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**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

Z - 37

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FULL PUBLIC REPORT**Z - 37****1. APPLICANT**

Lubrizol International Inc. of 28 River Street, SILVERWATER, NSW 2128 (ARBN 002 747 944) has submitted a **limited** notification statement in support of their application for an assessment certificate for Z – 37.

2. IDENTITY OF THE CHEMICAL

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

**Chemical Abstracts Service
(CAS) Registry No.:**

Not assigned

Marketing Name:

Z-37,
Lubrizol 2721 (containing 60% the notified polymer)

Other Names:

OS 144258

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C & 101.3 kPa: Brown viscous liquid

Melting Point: 49°C

Boiling Point: > 360°C

Relative Density: 960 kg/m³

Vapour Pressure: < 7.9x10⁻⁸ kPa at 25°C

Water Solubility: < 1.54x10⁻⁴ g/L at 20°C

**Partition
(n-octanol/water):** **Co-efficient**

Log P_{OW} >3.82 at 21°C

Hydrolysis as a Function of pH: Not determined (see comments below)

Adsorption/Desorption: Log K_{OC} >2.61 (calculated using QSARs)

Dissociation Constant:	Not determined (see comments below)
Particle Size:	Not applicable for a liquid
Flash Point:	175 ± 2°C
Flammability Limits:	Not determined
Autoignition Temperature:	> 400°C
Explosive Properties:	Not explosive
Reactivity/Stability:	Stable under normal conditions of use

Comments on Physico-Chemical Properties

Determination of the boiling point was attempted using differential scanning calorimetry (Woolley and Mullee, 1999), but no phase transition was observed up to 360°C. Also no decomposition of the notified polymer was apparent at this temperature.

The vapour pressure was determined at a number of temperatures using a mass difference technique (Tremain, 1999). The data were extrapolated to provide a value for 25°C. There was a good deal of scatter in the data, and no definitive value for the vapour pressure at 25°C could be calculated. It was estimated that the vapour pressure at this temperature was $<7.9 \times 10^{-8}$ kPa. A very low vapour pressure is expected for polymers containing ionic (salt like) moieties in the “head group”.

The water solubility was determined in triplicate using the flask method (Woolley and Mullee, 1999). Approximately 50-57 mg of the test material was weighed into three separate flasks, then shaken with 525 mL of double-distilled water at 30°C. After standing at 20°C for periods of 24, 48 and 72 hours the resulting solutions were filtered and duplicate samples analysed for the dissolved material using Gel Permeation Chromatography (GPC). Each water solution was evaporated to dryness, and the residues taken up in tetrahydrofuran for GPC. In all cases the detector responses were below the limits of quantification and consequently the water solubility at 20°C was determined as <0.154 mg/L. The agitation time had no bearing on the individual results, and the pH of the solutions was always slightly acid at around 5.5.

Hydrolytic degradation of the polymer was not studied due to its very low water solubility. However, while the material contains ester and amide linkages, these are unlikely to undergo significant hydrolytic cleavage in the usual environmental pH region where $4 < \text{pH} < 9$. The low water solubility indicates very little contact between water and the ester and amide groups, further reducing the potential for hydrolysis.

The n-octanol/water partition coefficient (P_{ow}) was determined using the shake flask method (Woolley and Mullee, 1999). Six different volumes (between 19 and 125 mL) of a solution of the notified polymer in n-octanol (concentration 5.088 g/L) were shaken with six different volumes (between 304 and 500 mL) of octanol saturated water for five minutes at 21°C. In these tests the n-octanol to water ratio was between 1:4 and 1:16, and in each test the two

phases were separated and analysed for the notified polymer using GPC. The aqueous and octanol phases were evaporated to dryness, and the residues taken up in tetrahydrofuran for GPC. In all six tests the test material aqueous concentration could only be determined as <0.736 mg/L, while the concentration in octanol was always around 4 900 mg/L. The P_{ow} at 21°C was consequently calculated as > 6 600, with corresponding $\text{Log } P_{ow} > 3.82$.

