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NATIONAL INDUSTRIAL CHEMICALS
NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

NRD-342

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

NRD-342

1. APPLICANT

Du Pont (Australia) Ltd., 188 Walker Street, North Sydney, NSW, 2060.

2. IDENTITY OF THE CHEMICAL

Chemical Abstracts Service (CAS) Registry No.:

None issued.

Trade name:

NRD-342

Other names:

MPD-7352A; Polysubstituted urethane; perfluoroalkyl substituted urethane.

Number-average molecular weight:

Maximum weight % below 500 = 0%
Maximum weight % below 1000 = 1%

Maximum content of residual monomers: 1%

Method of detection and determination:

NRD-432 may be characterised by its Infra-red spectrum.

3. PHYSICAL AND CHEMICAL PROPERTIES

NRD-342 will be imported as a dispersion in water containing 15-35% NRD-342 and 0-3% sodium dodecyl benzene sulfonate (CAS No.: 25155-30-0; see section 4 below). Under ambient conditions (20^{O}C

and 101.3 kPa) this aqueous dispersion of NRD-342 is a white or tan opaque, milky liquid with a slight ketonic odour, produced by residual methyl isobutyl ketone used in the manufacture of NRD-342. The NRD-342 polymer itself can be expected to have very low volatility since it is a high molecular weight polymer. The physical and chemical properties of the NRD-342 polymer include:

Melting point/Boiling point:

Under heating, NRD-342 polymer softens and eventually decomposes, rather than melting then boiling.

Density:

1.12×10^3 kg/m^3

Vapour pressure (25^{0}C):

NRD-342 is a high molecular weight polymer with negligible vapour pressure.

Water Solubility:

The water solubility of the polymer remains unclear. Attempts were made to clarify a number of contradictory statements in the notification which appear to have been caused by confusion on the part of Du Pont in converting g/L into ppm. The statement of < 0.001 g/L in the original notification statement is based on the US definition of insoluble but has not been determined experimentally. An attempt to determine solubility of the polymer suffered from a very insensitive detection limit. Solubility of up to 0.001 g/L is not low in environmental terms.

The notifier states the polymer has a very polar backbone which suggests a certain degree of water solubility, but the notifier has elsewhere indicated that the polymer contains a significant concentration of perfluorinated hydrocarbon segments which are hydrophobic and render the polymer insoluble in water.

Hydrolysis as a function of pH:

No data were provided for solubility on the grounds that NRD-342 is insoluble in water, a claim which is unclear as described above. Polymers containing hydrolysable linkages, such as

polyurethanes, are prone to attack by acids and bases (1), and NRD-342 may hydrolyse as it will be discharged into sewers where the pH of the water may range from pH 6-10. Hence, the potential for hydrolysis of NRD-342 remains unclear, but will not be pursued due to the low concentration of NRD-342 likely to be in the effluent (see Environmental Release, below).

Partition Coefficient:

Since NRD-342 is unlikely to bioaccumulate due to its high molecular weight, partition coefficient data is not required.

Dissociation Constant:

NRD-342 is unlikely to dissociate in water as it contains no dissociable groups.

Particle size:

Not applicable.

Fibre Length:

Not applicable.

Flash point:

NRD-342 does not form a vapour, upon heating, which can be ignited.

Flammability limits:

Not applicable.

Autoignition temperature:

NRD-342 does not ignite and undergo self-sustained combustion upon heating.

Explosion potential:

NRD-342 does not have explosive potential

Reactivity:

NRD-342 coagulates with cationic surfactants.

Pyrolysis/thermal decomposition products:

NRD-342 decomposes upon heating, in the absence of oxygen, to yield isocyanates and hydrogen fluoride. Heating NRD-342 above 200^{O}C or exposing it to fire will cause toxic decomposition products which may cause severe eye, nose, throat, and lung irritation.

4. PURITY OF THE CHEMICAL

Additives/Adjuvants: (in the aqueous dispersion of NRD-342)

Chemical name: Sodium dodecyl benzene sulfonate
CAS No.: 25155-30-0
Weight percentage: 0-3%
Toxic properties: harmful by oral route, severe eye irritant in rabbits at 1% concentration (2)

5. INDUSTRIAL USES

NRD-342 is intended to be used exclusively as a carpet fibre soil repellant finish. Its use is to be confined to carpet manufacturing plants. NRD-342 will be diluted with water and sprayed onto carpet during manufacture. The notifier indicates that it is intended that NRD-342 will not be sprayed outside of carpet manufacturing plants, where spraying will be performed using fixed airless spray booms located above carpet moving on a conveyor line. The notifier recommends that the airless spray units operate only at spray pressures below 60 psi. The carpet will then be dried and packaged for sale.

