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**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION  
AND ASSESSMENT SCHEME**

**FULL PUBLIC REPORT**

**Esterified Polymer in Lubrizol®7653**

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 and the assessment of public health is conducted by the Department of Health and Family Services.

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Director  
Chemicals Notification and Assessment

**FULL PUBLIC REPORT****Esterified Polymer in Lubrizol®7653****1. APPLICANT**

Lubrizol International Inc. of 28 River Street SILVERWATER NSW 2141 has submitted a notification statement accompanying their application for assessment of a synthetic polymer of low concern, Esterified Polymer in Lubrizol®7653

**2. IDENTITY OF THE POLYMER**

Esterified Polymer in Lubrizol®7653 meets the definition of a Polymer of Low Concern under the Act, and is not considered to be hazardous according to criteria of the National Occupational Health and Safety Commission (NOHSC). Therefore the chemical name, molecular formula, structural formula, molecular weight, spectral data, monomer identity and formulation details have been exempted from publication in the full public report.

**Other Name(s):** esterified polymer in Lubrizol® 7653

**Trade Name(s):** esterified polymer in Lubrizol®7653

**Number-Average Molecular Weight:** > 10 000

**Maximum Percentage of Low Molecular Weight Species (Polymers and Oligomers) (Molecular Weight < 1 000):** < 5 %  
**(Molecular Weight < 500):** ~ 2 %

**Means of Identification (List of Spectral Data Available):** data from ultraviolet/visible (UV/Vis) spectrophotometry, infrared (IR) and proton nuclear magnetic resonance (NMR) spectroscopy, and gel permeation chromatography (GPC)

**3. PHYSICAL AND CHEMICAL PROPERTIES**

**Appearance at 20°C and 101.3 kPa:** viscous dark amber liquid (note: the polymer is manufactured as a solution in mineral oil)

**Melting Point:** not applicable

<b>Specific Gravity:</b>	0.95 (estimated)
<b>Water Solubility:</b>	18.65 mg.L <sup>-1</sup> at 20°C
<b>Hydrolysis as a Function of pH:</b>	not determined (see comments below)
<b>Flammability Limits:</b>	the polymer is expected to be non-flammable
<b>Autoignition Temperature:</b>	not determined
<b>Explosive Properties:</b>	the polymer does not contain any functional groups associated with explosive properties
<b>Reactivity:</b>	stable under normal storage conditions
<b>Particle Size Distribution:</b>	not applicable

#### **Comments on Physico-Chemical Properties**

The water solubility was determined on the oil free fraction of the polymer material. This seems surprisingly high, but the partial neutralisation of the free carboxylic acid moieties of the polymer would assist in solubilising part of the polymer.

The polymer contains ester linkages which could potentially hydrolyse in the environmental pH range, particularly under alkaline conditions. Product information supplied with the notification indicates that the polymer can be mixed with vegetable oils to produce biodegradable hydraulic fluids. Hydrolysis is a major pathway in biodegradation suggesting that hydrolysis will occur under environmental conditions. However, no indication of the rate of degradation is given and it is likely to be slow at ambient temperature.

#### **4. PURITY OF THE CHEMICAL**

##### **Maximum Weight-Percentage of Residual Monomers and Impurities**

Because of the difficulty involved in the removal of residual monomers and other impurities from the sample, the substance has not been tested to determine the exact amount of residual monomers and impurities. The notifier has supplied a high speed GPC calibrated towards the determination of molecular weight species less than 1 000 which provides a value of 3.5% for the combined total of low molecular weight polymers, residual monomers and other impurities. Although there are some monomers of concern, their residuals are not likely to be present in concentrations exceeding the cut-off concentrations prescribed by the National Occupational Health and Safety Commission. Especially in light of the proportion of these monomers in the polymer formulation, the nature of the final polymer and the low level of species with molecular weight less than 500.

## 5. USE, VOLUME AND FORMULATION

The notified polymer will not be manufactured in Australia. It will be imported into Australia as a component in products, for example Lubrizol® 7653 in sealed 205 L drums. Import volumes of the notified polymer are expected to be:

Year	1	2	3	4	5
Import Volume (tonnes)	2	4	4	4	4

Products containing the notified polymer are expected to be formulated primarily into hydraulic lubricants by three customers covering six blending locations in Australia.

## 6. OCCUPATIONAL EXPOSURE

Minimal worker exposure is expected during transport of the drums containing the notified polymer in products such as Lubrizol® 7653 to the blending facilities of the various companies receiving the product. Blending is a simple process of mixing with, for example, vegetable oil to give the final fluid containing the notified polymer at less than 5%. The formulated fluid is filled into either 20 L or 205 L drums and sold to end users. It is expected that the blend operation is highly automated process using dedicated tanks and transfer lines. Likewise, the transfer of the blended product to the appropriate packaging is expected to be highly automated. Accordingly, worker exposure to the notified polymer is expected to be negligible. However, there is some potential for worker exposure to the notified polymer during disconnection of transfer lines.