A calculated estimate for $\text{Log } P_{ow}$ using the atom fragment method (Meylon and Howard, 1995) was also presented which gave the estimated $\text{Log } P_{ow} > 8$. A high value of $\text{Log } P_{ow}$ is expected for compounds such as the notified polymer, which contain a high proportion of aliphatic hydrocarbon.

$\text{Log } K_{oc}$ was not measured due to anticipated problems with the standard HPLC method arising from the presence of carboxylic acid functionalities in the notified polymer. Instead this parameter was estimated from the measured value of $\text{Log } P_{ow}$ using a quantitative structure activity relationship taken from an EEC technical guidance document (Directive 93/67/EEC). The equation used was

$$\text{Log } K_{oc} = 0.60 \times \text{Log } P_{ow} + 0.32$$

which is appropriate for organic acids. Using the measured value for $\text{Log } P_{ow}$ (ie. >3.82) gives the estimated $\text{Log } K_{oc} > 2.6$. It should be noted that the considerably higher calculated value for $\text{Log } P_{ow}$ (>8) would furnish a correspondingly larger $\text{Log } K_{oc}$. In any case the high hydrocarbon content and very low water solubility of the polymer indicate high affinity for the organic component of soils and sediments.

No dissociation constant data was provided, but the zwitterionic head group could be expected to make the molecule cationic under conditions of low pH (<4) and anionic at high pH (>11). Due to the excess of carboxylic acid groups, the condensation product is expected to exhibit slightly acidic behaviour in an aqueous environment, which is supported by the pH of 5.5 exhibited by the aqueous solutions.

The notified polymer is a powerful emulsifying agent specially suited to the stabilisation of water in oil emulsions. The effectiveness of the material depends on it having negligible true water solubility, although the formation of colloidal aggregated structures such as micelles may be possible. All the constituents contain a large branched chain aliphatic hydrocarbon portion coupled to a polar end group, and will be amphoteric in nature.

4. PURITY OF THE CHEMICAL

Degree of Purity: High

Hazardous Impurities: None

Additives/Adjuvants: Mineral oil (CAS No 64742-54-7, not designated as a hazardous substance under *List of Designated Hazardous Substances* [NOHSC:10005(1999)] because it contains less than 3% DMSO).

5. USE, VOLUME AND FORMULATION

The notified polymer will be imported at 60% (w/v) in mineral oil as an emulsifying agent for making stable emulsion explosives for use in the mining industry. The import volume of the polymer will be less than 300 tonnes per annum over the first 5 years. The notified polymer will be further diluted at 12-18% and used at a final concentration of 0.5-2% in an explosive emulsion.

6. OCCUPATIONAL EXPOSURE

Transport and Storage

The notified polymer, Z-37, will be imported as Lubrizol 2721 (containing 60% notified polymer and 40% mineral oil) in approximately 1 300 L (330 gallon) International Bulk Containers (IBC) or 200 L (55 gallon) drums. These will be transported to notifier or customer site by truck or rail.

Waterfront, transport and warehouse workers are not expected to be exposed to the notified polymer except in the case of an accident involving spillage of the polymer solution.

Blending

Approximately 20% of the import volume will be diluted in diesel fuel or other oil prior to distribution to customers. Alternatively customers may dilute the polymer solution at their facilities.

At the notifier's premises, 1 to 2 workers would be involved in the dilution process. The polymer solution is pumped via a closed system to a blender. Diesel fuel or '100N' oil is mixed to reduce the final concentration of the polymer in the product to 12-18%. The diluted product is drummed via a closed system and transported by road or rail to customer sites. The blending process is automated and the facility well ventilated. All residual material or mineral oil will be returned in the blend tank for the next batch. The notifier indicated that personal protective equipment such as protective aprons, nitrile rubber gloves and boots would be worn. Empty drums are recycled.

Manufacture of Emulsion Explosives

The reformulation of polymer solution into emulsion explosive will take place at mining sites or in manufacturing facilities located nearby and transported by designated tank trucks. It will involve mixing the diluted polymer with ammonium nitrate, fuel oil and other additives and introducing the mixture into mining bore holes for detonation. The finished emulsion explosive contains 0.5-2% of the notified polymer and is stable under normal conditions for up to 3 years.

