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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Araldite Resin 18

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Araldite Resin 18

1. APPLICANT

Ciba Specialty Chemicals of 235 Settlement Road THOMASTOWN Victoria 3074 has submitted a limited notification statement in support of their application for an assessment certificate for Araldite Resin 18.

2. IDENTITY OF THE CHEMICAL

The chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data, details of the polymer composition and details of exact import volume and customers have been exempted from publication in the Full Public Report and the Summary Report.

The number-average molecular weight is greater than 1000 g/mol.

The notified polymer is manufactured and immediately blended to give a liquid polymer mixture (designated as 'raw polymer resin' in this report). The raw polymer resin contains 90 % notified polymer and is used in the formulation of Araldite Resin 18.

3. PHYSICAL AND CHEMICAL PROPERTIES

The following physicochemical data are for the raw polymer resin containing the notified chemical at a concentration of 90%.

Appearance at 20°C and 101.3 kPa:	Amber viscous liquid, with a mild odour.
Boiling Point:	> 200°C
Specific Gravity:	1.04 - 1.07 g/cm^3 at 25 °C
Vapour Pressure:	< 0.01 Pa @ 20°C.
Water Solubility:	Insoluble in water at 25°C (see comments below).
Partition Co-efficient (n-octanol/water):	Not determined (see below).
Hydrolysis as a Function	The notified polymer contains ester groups which may

of pH:	undergo hydrolysis under extreme conditions.
Adsorption/Desorption:	Not determined (see below).
Dissociation Constant:	Not determined (see below).
Flash Point:	142 °C (Closed cup method).
Flammability Limits:	Not measured, but is expected to be nonflammable. The product is a combustible liquid
Autoignition Temperature:	Not expected to undergo auto-ignition.
Explosive Properties:	stable and not explosive.
Reactivity/Stability:	Not reactive.

Comments on Physico-Chemical Properties

No physico-chemical tests were performed by the notifier for the polymer. The values that are given have been derived from the Material Safety Data Sheet (MSDS) for the raw polymer resin and no test methods or reports have been supplied.

The water solubility of the notified polymer was not determined by any test method but the notifier claims that it will be insoluble due to the hydrophobic nature of its component monomers. The polymer contains ester and epoxide groups which may undergo hydrolysis under extreme conditions, however this would be unlikely to occur under ambient environmental conditions. The partition coefficient and adsorption/desorption values could not be determined due to the insoluble nature of the notified polymer. However, the high molecular weight and extremely low water solubility indicate that the value for K_{ow} would be high. Therefore, it could be expected that the notified polymer will strongly adsorb to organic matter in soils and sediment. The notified polymer contains no groups, hydrogens or basic functionalities likely to dissociate under environmental conditions.

In the event of heating the polymer in Araldite Resin 18 to the point of combustion, thermal decomposition will yield carbon monoxide, carbon dioxide and water. Thermal decomposition occurs at temperatures > 200 °C.

4. PURITY OF THE CHEMICAL

Degree of Purity:	High	
Hazardous Impurities:	None.	
Maximum Content of Residual Monomers:	Fatty acids	16.3 %
	All other monomers	<0.1 %

In use, the residual monomers and impurities are

	expected to be trapped within the cured polyamine based hardener matrix which encapsulates the electronic componentry of controlling units.
Non-hazardous Impurities (> 1% by weight):	None.
Additives/Adjuvants:	Polypropylene glycol glycidyl ether (CAS No.: 26142-30-3) (0-10 %)

5. USE, VOLUME AND FORMULATION

Use/Formulation
The notified polymer will be used as a component of an epoxy resin formulation Araldite Resin 18 which is used to encapsulate the electronic componentry of controlling units. The notified polymer is present at 90 % in the raw polymer resin which is then incorporated into Araldite Resin 18 at a concentration of 30-50 %. This resin is mixed with a hardener and dispensed into the blower controller units. The resin is then cured at 80ºC.

The notified polymer and raw polymer resin are to be manufactured at the Ciba plant in a sealed vessel (2500 L). The raw polymer resin will be stored in 200 L drums until blended with mineral fillers to make a flowable paste, Araldite Resin 18. This paste will contain 39 % raw polymer resin and will be transported to the customer in 20 L pails.

