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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Polymer in Derivative J, Sodium Salt

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Facsimile:	(61) (02) 9577 9465

Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Polymer in Derivative J, Sodium Salt

1. APPLICANT

Grace Australia Pty Ltd of 1126 Sydney Road FAWKNER VIC 3060 has submitted a Polymer of Low Concern notification statement in support of their application for an assessment certificate for Polymer in Derivative J, Sodium Salt.

2. IDENTITY OF THE CHEMICAL

The molecular and structural formulae, spectral data and details of the polymer composition have been exempted from publication in the Full Public Report.

Chemical Name:	2-propenoic acid, homopolymer, reaction products with polyethylene-polypropylene glycol 2-aminopropyl Me ether, sodium salt
Chemical Abstracts Service (CAS) Registry No.:	184785-41-9
Marketing Name:	Derivative J ADVA™ 100 ADVA™ 120

Characterisation as a Synthetic Polymer of Low Concern

Number-Average Molecular Weight (NAMW):	8 365.8 ± 837
Weight-Average Molecular Weight:	26 430
Polydispersity:	3.15
Maximum Percentage of Low Molecular Weight Species	
Molecular Weight < 500:	0.29% ± 0.13
Molecular Weight < 1 000:	1.34% ± 0.48
Polymer Stability	stable under all known conditions
Reactivity	polymer is not designed to be reactive under normal conditions of use, other than the natural acidity of the carboxylic acid groups

Charge Density	polymer contains pH-sensitive pendant carboxylic acid groups which can be protonated to form the undissociated free acid if pH falls below 5

The polymer meets the criteria for assessment as a synthetic polymer of low concern under Regulation 4A of the *Industrial Chemicals (Notification and Assessment) Act 1989*.

3. PHYSICAL AND CHEMICAL PROPERTIES

The data presented is for the acid version of the notified polymer unless otherwise stated.

Appearance at 20°C and 101.3 kPa:	light amber liquid
Boiling Point:	>100°C
Specific Gravity:	1.1
Vapour Pressure:	< 1.33 x 10^{-3} kPa at 25°C
Water Solubility:	polymer is soluble in water in all proportions from 1 to 90%
Hydrolysis as a function of Ph:	not specified
Flash Point:	243 °C
Flammability Limits:	Not applicable
Autoignition Temperature:	Not applicable
Explosive Properties:	Not applicable

Comments on Physico-Chemical Properties

GPC and physico-chemical results from the acid version of the notified polymer have been presented as a surrogate for the neutralised polymer.

Based on its high molecular weight, the notified polymer would be expected to have low volatility. However, the vapour pressure provided is a limit value and therefore, the actual volatility remains uncertain.

The notified polymer contains amide/imide, ether and carboxylic acid functional groups. The carboxylic functional groups may react with bases to give the polymer salt. The notified polymer is predicted to be soluble in water (1-90%) due to the presence of pendant *polycarboxylates* along the polyacrylate backbone. However, under Regulation 4A, high water solubility and the presence of reactive functional groups would exclude the notified polymer from the PLC classification. Under the proposed revised PLC criteria (Chemical

Gazette No. C 12, 1 December, 1998) the reactive carboxylic acid functional groups are considered to be of low concern and water solubility as a criterion has been deleted.

4. PURITY OF THE CHEMICAL

Degree of Purity:	> 99%
Maximum Content of Residual Monomers:	the notified polymer is formed by reacting two polymers, each with residual monomer level of <1.0%; full characterisation of reacting constituents are unavailable; it is assumed that the residual monomer content is < 1% since propylene oxide and acrylic acid have thresholds of 1% and ethylene oxide has 0.1%

5. USE, VOLUME AND FORMULATION

The notified polymer will be used as a concrete additive. It will be imported as a component of products, ADVA™ 100 and ADVA™ 120 (ADVA Products), at between 35% w/w (typical) and 75% w/w (maximum) together with defoamers and preservatives. ADVA Products are diluted to approximately 0.5% in batch concrete, the notified polymer is present at a maximum of 0.2%.

There is also a possibility that neat Polymer will be imported and subsequently reformulated to produce ADVA Products or slight variations of ADVA products for end use. Reformulation will be done by the notifier.

The notified polymer enables the reduction of water content in concrete mix production and at the same time producing concrete mix with improved workability. Annual import volume over the first five years is < 100 tonnes.

