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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

Polymer in Sika Viscocrete RMC-1

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Director
NICNAS

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1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Sika Australia Pty Ltd
55 Elizabeth Street
Wetherill Park, NSW, 2164

NOTIFICATION CATEGORY
Self Assessment: 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
- 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
- Manufacture Volume

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
TSCA, 2004

2. IDENTITY OF CHEMICAL

OTHER NAME(S)
polyglycoether-polycarboxylate

MARKETING NAME(S)
Polymer in Sika Viscocrete RMC-1

CAS NUMBER
None allocated

MOLECULAR WEIGHT (MW)
Number Average Molecular Weight (NAMW) >10000

3. COMPOSITION

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. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS
The notified polymer will be manufactured in 20 tonne batches at a new Viscocrete plant built at 55 Elizabeth St, Wetherill Park, NSW site. It will be manufactured as an aqueous solution containing <50% notified polymer.

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

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	<1200	<1200	<1200	<1200	<1200

USE
The polymer is intended to be used as a superplasticiser for concrete.

5. PROCESS AND RELEASE INFORMATION

5.1. Operation Description

SIKA AUSTRALIA SITE - Manufacture

Sika Australia will manufacture the notified polymer locally. Raw materials are loaded from storage tanks into the reactor in a closed circuit, and polymerisation occurs in a closed system. Any fumes generated by the process are collected by an appropriate scrubber The finished product will be transported in a bulk liquid tanker or decanted into smaller containers

The Viscocrete plant is internally bunded. Any spillages would be collected, analysed routinely and tested for quality and transferred into a suitable container before being either recycled into appropriate product or discharged to the on-site treatment plant in accordance with Sydney Water trade waste specifications. Spill kits containing booms and absorbent material are incorporated into the site.

The tank farm is bunded and is designed according to clause 5.7 of Australian standard AS 3780. The Viscocrete plant will have features designed to minimise waste through packaging and damaged/split product. Wastewater generated during the manufacturing process is recycled back into the dilutor and recovered in the finished product.

Flexible hoses are used for connecting various pipes and hence decoupling and flushing of hoses, fittings, filter bags etc will generate wastewater consisting of dilute Viscocrete finished products (5-10% solids). It is estimated that this will produce 1000 L wastewater per week for all products made.

Plant operators involved in blending of Viscocrete product – Sika Australia.

Some of the Viscocrete products will be blended with other ingredients. This involves mechanical mixing with other ingredients to obtain concentrations of <30% notified polymer. The blended product

is automatically fed into 205L drum or 1000 L IBC transport storage containers. QA samples are taken by the plant operators and are sent to the laboratory for analysis by laboratory staff.

End Use Plant Operators

Several customers will purchase the concrete admixtures containing <50%. End-use customers include ready mix and precast concrete plants and mining and tunnelling shotcretors. Concrete batching plants are automated and the mixing process is enclosed. One operator will pump Sika Viscocrete products or diluted products containing it from transport containers into the customer's on-site storage tanks. The product is then added to the initial batching water using an electronic dispenser unit. One operator is involved in the dosing operation, which will occur for 8 hours per day, 200 days per year. The rate of addition of Sika Viscocrete products is between 0.2 and 2.0% based on weight of concrete. The final concentration of notified polymer in the mixed concrete is <1/%, assuming the notified polymer is at a concentration of <50%. The mixed concrete is then gravity-fed into concrete transport trucks via a hopper. One operator is involved in the dispensing operation and 8 workers/site will be involved in the transport of the mixed concrete. Two plant operators will also be involved in cleaning operations (0.5 hour per day, 200 days per year) where the mixer and trucks are flushed out with water. This water is recycled into ensuing concrete batches.

For precast concrete plants and mining and tunnelling shotcretors the manufacture of the concrete is similar to above. However, once the concrete is manufactured it is feed into mouldings for precast concrete or fed into a shotcreting machine via a hopper.

The ready mix concrete will be used for a wide variety of construction applications such as building foundation, driveways etc. The ready mix concrete is gravity fed or pumped directly from the truck into the formwork. Once the area is filled, the concrete surface is smoothed and allowed to cure and dry.