There are standard operation procedures for handling explosive chemicals in the mining industry. The notifier indicated that local exhaust ventilation will be used if mist or vapour is generated during use. Workers will wear long sleeve shirt, nitrile or neoprene gloves, chemical goggles or faceshield, and disposable dust/mist mask. In addition, self-contained breathing apparatus will be used for entry into confined spaces or poorly ventilated areas, and for clean up large spills.

No notified polymer remains following explosion.

7. PUBLIC EXPOSURE

The notified polymer is to be sold and used only in the mining industry and the bulk of the notified polymer is likely to be incinerated during explosion of emulsion. Therefore, there is limited potential for exposure of the public to the notified polymer.

8. ENVIRONMENTAL EXPOSURE

Release

Around 20% of the imported Lubrizol 2721 may be diluted at the notifiers facility prior to being shipped to customers. This procedure is to be performed in a closed dedicated system, with any residuals mixed with subsequent batches. Accordingly, releases from disposal of residuals are expected to be low. Some spillage could be expected as a result of leaks and accidents during transfer operations. If it is assumed (as a worst case) that 1% of material diluted at the notifiers facility is lost in this manner, the estimated maximum release is 600 kg per annum. Such spills are likely to be contained within bunding, and would be collected and most probably be disposed of by incineration.

However, the notifier indicated that 2-3% of the Lubrizol 2721 may be left in drums, after dilution at the notifier's facilities or by end users, corresponding to a maximum of 9 tonnes of the new polymer per year. The notifier indicated emptied drums originating from their facility would be sent for recycling, where residual material would be removed through cleaning processes at the recycling plant. These residuals would become incorporated into waste sludge, and either be incinerated (most likely) or be placed into landfill.

When the explosive formulations are prepared at remote mine sites, it is likely that the emptied drums and residuals would be placed into landfill at the mine site.

Losses of the material during emulsion formulation are also expected to be very low, and residual emulsion (containing 0.5-2% of the notified material) left in the blending tanks would most likely be diluted with water and passed to on site waste water treatment plants. Residual material remaining in the drums or bulk containers would also be passed to these facilities following cleaning of the containers.

Fate

Due to the low water solubility and high estimated Log K_{OC} , the residual polymer passed onto wastewater treatment plants following cleaning of drums and other equipment used for emulsion production will become assimilated with sludge. The resultant sludge would presumably be placed into landfill, or incinerated. The notified polymer is not readily biodegradable, but in landfill could be expected to undergo slow degradation to carbon dioxide or methane, water and small amounts of nitrogen or ammonia. Incineration would destroy the polymer with production of water vapour, and oxides of carbon and nitrogen.

When the explosive emulsion is detonated, the polymer could be expected to be destroyed immediately, producing oxides of carbon and nitrogen.

No tests results on biodegradation of the new polymer were submitted but the notifier presented a report (Haberlein and Schaefer, 1997) on the biodegradation of polymer 205-71-0A, a very close analogue. The use of data from this analogue is accepted, and indicates that the notified material is not readily biodegradable. The tests performed in triplicate according to the protocols of the modified Sturm test (OECD TG 301B) indicated that less than 10% of the polymer 205-71-0A was degraded after 28 days. Under the same conditions > 80% of a control material, canola oil, had degraded after the 28 day period.

Polymer 205-71-0A has a high molecular weight (NAMW =1 060 g/mol) and a very high Log Pow (>7). Consequently it is expected to have low bioaccumulation potential.

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological data were available for the notified polymer. Studies were provided for the analogue, polymer 205-71-0A, the chemical identify of which is exempted from publication in the Full Public Report. Polymer 205-71-0A is accepted as a suitable analogue for Z-37.