Worker exposure to the notified polymer in the finished hydraulic fluid product is expected only during replacement or replenishment of the fluid. If this is carried out under controlled conditions, by trained personnel, the chance of exposure to the notified polymer is likely to be negligible. Should worker exposure to hydraulic fluids occur during this process, exposure to the notified polymer will be limited by its low concentration in the fluid.

## 7. PUBLIC EXPOSURE

Minor public exposure may result from the disposal of unused hydraulic fluid, or accidental spillage of the polymer during 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 notifier states that the blending operations will be highly automated with minimum release to the environment. Material is pumped directly into the blending tanks. Diluent oil is used to flush the tank car and the flushings are added to the blend. Filling the blended product to drums is also thought to be fully automated. During use, the polymer is contained in a closed system.

Some environmental release can occur through reconditioning of the 205 L import drums. Where on-site waste water treatment plants are available, drums are collected and cleaned, with the washings sent to the plant before disposal. Otherwise, drums and residues are expected to be landfilled.

Hydraulic systems are noted to lose very little volume over the service life of the oil, and a very high proportion is available as waste oil when used in fixed machinery (1). Releases to the environment may occur if the machinery is not functioning properly. However, it is difficult to determine the amount that may be released in this way as the size of the hydraulic equipment is a factor.

Loss of notified polymer will also occur via regular maintenance and replacement. The volume of hydraulic fluid used per application ranges between 10 to 1 000 L which will be replaced at six monthly intervals. Again, it is difficult to estimate the volume released in this way due to several factors, such as the expertise of the worker and the conditions of the equipment. However, the notifier believes that minimal ("only a few drops") of the finished oil are likely to be lost per oil change.

Losses attributed to accidental spills of larger amounts are likely to be extensively adsorbed to soils or absorbent materials. They can be shovelled up or recovered by vacuum equipment and disposed of at an appropriate waste disposal facility. The notified polymer is unlikely to enter the aquatic environment due to its low water solubility, except when sorbed to eroded soil particles.

Waste oil is likely to account for the greatest level of environmental exposure of the notified polymer, and may be disposed of in two ways. Some customers may elect to drain the used oil and store it in a used oil container for later collection by a contractor. However, it is realistic to assume that smaller and more remote facilities may dispose of the oil by open burning, or other unapproved disposal to soil or water.

### **. Fate**

The majority of the notified polymer released to the environment would be via spillage of the hydraulic oil at either the servicing or during use. This material will be collected and then disposed of at an approved incineration facility. When used oil is not contaminated with water the notified polymer will be directly burned for fuel. Most used oils in Australia are sold as burner fuel to power stations, cement kilns, brick works, limeworks etc (2). The polymer in the oil will be destroyed during such burning, yielding water and oxides of carbon and nitrogen.

No results for the biodegradation of the notified polymer have been supplied which is acceptable for a PLC. The product information indicates that it is for blending with vegetable oils to produce a biodegradable hydraulic fluid. However, there is no indication of the rate of degradation. Bioaccumulation of the polymer is not expected as its large molecular size is likely to inhibit membrane permeability and prevent uptake during exposure (3).

## 9. EVALUATION OF TOXICOLOGICAL DATA

Although not required for polymers of low concern with a NAMW greater than 1000 according to the *Industrial Chemicals (Notification and Assessment) Act*, 1989, the notifier has provided the following toxicological data. The tests were carried out to OECD Test Methods.

### 9.1 Acute Toxicity

#### Summary of the acute toxicity of the esterified polymer in Lubrizol® 7653

<b>Test</b>	<b>Species</b>	<b>Outcome</b>	<b>Reference</b>
acute oral toxicity	rat	LD <sub>50</sub> > 10 000 mg.kg <sup>-1</sup>	(4)
skin irritation	rabbit	slight irritant	(4)
eye irritation	rabbit	non-irritant	(4)

#### 9.1.1 Oral Toxicity (4)

<i>Species/strain:</i>	rat/Sprague Dawley
<i>Number/sex of animals:</i>	6 animals for 5 000 mg.kg <sup>-1</sup> test, 4 animals for 10 000 mg.kg <sup>-1</sup> test
<i>Observation period:</i>	14 days
<i>Method of administration:</i>	stomach tube syringe; 50% of notified polymer in corn oil vehicle
<i>Clinical observations:</i>	not specified
<i>Mortality:</i>	nil
<i>Morphological findings:</i>	not specified
<i>Test method:</i>	similar to OECD guidelines (5)
<i>LD<sub>50</sub>:</i>	> 10 000 mg.kg <sup>-1</sup>
<i>Result:</i>	the notified chemical was of low acute oral

toxicity in rats

### 9.1.2 Skin Irritation (4)

*Species/strain:* rabbit/albino

*Number/sex of animals:* 6/sex not specified

*Observation period:* 72 hours

*Method of administration:* 0.5 mL solution of the notified polymer (in mineral oil) was applied to the skin of rabbits using occlusive dressing for 24 hours

