NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

D.E.R. 6225

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 Arts, Sport, the Environment and Territories and the assessment of public health is conducted by the Department of Health, Housing and Community Services.

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

D.E.R. 6225

1. IMPORTER/MANUFACTURER

Dow Chemical (Australia) Limited, Kororoit Creek Rd, Altona, Victoria.

2. IDENTITY OF THE CHEMICAL

Marketing Name: D.E.R. 6225 Epoxy Resin

Molecular Weight: The number average molecular weight was demonstrated to be between 1200 and 2000 by gel permeation chromatography.

3. PHYSICAL AND CHEMICAL PROPERTIES

At room temperature and atmospheric pressure, D.E.R. 6225 Epoxy Resin is a solid, pale yellow flake.

Specific gravity:	1,100 - 1,200kg/m^3
Softening point:	85 - 95˚C
Water solubility:	0.0013g/L at 20˚C
Thermal decomposition products:	incomplete pyrolysis or combustion produces phenolics, carbon dioxide and water
Reactivity:	the polymer reacts with strong inorganic acids, inorganic bases and amines
Particle size:	approximately 0.1% of the resin has a particle size <200 micron and 0.0037% of the resin has a particle size <7 micron.

Comments on Physico-Chemical Properties

No data were provided for Flash Point, Flammability Limits or Autoignition Temperature which is acceptable for a polymer of this molecular weight.

The water solubility data provided indicate that the product may be slightly soluble. However, given the method used and

the presence of residual reactants, the water solubility value for D.E.R. 6225 is likely to be significantly lower.

No data were provided for hydrolysis and partition coefficient on the grounds that the substance has a low water solubility. Although it is considered that the substance may hydrolyse at the epoxide terminal site, the polymer's low water solubility would make this test difficult to perform and this hydrolysis would not materially affect the polymer's properties.

No data were provided for dissociation constant. This is acceptable given the lack of acidic or basic groups.

No data were provided for adsorption/desorption on the grounds that "Due to the flake size, polymer structure and insolubility of the resin, it is not anticipated to be mobile in the environment". This is acceptable.

This resin dusts freely when handled and the confined dust, when suspended in air may form flammable mixtures and pose a potential fire and explosion hazard if ignited.

It is anticipated that this polymer will behave in a similar manner to other solid epoxy resins which are not considered to be impact sensitive "by chemical structure or practical experience". Consequently shock sensitivity data has not been generated for this resin.

4. METHODS OF DETECTION AND DETERMINATION

Methods for detection and determination of D.E.R. 6225 are IR spectrum, Epoxide equivalent weight (Dow Method RPM 101A), Melt Viscosity (ASTM D445) and Gel Permeation Chromatography.

5. PURITY OF THE CHEMICAL

Degree of purity of notified polymer: 99.7%

Amount of notified polymer in D.E.R. 6225: at least 89.4%

Toxic or hazardous impurities:

the following hazardous impurities are contained in the resin:

Phenol (CAS No. 108-95-2) at 0.2%

A confidential impurity at 0.1%

6. INDUSTRIAL USE

D.E.R. 6225 is used as a binding agent which can be cured with epoxy cross-linking agents for pigmented epoxy powder coatings.

7. OCCUPATIONAL EXPOSURE

Manufacture of the resin involves heating and mixing of monomers in an enclosed reactor. Sampling of the reactor contents is carried out to monitor the process. When the desired product is obtained, the reactor product is flaked and then packaged. Filled bags of the resin are stacked onto pallets which are then warehoused. Exposure to the polymer is possible during sampling of reactor contents during production (hot liquid resin) and packaging of finished product (solid flake) into 25 kg bags.

Apart from sampling and packaging of the finished resin, production of the product is completely contained within the plant reactor. The finished product flows through a closed system to the flaker.

During packaging of the product an extraction system is in place to remove airborne resin dust particles.

After manufacture or import, the resin will be shipped to formulators of powder coatings in plastic lined, 4-ply Kraft paper bags. To prepare a powder coating, the formulator combines binder resin, curing agent and pigments/fillers then dry blends the ingredients in a large mixer prior to melt-mixing via an extruder. The extrudate is ground to a fine powder (typically less than 110 microns) and the resulting powder coating is then packaged.