9.1 Acute Toxicity

Summary of the acute toxicity of polymer 205-71-0A

<i>Test</i>	<i>Species</i>	<i>Outcome</i>	<i>Reference</i>
acute oral toxicity	rat	LD ₅₀ >16 000 mg/kg	(Gabriel, 1980a)
skin irritation	rabbit	slightly irritating	(Gabriel, 1980b)
eye irritation	rabbit	slightly to moderately irritating	(Gabriel, 1980c)
skin sensitisation	guinea pig	non sensitiser	(Costello, 1987)

9.1.1 Oral Toxicity (Gabriel, 1980a)

<i>Species/strain:</i>	rat/Sherman Wistar
<i>Number/sex of animals:</i>	25 males (5 per group)
<i>Observation period:</i>	14 days
<i>Method of administration:</i>	single oral dose (gavage) of 1.0, 2.0, 4.0, 8.0 or 16 g/kg bw of test substance as a 50% w/v suspension in corn oil
<i>Test method:</i>	section 772.112-21 CFR 40
<i>Mortality:</i>	one animal dosed at 16 g/kg died on day 2
<i>Clinical observations:</i>	none

Morphological findings: none

Comment: none

LD₅₀: > 16 000 mg/kg

Result: the test substance was of very low acute oral toxicity in rats

9.1.2 Skin Irritation (Gabriel, 1980b)

Species/strain: rabbit/New Zealand White

Number/sex of animals: 6

Observation period: 72 hours

Method of administration: 0.5 mL of the test substance was applied to abraded and intact skin (2 sites/animal) under semi-occlusive dressing for 24 hours

Test method: Similar to section 1500.41, 16 CFR

Draize scores:

	<i>Animal Number</i>	<i>Erythema</i>		<i>Oedema</i>	
		<i>24 hour</i>	<i>72 hour</i>	<i>24 hour</i>	<i>72 hour</i>
<i>Intact Skin</i>	1	1	0	0	0
	2	1	0	0	0
	3	1	0	0	0
	4	0	0	0	0
	5	1	0	0	0
	6	0	0	0	0
<i>Abraded Skin</i>	1	1	0	0	0
	2	1	0	0	0
	3	1	0	0	0
	4	1	0	0	0
	5	1	0	0	0
	6	0	0	0	0

Comment: none

Result: the test substance was slightly irritating to the skin of rabbits

9.1.3 Eye Irritation (Gabriel, 1980c)

Species/strain: rabbit/New Zealand White

Number/sex of animals: 6

Observation period: 7 days

Method of administration: 0.1 mL of the test substance was instilled into one eye, with the other eye serving as an untreated control

Test method: Similar to Section 1500.42, CFR 16

Draize scores of unirrigated eyes:

	<i>Time after instillation</i>														
<i>Animal</i>	<i>1 day</i>		<i>2 days</i>		<i>3 days</i>		<i>5 days</i>		<i>7 days</i>						
<i>Cornea</i>	<i>o</i>	<i>a</i>	<i>o</i>	<i>a</i>	<i>o</i>	<i>a</i>	<i>o</i>	<i>a</i>	<i>o</i>	<i>a</i>					
1	¹ 0	0	0	0	0	0	0	0	0	0					
2	0	0	0	0	0	0	0	0	0	0					
3	1	4	1	4	1	4	1	4	0	0					
4	1	4	1	4	0	0	0	0	0	0					
5	0	0	0	0	0	0	0	0	0	0					
6	0	0	0	0	0	0	0	0	0	0					
<i>Iris</i>															
1		0		0		0		0		0					
2		0		0		0		0		0					
3		1		1		1		0		0					
4		1		1		0		0		0					
5		0		0		0		0		0					
6		0		0		0		0		0					
<i>Conjunctiva</i>	<i>r</i>	<i>c</i>	<i>d</i>	<i>r</i>	<i>c</i>	<i>d</i>	<i>r</i>	<i>c</i>	<i>d</i>	<i>r</i>	<i>c</i>	<i>d</i>	<i>r</i>	<i>c</i>	<i>d</i>
1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	2	1	2	1	1	1	0	0	0	0	0	0	0	0	0
3	3	3	3	3	3	3	2	2	3	2	2	2	1	1	1
4	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0
5	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
6	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0

