File No: NA/455

Date: March 1997

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Z-31

This Assessment has been compiled in accordance with the provisions of *the Industrial Chemicals (Notification and Assessment) Act* 1989 (the Act), 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 Health and Family Services.

For the purposes of subsection 78(1) of the Act, copies of this full public report may be inspected by the public at the Library, Worksafe Australia, 92-94 Parramatta Road, Camperdown NSW 2050, between the following hours:

Monday - Wednesday	8.30 am - 5.00 pm
Thursday	8.30 am - 8.00 pm
Friday	8.30 am - 5.00 pm

For Enquiries please contact the Administration Coordinator at:

Street Address: 92 Parramatta Rd Camperdown, NSW 2050, AUSTRALIA
Postal Address: GPO Box 58, Sydney 2001, AUSTRALIA
Telephone: (61) (02) 9577-9466 **FAX (61) (02) 9577-9465**

Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Z-31

1. APPLICANT

Lubrizol International, Inc. of 28 River Street SILVERWATER NSW 2141 has submitted a limited notification statement in support of their application for an assessment certificate for Z-31.

2. IDENTITY OF THE CHEMICAL

Z-31 is not considered to be hazardous based on the nature of the polymer and the data provided. Therefore the chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data, details of the polymer composition and details of exact import volume have been exempted from publication in the Full Public Report and the Summary Report.

Trade Name:	Lubrizol 5620
Other Name:	polyoelfin diester/disalt
Number-Average Molecular Weight:	> 1 000 g/mol
Method of Detection and Determination:	ultraviolet/visible (UV/Vis) spectrophotometry, ^{13}C, ^{1}H nuclear magnetic resonance (NMR) spectrophotometry

3. PHYSICAL AND CHEMICAL PROPERTIES

In production, the notified polymer is made in the presence of a diluent oil so that the final product (Lubrizol 5620) is a fluid. A sample of Z-31 was prepared free of oil and solvents for the purpose of obtaining physical data described below.

Appearance at 20°C and 101.3 kPa:	dark brown, very viscous liquid
Melting Point:	< 223 K
Specific Gravity:	0.961 (pycnometer)

Vapour Pressure:	$4.2x10^{-4}$ to $1.1x10^{-3}$ Pa at 25°C (vapour pressure balance)
Water Solubility:	forms emulsions in water (see comments below)
Partition Co-efficient (n-octanol/water):	log P_{ow} > 6 (Rekker calculation)
Hydrolysis as a Function of pH:	not determined
Adsorption/Desorption:	not determined (see comments below)
Dissociation Constant:	not determined (see comments below)
Flash Point:	107.4°C
Flammability Limits:	not performed
Autoignition Temperature:	408°C
Explosive Properties:	none
Reactivity/Stability:	not an oxidising agent; not reactive towards water

Comments on Physico-Chemical Properties

Tests were performed according to EEC/OECD test guidelines at facilities complying with OECD Principles of Good Laboratory Practice.

During water solubility testing, on addition of the test article to water, a white, opalescent fluid formed with a considerable amount of foaming. Excess test article was visible in all but the two flasks of lowest concentration (1 g/L and 5 g/L). The notified substance was added in an attempt to produce a saturated solution. This did not occur, and a further study showed that it formed an emulsion or colloid with water in all proportions tested (between 1 and 100 g/L). It is expected that the substance may form micelles in water and also exhibit surface activity. It is possible that micelle formation may lead to colloids, or association with colloids in the water column, thereby making the polymer mobile.

Hydrolysis testing was not conducted. Due to emulsions being formed with solubility testing, it was assumed the same would happen with hydrolysis testing, which the notifier considered would invalidate the test. Ester linkages are present within the molecule, but due to limited solubility, hydrolysis is not expected within the environmental pH range.

An initial test to determine partition coefficient was performed by the shake flask method. The Rekker calculation approach was adopted when levels observed in the aqueous phase was below the limit of detection. The quoted value should be

treated with caution as partition coefficients for surface active substances are difficult to measure (2).

Due to the lack of sufficiently high concentrations in water and lack of analytical method, adsorption/desorption and dissociation constant tests were not performed. The expected surface activity of the notified polymer means it will seek surfaces, and adsorb to organic matter in soils and sediment. The salt functionality suggests the substance will dissociate in water.