Volume
The estimated quantity of the notified polymer to be manufactured will be *ca.* 20 tonnes per annum for the first 5 years. Alternatively, the notified polymer may be imported directly within the raw polymer resin or within Araldite Resin 18.

6. OCCUPATIONAL EXPOSURE

Transport and Storage
Only in the event of spillage, up to 6 dockside and transportation workers could be exposed to Araldite Resin 18 which contains up to 36 % of the notified raw polymer.

Manufacture of Raw Polymer Resin (at Ciba)
The notified polymer may or may not be manufactured in Australia. If it is not imported, it will undergo an initial manufacturing step at the Ciba site using the following process.

The notified polymer will be synthesised by reacting an acid-terminated polyester with several other ingredients in a sealed vessel (2500 L). On reaction completion, the notified polymer is blended immediately with a glycidyl ether and an epoxy resin to produce the raw polymer resin, which is a black flowable liquid containing 90 % notified polymer. Under normal circumstances, the notified polymer is not isolated. The raw polymer resin will then be decanted into 200 L drums. During the synthesis and blending processes, dermal exposure to the notified polymer may occur during the manual filling of 200 L drums from the reactor, particularly in the event of spillage or overfilling of drums. Inhalational exposure is unlikely due to the viscous nature of the resin. No exposure to the notified polymer is expected prior

to filling as the process is enclosed. The frequency of exposure is 1-2 days per batch, up to 10 batches per year, with 6-10 workers involved in the process. No detailed information on personal protective equipment was provided in the submission, however, from the MSDS provided, protection would include overalls, safety glasses and gloves (nitrile or neoprene).

Incidental dermal exposure to the notified polymer may also occur during QA testing and clean-up procedures, when reaction vessels are cleaned using heated solvent or water-detergent spray.

Manufacture of Araldite Resin 18 *(at Ciba)*
The raw polymer resin is blended with mineral fillers in a closed 500 L mixing vessel to make a flowable paste, Araldite Resin 18**,** which is pressure pumped from the mixer into 20 L pails. Addition of raw polymer resin to the mixer from 200 L drums is likely to occur by gravity via a hopper and incidental dermal exposure to the notified polymer may occur during this process. However, inhalational exposure to the viscous liquid is unlikely. Exposure to the notified polymer during filling of the 20 L pails of the paste containing 36% notified polymer is unlikely as the process is enclosed. Manufacture of the paste is carried out by the same operators who manufacture the raw polymer resin, and the frequency of exposure per batch and level of personal protection are the same as stated above.

As for the manufacture of the raw polymer resin, incidental skin contact with the notified polymer in a more diluted form may also occur during QA testing and clean-up procedures.

Application of Araldite Resin 18 *(at Customer)*
Araldite Resin 18 is used to encapsulate electronic controller units. The process is closed with automated mixing and dispensing, with the exception of filling the resin hopper manually. The resin, in 20 L pails, is pre-warmed to 60 °C and poured into the mix/metering equipment. The control units are automatically conveyed to a curing oven. The oven is vented externally via a scrubber system. After the curing process, the polymer is incorporated into the matrix, hence there should be no exposure.

As the concentration of the notified chemical is up to 36 %, dermal exposure to the paste may occur during the manual hopper filling process. Up to 15 production and machine setting operators would be involved in this manufacturing process, which occurs throughout the year.

Workers may also be exposed to the notified polymer during equipment maintenance, which involves removing the mixing head and transferring it to an acetone bath (*ca.* each 8 weeks). Annual or special maintenance is carried out by designated personnel. Exposure to both epoxy resins, including Araldite Resin 18 and the acetone bath are addressed by air extraction and the wearing of PPE, namely overalls, safety glasses and impervious gloves.

7. PUBLIC EXPOSURE

There is little potential for exposure of the public to the notified chemical in the encapsulation of electronic controller units. The public would only be exposed to the notified polymer in the event of an accident during transportation between dockside, manufacturing site and the end customer site. Once encapsulated (cured) in the controller units, there is little likelihood of exposure of the public. At least 90 % of the controller units will be exported.

8. ENVIRONMENTAL EXPOSURE

Release

Release into the environment may occur at a number of stages along the production and distribution line. In the notifier's plant, spillages will be contained by bunding, absorbed onto inert material and disposed of by incineration. Water used in clean-ups would be treated and disposed of by licensed contractors. The notifier has given no estimate of the expected volume of polymer that may be spilt during manufacture but it is estimated at 1 % (200 kg/annum). Spillage would be subjected to treatment on-site and the notifier estimates 80 % (160 kg) of the organics will be removed as sludge and incinerated with the remaining 20 % (40 kg) being released to the sewer.