¹ see Attachment 1 for Draize scales

o = opacity a = area r = redness c = chemosis d = discharge

Comment: slight corneal opacity was observed in 2 animals on day 1 which persisted up to day 2 in one and up to day 5 in the other

slight iridial inflammation was observed in 2 animals on day 1 which persisted up to day 2 in one and up to day 3 in the other

conjunctival redness was observed in 5 animals on day 1 persisting in 3 animals up to day 2 and persisted in 1 animal through to day 7

conjunctival chemosis was observed in all animals persisting in 3 animals on day 2 and persisting in 1 animal through to day 7

conjunctival discharge was observed in all animals persisting in 2 animals on day 2 and persisting in 1 animal through to day 7

Result: the test substance was slightly to moderately irritating to the eyes of rabbits

9.1.4 Skin Sensitisation (Costello, 1987)

Species/strain: guinea pig/Dunkin-Hartley

Number of animals: control: 5 males;
test: 12 males;
positive control: 12 males

Induction procedure:
test group: 0.5 mL (2.5% w/v in white mineral oil) of test substance was applied to test site of each animal and held under occlusive dressing for 6 hours

after 24 hours the above procedure was repeated three times weekly for a total of 9 applications

positive control group: 0.5 mL of 1-chloro-2, 4-dinitrobenzene (0.15% w/v suspension in 25% ethanol and saline) applied to test site of each animal and held under occlusive dressing for 6 hours

after 24 hours the above procedure was repeated as for test group

Challenge procedure: 2 weeks after the last induction application, the animals were challenged at a different site at the same concentrations (test and positive control groups) used for the induction and held under occlusive dressing for 24 hours

the control group animals received only the challenge test dose

Test method: Modified Buehler method, similar to OECD TG 406

Challenge outcome:

<i>Challenge concentration</i>	<i>Test animals</i>		<i>Control animals</i>	
	<i>24 hours*</i>	<i>48 hours*</i>	<i>24 hours</i>	<i>48 hours</i>
2.5 w/v%	**0/12	0/12	1/5	1/5
*	time		patch	removal
**	number of animals exhibiting positive response			

Comment: the positive controls elicited responses both at the 24 and 48 hour observation periods

Result: the test substance was not sensitising to the skin of guinea pigs at a concentration of 2.5% (w/v)

9.2 Genotoxicity

9.2.1 *Salmonella typhimurium* Reverse Mutation Assay (Stankowski, 1993)

Strains: *Salmonella typhimurium*: TA98, TA100, TA1535, TA1537 and TA1538; *Escherichia coli* WP2uvrA

Metabolic activation: 6% rat liver S9 fraction (Aroclor 1254-induced) in standard cofactors

Concentration range: with and without S9: 16.6, 50.0, 167, 500, 1 670 and 5 000 µg/plate

Positive controls: without S9:
sodium azide: 10.0 µg/plate for TA1535 and TA100
9-aminoacridine: 150 µg/plate for TA1537
2-nitrofluorene: 5.0 µg/plate for TA1538 and TA98
N-ethyl N-nitro nitrosoguanidine (ENNG): 2.0 µg/plate for WP2uvrA

with S9:
2-anthramine: 2.5 µg/plate for TA98, TA100, TA1535, TA1537 and TA1538; 80 µg/plate for WP2uvrA

Test method: OECD TG 471

Comment: all dose were tested in triplicate and the experiment was repeated

evidence of toxicity was seen at the highest concentrations both in the presence and absence of S9

the test substance was incompletely soluble at doses $\geq 1\ 670$ $\mu\text{g}/\text{plate}$ with or without S9

no significant increase in the frequency of revertants was recorded for any of strains, at any dose level, either with or without S9; all positive controls responded appropriately

Result: the test substance was considered to be non-mutagenic under the conditions of the assay

9.3 Overall Assessment of Toxicological Data

The analogue, polymer 205-71-0A, was of very low acute oral toxicity with an $\text{LD}_{50} > 16\ 000$ mg/kg bw in rats. It was slightly irritating to the skin of rabbits and slightly to moderately irritating to the eyes of rabbits. The test substance was not sensitising to the skin of guinea pigs and non mutagenic in a bacterial mutagenicity assay.