4. PURITY OF THE CHEMICAL

Degree of Purity: high

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

Maximum Content of Residual Monomers: < 5%

Comments on Residual Monomers

One of the residual monomers can be irritating to eyes, skin and respiratory system and another is harmful if ingested (1).

5. USE, VOLUME AND FORMULATION

The notified polymer will not be manufactured in Australia. The product Lubrizol 5620 will contain the notified polymer at a high concentration, and will be used as an emulsifier in water-based metal working fluids. Lubrizol 5620 will be imported in 1 tonne steel containers. These will be shipped directly to customers where they may re-label the containers and ship to end-users, still in the original container. End users will then prepare metal working fluid containing the notified polymer at a concentration of less than 2%.

The notifier estimates that up to 10 tonnes of the notified polymer will be imported annually for each of the next 5 years.

6. OCCUPATIONAL EXPOSURE

Waterside and transport workers are unlikely to come into contact with the notified polymer under normal circumstances, however, if an accident occurred or packaging leaked, substantial exposure could occur due to the large size of the transport containers.

Drums of the product will be transported directly to customers, who may relabel the drums and ship them to end users, for formulation on-site into metal working fluid. Dermal exposure may occur when Lubrizol 5620 (containing the notified polymer) is

added to oil via direct lines and/or taps in the drums. Oil containing the additive will then be emulsified with water to produce a metal working fluid, which will contain the notified polymer at a final concentration of less than 2%. It is expected that reformulation of the notified polymer would take place infrequently, and exposure times will be relatively short. The final fluid will be stored in sumps (which will range in size from 1 800 to 38 000 L), and will be used in industrial settings to cool metal and to remove metal shavings during metal working processes.

Metal working fluid containing the notified polymer will be directed onto the metal via a nozzle. The fluid will move over the worked metal, cooling it and removing metal fragments produced during cutting etc. The fluid is then trapped and returned to the sump for recirculation. Dermal exposure to low concentrations of the notified polymer in metal working fluid may occur when workers are cutting or working metal, as residues of the fluid will remain on the metal surface. Inhalational exposure to the notified polymer may also occur, as mists of the fluid may form during metal working processes. If the fluid mists or spatters, ocular exposure may also occur.

The notifier states that cleaning of sumps, lines and equipment is likely to be infrequent or not needed at all, so exposure to the notified polymer due to these processes is likely to be negligible.

Dermal, inhalational and ocular exposure to mineral oil in the metal working fluid may also occur. While use of products containing the notified polymer will not be under the direct control of the notifier, the notifier recommends that local exhaust ventilation and fittings such as splash guards be used to control exposure to the notified polymer and mineral oil.

7. PUBLIC EXPOSURE

The notified polymer will only be used in an industrial environment and no residual polymer will remain on the metal at the completion of the production process. When used in an industrial setting, no public exposure will occur.

Minor public exposure may result from disposal of unused polymer or accidental spillage of the notified polymer during use, transport and storage. However, adequate measures are described by the notifier to minimise the risk of public exposure during disposal, or in the event of accidental spillage.

8. ENVIRONMENTAL EXPOSURE

Release

The product, Lubrizol 5620, is transported by road in 1 000 kg steel containers. Any release will be a result of accidental spillage, and the large container size gives the potential for significant exposure in this event. Spills should not be allowed to enter drains or waterways, and instructions for this appear on the Material Safety Data Sheet (MSDS).

At end-user sites, Lubrizol 5620 will be formulated into metal working fluid. The final concentration of the notified polymer will be less than 2%. If cleaning of equipment is required, the washings are likely to be added to the next blend, and any losses during blending are expected to be minimal.

The main environmental input is expected to take place during industrial use. Sewage water contamination arises from either used cooling lubricant emulsions (waste emulsions) or washing and scouring solutions from cleaning machines, tools, pipes and work pieces (3). The emulsion is generally run in closed circuits, with application being directed from a nozzle onto the area where metal is being cut or processed. Waste trapping technology (catch pans and splash guards) directs any losses back into the system for reuse, so fugitive emissions into the factory environment, and consequently to the sewer will be very low.