The estimated import volume of NRD-342 is 1-10 tonnes for each of the first five years of import.

6. OCCUPATIONAL EXPOSURE

The notifier estimates that up to 24 employees per shift will be exposed to the chemical at a number of sites involved in the carpet manufacture and treatment process. The main route of exposure during spray operations is likely to be via inhalation, with exposure via the skin and eyes also possible. Maintenance

employees may also be exposed during work on spray and pumping equipment. Skin and eye contact with NRD-342 may be more likely during these maintenance operations.

The notifier has indicated that in a typical application system, the atmospheric concentration of NRD-342 adjacent to the spray booms was 0.057 mg/m^3 (respirable mist) and 0.097 mg/m^3 (total mist).

7. PUBLIC EXPOSURE

Under normal conditions, the potential for public exposure to NRD-342 is low. The chemical is manufactured outside Australia, and is imported in fibre drums with polyethylene liners. Waste from spraying and cleaning of equipment is expected to be disposed of via the sewage system to a sewage treatment plant. The quantity of waste is estimated at no more than 1-2kg per treatment line per shift. The storage drums will be rinsed out, punctured and disposed of at an approved municipal tip, with the rinse liquor reused.

NRD 342 is expected to be permanently bound to the fibre surface of the carpet, due to the very polar backbone of the polymer having a strong interaction with the fibre matrix. Low quantities are applied since a monomolecular layer is considered sufficient to provide the desired soil repellency. The bonding can withstand subsequent carpet processing and exhibits minimal loss in home cleaning and traffic.

8. ENVIRONMENTAL EXPOSURE

8.1 Release

No processing sites where carpets are treated are located inland or discharge to inland waterways. All manufacturers are in areas serviced by metropolitan sewerage and stormwater systems. The company states that no atmospheric releases and no soil contamination are foreseen.

The company states that minimal waste will be generated at the carpet manufacturers' sites. Besides spray application, the polymer will enter the environment through waste streams associated with the clean-out of equipment machine supply tanks and sprayers. A small amount of waste is expected to be generated per shift.

Batch tanks range in size from 400 - 1000 litres and 2 - 4 batches/day would be applied to a carpet line. Mixing vessels do

not need to be cleaned between batches. The spray delivery piping is flushed with water through the nozzles onto carpet at the end of each day or production run. Hence NRD-342 in these lines does not go to waste. Spray lines operate for less than 20% of scheduled work days. Excess spray is recovered in catch trays under the process and returned to the mix tank for re-use after filtering.

The company estimates that for an online facility operating for 1 week, less than 1 kg/week of active polysubstituted urethane would leave the process as waste. This figure is based on US experience on the environmental release of waste where no more than 2 kg waste/treatment would be generated per shift. The figure for Australian conditions is less due to the smaller scale of production lines and the mixing tanks used in Australia.

The generated waste will be co-mingled with other plant aqueous-based wastes. diluted and directed via closed sewage lines to the local municipal sewage treatment plant for disposal. The total effluent flow from a carpet manufacturer would be 1 - 2.5 million litres per week. Therefore, the concentration of active polysubstitued urethane released into the sewer is < 1 ppm.

8.2 Fate

The company states that the polymer is non-volatile and insoluble in water and therefore no measurable losses would be expected to occur through volatility or leaching. Leaching of the polymer is unlikely as waste will not be disposed of to landfill.

Biological oxygen demand (BOD) determination gave a BOD value that was below detection. This result indicates the polymer is not readily biodegradable.

When the polymer is discharged to the sewer it is unlikely to biodegrade. The structure of the polymer suggests it may undergo hydrolysis, but whether it would under environmental conditions remains unclear.

Once the polymer has been applied to the carpet it is unlikely to move off the surface. The chemical forms a very thin coating on the fibre. The polymer has a very polar backbone and has strong interactions with the fibre matrix. The company states that bonding is strong enough to withstand subsequent carpet processing which can include heating, chemical scouring and

dyeing. Less than 10% of the material was lost after 5 accelerated cleanings, which is stated to be equivalent to 25 hot water extraction cleanings by the consumer followed by shampoo cleaning. Little to none of the chemical is expected to be removed in the normal life time of the carpet. The polymer is likely to remain with the carpet fibres after their disposal.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Studies

The following acute toxicity tests were performed using the aqueous dispersion of 15-35% NRD-342 plus 0-3% sodium dodecyl benzene sulfonate. This dispersion is referred to below as NRD-342.

