

File No: NA/212

Date: 10 May 1995

**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

ADHESION RESIN BL 215 C

This Assessment has been compiled in accordance with the provisions of *the Industrial Chemicals (Notification and Assessment) Act 1989*, and Regulations. This legislation is an Act of the Commonwealth of Australia. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by Worksafe Australia which also conducts the occupational health & safety assessment. The assessment of environmental hazard is conducted by the Department of the Environment, Sport, and Territories and the assessment of public health is conducted by the Department of Human Services and Health.

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT
ADHESION RESIN BL 215 C

1. APPLICANTS

Robert Bryce & Co Ltd of 145 - 147 Glenlyon Rd, Brunswick VIC 3056

2. IDENTITY OF THE CHEMICAL

Chemical name: Hexanedioic acid, polymer with (E)-2-Butenedioic acid and Octahydro-4,7-methano-1H-indene-dimethanol.

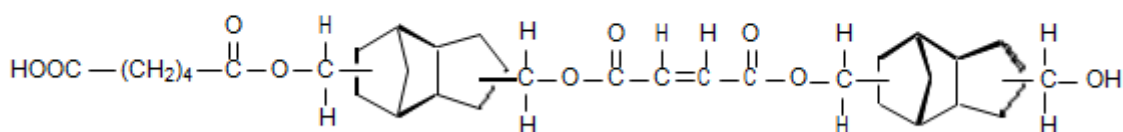
**Chemical Abstracts Service
(CAS) Registry No.:** 58891-19-3

Other names: Unsaturated polyester resin from dibasic acids and polyol
 Unsaturated polyester resin, styrene free

Trade names: Adhesion Resin BL 215 C (name of polymer)
 Adhesion Resin LTW (marketed product)

Molecular formula: $(C_6H_{10}O_4 \cdot C_4H_4O_4 \cdot C_{12}H_{20}O_2)_x$

Structural formula:



Number-average molecular weight: 2,300

Polydispersity: 1.090

Maximum percentage of low molecular weight species (molecular weight < 1000): 8.0%

(molecular weight < 500): 3.3%

Monomers:

Chemical Name	CAS No.	Weight %
Hexanedioic acid	124-04-9	21
(E)-2-Butenedioic acid	110-17-8	13.5
(Z)-2-Butenedioic acid	110-16-7	≤ 0.05
Octahydro-4,7-methano-1H-indenedimethanol, (Digidol)	26896-48-0	65.5

Method of detection and determination: No specific methods known. Identification possible through IR and NMR spectroscopy (¹H, ¹³C).

Spectral data: Infrared Spectrum main peaks occurred at the following wavenumbers:

Wavenumber cm ⁻¹	Absorbance %	Wavenumber cm ⁻¹	Absorbance %	Wavenumber cm ⁻¹	Absorbance %
3100	8.4	2800	25.2	1720	3.4
1450	36.1	1290	8.4	1250	10
1145	9.2	1080	42.8	997	21.8
970	24.4	760	47.9		

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa: tough, slightly tacky, glassy mass and slightly yellowish

Melting Point/Boiling Point: not applicable

Density: 1,190 kg/m³

Vapour Pressure: not provided, estimated to be very low

Water Solubility: expected to be very low.

Partition Co-efficient (n-octanol/water) log P_{ow}: not provided

Hydrolysis as a function of pH: not provided

Adsorption/Desorption: not provided

Dissociation Constant pK_a: not provided

Flash Point:	not provided
Flammability Limits:	not flammable
Combustion Products:	CO, CO ₂ , miscellaneous hydrocarbons, H ₂ O
Decomposition Products:	as a result of saponification of esters, monomeric dicarboxylic acids and alcohol components.
Autoignition Temperature:	> 450°C
Explosive Properties:	not expected to be explosive based on its chemical structure.
Reactivity/Stability:	adhesion Resin BL 215 C has no oxidizing properties. It may react via the free carboxyl and hydroxyl groups, which are bonded after application. Decomposition of the monomer groups is unlikely under normal conditions. It is stable under ambient conditions for at least one year.
Particle size distribution:	not applicable to a resin, imported as a solution in xylene

Comments on Physico-Chemical Properties

The notifier argues that the component monomers of the polyester resin are sparingly soluble in water therefore the polymers would be less soluble than the monomer components. Polyesters are known to be highly insoluble.

