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October 2001

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Z-45

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Director
Chemicals Notification and Assessment

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1. APPLICANT

Lubrizol International, Inc. (ACN 002 747 944) of 28 river Street, SILVERWATER NSW 2128 has submitted a standard notification statement in support of their application for an assessment certificate for Z-45.

2. IDENTITY OF THE CHEMICAL

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

Other Names:	OS144265
Marketing Name:	Z-45
Method of Detection and Determination:	Infrared (IR), ultraviolet (UV) and nuclear magnetic resonance (NMR) spectroscopy.
Spectral Data:	IR, UV and NMR spectra were provided.

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C & 101.3 kPa:	Clear, slightly yellowish liquid.
Boiling Point:	241°C at 101.46 kPa
Specific Gravity:	1.02 at 20°C
Vapour Pressure:	$< 1.8 \times 10^{-7}$ kPa at 25°C
Water Solubility:	Amine component: - loading concentration 5.50 g/L, 2.14 g/L actual solubility - loading concentration 28.5 g/L, 6.46 g/L actual solubility Phosphate ester mix: - loading concentration 5.50 g/L, 0.838 g/L actual solubility phosphorous and 0.938 g/L sulphur

	- loading concentration 28.5 g/L, 2.59 g/L actual solubility phosphorous and 2.82 g/L sulphur
Partition Co-efficient (n-octanol/water):	Amine component, log P_{ow} = 0.76 Phosphate ester mix: - Phosphorous, log P_{ow} = 1.10 sulphur, log P_{ow} = 2.02
Hydrolysis as a Function of pH:	Not determined.
Adsorption/Desorption:	Range for components 2.81-11.2 (Estimation log K)
Dissociation Constant:	Not determined.
Flash Point:	88 ± 2°C
Particle Size:	Not applicable for liquids.
Flammability Limits:	Not determined.
Autoignition Temperature:	290 ± 5°C
Explosive Properties:	The chemical is not expected to be explosive.
Reactivity/Stability:	The chemical is not an oxidizer. The amine component of the test material would be expected to be stable in aqueous media. Based on differential scanning calorimetry, Z-45 is thermally stable.

3.1 Comments on Physico-Chemical Properties

All tests were performed by Safepharm Laboratories Ltd (Safepharm Laboratories, 2000a, 2000b).

The vapour pressure provided was determined using a vapour pressure balance and Method A4 of Commission Directive 92/69/EEC. Linear regression analysis was used to calculate vapour pressure at 25°C. The low value determined indicates that the notified chemical is classified as being slightly volatile.

The water solubility was determined using the column elution method detailed in Method A6 of Commission Directive 92/69/EEC. Z-45 consists of two main components, a phosphate ester mix and a hexyl amine, thus the water solubility of each component was analysed separately after centrifugation and filtration of the sample solutions which had been shaken for 48 hours and stood for 24 hours. It was found that the solubility of the components varied with nominal concentration. Overall, the water solubility would be considered significant in environmental terms.

The hydrolysis as a function of pH and dissociation constant were not determined due to the

complex nature of the notified chemical. The phosphate ester is not likely to hydrolyse in the environmental pH range 4-9.

The partition coefficient has was determined using the shake-flask method detailed in Method A8 of Commission Directive 92/69/EEC. Overall, the results indicate that the components of the notified chemical would tend to be hydrophilic although both components may have surfactant properties under aqueous conditions.

A test for adsorption/desorption could not be performed because of the chemical nature and complexity of the notified chemical. Estimation of the adsorption coefficients of the individual components in the chemical was carried out using PCKOCWIN version 1.666, SRC_PCKOC for Microsoft Windows software package. The estimated log Koc range was from 2.81 to 11.2. The notified chemical is therefore not likely to be mobile in soils though the results are in apparent conflict with those for the partition coefficient.

The notified chemical is an organic salt and both the phosphate ester anion component and the amine containing cation will remain dissociated in the environmental pH range of 4-9 due to the strong acidic properties.

4. PURITY OF THE CHEMICAL

Degree of Purity: High.

Hazardous Impurities: The impurity is unidentified.

