved in the transport, storage or ore processing aspects of Reagent S-7620 Depressant. The Polymer in Reagent S-7620 Depressant is not classified as hazardous according to the Approved Criteria (9).

The notified polymer has a low level of residual monomers, which are known to cause skin and eye irritation. Acrylamide, a potential carcinogen,

¹ Effluent flow into the dam is approximately 14 000 tonnes/day.

will be present at low concentrations (< 0.09% in the imported formulation). All residual monomers including acrylamide are present at concentrations below the threshold requiring classification according to Worksafe Australia's *Approved Criteria for Classifying Hazardous Substances* (Approved Criteria) (9). 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 due to exposure to other components of the polymer solution under specific conditions, for instance, if the formulation is used in confined spaces. Sodium metabisulphite and isopropanol each constitute up to 10% of Reagent S-7260. These chemicals have the potential to cause irritation of the skin and eyes. Isopropanol has an occupational exposure standard of 983 mg/m³ Time Weighted Average (TWA). 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 TWA 5 mg/m, no concentration threshold is listed for classification of mixtures according to Worksafe Australia's *List of Designated Hazardous Substances* (8). However the Approved criteria indicate that a mixture is classified as hazardous when a sensitiser is present at concentrations in excess of 1%, on this basis the formulation containing the notified polymer would be classified as hazardous. Dilution as would occur during use when with the ore mixture will minimise exposure risks.

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 measures 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 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-7260 is unlikely to pose a significant risk to public health under the conditions of importation, transport and final use at the nickel concentrating plant.

13. RECOMMENDATIONS

To minimise occupational exposure to Polymer in Reagent S-7260, 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.
- In addition, when handling the imported formulation Reagent S-7260 Depressant, protective clothing conforming to and used in accordance with Australian Standard (AS)2919 (10) and protective footwear conforming to Australian/New Zealand Standard (AS/NZS) 2210 (11) should be worn as a matter of course. It is advisable when handling the polymer solution to wear chemical-type goggles (selected and fitted) according to AS 1336 (12) and meeting requirements of AS/NZS 1337 (13), impermeable gloves AS 2161-1978 (14) and respiratory protection (selected and fitted) according AS/NZS 1715 (15) meeting the requirements of AS/NZS 1716 (16), to minimise exposure to other, hazardous, constituents of the formulation.
- 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* (17) should be used as a guide in the control of acrylamide, isopropanol and sodium metabisulphite vapours or mists generated during mixing of the solution containing 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 reagent containing the notified polymer was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (18).

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.

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