6. EXPOSURE INFORMATION

6.1. Summary of Occupational Exposure

The following categories and numbers of workers that may be exposed to the notified polymer during importation and application are broadly estimated for the typical types of workers (and exposure scenarios), independent of the specific application process, as shown in the Table below:

Number and Category of Workers			
Category of Worker	*Number*	*Exposure Duration Hours/Day*	*Exposure Frequency*
Sika Australia – Manufacture and Formulation			
Warehouse/Storage	5	8	48 weeks/annum
Transport	5	8	48 weeks/annum
Plant Operators	3	8	48 weeks/annum
End users – Batching Plant			
Warehouse/Storage	1/site	8	12 days/year
Transport	8/site	8	200 days/year
Plant Operators	4/site	8	200 days/year

Transport and warehousing

Workers are not expected to be exposed to the notified polymer, as they will be handling closed containers. The notified polymer will be in 205 L drums and/or 1,000 L IBCs and transported in secure pallets. Exposure is possible in the event of an accident involving damage to packaging. Warehouse and transport personnel will wear overalls and work boots.

Manufacturing and Formulation Processes

The production occurs in an enclosed system. Thus, exposure via dermal, oral and inhalation routes will be minimal. The final product is a semi-viscous liquid with low vapour pressure. It is not expected to be an inhalational hazard. Local and general ventilation is present with scrubber. Some spillage will occur during connecting various pipes and hence decoupling and flushing of hoses, fittings, filter bags etc. Workers will only be exposed in the event of a spillage through the dermal route mainly.

During formulation workers will wear coveralls, safety goggles, boots, face shield, apron and impervious gloves.

End-use operations
End-use customers include ready mix and precast concrete plants and mining and tunnelling shotcretors. Once the notified polymer is added to the concrete, the concentration of the notified polymer will be relatively low (<1%). Workers will wear coveralls, safety goggles, boots, face shield, apron and impervious gloves. The concrete batching plant automated and the transfer of the notified polymer from the storage tanks to the mixer occurs via permanent pipe and pumping station. Thus, there is minimal worker exposure. Similarly, the mixed concrete is dispensed into the ready mix trucks, shotcrete trucks, or moulds for prefabricated concrete structures using flexible hose fittings and pumps. Exposure of workers to the notified polymer is only likely to occur indirectly; via exposure to the mixed concrete, which contains a low concentration of the notified polymer. The main route of exposure will be dermal. Workers will wear overalls, safety boots, gloves and eye goggles.

During application of the concrete using shotcreting, workers will hold and direct the nozzle of the hose which will "spray" the concrete onto the wall of the tunnel. With large scale operations, this is done by a machine. The main route of exposure will be dermal. Workers will wear overall, safety boots and gloves and eye goggles.

During manufacture of pre-cast concrete structures, the concrete is pumped into the moulds. Worker will connect and disconnect flexible hoses which are used to fill the moulds. The main route of exposure will be dermal. Workers will wear overalls, safety boots, gloves and eye goggles.

When ready mixed concrete is used, transport workers will connect and disconnect flexible hoses which are used to fill the formwork. Concrete workers will spread and smooth concrete. Workers will wear overalls, safety boots and gloves.

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. Exposure may occur during disconnection of and connection of pumping equipment and hoses, flushing out of pipelines etc. 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 during transportation from manufacturing site to the customers.

There is likely to be a high level of public exposure arising from dermal contact with finished concrete structures containing the notified polymer at <1%. However, the majority of the polymer will be bound within the matrix of the concrete and once hardened will remain immobile. Therefore it is unlikely the public will be exposed.

6.3. Summary of Environmental Exposure

6.3.1. Environmental Release

RELEASE OF CHEMICAL DURING MANUFACTURE AND FORMULATION

During manufacture and formulation release of the notified polymer to the environment may occur from residues in transport containers, spills and leaks, cleaning of equipment. The release from these sources, assuming a worst case scenario are estimated to be as follows:

1. Spills during manufacture, occurring during transfer from holding tank to transport containers are estimated at: 5,000 kg* notified polymer/annum
2. Spills and leaks occurring during other operations are estimated at: 5,000 kg* notified polymer/annum

3. Cleaning of equipment: 400 kg notified polymer/annum

Total: 10,400 kg/annum

Note: * some of these quantities will be recycled back into the product.

. Spillages during the production process would be contained by plant bunding, collected and routinely sampled and tested for quality and transferred into a suitable container before being either recycled into appropriate product or soaked up with absorbent material and transported off-site for disposal by landfill. All washings from cleaning of equipment are collected, analysed for quality and disposed of to a liquid waste treatment facility by a licensed waste contractor. There is no release to sewer.