The major source of release expected through industrial use occurs when machined or fabricated parts are removed from machinery. These parts will have residues of fluid on them. They are cleaned by solvent cleaning methods, and again, no release to sewer will occur.

The fluid is also used for sweeping away metal chips resulting from machining of metal. These chips are filtered out so as not to contaminate the fluid. While they will contain residues of the fluid, they will be disposed of as solid waste.
Losses during use are stated by the notifier at around 10% (up to 1 000 kg per annum, or around 125 kg per site). For the most part, this loss is contained within the facility through waste trapping technology, and it is claimed they will be disposed of in the same manner as spent emulsion, and if handled correctly, only small amounts are likely to reach the sewer.

Once past its useful life, the spent emulsion is disposed of in two ways. In smaller facilities, it is likely to be disposed of to an authorised disposal company. In larger facilities, some waste handling may be done on site, where the emulsion is split into the oil and water fractions. The oil fraction is sent for disposal (or recycling, although the notifier has indicated this is not expected to occur), and the aqueous fraction is disposed of as waste water. Physical separation involves passing the emulsion through ultra filtration, and the waste water has been shown to have an oil content of around 20 mg/L (ppm) (3). This would mean a loss to sewer of less than 1% (ie, less than 12.5 kg per site per annum).

All clean up of spills and disposal of empty packaging should be carried out according to the MSDS.

Fate

The majority of the notified polymer will remain with the oil phase, and be incinerated after breaking the emulsion. Incineration will destroy the polymer and liberate oxides of nitrogen and carbon.

Some of the notified polymer could be expected to be released to sewer. The majority of this is likely to adsorb to or associate with sludge, and be removed within

the sewage treatment plant, prior to discharge to receiving waters. Any polymer reaching receiving waters would be expected to associate with sediments.

No biodegradation tests have been carried out on the notified polymer. However, a similar diester/disalt from the notifier containing side chains of, on average, lower molecular weight than the notified polymer has been tested for ready biodegradability using a modified MITI test. This material attained an average of 38% degradation after 28 days, and cannot be considered as readily biodegradable. Therefore, it is likely the notified polymer is not readily biodegradable, but it would be expected to be inherently biodegradable and not highly persistent.

The relatively large molecular weight of the polymer indicates it will not readily cross biological membranes, and a low potential for bioaccumulation is predicted.

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological data were provided, which is acceptable for polymers of number-average molecular weight (NAMW) greater than 1 000 according to the Act.

The notifier's MSDS states that data obtained from similar materials indicates that the notified polymer is likely to be of low oral and dermal toxicity in rats and rabbits, respectively. Data from similar substances indicates that the notified polymer may cause eye irritation, but is not expected to be a primary skin irritant. No primary or analogue data is available on other toxicological parameters.

As the notified polymer has a molecular weight greater than 1 000, it is unlikely to readily cross biological membranes. However, the levels of low molecular weight species are quite high. While the levels of low molecular weight species in the imported product will be correspondingly high, the concentration of the notified polymer in the final metal working fluid will be less than 2%. Therefore levels of low molecular weight species will be correspondingly reduced.

The levels of residual monomers in the notified polymer are less than 5%. A number of these monomers are classified as hazardous according to Worksafe Criteria (1, 4). However the notified polymer would not be classified as hazardous based on the content of these residual monomers, as they are present at levels below those recommended for classification (1, 4).

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicity tests have been carried out on the notified polymer. The notifier has provided data for a similar diester/disalt, and an ester/salt which serve as a guide to the potential toxicity of the notified polymer. The results are summarised below.

Ecotoxicity Test Results

Chemical	*Species*	*Result (mg/L)*
Diester/disalt	Rainbow trout (*Oncorhynchus mykiss*)	96 hour LC_{50} = 1.2 [a]
Ester/salt	Sheepshead Minnow (*Cyprinodon variegatus*)	96 hour LC_{50} > 1000 [b]
Ester/salt	Fathead Minnow (*Pimephales promelas*)	96 hour LC_{50} = 330-3300 [c]

a) based on measured concentrations. b) based on nominal concentrations. c) Results of a range finding dispersion test

The chemical corresponding most with the notified polymer is the diester/disalt. While its backbone appears the same as the notified polymer, the side chains associated with the polymer are, on average, of less molecular weight than the side chains for the notified chemical. During testing with this chemical, sublethal effects at concentrations greater than 1 ppm were observed, including swimming at the surface and bottom of test vessels, loss of equilibrium and the presence of moribund fish.