Toxicity of polymer 205-71-0A is taken as representative of toxicity of the notified polymer. The notified polymer cannot be classified as a hazardous substance according to the *NOHSC Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999) based on the findings of the acute oral toxicity, skin and eye irritation and sensitisation studies using the analogue.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The following ecotoxicity studies have been supplied by the notifier. The studies were conducted with the analogue polymer 205-71-0A, and given the close structural analogy between this material and the notified polymer Z-37, the use of the analogue data is acceptable. The tests were conducted according to OECD and US EPA protocols.

<i>Test</i>	<i>Species</i>	<i>Results</i>
Acute toxicity (freshwater fish)	Fathead minnow <i>Pimephales promelas</i>	LC ₅₀ (96 h) = 1 000 mg/L. NOEL = 330 mg/L. (See notes below)
Acute toxicity (saltwater fish)	Sheepshead minnow <i>Cyprinodon variegatus</i>	LC ₅₀ (96 h) >1 000 mg/L.
Acute toxicity (saltwater invertebrate)	Mysid (<i>Mysidopsis bahia</i>)	Shrimp LC ₅₀ (96 h) = 744 mg/L. NOEL = 360 mg/L.
Inhibition of Sewage sludge Bacteria Bacterial Respiration		EC ₅₀ > 10 000 mg/L.

* NOEC - no observable effect concentration

Fish

The tests on the Fathead minnow (Ward et al., 1996) were conducted using static methodology over a 96 hour test period according to OECD test guidelines. Nominal concentrations of the test substance of 0 (control), 0.33, 3.3, 33, 330 and 3 300 mg/L were introduced into the test chambers directly at the beginning of each test, and maintained in suspension through mechanical agitation. It was noted that insoluble material (cloudiness) was apparent throughout the 96 hour test period in the test media at the two highest loadings. The test was conducted at 22°C using 10 fish at each nominal test loading, and the pH and dissolved oxygen levels were always between 8.2 and 9, and 99 and 106% saturation (8.7 mg/L at 22°C) respectively.

Although 10% mortality (one fish) was observed after 96 hours exposure to the 3.3 mg/L loading, no mortality of any of the test animals was observed over the 96 hour period at 330 mg/L, although all had died after 72 hours exposure to the 3 300 mg/L test medium. No sublethal effects were observed during the tests, but due to cloudiness of some of the test media, the possibility of unobservable effects could not be discounted. While the single mortality at 3.3 mg/L may not be statistically significant, the authors nevertheless recorded a No Observed Effect Loading (NOEL) of 330 mg/L, and an LC₅₀ of 1 000 mg/L (95% confidence 330-3 300 mg/L). This result indicates that the test material exhibits low toxicity to this freshwater species.

The tests on the salt water species, Sheepshead minnow (LeLievre, 1991) were conducted in triplicate using a water accommodation fraction (WAF) of the test material prepared by stirring test material sufficient to produce a nominal 1 000 mg/L loading with the test water (salinity 31 g/L) for 20 hours. The test was performed using semi-static methodology over a 96 hour test period, with renewal of the WAF at 48 and 72 hours. The test was conducted at 22±0.5°C using 10 fish in the test vessel, and the pH and dissolved oxygen levels were always between 7.1 and 7.6, and 75 and 96% saturation (8.7 mg/L at 22°C) respectively. No mortality or sublethal effects were observed in any of the test animals over the 96 hour period. Accordingly the test material was found to be non toxic to this salt water species up to the limit of its water solubility.