RELEASE OF CHEMICAL FROM USE

Release of the notified polymer to the environment during end-use is expected to be minimal, unless an accidental spillage occurs.

At the concrete batching plant, Sika Viscocrete products will be transferred from transport containers into the customer's on-site storage tanks. The product is then added to the initial batching water using an electronic dispenser unit. The rate of addition is such that the final concentration in the concrete is <1% notified polymer.

Release of the notified polymer to the environment are estimated to be as follows:

1. Residues in transport containers is estimated at: 10,000 kg* notified polymer/annum.
2. Spills and leaks is estimated at: 5,000 kg notified polymer/annum
3. Cleaning of equipment: 500 kg* notified polymer/annum

Total: 15,500 kg/annum

Note: * some of these quantities will be recycled back into the process.

The empty transport containers are rinsed with water and the water is recycled into subsequent concrete mixtures. Wash water from cleaning of equipment (mixer, cement trucks etc.) is added to on-site settling tanks and the clear water is recycled. Any spilt polymer is contained within bunding and is collected by using absorbent material, which is disposed of to landfill. There is no release of the notified polymer to sewer or receiving waters.

Once the treated concrete has set, the notified polymer will be trapped within the concrete and will not be available for release. Any unused wet cement will be allowed to dry before disposal to landfill. Similarly any old treated concrete from demolition operations will be disposed of to landfill.

In summary, it is expected that the notified polymer will not present a significant adverse risk to the environment.

6.3.2. Environmental Fate

No environmental studies were performed. Biodegradation study is not available. The notified

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

The notified polymer is expected to be highly water soluble and, as a result, would be mobile in both terrestrial and aquatic compartments. However, there would be no direct release of the notified polymer to receiving waters. The majority of the notified polymer will be bound within the matrix of the concrete and once hardened will remain immobile. Its fate will be linked to the disposal of the concrete fabrications into which it is incorporated. The concrete rubble from building demolitions is usually directed to landfill where the notified polymer is expected to remain immobile and not leach out.

If the spilt material cannot be recycled, it is likely to end up in landfill. Given the solubility, the notified polymer may be considered to be mobile in soils and will slowly degrade through abiotic and biotic processes to water vapour and oxides of carbon and nitrogen.

7. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20ºC and 101.3 kPa	Colourless to amber liquid with mild odour (for product containing the notified polymer)
Boiling Point	100°C (for product containing the notified polymer)
Density	Approx. 1.09 g/cm^3 (for product containing the notified polymer)
Water Solubility	Completely miscible with water
Dissociation Constant	Not determined. The notified polymer contains three acidic functional groups which will have pKa of 3.0-5.0, -1.0 – 1.0 and 0.3-4.0, respectively
Reactivity	Stable under normal conditions and polymerisation will not occur. Avoid contact with acids and strong oxidizing agents.
Degradation Products	Hazardous decomposition will not occur if used under prescribed conditions. In the event of fire the following can be released: carbon monoxide, carbon dioxide and nitrogen oxides

8. HUMAN HEALTH IMPLICATIONS

8.1. Toxicology

No toxicological studies were with the application. The notified polymer meets the Polymer of Low Concern Criteria and is not expected to be hazardous.

8.2. Human Health Hazard Assessment

The notified polymer meets the PLC criteria and can therefore be considered to be of low hazard. The final product contains the notified polymer at a low concentration of <1%, which is bound within the concrete. The polymer has a relatively high molecular weight and is unlikely to absorb across the skin or other biological membranes. Furthermore it contains no moderate or high concern reactive functional groups. Thus it is not expected to have any significant toxicity to humans. Also it does not contain any hazardous residual monomers, which are present above the lowest cut-off concentrations. The notified polymer is not classified as hazardous to human health.

9. ENVIRONMENTAL HAZARDS

9.1. Ecotoxicology

No ecotoxicological studies were submitted with the application. The notified polymer meets the Polymer of Low Concern Criteria.

9.2. Environmental Hazard Assessment

The notified polymer meets the Polymer of Low Concern criteria and can therefore be considered to be of low hazard.