In each part of the production process, an effective extraction system is in operation to remove airborne particulate matter. The only part of production where contact with the resin is likely is in weighing of raw materials. Once produced, the finished powder is stored in sealed plastic lined fibreboard boxes.

Powder coating applicators apply the powder coating using electrostatic spray guns located in spray booths designed to capture and ultimately recycle the oversprayed powder. It is estimated that no more than 5% of the powder is lost as a result of equipment cleaning.

8. PUBLIC EXPOSURE

The potential for public exposure to D.E.R. 6225 resin in its uncured form is low, as it will be produced in enclosed vessels, packaged for transport, and then combined with pigments and other additives to form powder surface coatings. Use of both the uncured resin and powder coating is confined to industry.

Exposure to the surface coatings of which D.E.R. 6225 is a constituent will be widespread, but the resin will be in its cured form following application and should present no significant hazard.

9. EVALUATION OF TOXICOLOGICAL DATA

Summary of Acute Toxicity of D.E.R. 6225

Test	Species	Outcome
Acute Oral	Sprague Dawley Rats	LD_{50} > 1000mg/kg
Acute Dermal	NZ White Rabbits	LD_{50} > 2000mg/kg
Skin Irritation	NZ White Rabbits	Not irritating
Eye Irritation	NZ White Rabbits	Moderately irritating

9.1 Acute oral toxicity (1)

Groups of four male Sprague Dawley rats received oral doses of 250, 500 or 1000 mg/kg resin in corn oil. Following treatment, wetness was observed in the perineal area of rats at the highest dose level. All animals survived and gained weight until sacrifice 14 days post treatment. No lesions were observed upon gross pathological examination. The acute oral LD50 of the test material was >1000 mg/kg in the rat.

9.2 Acute dermal toxicity (1)

A 2000 mg/kg quantity of the resin was applied for 24 hours to the clipped intact skin of two female New Zealand White rabbits. Both animals remained asymptomatic throughout the subsequent 14 day observation period. The acute dermal LD50 of the test material was > 2000 mg/kg in the rabbit.

9.3 Skin irritation (1)

0.5 gram quantities of the resin were applied to the shaved skin of two New Zealand White rabbits. Five applications were made onto intact skin over five successive days, while three applications were made onto abraded skin. Neither animal displayed any reaction to treatment. Under the conditions employed, the test material was not irritating to the rabbit skin.

9.4 Eye irritation (1)

A 0.1 g quantity of the resin was instilled into each eye of a New Zealand White rabbit. One eye was then washed, while the contralateral eye was left unwashed. There was a very slight pain response to instillation. One hour post treatment, conjunctival capillaries were swollen in both eyes, and very slight corneal opacity was observed in the unwashed eye. Both conjunctivae were normal 24 hours post treatment, while the cornea of the unwashed eye was normal at 48 hours. The test material should be classified as moderately irritating to the rabbit eye.

9.5 Overall Assessment of the Toxicological Data

The acute toxicological hazard associated with D.E.R. 6225 is low. The material is of low acute oral and dermal toxicity and does not irritate the skin. However, the resin is moderately irritating to the eye.

10. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The toxicological profile of D.E.R. 6225 suggests that it would not present a significant hazard on the data supplied. However, liquid epoxy resin, one of the components of D.E.R. 6225 and comprising up to 10% of the finished product, may be a skin sensitiser and genotoxin according to the supplied MSDS. Because this monomer is of high molecular weight, it may not be readily lost from the polymer matrix during normal handling and storage and is thus less of a concern than would otherwise be the case.

The notifier states that no adverse effects on exposed persons have been observed for other solid epoxy resins of similar molecular weight produced over a number of years at the production site.

It would appear that engineering controls are in place to control exposure to D.E.R. 6225 dust produced during its manufacture and during the manufacture and use of powder coating resins. If, in addition to these controls, personal protective equipment is used, then any potential hazard from this source would be minimised.

11. ENVIRONMENTAL EXPOSURE

Release

During manufacture of D.E.R. 6225 in a closed reactor vessel, the vessel is not normally cleaned between batches or after multiple runs. Thus, negligible waste disposal is expected from this source.