Approximately 1% of the import volume of the polymer (*ie* 200 kg/annum) will be left as residues in the blending tank in the production of the notified polymer and a further 110 kg/annum will be left as residues in the blending of Araldite Resin 18**.** These will be removed by solvent boil out and treated on-site (248 kg polymer removed as sludge and incinerated and the remaining 62 kg released to sewer).

The notifier has not estimated the amount of the raw polymer resin that will be left as residues in the 200 L storage drums but it is estimated at 1%, *i.e.* 200 kg/annum and is likely to be disposed to landfill.

At the customers site, the notifier estimates that 1-2 kg/day of the polymer may be lost in spills and will likely be disposed of to landfill or incinerated after curing.

Approximately 1% of the Araldite Resin 18 will remain as residue in the 20 L pails after emptying and will be incinerated by licensed contractors.

The notifier estimates that approximately 18-24 kg/week (936-1248 kg/annum) of Araldite Resin 18 will be used to flush the machine lines by the customer. This will equate to 333-444 kg/annum of the notified polymer, and will be incinerated by licensed contractors.

The mixing head at the customer's site is also cleaned by resin flushing and requires 1-10 kg two or three times/year or 2-30 kg/annum of the resin (0.7-10.7 kg polymer). This will also be incinerated by contractors.

Fate

The notified polymer is intended for use in electronic controller units. As such, the fate of the majority of the chemical will share the fate of these units, which will usually be sent to landfill.

Incineration of the articles and the wastes produced during the manufacturing process will destroy the polymer and create decomposition products of water and oxides of carbon and hydrogen.

The amount of polymer waste produced at the notifiers' site that will be incinerated would be *ca.* 408 kg/annum. The Ciba plant would also release *ca.* 102 kg/annum of the notified

polymer to the sewer/annum and 200 kg/annum to landfill. The customer's plant would produce *ca.* 1255 kg/annum of waste for incineration.

The waste polymer released to the sewer and landfill would be expected to be strongly bound to the soil and sediments and not become associated with the water compartment in the environment.

While the polymer could theoretically bioaccumulate, the hazard is anticipated to be minimal due to the expected very low exposure to the aquatic compartment and the very low water solubility [Connell (1989)].

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological data was submitted for the notified chemical. The NAMW of >1000 indicates that the notified polymer is unlikely to cross biological membranes readily, however 16.3 % of the polymer has a molecular weight less than 1000. Considering the polyester nature of the raw polymer, the toxicity is likely to be low. The MSDS for the raw polymer resin indicated that it may irritate the skin and eyes and may cause sensitisation by skin contact. An oral rat of LD_{50} of >5000 mg/kg was also provided on the MSDS.

Two of the components of the raw polymer resin are hazardous substances, *viz.* Bisphenol A-epichlorohydrin reaction product [CAS no.: 25068-38-6] and 1,4-butanediol diglycidyl ether [CAS no.: 2425-79-8]. They are assigned the following risk phrases;

Bisphenol A-epichlorohydrin reaction product; R 36/38, R43; irritating to skin and eyes; may cause sensitasation by skin contact

1,4-butanediol diglycidyl ether; R20/21, R36/38, R43; harmful by inhalation, in contact with skin and if swallowed; irritating to skin and eyes; may cause sensitisation by skin contact

Based on its molecular weight and polyester nature, the notified polymer is unlikely to be a hazardous substance in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (Approved Criteria) (NOHSC, 1999).

The raw polymer resin, through the hazards of two of its components, is a hazardous substance in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999) and the risk phrases R20/21 'harmful by inhalation', R36/38 'harmful in contact with skin and if swallowed' and R43 'irritating to skin and eyes; may cause sensitisation by skin contact' are assigned.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The notified polymer will be manufactured into a resin that will be used to encapsulate the

electronics of controller units at one site. Once cured and incorporated into the units, the notified polymer is very unlikely to present an environmental hazard.

The resin containing the polymer is transported by road. The final resin, Araldite Resin 18 is a thick paste containing 36 % polymer and is packed into 20 L pails. As such, any accidental spillage should be small and easily contained, and should not present a hazard.