Approximately 90% of the total imported ADVA Products will be transported, stored, then delivered in bulk from the notifier's site and the remaining volume will be transported directly in 205 L drums will be transported, stored at notifier's site and transported directly to commercial customers. The notified polymer will not be available to domestic customers.

6. OCCUPATIONAL EXPOSURE

At the notifier's site

The notified polymer will be imported as a component of a ready-mix finished product or (in the future) as neat concrete additive, in 205 L drums. However, depending on customer demands, it is possible that the concrete additive will be shipped into Australia in iso-tanks, totes or bulk via tanker trucks, in the future.

Finished ADVA Products will be sold to customers as a ready mix additive for incorporating into a concrete mix. When imported neat, defoamers and other ingredients will be added to the notified polymer at the notifier's site before delivery to customers.

Workers who will handle ADVA Products and the neat notified polymer are as follows:

Location	*Worker Category*	*Job Description*	*Approximate Number of Workers*
Grace Australia	Plant Operator	Chemical Plant Operator	10
	Fork Lift Drivers	Fork Lift Driver	8
	Truck Drivers	Truck Deliveries	10
	Quality Control	QC Testing	5
	Supervisor	Supervisory	5
	Dispensor	Dispensor	5
	Technician	Installation and Service	
Concrete Producer	Quality Control	Quality Control of Concrete Mixes	25
	Labourer	General Labour at Concrete Plant	100
	Truck Driver	Truck Delivery of Concrete	400
Concrete Contractor	Placing and Finishing Crew	Concrete Placing and Finishing	1 000
Concrete Testing Laboratory	Jobsite Technician	Forming of Concrete Test Specimens	100

Transport workers
Following importation, finished product containing the notified polymer will be transported to the notifier's site or delivered to customers. If imported in bulk in the future, workers will hook-up the sealed delivery systems, which pump the product into the tanker trucks and dispense it into storage tanks at the customer facilities. In the future they may need to transport neat polymer. The maximum exposure for these workers is estimated as 4 hours/day.

Fork lift drivers
These workers are involved in the on and off loading of palletised ADVA Products or (in future) neat polymer from transport trucks. The maximum exposure for these workers is estimated as 2 hours/day.

Quality control technicians
Quality control technicians are involved in the sampling and testing of ADVA Products. The maximum exposure for these workers is estimated as 1 hour/day.

Plant operators
Plant operators are not expected to be exposed to the notified polymer. In the event that the ADVA Products will be formulated in Australia, plant operators will supervise the pumping of the notified polymer and the addition of other components from the storage tanks into the

mix tanks, and operation of the mix tank. The maximum duration exposure for these workers is estimated to be 2 hours/day.

Salesmen
During a small-batch run test, the salesmen will dispense the ADVA Products by hand into laboratory mixers. The maximum duration exposure for these workers is estimated to be 4 hours/day.

Dispenser technicians
Dispenser technicians install the storage and dispensing systems at the customer's concrete plant. The dispensing systems will automatically dispense ADVA Products from the storage tanks directly into a concrete mixing truck, where it is subsequently mixed with other concrete ingredients to a concentration of 0.2% notified polymer. Exposure to the notified polymer is expected to be primarily through trials of newly installed systems. The maximum duration exposure for these workers is estimated to be 4 hours/day.

At the concrete producer's site

Concrete producer and labourers
Concrete producers are involved in the development of concrete mix designs. Labourers provide general labour at the concrete plant. These workers may be exposed to fresh concrete containing the notified polymer at 0.2% when carrying out their tasks. The maximum exposure for these workers is estimated as 4 hours/day.

Truck drivers
Truck drivers may be exposed to the fresh concrete and fumes when washing out the inside of concrete truck mixing drum. The maximum exposure for these workers is estimated as 4 hours/day.

At the concrete contractor's site

Placing and finishing crew
These workers will shovel and rake fresh concrete containing 0.2% notified polymer, consolidate with vibrators and trowel finish the concrete surface. The maximum exposure for these workers is estimated as 8 hours/day.

Jobsite technicians
These workers are involved in sampling and testing of fresh and hardened concrete. The maximum exposure for these workers is estimated as 6 hours/day.

The notified polymer is not expected to be separately available for exposure or absorption, in hardened concrete. Workers involved in handling the notified polymer as a component of ADVA Products or as an ingredient in concrete will be equipped with personal protective equipment such as safety glasses, impervious gloves, rubber boots and overalls. Respiratory protection is not normally required; however, if specific use generates vapours or mist, purifying respirators designed to filter mist and organic vapours is recommended. Concrete mixing trucks are also equipped with compressed air flushing of hoses, which would eliminate spills and worker exposure to any material left in hoses.