Invertebrates

Although not specified in OECD test guidelines for ecotoxicity, tests on mysid shrimp

(*Mysidopsis bahia*), a representative marine invertebrate, are recognised by the US EPA, and were conducted for the notified polymer (Hauthaway, 1997). In this study the shrimps were exposed to the WAF of the notified chemical derived from quantities of the test material calculated to give nominal loadings of 0 (control), 77.7, 129.6, 216.0, 360.0, 600.0 and 1 000.0 mg/L. The 96 hour test was performed using semi static methodology with test media renewal every 24 hours. Natural sea water was used for the WAF preparations (salinity around 22 g/L) at temperature $24\pm1^{\circ}\text{C}$, while the pH and dissolved oxygen levels of the test media were always between 8.0 and 8.8 and 6.7 and 7.1 mg/L, respectively. The test was performed in duplicate using 10 shrimp in each test vessel. No mortalities were observed over the 96 hour test period for the WAFs prepared at 216 mg/L loading and below, but for the 360 mg/L WAF 10% mortality was observed after 24 hours, although no further deaths occurred in the ensuing 72 hours. For the 1 000 mg/L WAF, 10% mortality had occurred after 24 hours exposure, and after 96 hours approximately 80% of the animals had died. It was noted that after 48 hours exposure at the highest WAF loading, obvious sublethal effects were observed in a large proportion of the test animals. The data was analysed using probit analysis, and furnished the results tabulated above. This result indicates that the material polymer 205-71-OA exhibits some toxicity to this species.

Algae

No data on the toxicity of the notified polymer or its close analogues to green algae was included with the application. Since the polymer contains an amino group, toxicity towards this species is possible (Boethling and Nabholz, 1997). However, the low toxicity against other species indicate that toxicity to algae may not be high. In any case, little of the polymer is likely to be released to the water compartment, and due to low water solubility and high estimated value for Log K_{oc} any that did would rapidly become associated with particulate matter and sediments which would lower potential exposure and mitigate any toxicity.

Sewage bacteria

A test was conducted on the effects of polymer 205-71-OA on the respiration (oxygen uptake) of sewage bacteria (Woodward-Clyde, 1994). This test was conducted in duplicate using the protocols of OECD TG 209.

This test material was added to the artificial sewage media at nominal loadings of 0 (control) 1, 10, 100, 1 000 and 10 000 mg/L. The test flasks were inoculated with sewage sludge bacteria then aerated for 3 hours. Following aeration, the rate of oxygen consumption was measured for the dispersions, and compared with that in the controls. There was some inhibition of respiration at all test loadings, ranging from 19.8% to 47.8% at the highest test material loading, but since 50% inhibition was not observed over the exposure levels employed, the EC₅₀ could not be calculated but was > 10 000 mg/L. This result indicates that the test material is not toxic to sewage bacteria up to the limits of its water solubility.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The environmental hazard from the notified polymer is considered to be low, and most will be destroyed as a consequence of its use as a component of explosives. However, up to 3% of the notified polymer may be released as a result of incomplete emptying of the drums in which the notified polymer is imported. Some of the notified polymer will be recovered at drum recycling facilities where it would become incorporated with waste sludge then either incinerated or sent to landfill. Most of the notified polymer (around 80% of annual imports)

will be used at, or close to mine sites, and here it is likely that the empty drums containing the residuals will be placed into landfill with other industrial wastes. Assuming that 3% of total imports is released to the soil compartment in this manner, the maximum annual release is 9 tonnes. Since mines and quarries are spread all over the Australian landmass, release will be globally diffuse, but locally concentrated.

The polymer is hydrophobic with high P_{OW} and K_{OC} , and consequently once released to the soil compartment is unlikely to be mobile. Except in the case of a transport accident the polymer is unlikely to reach the water compartment in quantity, and would in any case be expected to become associated with natural organic matter in the sediments. Ecotoxicity tests performed on a very close analogue polymer indicate that the notified polymer may exhibit some toxicity ($LC_{50}=744$ mg/L) to aquatic species (specifically fathead minnow and shrimp), although the suite of data included in the notification did not include tests on algae which are expected to be the most sensitive species.

The notified polymer is not readily biodegradable, but prolonged residence in a landfill in association with soils and sediments is expected to lead to its eventual degradation through slow biological and abiotic processes. The degradation products from slow degradation in a landfill would be water and oxides of carbon and nitrogen.