Of each manufacture batch 0.13% waste substance will be generated. The waste resin is not pretreated before disposal at Envirogard, a licensed EPA landfill located at Tullamarine, Victoria.

The polymer is sold in flake form to formulators who dry-blend it, at 25 - 35%, with curing agent and pigments/fillers in a mixer, melt-mix the material via an extruder and grind the extrudate to form a fine powder.

Powder coating applicators apply the powder coating using electrostatic spray guns located in spray booths designed to capture and ultimately recycle the oversprayed powder. The powder can be applied to a number of substrates including household appliances, garden tools, pencils and pens. It is estimated that 5% waste will be generated from, predominantly,

cleaning of spray equipment which is expected to be disposed of to landfill.

Fate

The polymer is likely to undergo further polymerisation during the powder coat curing process.

By the nature of the application and the inert nature of the finished product, the polymer is required to be stable under a wide range of conditions.

The polymer will form oxides of carbon and water vapour on combustion and additionally, phenolics during incomplete combustion.

At the landfill, "off specification" polymer from manufacture may undergo hydrolysis at the epoxide site of the molecule. In mildly acidic conditions, hydrolysis may yield a diol or ketone of the original polymer (2), but not react further.

12. ASSESSMENT OF ENVIRONMENTAL EFFECTS

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

13. ASSESSMENT OF ENVIRONMENTAL HAZARD

The polymer is unlikely to present a hazard to the environment when incorporated into powder coating paint and applied to household appliances, garden tools, pencils and pens.

Wastes generated from the manufacture through to application of the substance will be less than 0.2% of total volume. The waste will be disposed of to a specified landfill which tests all new waste material for combustibility.

There appears to be no significant hazard from the possible hydrolysis of the polymer given the small quantity of polymer disposed of to landfill and the likely hydrolytic products, which will also have a high molecular weight and similar physico-chemical properties to the original polymer.

14. RECOMMENDATIONS FOR SAFETY PROCEDURES TO CONTROL OCCUPATIONAL EXPOSURE AND OCCUPATIONAL HAZARDS

To minimise public and worker exposure to D.E.R. 6225, the following guidelines and precautions should be observed:

. a copy of the Material Safety Data Sheets for D.E.R. 6225 and formulated products should be easily accessible to all employees in the appropriate workplaces;

. engineering controls such as local exhaust ventilation and enclosed booths for powder application should be employed; and

. workers who frequently come into direct contact with the resin and formulated products should:

- wear appropriate gloves (such as impervious gloves), which comply with Australian Standards (AS);

- wear appropriate protective clothing;

- wear dust masks where the dust from the resin is liberated and when handling the formulated products;

- observe good hygiene practices at work; and

- avoid the generation of dust clouds.

Because D.E.R. 6225 dusts freely when handled and the dust constitutes an explosion hazard, sources of ignition should be eliminated from work areas. Devices should be constructed of non-sparking material. All electrical equipment should meet the requirements of AS 3000 - *Electrical Installations - Buildings, Structures and Premises* (3), and conductive articles should be electrically grounded.

15. RECOMMENDATIONS FOR MATERIAL SAFETY DATA SHEET (MSDS)

The MSDS for D.E.R. 6225 has been compiled in accordance with Worksafe Australia format (4).

16. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989* (the Act), secondary notification of D.E.R. 6225 shall be required if any of the circumstances stipulated under section 64(2) of the Act arise.

17. REFERENCES

1. D.E.R. 6225: Acute Toxicological Properties, Data on File, Health and Environmental Sciences, Dow Chemical Company, Texas, U.S.A., Laboratory Report TXT:DR-0285-1754-001.

2. Carruthers W (1971), Some Modern Methods of Organic Synthesis, Cambridge University Text, p269-274.

3. Australian Standard 3000-1986 *Electrical Installations - Buildings, Structures and Premises*, Standards Association of Australia Publ., Sydney, 1986.

4. National Occupational Health and Safety Commission, *Guidance Note for the Completion of a Material Safety Data Sheet,* 2nd. Edition, AGPS, Canberra, 1990.