7. PUBLIC EXPOSURE

Public exposure may occur in the event of an accidental spill. Spillage will be contained and absorbed using inert material such as sand, earth or vermiculite, and collected into containers. Containers are sealed and disposed of according to local regulations.

8. ENVIRONMENTAL EXPOSURE

Release

The notifier states that release of the notified polymer will be limited to fugitive emissions (volatilisation and spillage). Based on its high molecular weight, the notified polymer would be expected to have low volatility. However, some low molecular weight species in the notified polymer may be volatile.

Spillage of the notified chemical is expected to occur during transfer of drum contents into bulk delivery tanks. The notifier estimates total release across all sites to be approximately 100 L/annum. The concentration of notified polymer in ADVA™Flow is typically 35% but may be as high as 75% (w/w). This represents an annual release of approximately 35 to 75 L/annum of the notified polymer. The notifier has stated that this spillage is directed to water recycling tanks then reused in subsequent admixtures.

Residual in transport drums is estimated to be 1% (410 L/annum). This represents approximately 144 to 383 L of notified polymer released per annum.

There is also potential for release of notified polymer via waste water from external and internal washing of ready-mix concrete mixing trucks. Waste water is stored temporarily in concrete setting bays then reused in subsequent admixtures. The notifier has stated that setting bays are designed to minimise risk of overflow during significant rainfall events. Where occasional overflow does occur, contaminated waste water will be discharged to the sewer in a diluted form. The notifier estimates the maximum concentration of the notified polymer in the setting basin is approximately 50 ppm. Assuming the setting bay has a volume of 30,000 L, and a concentration of 50 ppm at 50% capacity, then at the point of overflow the concentration of the notified polymer is expected to be around 25 ppm.

The notifier has stated that the balance of the notified polymer will be bound within the concrete matrix where minimal migration of the notified polymer is expected.

The potential total release of notified polymer (in its liquid form) across all sites is estimated at 179 to 383 L per annum. However, this volume is likely to be reduced further where spillage and contaminated wash out water is contained and reused in subsequent admixtures.

Fate

The majority of the notified polymer will be bound within the matrix of the concrete. Minimal migration of the notified polymer is expected from hardened concrete.

It is anticipated that the notified polymer will enter both the aquatic compartment (in wash-out water from drums and trucks) and landfill (in rubble concrete, residual in non-recycled drums, and absorbants used to recover spills).

No information was provided regarding the degradability of the notified polymer. It is possible that it will partition between solution and sorbed phase (bound to aquatic sediments and organic particles in suspension) through the presence of reactive carboxyl functional groups. Under these circumstances it is anticipated that the notified polymer will degrade very slowly via biotic and abiotic processes. Polymers of high molecular weight are considered to be impermeable to biological membranes (Connell, 1990) and consequently bioaccumulation of the notified polymer is not expected.

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicology data were submitted. This is acceptable for Polymers of Low Concern under the Act.

The Material Safety Data Sheets (MSDS) for the notified polymer and ADVA products cite toxicity information for the notified polymer. Based on analogue data (ADVA 120) the notified polymer may have acute oral toxicity of LD_{50} >500 in rats. Potential health effects from exposure to the notified polymer were also described in the MSDS. These include:

- May cause irritation of eye and prolonged contact with skin may cause redness and irritation to those persons with sensitive skin.

- Vapour is not expected to cause any adverse health effects during typical handling. Exposure to high air concentrations of vapour or aerosols and mists, generated by heating, spraying and use in poorly ventilated areas, may cause irritation of the nose and throat. May result in headaches, nausea and drowsiness.

- Ingestion of large amounts of the notified polymer may irritate the digestive system resulting in stomach pain, nausea and vomiting. May cause central nervous system damage. Visual disturbances, pulmonary edema, sterility, liver and kidney damage, coma or death may also result from overexposure by ingestion.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided. This is acceptable for polymers of low concern under the Act. Nabholz *et al.* (1993) indicate that anionic polymers can be a concern for algal growth inhibition. Toxicity to green algae as defined by the 96 h EC_{50} for growth inhibition is moderate, with toxicity values ranging from 1 to 100 mg/L. Furthermore, they note that the highest toxicity is related to those with carboxylic acid groups on every other carbon in the polymer backbone. Whilst this appear to be likely in this case, exposure to the

aquatic compartment will be low.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The majority of the notified polymer will be incorporated into the matrix of the concrete. Once solidified, the notified polymer is expected to pose minimum risk to the environment.