Non-hazardous Impurities (> 1% by weight): The impurity is unidentified

Additives/Adjuvants: None

5. USE, VOLUME AND FORMULATION

The chemical Z-45 is an additive intended for use in the manufacture and formulation of chemicals in the lubricant additive industry, specifically gear oil formulations. It will be formulated with other chemicals to product a “concentrate” or “additive package”. This concentrate would be the form in which the notified chemical would be imported into Australia. Z-45 would typically be present in the concentrate at 10 to 20 weight percent. This product would then be processed by dilution with oil and possibly other components to make the final lubricant. Z-45 would typically be found in the final finished lubricant at 0.5 to 1.25 weight percent.

Z-45 will be imported at less than 100 tonnes per annum for the first 5 years in 205 L drum or 40000 L isotainers.

6. OCCUPATIONAL EXPOSURE

As the vapour pressure of the notified chemical is very low, skin contamination would be the

main route of occupational exposure. Eye exposure is possible from spills and secondary transfer from hands. Inhalation exposure may occur if oil mist is generated.

The notifier was unable to provide details of the customers and the exact nature of the oil blending facilities. The following description is typical of oil blending operations in Australia.

Transport and Storage

The notified chemical will be imported into Australia in steel drums and bulk isotainers. The drums or isotainers would then be transported to customer sites by truck or rail. Exposure to the notified chemical during transport or storage is unlikely except in the case of accidental spillage.

Blending and Packaging

At the blending site, the concentrate product containing the notified chemical is decanted from drums or isotainers into a storage tank from which it is pumped into a blend tank. Small samples are typically taken for QC testing prior to a shipment being accepted from the notifier. The additive package is formulated into gear oil products by mixing with oil(s) and other additives or additive packages. The blend facility is a fully automated closed system. The final products resulting from this blending process will contain 0.5 to 1.25% Z-45. Dermal contamination from residues in pump lines and on drum bungs may occur when workers connect and disconnect the pump lines. However, dry couplings are typically used. The opportunity exists for exposure when cleaning up spills or leaks and during machine maintenance. The equipment does not require cleaning after each batch as residue is left for next blend. Clearing of lines or tanks is generally accomplished by flushing with baseoil. There will be negligible occupational exposure during the fully automatic and closed blending process.

After blending, the final products containing the notified chemical will be packaged into containers ranging from 1 to 205 litres. The packaging facility is usually located near the blend operation. Equipment can be automated but the tanks can also be unloaded using a drum spear and the operator can receive substantial dermal exposure while manually replacing the drum bung under the still dripping outlet. Occupational exposure during packaging can also occur from broken packages or overflow.

Batch sizes typically range from 1000 to 50000 L of final product per batch. Each batch will involve 1 to 2 formulators for approximately 3 hours, and 2 to 3 packers for 2 to 5 hours. Blending and packaging facilities are expected to be well ventilated, and all workers have the opportunity to wear safety glasses or face shields, long sleeved shirts, apron and nitrile or neoprene gloves.

End use

The final products contain up to 1.25% of the notified chemical. Gear oil is factory filled on new vehicles and is designed to last for the life of the vehicle. It usually does not need to be changed. If, for some reason, a gear oil change is required, it will be done by repair shop technicians. Accidental spillage during factory fill or at a repair shop is expected to be minimal. Used gear oil for disposal is expected to be collected by a licensed contractor and

sent for recycling or incineration.

7. PUBLIC EXPOSURE

In Australia, the public may have contact with spilled concentrate following an accident with respect to unloading at the arrival wharf, transport by road or rail, or at a blending facility. In the event of a spill, the liquid should be collected for recycling and/or disposal by incineration. It may be absorbed on inert material. Public contact with gear oil as a final blended product may occur in similar accidental ways but the smaller volumes of oil involved and the lower concentration of Z-45 are likely to mean a lesser exposure.

Gear encasements on vehicles are filled with the final blended product during the manufacture of the vehicles. The oil is intended to last for the lifetime of the vehicle. The blended oil will only be available to vehicle manufacturers and trained technicians at repair shops. The rebuilding of gears and encasements is not a routine domestic procedure and contact with the oil by home enthusiasts will be limited. The usage pattern for the concentrate and the gear oil indicate that public exposure is likely to be limited and infrequent.

8. ENVIRONMENTAL EXPOSURE

8.1 Release

There will be three main sources of release of the notified chemical: accidental spills, processing and end-use.