The notified polymer is not likely to present a hazard to the environment when it is stored, transported and used in the described manner.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The notifier provided toxicological data for an analogue chemical, polymer 205-71-0A. The acute oral toxicity of polymer 205-71-0A is very low. It is a slight skin irritant and a slight to moderate eye irritant. It is not a skin sensitiser in guinea pigs. No evidence of genotoxicity was observed in one *in vitro* genotoxicity test. Based on the analogue data, the notified polymer would not be classified as a hazardous substance according to the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999).

As a precaution, the notifier calls the notified polymer a hazardous substance based on skin irritation following long term exposure. Risk phrase R38 'Irritating to skin' appears on the MSDS of the notified polymer and its product. The MSDS for Lubrizol 2721 specifies health effects such as redness, oedema, drying, defatting and cracking of the skin following prolonged and repeated contact with skin, and irritation of respiratory tract. These effects relate predominantly to the additives rather than the notified polymer. The notifier provided evidence that the mineral oil used for Lubrizol 2721 contains <3% DMSO, therefore it is not considered carcinogenic.

Occupational Health and Safety

There is little potential for significant occupational exposure to the notified polymer in the transport and storage of the product containing this polymer.

About 20% of the import volume will be diluted in diesel fuel or other oil at the notifier's premises prior to distribution. The blending process is automated and the facility is ventilated. Workers will transfer Lubrizol 2721 containing 60% Z-37 and the diluted mixture

containing 12-18% Z-37 via closed systems. Dermal and ocular contamination may occur during connecting and disconnecting hoses. Workers at the blending site should wear goggles and nitrile or neoprene gloves to minimise the occupational exposure and risk of topical effects. Considering the low toxicity of the notified polymer, using industrial control measures at the blending site and wearing personal protective equipment, the health risk for workers involved in blending is expected to be low.

The remaining import volume (80%) of the notified polymer will be diluted and reformulated at or close to the mining sites. Details were not provided, however workers may become exposed to the notified polymer at 12-18% or 0.5-2%, during transfer, blending, transport or pre-blasting operations. Mining industry has standard operating procedures for handling explosive chemicals. The employers should provide appropriate industrial controls, and ensure workers follow the standard operating procedures including wearing adequate personal protective equipment. Based on the anticipated low systemic health hazard and the low concentration of the polymer in the final emulsion preparations, the health risk due to the notified polymer for workers at mining sites is low.

No occupational exposure or health risk in cleaning up as the notified polymer is consumed by explosion.

Public Health

There is negligible potential for public exposure to the notified polymer arising from its use as a component of emulsion explosives. It is only available to the mining industry and the bulk of the notified polymer is expected to be incinerated during explosion.

13. RECOMMENDATIONS

The notified polymer may be imported, manufactured and/or used as a component of formulations which contain hazardous existing chemicals. It is the responsibility of the notifier to ensure that appropriate measures are taken to control exposure to these chemicals in accordance with the appropriate State or Territory Hazardous Substances legislation.

To minimise occupational exposure to Z-37 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), the notifier recommends protective aprons; impermeable gloves should conform to AS/NZS 2161.2 (Standards Australia), the notifier recommends nitrile rubber and neoprene gloves; 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 Material Safety Data Sheet (MSDS) should be easily accessible to employees.

14. MATERIAL SAFETY DATA SHEET

The MSDS for 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).

The 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 subsection 64(2) of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

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Attachment 1

The Draize Scale (Draize, 1959) for evaluation of skin reactions is as follows:

<i>Erythema Formation</i>	<i>Rating</i>	<i>Oedema Formation</i>	<i>Rating</i>
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 (Draize *et al.*, 1944) for evaluation of eye reactions is as follows:

CORNEA

<i>Opacity</i>	<i>Rating</i>	<i>Area of Cornea involved</i>	<i>Rating</i>
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

<i>Redness</i>	<i>Rating</i>	<i>Chemosis</i>	<i>Rating</i>	<i>Discharge</i>	<i>Rating</i>
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.
Diffuse beefy red	3 severe	Swelling with lids half-closed	3 mod.	Discharge with moistening of lids and hairs and considerable area around eye	3 severe
		Swelling with lids half-closed to completely closed	4 severe		

IRIS

<i>Values</i>	<i>Rating</i>
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

MSDS