There is potential for 179 to 383 L/yr of the notified polymer to be released into the environment from spillage and drum residues. As spillage is expected to be distributed across several sites and not restricted to a single sites, the degree of risk to the environment at any given time would be minimised.

The main environmental hazard would arise from release of the notified polymer during storage or transport. The use of bunded containment minimises the risk of release at storage sites. The MSDS contains adequate information on spills and disposal.

A further environmental hazard could arise from release of untreated polymer-contaminated water into the aquatic compartment. This risk is greatly reduced by the process of discharging truck wash water into concrete setting basins and recycling it in subsequent batches of cement.

The low expected environmental exposure of the notified polymer when integrated into concrete suggest the overall environmental hazard should be minimal.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Assessment of Toxicological Hazard
The acute toxicity information contained in the MSDS indicates that the notified polymer has a low acute oral toxicity (LD_{50} >500) in rats. Considering the summary data only described in the MSDS, the oral toxicity of the notified polymer cannot be assessed against the NOHSC *Approved Criteria for Classifying Hazardous Substances* (National Occupational Health and Safety Commission, 1999). The notified polymer is not highly reactive and has a high molecular weight, therefore it will not readily cross biological membranes.

The notifier states that no injuries or diseases related to the use of the notified polymer have been reported from overseas experience. However, there have been a few recorded accounts of worker complaints of minor transient health effects such as nose and throat irritation, headache and nausea following exposure to ADVA Products. Irritant effects were described in the MSDS. Imported ADVA Products contain the notified polymer at 35 – 75%.

Occupational Health and Safety
At the notifier's site, transport workers and fork lift drivers are not expected to be exposed to the notified polymer since they will be handling sealed drums of ADVA Products. Quality control technicians, plant operators, salesmen and dispenser technicians may experience dermal exposure to the notified polymer when carrying out their tasks. To minimise exposure to the notified polymer and topical (irritant) effects, workers are to wear overalls, safety glasses or goggles, rubber boots and PVC or rubber gloves. Faceshield as appropriate

may also be worn. Respiratory protection is not normally required; however, if specific use generates vapours or mist, purifying respirators designed to filter mist and organic vapours are recommended.

Since concrete mixing and dispensing is carried out using automated and enclosed processes, worker exposure is expected to be low. In addition, concrete mixing trucks have the capability for compressed air flushing of hoses, which would minimise spills and worker exposure to any material left in hoses.

At the concrete producer's site, labourers and truck drivers may be exposed to fresh concrete containing the notified polymer. The maximum concentration of the notified polymer in concrete is 0.2%. Truck drivers may also be exposed to the fresh concrete and fumes when washing out the inside of the concrete truck mixing drum. Given the low concentration of notified polymer, this is not of occupational health and safety concern.

At the contractor's site, workers may experience dermal exposure to the notified polymer during shoveling and raking, and sampling of fresh concrete, or when placing fresh concrete into moulds for subsequent testing of the quality of the hardened concrete. Once the concrete is hardened, the notified polymer will be bound within the concrete matrix, therefore exposure or health effects are not expected.

The presence of low concentrations of notified polymer in the concrete mix is expected to be a negligible contributor of health risk when handling fresh concrete. Due to the high pH of the fresh concrete, concrete producers, contractors and labourers are to wear rubber boots and impervious gloves when handling concrete.

Public Health
The notified polymer will be supplied to industrial customers and not the general public. Public contact will only occur from touching hardened concrete or from accidental dermal, ocular and inhalation exposure from a spill. Consequently, the potential for public exposure to the notified polymer during all phases of its life cycle is considered to be very low.

13. RECOMMENDATIONS

To minimise occupational exposure to the notified polymer the following guidelines and precautions should be observed:

- Safety goggles should be selected and fitted in accordance with Australian Standard (AS) 1336 (Standards Australia, 1994) to comply with Australian/New Zealand Standard (AS/NZS) 1337 (Standards Australia/Standards New Zealand, 1992), industrial clothing should conform to the specifications detailed in AS 2919 (Standards Australia, 1987) and AS 3765.2 (Standards Australia, 1990), impermeable gloves or mittens should conform to AS 2161.2 (Standards Australia, 1998), and all occupational footwear should conform to AS/NZS 2210 (Standards Australia/Standards New Zealand, 1994);

- Spillage of the notified chemical should be avoided. Spillages should be cleaned up promptly with absorbents which should then be put into containers for disposal;

- Good personal hygiene should be practised to minimise the potential for ingestion;
- A copy of the MSDS should be easily accessible to employees.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the notified polymer and products containing the notified polymer were provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (National Occupational Health and Safety Commission, 1994).