Test	Species	Outcome	Reference
Oral	Rat	LD50>11000 mg/kg	3
Skin irritation	Rabbit	non irritant	4
Eye irritation	Rabbit	moderate irritant	5
Inhalation	Rat	LC50 = 920 mg/m^3	6

9.1.1 Oral Toxicity

Oral administration of NRD-342 produced no mortality in individual male rats given doses up to 11,000 mg/kg. Symptoms of intoxication were lethargy 1 hr after dosing at 11000 mg/kg and body weight losses (5%) 1 day after dosing at 5000 and 7500 mg/kg. On the basis of these results it can be concluded that the acute oral toxicity of NRD-342 is very low.

9.1.2 Skin Irritation

Five male and one female New Zealand White rabbits were each treated with 0.5 ml doses of NRD-342 which were held in contact with the skin for 24 hours. The skin at the site of application was then observed at 24 and 48 hours after application. There was no evidence of erythema, odema or other dermal effects. On the basis of these results, it can be concluded that NRD-342 is not a skin irritant.

9.1.3 Eye Irritation

Eye irritation was measured by instilling 0.01 ml of NRD-342 into the lower conjunctival sac of one eye in each of two female New Zealand White Rabbits. The other eye of each animal was not treated and served as a control. Twenty seconds after instillation, the eyes of one animal were washed for one minute with water, while the eyes of the other animal remained unwashed.

Examination of the eyes by illumination, magnification and fluorescein dye was performed at 1 and 4 hours, and 1, 2, and 3 days after instillation.

Conjunctivitis, chemosis and blood tinged ocular discharge were seen 1hr after instillation and subsequent washing. The conjunctivitis persisted for 4hrs. Similar responses were observed in unwashed eyes with the added effects of chemosis persisting for 4 hrs, iritis seen at 1 and 4 hrs and generalised corneal opacity appearing at 4 hrs. No lesions were seen after 1 day and there were no signs of corneal injury with fluroescein staining and biomicroscopic examination. On the basis of these results it can be concluded that NRD-342 is a moderate eye irritant.

9.1.4 Inhalation Toxicity

Groups of 6 male rats were exposed nose-only for a single, 4 hour period to aerosols of NRD-342 at 440, 590 and 920 mg/m^3. Deaths occurred following exposure at 590 (1/6) and 920 mg/m^3 (3/6). All deaths were post-exposure and occurred within 24 hours of exposure. Clinical signs observed immediately after exposure included red nasal and ocular discharges, and lethargy. During the first three days after exposure, the surviving rats exhibited clinical signs of lethargy, hunched posture, nasal discharge, laboured breathing and decreased body weights. These signs resolved after day three. The 4-hour inhalation LC_{50} for NRD-342 was 920 mg/m^3. On the basis of these results, it can be concluded that NRD-342 is toxic by inhalation.

9.2 Overall Assessment of Toxicological Data

NRD-342 (as the aqueous dispersion containing 15-35% NRD-342 and 0-3% sodium dodecyl benzene sulfonate) has low oral toxicity and is not a skin irritant. However, NRD-342 is a moderate eye irritant and is toxic via inhalation exposure.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The notifier has provided results of a study on the acute toxicity (96-hour) of the polymer to Fathead Minnows. The study records a result of an LC_{50} greater than 4000 mg/L. All concentrations above 800 mg/L were milky throughout the test, making fish hard to see. Therefore, the polysubstituted urethane is not toxic to fish up to the level of its solubility. The polymer's high molecular weight (Number Average Molecular Weight > 1000) indicates that it is unlikely to cross biological membranes. As no ecotoxicological data is required for polymers of NAMW > 1000, the toxicity data provided are adequate.

11. ASSESSMENT OF ENVIRONMENTAL HAZARDS

The environmental hazard of the polymer is likely to be low as the effluent from the manufacturing sites containing the polymer will be discharged into metropolitan sewerage and stormwater systems, where dilution will lead to low concentrations. The notifier states that no sites discharge to inland waterways. The concentration of the polymer in the factory effluent is low (< 1 ppm). Further dilution will occur as it enters the sewerage stream. Using the average daily flow rate of 500 ML at the Werribee (Victoria) treatment complex as an example of a metropolitan sewerage volume, the concentration of the polymer will be diluted to < 2 ppb when it passes through metropolitan sewerage treatment works. While dilution may be less in other situations, concentrations are still likely to be well under toxic levels.

The disposal of carpet containing the polymer is unlikely to present a hazard to the environment, as the polymer is likely to remain with the carpet fibres.

12. ASSESSMENT OF OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Under correct application conditions via automated fixed-boom airless spraying at pressures below 60 psi, the potential for worker exposure to NRD-342 outside the vicinity of the spray boom is low. The use of local exhaust ventilation to remove overspray and bounce-back of spray mist would further reduce the health hazard posed by NRD-342. Under correct application conditions with local exhaust ventilation, use of this substance poses a low acute health hazard.