Hydrolysis of the components of the polymer is only slow when subjected to high temperatures and strong acidic or base conditions. The polyester of these chemicals would be unlikely to do so under environmental conditions.

Because of the insolubility of the notified substance a partition coefficient is not able to be established. The polymer has no free acid or basic functionalities.

The compound is a resin and would be expected to be immobile and bind to soil particles.

4. PURITY OF THE CHEMICAL

Degree of purity: > 99%

Toxic or hazardous impurities:

- | | |
|---------------------------|---|
| Chemical name: | Hexanedioic acid |
| CAS No.: | 124-04-9 |
| Weight percentage: | < 0.08% |
| Toxic properties: | severe eye irritant, intraperitoneal (i.p.) mouse/rat = 275 mg/kg LD ₅₀ , (A), (B),. |

- | | |
|---------------------------|--|
| Chemical name: | (E)-2-Butenedioic acid |
| CAS No.: | 110-17-8 |
| Weight percentage: | < 0.07% |
| Toxic properties: | skin/eye irritant, i.p. rat LD ₅₀ = 587 mg/kg |

- Chemical name:** (Z)-2-Butenedioic acid
CAS No.: 110-16-7
Weight percentage: < 0.05%
Toxic properties: skin/eye irritant, moderately toxic via skin and oral routes. (oral rat LD50 = 708 mg/kg)
- Chemical name:** Octahydro-4,7-methano-1H-indenedimethanol
Synonym(s): Digidol; Tricyclodecanedimethanol
CAS No.: 26896-48-0
Weight percentage: < 0.4%
Toxic properties: unknown

Non-hazardous impurities: (> 1% by weight): none

Maximum content of residual monomers: 0.60 %

Additives/Adjuvants: none

5. INDUSTRIAL USE

Adhesion Resin BL 215 C is used as a resin additive to improve the adhesion of vinyl chloride copolymer coatings and other binders. It will be used on metallic and inorganic substrates and on certain plastics. There are no known instances of occupational disease as a result of the use of this chemical in Europe since the 1970s.

6. OCCUPATIONAL EXPOSURE

Adhesion Resin BL 215 C will be imported at less than 50 tonne per year as a product in 25 and 100 kg closed drums. No repackaging will be done and no reprocessing by Robert Bryce & Co Ltd who will instead distribute the resin to other paint companies. It will be imported into Australia in a 60% solution with xylene, known commercially as Adhesion Resin LTW. It is generally employed at levels of 5 - 20% on the binder.

At lacquer manufacturers, laboratory workers will take a small quantity via a pipette for quality control purposes. One or two factory workers will use pumps to empty the drums into closed system mixers with other ingredients for producing lacquers. The finished lacquers will be automatically filled into drums, which will be closed immediately. The lacquers will normally be used in industrial fields. The imported resin will be used in quantities of 5 - 20% based on the binder (typically vinyl chloride copolymers) and therefore significantly less in the lacquers (max 5%). Exposure will be restricted by the use of closed systems and precautions to avoid the known hazards of the large xylene component, including exhaust ventilation and personal protective clothing.

One or two workers may also be exposed to Adhesion Resin BL 215 C during cleaning of the production line.

Lacquer applicators may be exposed to Adhesion Resin BL 215 C as a 5% component of the via inhalation and skin contact.