The notified polymer is a diester/disalt. The results of the ester/salt tests showing markedly reduced toxicity are not considered to be relevant to the notified polymer. This chemical differs significantly in molecular structure and chemistry.

For the purpose of this assessment, based upon the test of the diester/disalt to fish, it will be assumed that the notified polymer is highly to moderately toxic to fish. The counter ion is an ammonium group containing a labile hydrogen. Aliphatic amines exhibit acute toxicity to aquatic organisms because they are self-dispersing and form micelles in water as detergents do. Cationic surfactants (most commonly quaternary ammonium compounds) are considered the most toxic class of surfactants, with algae assumed to be the most sensitive species during acute exposure, and fish and aquatic invertebrates the most sensitive during chronic exposure (5).

The polymer contains carboxylic acid groups on one end, which carry a negative charge. It is possible this will possess the properties of an anionic surfactant. Information on toxicity of anionic surfactants in the literature is limited. However, all surfactants are assumed to have parabolic structure-activity relationships, whereby toxicity is a function of the size of the hydrophobic component to the hydrophilic component (5). Generally, when the hydrophobic component becomes larger than the hydrophilic component (as with this polymer), toxicity decreases (5).

No data on algae or aquatic invertebrates are available for the notified polymer or closely related substances.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

There will be 8 to 10 end user sites spread around the country. This substance is most likely to be used by big lathing and engine companies, and country use is highly unlikely. Exposure to the aquatic system will predominantly occur through discharge of the aqueous phase of the emulsion which will contain less than 1% of the imported notified polymer. While discharge to sewer is unlikely during end use,

as a worst case, we will assume total release during end use of 5% of the import volume, to allow for inappropriate disposal of waste material.

The following predicted environmental concentration (PEC) has been calculated:

Average quantity used per plant (up to 10 tonnes @ 8 plants)	1 250 kg
Average daily use (260 days per annum of use)	4.8 kg
Release to sewer from discharge of aqueous waste from emulsion (1%)	48 g
Release to sewer during end use (5%)	240 g
Total release to sewer per day	288 g
Sewer output per day	250 ML
Concentration in sewer	1.15 ppb
Dilution in receiving waters	10
PEC in receiving waters	**0.1 ppb**

This is several orders of magnitude below the expected worst environmental effects concentration in the order of 1 ppm for fish for a related polymer. While this assumes no removal of the polymer within the sewage treatment plant (STP), in reality, due to the charged nature of the polymer and the high partition coefficient, removal in the STP would be expected to be high, thereby lowering the PEC in receiving waters further. Overall, quaternary ammonium compounds removal in wastewater treatment should generally exceed 90% (6). As a class, quaternary ammonium compounds sorb strongly and rapidly to suspended solids (6), and the presence in receiving waters of sediments, organic carbon and humic acid would result in further binding of the polymer, reducing further its bioavailability and aquatic toxicity.

All practical measures should be taken to prevent the notified polymer entering aquatic systems. The MSDS contains adequate instructions for clean up and disposal of spills.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The occupational health risk posed to waterside and transport workers is minimal, given the expected low exposure under normal working conditions.

There is a low occupational health risk for workers who will be handling relatively large amounts of Lubrizol 5620 (which contains the notified polymer at a high concentration) when infrequent reformulating of metal working fluids is required on site. Based on information provided by the notifier, irritation may result if ocular exposure occurs, and the levels of low molecular weight species in the concentrated product indicate that absorption of the polymer may occur if dermal contact occurs.

There is also a low occupational health risk posed to workers using metal working fluids containing the notified polymer at concentrations up to 2%. Exposure via inhalational, ocular and dermal routes is likely, and workers may be exposed frequently while using machinery. As discussed above, eye irritation and/or dermal

absorption may occur, although the notifier indicates that engineering controls and personal protective equipment will be recommended to end users to minimise exposure.