It is likely that less than 1% will be lost due to accidental spills during formulation or end-use. Any spilt material is likely to be collected with absorbent material and disposed of in the appropriate manner and there is the possibility that some of the notified chemical may enter stormwater and ultimately the aquatic environment.

Typically the blending and filling equipment will be cleaned with oil and these washings will be used in the formulation of the next batch or another oil blend. Release would only occur via accidental spillage and would be recycled or collected for incineration. Any Z-45, expected to be less than 1% (less than 1000 kg maximum), remaining in the import containers will be washed with mineral oil prior to disposal.

The gear oil containing the notified chemical will be used by trained tradespeople generally in a car factory and the likelihood of spills will be minimal. Gear oil is designed to last the life of the vehicle and is unlikely to be changed. However, any removed gear oil should be disposed of appropriately and there should be negligible release from these professional activities. Any material that is released is likely to become associated with soils or sediments.

It is estimated that less than 1% of gear oil will remain in user containers. The containers will be sent to licensed waste contractors, where they will be cleaned and the oil disposed of appropriately. This would account for less than 200 kg of the notified chemical.

As gear oil is designed to last the life of the vehicle, the majority of the notified chemical imported will be disposed of with the car containing it. Cars may be disposed of either to

landfill, in which case the gear oil containing the notified chemical would ultimately become associated with the soil, or to scrap yards. If the latter, the oil and notified chemical will ultimately be disposed of via incineration in the metal reclamation process.

Since the lubricating oils will be used throughout Australia, all releases resulting from use or disposal of used oil will be diffuse, and release of the notified chemical in high concentrations is unlikely except as a result of transport accidents.

8.2 Fate

A biodegradation study was conducted using the notified chemical according to OECD TG 301B – Ready Biodegradability; CO_2 Evolution Test (Safepharm Laboratories, 2000c). From the result of the test, the notified chemical cannot be considered to be readily biodegradable as it failed to satisfy the 10-day window criterion whereby 60% degradation must be attained within 10 days of the degradation exceeding 10%. However, despite the low apparent rate of biodegradation, it is expected that if placed into landfill the material would slowly degrade through the biological and abiotic processes operative in these facilities. These processes could be expected to produce carbon dioxide, nitrogen dioxide, phosphorus, methane and water.

Incineration of waste oil containing the notified chemical would destroy the substance with evolution of water vapour and oxides of carbon. Sludges from waste treatment plants or oil recycling facilities could also be incinerated.

The notified chemical is not readily biodegradable which indicates that it may have the potential to bioaccumulate (Connell, 1990). This potential is expected to be moderated by the high water solubility, low log Pow (< 2) and the inherent biodegradability.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Toxicity

Summary of the acute toxicity of Z-45

Test	*Species*	*Outcome*	*Reference*
acute oral toxicity	rat	LD50 > 2000 mg/kg	(Safepharm Laboratories, 2000d)
acute dermal toxicity	rat	LD50 > 2000 mg/kg	(Safepharm Laboratories, 2000e)
skin irritation	rabbit	slight to moderate irritant	(Safepharm Laboratories, 2000f)
eye irritation	rabbit	slight to moderate irritant	(Safepharm Laboratories, 2000g)
skin sensitisation	guinea pig	skin sensitiser	(Huntingdon Life Sciences 1999)

9.1.1 Oral Toxicity (Safepharm Laboratories, 2000d)

Species/strain:	rat/ Sprague-Dawley.
Number/sex of animals:	3/sex treated at 2000 mg/kg.
Observation period:	14 days
Method of administration:	Gavage, using arachis oil as vehicle.
Test method:	OECD TG 423
Mortality:	None.
Clinical observations:	None.
Morphological findings:	None.
LD_{50}*:*	> 2000 mg/kg.
Result:	The notified chemical was of very low acute oral toxicity in rats.

9.1.2 Dermal Toxicity (Safepharm Laboratories, 2000e)

Species/strain:	rat/ Sprague-Dawley.
Number/sex of animals:	5/sex
Observation period:	14 days.
Method of administration:	Under semi-occluded gauze dressing for 24 hours, dose 2000 mg/kg.
Test method:	OECD TG 402
Mortality:	None.
Clinical observations:	None.
Morphological findings:	None.