7. PUBLIC EXPOSURE

Public exposure to Adhesion Resin BL 215 C is not expected to arise from paint formulation or industrial application activities, but some paints containing Adhesion Resin BL 215 C will also be available to the public. It is therefore probable that paint users will make dermal contact with the notified polymer in its uncured state. Although widespread public contact with painted articles will

occur, by this stage the Adhesion Resin BL 215 C component will be incorporated into an inert coating, from which it can not be released.

8. ENVIRONMENTAL EXPOSURE

. **Release**

Manufacture and packing of the paint containing the notified substance would take place at the formulating and blending plants of major paint manufacturers. The process is conducted in a banded area under exhaust ventilation with the vapours conducted to the plant incinerator. Spillages and rinsate from cleanup procedures are treated and the solvent is reclaimed or incinerated. Solids and sludge are dried and consigned to landfill. Estimates of the quantity of paint containing the polymer to be disposed of to landfill from formulation and filling processes are not given but may be in the vicinity of 200 kg per annum.

The formulated coatings stored in cans from 1 to 200 L in size is transported to the customer by road or rail.

At the customer site the paint products are applied by spray, brush or roller. Estimates of loss to the environment from brush and roller application are between 1-2% including losses to water and soil during cleanup. Spray painting in exposed areas can lead to losses to the environment of up to 75% as small widely dispersed particles (Randall P M 1992)¹. In the loss to soil, water and air the paint formulation containing the polymer will adhere strongly to soil and sediment and become immobilised. Paint formulations containing this resin are likely to be immobile and non dispersive when spilt. Mechanical cleanup of dried paint and consignment to landfill is the suggested procedure for spillages at the application sites.

Empty drums containing resin are cleaned by solvent which is then used in the next batch. The empty drums can be used to hold formulated paint.

. **Fate**

As the notified substance is a polymer with low water solubility degradation in or leaching from landfill sites is not expected. Incineration of the notified substance is expected to produce water and oxides of carbon and nitrogen.

Most of the notified polymer is not expected to be released to the environment until it has been fully cure a solid polymer matrix on the surface of the treated object. Bioaccumulation of the polymer is unlikely due to the high molecular weight (≈ 2000) of the polymer.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 **Acute Toxicity**

Table 1 Summary of the acute toxicity of Adhesion Resin BL 215 C

Test	Species	Outcome	Reference
Acute oral toxicity	Rat	LD50 > 5000 mg/kg	(1)
Skin Irritation	Rabbit	slight irritant	(2)
Eye irritation	Rabbit	non irritant	(3)

9.1.1 Oral Toxicity (1)

The study was carried out in accordance with the *OECD Guide-lines for testing of Chemicals No: 401*.

Rats of a Wistar derived strain (5 per sex) were administered (by gavage) a single dose of 5000 mg/kg of a 50% solution of Adhesion Resin BL 215 C in acetone. Animals were observed for a period of 14 days after which necropsy was performed.

One hour after administration 4 animals had ruffled hair. The remaining six animals showed mild sedation and ataxia, slowed movements, ruffled hair and a squatting position. After 2 hours, giddiness and a prone position were observed in addition to the above affects. Hypothermia was apparent after 3 hours and gasping breathing after 5' hours. At 24 hours one animal showed the above symptoms in addition to slowed breathing and bleeding from the nose and eye margins. By 48 hours all animals were free of signs.

At necropsy, one female showed partial hyperaemia of the small intestinal mucosa. No other clinical signs, deaths, macroscopic changes or changes in body weight were observed in any animal.

It was concluded that the oral LD₅₀ of Adhesion Resin BL 215 C was > 5000 mg/kg.

9.1.2 Skin Irritation (2)

The study was carried out in accordance with the *OECD Guide-lines for testing of Chemicals No: 404*.

White Russian rabbits (three males and three females) were administered a single dose of 0.5 g of the freeze dried and powdered Adhesion Resin BL 215 C.