Approximately 102 kg of the notified polymer is expected to be lost to the sewer per annum from the manufacturing site through spills and residues. As a worst case, if this were to enter the sewer on any single day, the following Predicted Environmental Concentration (PEC) would apply.

Werribee Treatment Plant:	Uncured polymer released	102 kg
	Water volume/day	500 ML
	Dilution in receiving water	1:10
	PEC in receiving water	0.204 ppm

The very low water solubility and high partition coefficient suggest the majority of this will be adsorbed to sediments and soil of the paddocks of the Werribee Treatment Plant and will not be released into the aquatic environment.

The polymer disposed of to landfill is also not expected to enter the water compartment but will stay bonded to the soils and sediment. While the chemical could theoretically bioaccumulate the hazard is anticipated to be minimal due to the expected very low exposure to the aquatic compartment and the very low water solubility [Connell (1989)].

Most of the waste polymer will be incinerated producing oxides of carbon and hydrogen.

When used in the proposed manner, the use of the notified chemical is expected to have a low potential for environmental hazard.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Hazard Assessment
No toxicological information or sufficient chemical data were provided for the notified polymer and therefore it cannot be classified in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999). However, the NAMW of > 1000 indicates that it is unlikely to cross biological membranes readily and its polyester nature suggests low toxicity.

The raw polymer resin, which contains the notified polymer at 90%, contains the hazardous ingredients Bisphenol A-epichlorohydrin reaction product and 1,4-butanediol diglycidyl ether. Based on their concentration and hazard classification, the raw polymer resin is classified as a hazardous substance in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999) and the risk phrases R20/21 ‘harmful by inhalation, in contact with skin and if swallowed’; R36/38 ‘irritating to skin and eyes’ and

R43 ‘may cause sensitisation by skin contact’ assigned.

Araldite Resin 18, the paste containing the notified polymer at 36 %, also contains the same hazardous ingredients, but at a lower concentration. Based on their concentration and hazard classification, Araldite Resin 18 is classified as a hazardous substance in accordance with the NOHSC *Approved Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999), with the risk phrase R43 ‘may cause sensitisation by skin contact’ assigned.

Occupational Health and Safety
The health risk associated with the manufacture of the notified polymer and its resins is due to the hazards of the resin ingredients rather than the polymer itself. The manufacture of the notified polymer and its resins is conducted largely in enclosed reaction and mixing vessels, with possible exposure confined mainly to incidental exposure during transfer and cleaning operations. There is a risk of skin sensitisation if skin contact occurs during these operations, for example, drumming off the raw polymer resin and addition to the mixing vessel for the manufacture of Araldite Resin 18 paste. There is also some risk of skin and eye irritation if exposure occurs during the handling of the polymer resins, so personal protection consisting of overalls, gloves and safety glasses or goggles is required.

Dermal exposure may also occur during the cleaning and maintenance of equipment, hence similar PPE should be worn during these operations to minimise the risk of skin and eye irritation and skin sensitisation.

In the application of resin at the customer site, the process is largely closed and automated, however, dermal exposure to the notified polymer (at 36 %) when feeding the hopper to the mixing/melting equipment may occur. There is the risk of skin sensitisation during the addition process and during any cleaning and maintenance activities. Once the blower units have passed through the curing oven, the polymer is bound within the polymer matrix and is not bioavailable. The health risk arising from exposure to the notified chemical at this point is negligible. The overall risk of adverse health effects is low.

Transport and warehouse personnel would only be exposed to the chemical in the event of a drum rupture. Therefore, the risk of skin sensitisation and irritation is extremely low.

Public Health Risk
There is negligible potential for public exposure to the notified chemical arising from its use in the encapsulation of electronic controller units. There will be public contact with the notified chemical when incorporated into products, however the low exposure indicates a negligible risk to public health. Therefore, based on this information, it is considered that the notified polymer will not pose a significant hazard to public health when used in this proposed manner.

13. RECOMMENDATIONS

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

- Enclose and automate the process as much as possible to reduce the risk of skin sensitisation

- 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 (Standards Australia 1990; Standards Australia 1990); impermeable gloves (nitrile rubber or neoprene) should conform to AS/NZS 2161.2 (Standards Australia/Standards New Zealand 1998); 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 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 resin containing the notified polymer was provided in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC 1994).

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 may be required if any of the circumstances stipulated under section 64 of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

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