*Draize scores:*

<b>Time after treatment (days)</b>	<b>Animal #</b>					
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>Erythema</b>						
1	0 <sup>a</sup>	1	1	0	0	0
3	1	0	0	0	0	2
<b>Oedema</b>						
1	0	0	0	0	0	0
3	0	0	0	0	0	0

<sup>a</sup> see Attachment 1 for Draize scales

*Test method:* similar to OECD guidelines (5)

*Result:* the notified chemical was a slight irritant to the skin of rabbits

### 9.1.3 Eye Irritation (4)

*Species/strain:* rabbit/New Zealand White

*Number/sex of animals:* 6/sex not specified

*Observation period:* 72 hours

*Method of administration:* 0.1 mL of notified polymer was instilled into one eye of each rabbit

*Test method:* similar to OECD guidelines (5)

*Comments:* no corneal, iridal or conjunctival effects noted

over the entire test

**Results:** the notified polymer was not irritating to the eyes of rabbits

## 9.2 Overall Assessment of Toxicological Data

The notified polymer is of low oral toxicity, with a LD<sub>50</sub> exceeding 10 000 mg.kg<sup>-1</sup>. It is a slight skin irritant, with the potential to cause erythema. However, the polymer is non irritating to the eye. These data confirm the classification of this polymer as a polymer of low toxicological concern.

## 10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

Although not required for polymers of low concern with a NAMW greater than 1000 according to the *Industrial Chemicals (Notification and Assessment) Act*, 1989, the notifier has provided the following ecotoxicological data. The tests were carried out to OECD Test Methods.

Species	Test	Concentrations <sup>a</sup> (mg.L <sup>-1</sup> )	Result (mg.L <sup>-1</sup> )	References
Fathead minnow	96 hour acute	0, 134, 216, 360, 600, 1 000	LC <sub>50</sub> > 1 000 NOEC = 250	(6)
Water Flea ( <i>Daphnia magna</i> )	48 hour acute	0, 4.2, 7.0, 12, 19, 32, 54, 90	EC <sub>50</sub> = 21 NOEC = 4.2	(7)
Activated sludge	3 h	0, 1, 100, 1 000, 10 000	EC <sub>50</sub> > 10 000	(8)

<sup>a</sup>Nominal concentrations.

The nominal concentrations of the notified polymer used in the ecotoxicity studies are well above the water solubility of the of the polymer. In the fish study the test media were cloudy white solutions with small beads of test substance observed on the surface of the water. An oily surface film of the test substance was observed in the water flea study. In both studies the amount of undissolved test substance increased in proportion to concentration.

In the 96-hour acute toxicity to fish test 5 and 10% mortality rates were observed in the control and 134 mg.L<sup>-1</sup>, respectively. No mortalities were observed at higher concentrations and those at low levels were attributed to disease rather than the effect of the polymer. A low percentage of test animals in the 48-hour acute toxicity to water fleas test were observed to be lethargic and some were trapped on the surface and resubmerged.

The ecotoxicity data provided for the polymer indicate that it is practically non-toxic to fish up to the limit of its solubility, slightly toxic to water fleas and does not inhibit the respiration of sewage microorganisms.



## **11. ASSESSMENT OF ENVIRONMENTAL HAZARD**

The notified polymer is unlikely to present a hazard to the environment at any stage of its use. Of the original quantity of the notified polymer imported (between 2-4 tonnes per annum in the first 5 years) it is expected that negligible amounts will be released from the blending sites.

Maintained machinery should have minimal leakage of hydraulic oils. The greatest exposure is likely to be during the infrequent changing of hydraulic fluids. The ultimate fate of most waste hydraulic oil is burner fuel for power stations, cement kilns, brick works, limeworks etc (2). Some may be disposed inappropriately by open burning, or other unapproved disposal to soil or water.

Any accidental spillage would be expected to sorb strongly to soils, and only reach the aquatic compartment if sorbed to eroded soil particles. Biodegradation in soils/water may be expected. Combustion of the notified product will produce oxides of carbon, nitrogen and hydrogen.

A low environmental hazard is expected through the use of this polymer.