On day one of the procedure the test substance was applied to a portion of the shaved skin, topped by a patch and covered with a semi-occlusive dressing. The test substance remained on the skin for four hours after which time it was removed with warm tap water. Animals were then observed at 1, 24, 48 and 72 hours after removal of the dressing, and also after 6, 8, 10 and 14 days.

During application the product fused with the skin and to the patch. When the patch was removed it caused depilation and irritation of the skin, and a tacky film remained on the skin.

After 1 hour, slight erythema was observed in all but one animal which showed well defined erythema. No oedema was present. By 24 hours, well defined erythema was present in all animals and slight or very slight oedema in all animals. Oedema and erythema decreased after this time to become absent by 10 days. Tissue hardening was observed in 2 males at 72 hours. Eschar formation was observed in 5 animals at 6 days and 3 animals at 8 days.

Body weights were normal and no other clinical symptoms were observed.

Adhesion Resin BL 215 C was concluded to be a slight irritant to the skin of rabbits under the conditions of this study.

9.1.3 Eye Irritation (3)

The study was carried out in accordance with the *OECD Guide-lines for testing of Chemicals No: 405*.

Small white Russian rabbits (three males and three females) were administered a single dose of 0.05g Adhesion Resin BL 215 C into the conjunctival sac of the right eye. The other eye remained untreated and was used as a control. Animals were observed at 1, 24, 48 and 72 hours after administration of the test substance.

No effects were observed in the cornea or iris. After 1 hour, slight redness of the conjunctivae was present in five animals and slight discharge of the conjunctivae in 2 animals and persisted for 24 hours. Symptoms were absent by 24 hours.

Adhesion Resin BL 215 C was concluded to be a non-irritant to the eye of the rabbit under the conditions of the study.

9.2 Genotoxicity

9.2.1 Salmonella typhimurium Reverse Mutation Assay (4)

The study was carried out in accordance with the *OECD Guide-lines for testing of Chemicals No: 471*.

Adhesion Resin BL 215 C was tested in the reverse mutation assay on *S. typhimurium* strains TA98, TA100, TA1535, TA1537 and TA1538 in the presence or absence of rat liver microsomal S9 activation.

Only summary results were provided, and these stated that no mutagenic effect was observed in any strain when the test substances were used in concentrations between 10 and 5000 µg/plate. No reference was made to the results of the control substances used.

In conclusion, under the conditions of this experiment, Adhesion Resin BL 215 C was considered not to be mutagenic to *Salmonella typhimurium*. by the study author.

9.4 Overall Assessment of Toxicological Data

Adhesion Resin BL 215 C was found to be of low oral toxicity, with an LD₅₀ of > 5000 mg/kg. It was a slight skin irritant but a non-irritant to the eye. This discrepancy may be due to the substance becoming fused to the skin during skin application, so that removal of the patch and dressing caused depilation and irritation t the skin. A brief summary report stated that Adhesion Resin BL 215 C was not mutagenic to any of five stains of *S. typhimurium* strains with or without metabolic activation.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided, which is acceptable for polymers of NAMW > 1000 according to the *Act*.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The polymer is unlikely to present a hazard to the environment when it is incorporated into the paint and applied to solid substrates.

The polymer is also unlikely to present a hazard to aquatic organisms due to the end-use application and the polymer's high molecular weight.

The main environmental exposure arises from landfill disposal of recovered waste paint containing the resin. However, since it is stable and immobile in soil, environmental hazard is expected to be low.

The paint containing the polymer resin is applied to objects where superior bonding of the paint to the substrate is required. These objects will be consigned to landfill or recycled at the end of their useful life and the coating containing the notified substance will share their fate.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Adhesion Resin BL 215 C has low oral toxicity and is non-irritating and slightly irritating to the eyes and skin respectively. Exposure to the Adhesion Resin BL 215 C is likely to be low due to the precautions taken to avoid the hazards of the xylene in which it resides. Processing is performed in closed systems and the final component of Adhesion Resin BL 215 C in lacquers etc is estimated to be no greater than 5%. The polymer has a number-average molecular weight of 2,300 and 8.0 % of its components are below 1000. It is therefore unlikely to cross biological membranes in significant quantities. From what is known of the toxicity of Adhesion Resin BL 215 C this is unlikely to cause ill effects.