According to Nabholz et al. (1993) polyanionic polymers that are polycarboxylic acids with molecular weights >1000 and water-soluble are known to be toxic only to green algae. The 96-hour EC50 values ranging from 1 to 100 mg/L (moderate toxicity) are quoted and the mode of toxic action on algae is overchelation of nutrient elements thus resulting in growth inhibition. Highest toxicity occurs when there is a carboxylic acid on every other (or alternating) carbon(s) in the polymer backbone for which there is a high potential for the notified polymer. However, when calcium (as calcium carbonate in water) is added to the polymer (satisfying the anionic charges) the toxicity to algae has shown to be considerably mitigated.

10. RISK ASSESSMENT

10.1. Environment

The notified polymer is a superplasticiser used in concrete. The polymer will be manufactured in Australia in a range of products consisting of polymer (<50%) in aqueous solution. The manufacturing process takes place in an automated enclosed system and hence, environmental release of liquid containing the notified polymer is expected to be minimal during the manufacturing process. The manufacturing plant is fully bunded and equipped to contain spills and prevent release to the sewer system.

It is estimated that 18000 kg per annum of waste polymer will be generated from accidental spills and approximately 10,200 kg per annum from residues in empty containers. Spills will be collected by absorbent inert material and placed in containers and taken to landfill by licensed waste contractors. In landfill, the notified polymer may be considered to be mobile in soils and will slowly degrade though abiotic and biotic processes to water vapour and oxides of carbon and nitrogen. Residues will be washed out and recycled into the manufacturing process at Sika Australia and the same will occur at the customer sites.

Since there is no direct release to natural receiving waters the risk to the environment from the notified polymer will be negligible. Release to the environment may occur during transport of product to the end-customers.

10.2. Occupational Health and Safety

Transport and Storage Workers

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

Manufacturing and blending Workers

Engineering controls such as automated dosing, mixing and dispensing systems will be used in addition to local fume extraction and good general ventilation to minimise worker exposure. Workers will also wear suitable protective clothing, gloves, boots, and safety glasses. Thus, the exposure of workers to the notified polymer will be limited.

Worker exposure may occur when transferring the end product to drums and IBCs, during attachment of hoses, pipes etc and during transferal of products to customer storage containers. Likely routes of exposure are dermal and ocular. Exposure may also occur during the washing out of residual material in the containers. Exposure may occur during the maintenance and cleaning of the manufacturing and cleaning equipment.

When installing the drum and IBCs and during maintenance work workers will wear eye protection, impermeable gloves and overalls, as required. The manufacturing process will occur in well-ventilated areas, where local ventilation will be used.

End Uses

Exposure to workers in ready mix and precast concrete plants will be minimal as the dosing, mixing and dispensing process is automated and enclosed. The mixed concrete is then either transported to building sites where it is poured into formwork or it is used to manufacture precast concrete structures. During these process workers may come into contact with the concrete containing the notified polymer. This is similar to exposure of shotcretors. The most likely route of exposure will be dermal. However, as has hazards of concrete (skin irritation and corrosivity due to high alkalinity) are well known, adequate precautions will be taken to ensure dermal exposure is minimised. Thus, the exposure to the notified polymer will also be minimal.

The notified polymer in the end stage use is at a low concentration of <1% and once the concrete has set, the notified polymer will be trapped within the concrete matrix and will not be available for human exposure.

Hazard Overview

The notified polymer has a relatively high molecular weight (NAMW > 10,000) and thus it is unlikely to cross biological membranes and cause systemic toxicity. Furthermore, it does not have any functional groups of moderate or high concern. Therefore, the toxicity profile of this polymer is expected to be relatively benign.

Overall, although worker exposure to the notified polymer could occur as described above, the risk to workers is expected to be low due to the predicted low toxicity of the notified polymer.

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 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 Low 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 a super plasticiser agent.

12. MATERIAL SAFETY DATA SHEET

12.1. 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.

13. 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.

Disposal

- The concrete containing the notified polymer should be disposed of to licensed landfill sites.

Emergency procedures

If spills are not possible to recycle then the spill should be handled by covering with some inert absorbent and sweeping material up into containers for disposal to landfill.

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.

14. BIBLIOGRAPHY

Nabholz JV, Miller P & Zeeman M (1993) Environmental Risk Assessment of New Chemicals Under the Toxic Substances Control Act (TSCA) Section Five. In: Landis WG, Hughes JS & Lewis MA ed. Environmental Toxicology and Risk Assessment, ASTM STP 1179. Philadelphia, American Society for Testing and Materials.