The MSDS were provided by the applicant as part of the notification statement. These are 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 subsection 64(1) of the Act, secondary notification will be required if the polymer characteristics cease to satisfy the criteria under which it has been accepted as a Synthetic Polymer of Low Concern. Secondary notification of the notified polymer shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

Connell DW (1990) General Characteristics of Organic Compounds which Exhibit Bioaccumulation. In: Bioaccumulation of Xenobiotic Compounds. CRC Press, Boca Raton, USA.

Mensink B, Montforts M, Wijkhuizen-Maslankiewics L, et al. (1995) Manual for Summarising and Evaluating the Environmental Aspects of Pesticides, Report No. 679101022, National Institute of Public Health and Environment, Netherlands.

Nabholz, JV., Miller P and Zeeman, M. (1993) Environmental Risk Assessment of New Chemicals Under the Toxic Substances Control Act (TSCA) Section Five. In: Environmental Toxicology and Risk Assessment, pp. 40-55. ASTM, Philidelphia, USA.

National Occupational Health and Safety Commission (1994) National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]. Australian Government Publishing Service. Canberra.

National Occupational Health and Safety Commission (1999) Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1999)]. Australian Government Publishing Service, Canberra.

Standards Australia (1987) Australian Standard 2919-1987, Industrial Clothing. Standards Association of Australia, Sydney.

Standards Australia (1990) Australian Standard 3765.2-1990, Clothing for Protection Against Hazardous Chemicals Part 2 Limited Protection Against Specific Chemicals. Standards Association of Australia, Sydney.

Standards Australia (1994) Australian Standard 1336-1994, Eye protection in the Industrial Environment. Standards Association of Australia, Sydney.

Standards Australia (1998) Australian Standard 2161.2:1998, Occupational Protective Gloves, Part 2: General Requirements. Standards Association of Australia, Sydney.

Standards Australia/Standards New Zealand (1992) Australian/New Zealand Standard 1337-1992, Eye Protectors for Industrial Applications. Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.

Standards Australia/Standards New Zealand (1994) Australian/New Zealand Standard 2210-1994, Occupational Protective Footwear. Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.

Attachment 1

The Draize Scale for evaluation of skin reactions is as follows:

Erythema Formation	*Rating*	*Oedema Formation*	*Rating*
No erythema	0	No oedema	0
Very slight erythema (barely perceptible)	1	Very slight oedema (barely perceptible)	1
Well-defined erythema	2	Slight oedema (edges of area well-defined by definite raising	2
Moderate to severe erythema	3	Moderate oedema (raised approx. 1 mm)	3
Severe erythema (beet redness)	4	Severe oedema (raised more than 1 mm and extending beyond area of exposure)	4

The Draize scale for evaluation of eye reactions is as follows:

CORNEA

Opacity	*Rating*	*Area of Cornea involved*	*Rating*
No opacity	0 none	25% or less (not zero)	1
Diffuse area, details of iris clearly visible	1 slight	25% to 50%	2
Easily visible translucent areas, details of iris slightly obscure	2 mild	50% to 75%	3
Opalescent areas, no details of iris visible, size of pupil barely discernible	3 moderate	Greater than 75%	4
Opaque, iris invisible	4 severe		

CONJUNCTIVAE

Redness	*Rating*	*Chemosis*	*Rating*	*Discharge*	*Rating*
Vessels normal	0 none	No swelling	0 none	No discharge	0 none
Vessels definitely injected above normal	1 slight	Any swelling above normal	1 slight	Any amount different from normal	1 slight
More diffuse, deeper crimson red with individual vessels not easily discernible	2 mod.	Obvious swelling with partial eversion of lids	2 mild	Discharge with moistening of lids and adjacent hairs	2 mod.
		Swelling with lids half-closed	3 mod.	Discharge with moistening of lids and hairs and considerable area around eye	3 severe
Diffuse beefy red	3 severe	Swelling with lids half-closed to completely closed	4 severe		

IRIS

Values	*Rating*
Normal	0 none
Folds above normal, congestion, swelling, circumcorneal injection, iris reacts to light	1 slight
No reaction to light, haemorrhage, gross destruction	2 severe