The monomer components have toxicity features including skin and eye irritation, and oral and intraperitoneal toxicity. Loss of monomers is unlikely, and none of the monomers are volatile. The monomers are locked in a water insoluble polymeric matrix and losses by water leaching may occur but are thought to be insignificant. Exposure to the monomers is therefore unlikely so that the risk of exposure to their hazards is low.

The risks, to workers and the public, associated with the use of Adhesion Resin BL 215 C appear to be small based on the known hazards of the chemical and its use pattern.

13. RECOMMENDATIONS

To minimise occupational exposure to Adhesion Resin BL 215 C the following guidelines and precautions should be observed:

- . If engineering controls and work practices are insufficient to reduce exposure to Adhesion Resin BL 215 C to a safe level, the following personal protective equipment conforming to and used in accordance with Australian Standards (AS) should be used for respiratory protection (AS1715 and AS 1716) (5,6), chemical-type goggles (AS 1336 and 1337) (7,8), impervious gloves (AS 2161) (9), and overalls.
- . good work practices should be implemented to avoid spills.
- . spills should be cleaned up promptly.
- . good personal hygiene practices should be observed.
- . a copy of the Material Safety Data Sheet (MSDS) for Adhesion Resin BL 215 C and products containing it should be easily accessible to all employees.

14. MATERIAL SAFETY DATA SHEET

The attached MSDS for Adhesion Resin BL 215 C was provided in Worksafe Australia format (10).

This MSDS was provided by Robert Bryce & Co Ltd as part of their notification statement. The accuracy of this information remains the responsibility of Robert Bryce & Co Ltd.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989*, secondary notification of Adhesion Resin BL 215 C 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

1. MÄrmann, P. 1985, Acute Oral Toxicity of Adhesion Resin BL 215C for Rats, Report No. 0429, Chemische Werke HÄls.
2. MÄrmann, P. 1985, Test of the Acute Skin Irritation Effect of Adhesion Resin BL 215C, Report No. 0430, Chemische Werke HÄls.
3. MÄrmann, P. 1985, Test of the Acute Irritant Effect on Eyes and Mucosa of Adhesion Resin BL 215C, Report No. 0431, Chemische Werke HÄls.
4. Schülberl, P. 1985, Mutagenicity test on Adhesion Resin BL 215C by means of the Ames Salmonella typhimurium/microsomes mutagenicity test, Report 85/12, Project X 41, Chemische Werke HÄls.
5. Standards Australia, 1991, Australian Standard 1715-1991, *Selection, use and maintenance of Respiratory Protective Devices*, Standards Association of Australia Publ., Sydney.
6. Standards Australia, 1991, Australian Standard 1716-1991, *Respiratory Protective Devices*, Standards Association of Australia Publ., Sydney.
7. Standards Australia, 1982, Australian Standard 1336-1982, *Eye Protection in the Industrial Environment*, Standards Association of Australia Publ., Sydney.
8. Standards Australia, 1984, Australian Standard 1337-1984, *Eye Protectors for Industrial Applications*, Standards Association of Australia Publ., Sydney.
9. Standards Australia, 1978, Australian Standard 2161-1978, *Industrial Safety Gloves and Mittens (excluding Electrical and Medical Gloves)*, Standards Association of Australia Publ., Sydney.
10. Worksafe Australia, March 1994, *National Code of Practice for the Preparation of Material Safety Data Sheets* [NOHSC:2011(1994)], Australian Government Publishing Service, Canberra.

ⁱ Randall P M 1992 *Pollution Prevention Methods in the Surface Coating Industry*, Journal of Hazardous Materials, 29 pp. 275-295