Draize scores: All scores zero.

LD_{50}*:*	> 2000 mg/kg.
Result:	The notified chemical was of low acute dermal toxicity in rats.

9.1.3 Inhalation Toxicity

No data provided.

9.1.4 Skin Irritation (Safepharm Laboratories, 2000f)

Species/strain: rabbit/New Zealand White (NZW).

Number/sex of animals: 2 males/ 1 female.

Observation period: 14 days.

Method of administration: 0.5 mL, single, 4-hour, semi-occluded application.

Test method: OECD TG 404

Draize scores:

Time after treatment (days)	***Animal***		
	1	***2***	***3***
Erythema			
1 hour	1[a]	2	2
1	1	1	2
2	0	1	1
3	0	1	1[b]
7	0	0[c]	0[c]
14	0	0	0
Oedema			
1	1	1	1
1	0	0	1
2	0	0	0
3	0	0	0
7	0	0	0
14	0	0	0

[a] see Attachment 1 for Draize scales; [b] loss of skin elasticity; [c] moderate desquamation

Mean Scores (24 – 72 hours)

	1	***2***	***3***
Erythema	0.3	1.0	1.3
Oedema	0	0	0.3

Result: The notified chemical was a slight to moderate irritant to the

skin of rabbits.

9.1.5 Eye Irritation (Safepharm Laboratories, 2000g)

Species/strain: rabbit/NZW.

Number/sex of animals: 3 males.

Observation period: 7 days.

Method of administration: 0.1 mL instilled into one eye of each animal.

Test method: OECD TG 405

Draize scores:

Animal	***1 hour***			***1 day***			***2 days***			***3 days***		
Cornea	***o***		***a***	***o***		***a***	***o***		***a***	***o***		***a***
1	0		0	0		0	0		0	0		0
2	0*		2	1		1	0		0	0		0
3	0*		2	1		1	0		0	0		0
Iris												
1	0			0			0			0		
2	1			1			0			0		
3	0			0			0			0		
Conjunctiva	***r***	***c***	***d***	***r***	***c***	***d***	***r***	***c***	***d***	***r***	***c***	***d***
1	2[1]	1	2	1	0	0	0	0	0	0	0	0
2	2	2	3	2	2	2	1	1	0	1	1	0
3	2	2	2	2	1	1	1	0	0	0	0	0

[1] see Attachment 1 for Draize scales; * dulling of the normal lustre of corneal surface
o = opacity a = area r = redness c = chemosis d = discharge

Comment: Rabbit number 2 was observed at the 7 day time point and Draize scores were all zero.

Result: The notified chemical was a slight to moderate irritant to the eyes of rabbits.

9.1.6 Skin Sensitisation (Huntingdon Life Sciences 1999)

Species/strain: guinea pig/Dunkin-Hartley.

Number of animals: 20 test/10 control animals.

Induction procedure:

test group:

day 1 — Pairs of intradermal injections (0.1 mL) to the scapular region as follows:
- Freund's Complete Adjuvant (FCA), 1:1 in water;
- Z-45, 1% in Alembicol D;
- Z-45, 1% in FCA, 1:1 in Alembicol D.

day 8 — 100% Z-45 under occlusive patch for 48 hours.

control group: Treated similarly to the test animals except that the test substance was omitted from the intradermal injections and the topical application.

Challenge procedure:

day 22 — Topical application on the flank of Z-45, 25% and 12.5% in Alembicol D for 24 hours under occlusive dressing. Control animals treated similarly except that the test substance was omitted from the topical application.

Test method: OECD TG 406

Challenge outcome:

Challenge concentration	***Test animals***			***Control animals***		
	24 hours*	***48 hours***	***72 hours***	***24 hours***	***48 hours***	***72 hours***
12.5%	0/20**	1/20	1/20	0/10	0/10	0/10
25%	7/20	15/20	15/20	0/10	0/10	0/10

* time after patch removal
** number of animals exhibiting positive response ie grade 2 erythema (see comments below)

Comment: A total of 7 out of 10 control animals exhibited grade 1 erythema. Therefore, test animals which exhibited only this level of erythema were not considered to be positive.

Result: The notified chemical was sensitising to the skin of guinea pigs.