Exposure to the mineral oil component of the metal working fluid may also occur, and the exposure standard for oil mists (5 mg/m^3, time weighted average) (7) should be observed in areas where metal working fluids are being used.

Given that the notified polymer will not be available to the general public, and there is only a minor potential for public exposure during use, transport and disposal of the notified polymer if accidentally spilt, it is unlikely that the notified polymer will pose a significant hazard to public health when used in the proposed manner.

13. RECOMMENDATIONS

To minimise occupational exposure to Z-31 the following guidelines and precautions should be observed:

- It is good work practice to wear industrial clothing which conforms to the specifications detailed in Australian Standard (AS) 2919 (8) and occupational footwear which conforms to Australian and New Zealand Standard (AS/NZS) 2210 (9) to minimise exposure when handling any industrial chemical;

- When handling the notified polymer in concentrated form, safety goggles should be selected and fitted in accordance with Australian Standard (AS) 1336 (10) to comply with Australian/New Zealand Standard (AS/NZS) 1337 (11) and impermeable gloves or mittens should conform to AS 2161 (12) should be worn;

- Spillage of the notified polymer should be avoided, spillages should be cleaned up promptly with absorbents which should then be put into containers for disposal;

- Good personal hygiene should be practised to minimise the potential for ingestion;

- A copy of the MSDS should be easily accessible to employees.

In addition, the Worksafe Australia document *Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards* (7) should be used as a guide in the control of workplace exposure to the mineral oil component of products containing the notified polymer, and appropriate personal protective equipment should be worn where necessary to minimise exposure to this substance.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the notified polymer was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (13).

This MSDS was provided by the applicant as part of the notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of the applicant.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Act, secondary notification of the notified polymer shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise.

Secondary notification should be requested if the notified polymer is to be used under different circumstances which may lead to increased exposure to the aquatic system, including inland use.

16. REFERENCES

1. National Occupational Health and Safety Commission 1994, *List of Designated Hazardous Substances [NOHSC:10005(1994)]*, Australian Government Publishing Service, Canberra.

2. Organisation for Economic Co-operation and Development 1995-1996, *OECD Guidelines for the Testing of Chemicals on CD-Rom*, OECD, Paris.

3. European Commission 1996, *Technical Guidance Document in Support of Commission Directive 93/67/EEC on Risk Assessment for New Notified Substances and Commission Regulation (EC) No 1488/94 on Risk Assessment for Existing Substances. Part IV*, ECSC-EC-EAEC, Brussels, 672-673.

4. National Occupational Health and Safety Commission 1994, *Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1994)]*, Australian Government Publishing Service, Canberra.

5. Nabholz, J.V., Miller, P. & Zeeman, M. 1993, 'Environmental Risk Assessment of New Substances under the Toxic Substances Control Act Section Five', in *Environmental Toxicology and Risk Assessment, American Society for Testing and Materials*, ASTM STP 1179, Philadelphia, pp. 40-55.

6. Boethling, R. & Lynch, D. 1992, 'Quaternary Ammonium Surfactants', in *Handbook of Environmental Chemistry*, pp. 145-177.

7. National Occupational Health and Safety Commission 1995, 'Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment, [NOHSC:1003(1995)]', in *Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards*, Australian Government Publishing Service, Canberra.

8. Standards Australia 1987, *Australian Standard 2919-1987, Industrial Clothing*, Standards Association of Australia, Sydney.

9. Standards Australia/Standards New Zealand 1994, *Australian/New Zealand Standard 2210-1994, Occupational Protective Footwear*, Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.

10. Standards Australia 1994, *Australian Standard 1336-1994, Eye protection in the Industrial Environment*, Standards Association of Australia, Sydney.

11. Standards Australia/Standards New Zealand 1992, *Australian/New Zealand Standard 1337-1992, Eye Protectors for Industrial Applications*, Standards Association of Australia/Standards Association of New Zealand, Sydney/Wellington.

12. Standards Australia 1978, *Australian Standard 2161-1978, Industrial Safety Gloves and Mittens (excluding electrical and medical gloves)*, Standards Association of Australia, Sydney.

13. National Occupational Health and Safety Commission 1994, *National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]*, Australian Government Publishing Service, Canberra.