However, NRD-342 poses an inhalation and eye irritation hazard to workers who may be exposed to NRD-342 spray mist during spraying, equipment testing or maintenance.

Accidental spraying of NRD-342 mist into the workplace atmopshere beyond the general vicinity of the spray booms would also pose an inhalation and eye irritation hazard.

In addition, there is an eye irritation hazard for workers who may accidentally splash liquid formulated NRD-342, for example during refilling or maintenance of spray tanks.

13. ASSESSMENT OF PUBLIC HEALTH EFFECTS

13.1 Assessment of toxicological hazard

NRD-342 has a very low acute toxicity as well as low skin irritant potential. It does have moderate eye irritant potential and is toxic via acute inhalation exposure.

13.2 Assessment of public exposure

Under correct handling and application procedures the potential for public exposure is minimal. A limited potential for exposure occurs from sewerage discharge.

13.3 Recommendations

The use pattern described by the notifier suggests minimal public health exposure. There are no objections to issuing an assessment certificate for NRD-342 when used in the proposed manner.

In the event of an accidental spill, care should be taken with its disposal due to its inhalation effects and eye irritant properties.

If the conditions of use are varied, greater exposure of the public may occur. If the chemical is to be formulated in a domestic product a submission should be made to the Drugs and Poisons Schedule Committee of the NHMRC.

14. RECOMMENDATIONS FOR THE CONTROL OF WORKER EXPOSURE

To minimise worker exposure to NRD-342 the following guidelines and precautions should be observed:

. copies of the Material Safety Data Sheets for formulated NRD-342 should be made available to all workers who may be exposed to NRD-342;

. spray application of NRD-342 onto carpet should only be performed using automated fixed boom airless spray equipment;

. good work practices and spraying procedures should be observed to minimise the generation of overspray and/or bounceback mist, the accumulation of such a mist, and/or the dispersal of this mist beyond the vicinity of the spray booms;

. local exhaust ventilation should be used to remove overspray and bounceback mist from the vicinity of the spray booms; and

. workers in the vicinity of the spray equipment who may be exposed to NRD-342 during spraying, equipment testing or maintenance should:

- avoid inhalation of the spray mist by wearing a respirator with a particulate (P1) filter complying with Australian Standard AS 1716 *Respiratory Protective Devices* (7), and chosen and used in accordance with Australian Standard AS 1715 *Selection, Use and Maintenance of Respiratory Protective Devices* (8);

- avoid contact of NRD-342 spray mist or liquid with the eyes by wearing safety glasses or goggles complying with Australian Standard AS 1337 *Eye Protectors for Industrial Applications* (9), and chosen and used in accordance with Australian Standard AS 1336 *Recommended Practices for Eye Protection in the Industrial Environment* (10); and

- observe good personal hygiene practices at work.

15. MATERIAL SAFETY DATA SHEET

The Material Safety Data Sheet (MSDS) for formulated NRD-342 is provided at Attachment 1. This MSDS was provided by DuPont (Australia) Ltd. as part of their notification statement. It is reproduced here as a matter of record. The accuracy of this information remains the responsibility of Du Pont (Australia) Ltd.

16. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989* (the Act), secondary notification of NRD-342 shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

17. REFERENCES

(1) Schnabel, W. (1981) *Polymer Degradation, Principles and Practical Applications*, pp. 179-183, Hanser, Munich

(2) U.S. National Institute for Occupational Safety and Health, *Registry of Toxic Effects of Chemical Substances (RTECS)*, May 1991.

(3) Approximate Lethal Dose (ALD) of MPD-7352A in Rats. J.W. Sarver,Haskel Laboratory for Toxicology and Industrial Medicine, USA. Report No 391-89.

(4) Skin Irritation Test in Rabbits of MPD-7352A. J.W. Sarver, Haskell Laboratory for Toxicology and Industrial Medicine, USA Report No. 360-89.

(5) Eye Irritation Test with MPD-7352A in Rabbits. D.E. Malek, Haskel Laboratory for Toxicology and Industrial Medicine, USA. Report No. 385-89.

(6) Inhalation Approximate Lethal Concentration (ALC) of MPD-7352A. R. Valentine, Haskell Laboratory for Toxicology and Industrial Medicine, USA, 1989, 466-89.

(7) Standards Australia, AS 1716 *Respiratory Protective Devices*,Sydney, 1984.

(8) Standards Australia, AS 1715 *Selection, Use and Maintenance of Respiratory Protective Devices*, Sydney, 1982.

(9) Standards Australia, AS 1337 *Eye Protectors for Industrial Applications*, Sydney, 1984.

(10) Standards Australia, AS 1336 *Recommended Practices for Eye Protection in the Industrial Environment*, Sydney, 1982.