## **12. ASSESSMENT OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY EFFECTS**

Esterified polymer in Lubrizol® 7653 has been notified as a synthetic polymer of low concern under section 23 for the purposes of section 24A of the Act. The polymer meets the criteria for a synthetic polymer of low concern specified in regulation 4A of the Act and can, therefore, be considered to be of low hazard to human health. The constituent monomers contain groups which when reacted form a polymer of NAMW greater than 10 000 which contains no chemically reactive side chains. This structure ensures low aqueous solubility and reduces the likelihood of the notified polymer entering biological systems. Although the total level of unreacted monomers is unknown, GPC analysis has shown that approximately 2% of the polymer is constituted by species with molecular weight less than 500. Hence it is likely that the residual monomer contents, especially those residual monomers of concern are likely to be below the cut-off concentrations prescribed by the National Occupational health and Safety Commission.

Given the non-hazardous nature of the polymer, and that worker exposure during handling and storage is only likely in the event of an accidental spill, the risk to workers is negligible. Likewise, the risk to workers involved in the blending of the additive with vegetable oil to make the final hydraulic oil product is negligible since worker exposure is minimised by the highly automated nature of the blending facilities. Workers may be exposed to the notified polymer during disconnection of transfer lines, however the risk of adverse health effects is likely to be low given the short duration of exposure and the minimal hazard of the notified polymer.

There is potential for worker exposure (predominantly by the dermal route) to the

notified polymer during replacement/replenishment of hydraulic fluids. The notifier states that in general this will be carried out by trained personnel, with loss of “only a few drops”. Greater exposure to hydraulic fluid may occur should these operations be carried out by less competent persons, however the risk due to contact with the notified polymer is likely to be low on account of its low concentration, the irregularity of contact, and the low toxicological concern of the polymer.

Exposure of the public to the notified polymer may occur through accidental spill during transportation of the oil additive or finished hydraulic oil product, or careless disposal of used hydraulic oil. Nevertheless the risk to human health through exposure to the notified polymer is likely to be low based on the facts discussed in the previous paragraph.

## **12. RECOMMENDATIONS**

To minimise occupational exposure to the esterified polymer in products such as Lubrizol® 7653 the following guidelines and precautions should be observed:

Spillage of the oil additive package and final oil products containing the notified polymer should be avoided, and 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 Material Safety Data Sheet (MSDS) should be easily accessible to employees.

## **13. 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* (9).

This MSDS was provided by the notifier 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 notifier.

## **14. REQUIREMENTS FOR SECONDARY NOTIFICATION**

Under the Act secondary notification of Esterified Polymer in Lubrizol® shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

## **15. REFERENCES**

1. Macpherson, E. *Minimising the Environmental Impacts of Oil*. in *Proceedings of the Used Oil Management Conference*. 1997. Brisbane.
2. Fortesque G. *Used Oil - Collection, Processing and Disposal*. in *Proceedings of the Used Oil Conference*. 1997. Brisbane.

3. Gobas, F.A.P.C., Opperhuizen, A. & Hutzinger, O. 1986, 'Bioconcentration of hydrophobic chemicals in fish: relationship with membrane permeation', *Environmental Toxicology and Chemistry*, vol. 5, pp. 637-646.
4. Swan C B 1970, , Project no., 0052064, WARF Institute Inc., Madison, Wisconsin.
5. Organisation for Economic Co-operation and Development 1995-1996, *OECD Guidelines for the Testing of Chemicals on CD-Rom*, OECD, Paris.
6. Morris RG Holmes CM Martin KH and Swigert JP , *A 96-hour Static-Renewal Acute Toxicity Test with the Fathead Minnow (Pimaphales promelas)*, Project no., 331A-121, Wildlife International Ltd, Easton Maryland USA
7. Conner BP Morris RG Martin KH and Swigert JP 1994, *A 48-hour Static Acute Toxicity Test with the Cladoceran (Daphnia magna)*, Project no., 331A-122B, Wildlife International Ltd, Easton, Maryland, USA
8. Goodrich MS 1994, *The Effect of Lubrizol OS#24734Y on the Respiration of Activated Sludge (expanded range assessment)*, Project no., 109312, Woodward-Clyde Consultants, Franklin, Tennessee, USA.
9. 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.

## Attachment 1

The Draize Scale for evaluation of skin reactions is as follows:

<b>Erythema Formation</b>	<b>Rating</b>	<b>Oedema Formation</b>	<b>Rating</b>
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 for evaluation of eye reactions is as follows:

### **CORNEA**

<b>Opacity</b>	<b>Rating</b>	<b>Area of Cornea involved</b>	<b>Rating</b>
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**

<b>Redness</b>	<b>Rating</b>	<b>Chemosis</b>	<b>Rating</b>	<b>Discharge</b>	<b>Rating</b>
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**

<b>Values</b>	<b>Rating</b>
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