9.2 Repeated Dose Toxicity (Safepharm Laboratories, 2001)

Species/strain: rat/ Sprague-Dawley.

Number/sex of animals: 5/sex/dose group and 5/sex in the two recovery groups.

Method of administration: The notified chemical in Arachis oil was administered for 28 consecutive days at the following concentrations:

dose (mg/kg/day)	group	14-day recovery
0	control	yes
15	low	no
150	intermediate I	no
500	intermediate II	no
1000	high	yes

Dose/Study duration: Gavage (oral).

Test method: OECD TG 407

Bodyweight and Food consumption
Reduced body weight gain observed in high dose males during weeks 1 and 2 correlated with reduced food consumption.

Clinical observations
High dose animals exhibited increased salivation up to 10 minutes after dosing together with red/brown staining and/or wetness of the external body surface and generalised fur loss. Hunched posture was apparent from day 6 with isolated or sporadic incidents of prolonged increased salivation, noisy or increased respiration, diuresis, abdominal extension and tiptoe gait. Signs regressed during recovery. The clinical signs seen in the intermediate dose groups were similar to those in the high dose group but at reduced incidence and severity.

Clinical chemistry/Urinalysis/Haematology

Clinical chemistry: Reduced plasma triglycerides was statistically significant in high dose males but was not statistically significant in high dose females.

Urinalysis: A statistically significant increase in urine volume was observed in females at the intermediate and high doses with a significant reduction in urine specific gravity at the high dose. Similar effects in males were not statistically significant.

Haematology: No treatment-related changes.

Macroscopic findings

No treatment-related abnormalities.

Organ weights
Liver weight relative to body weight was elevated in high dose animals and intermediate II males. It was also elevated for recovery males.

Histopathology

There was an increased incidence of minimal or slight centrilobular hepatocyte hypertrophy in the livers of males from all dose groups except for the recovery group.

Slight or moderate thyroid follicular epithelial hypertrophy was observed in intermediate II and high dose males. A minimal level was observed in a single male from the control, low and intermediate I dose groups. Minimal or slight levels were observed in 3 high dose females.

Comment

The observed clinical signs were ascribed to the test substance being unpalatable or slightly irritant. This was also suggested by the increased urine volumes at the high dose. An unpalatable substance may have caused the animals to increase water consumption although this was not measured quantitatively.

Increased relative liver weights, and the liver and thyroid histopathological observations were ascribed to adaptive changes and were not toxicologically significant.

Result
The No Observed Adverse Effect Level (NOAEL) is considered to be 500 mg/kg/day given that minimal liver and thyroid effects and minor clinical signs occurred at and below this dose.

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium* Reverse Mutation Assay (Safepharm Laboratories, 2000h)

Strains:	*S. typhimurium* TA 1535, TA 1537, TA 98 and TA 100; *Escherichia coli* WP2*uvrA*
Metabolic activation:	Phenobarbitone/ β-naphthoflavone-induced Sprague-Dawley rat liver S9 fraction.
Concentration range:	0, 15, 50, 150, 500, 1500 and 5000 microgram/plate. *E. coli* was not tested at 15 microgram/plate.
Test method:	OECD TG 471
Comment:	The test substance produced an oily precipitate at and above 1500 microgram/plate. The most sensitive strain to the toxicity of the notified chemical was TA 1537 with which a weakening of the bacterial background lawn was observed at 1500 microgram/plate. All concentrations were tested in triplicate. Positive and negative controls responded appropriately. The negative solvent control was acetone and the positive controls in the absence of S9 fraction, N-ethyl-N'-nitro-N-nitrosoguanidine for *E. coli* WP2*uvr*A, TA 100 and TA 1535; 9-aminoacridine for TA 1537, 4-nitroquinoline-1-oxide for TA 98 and in the presence of S9 fraction, 2-aminoanthracene for all strains but TA 98 in which case

benzo(a)pyrene was used.

Result: The notified chemical was non mutagenic under the conditions of the test.

9.3.2 Chromosomal Aberration Assay in Chinese Hamster Lung (CHL) cells (Safepharm Laboratories, 2000i)

Cells: CHL cells.

Metabolic activation system: Phenobarbitone/ β-naphthoflavone-induced Sprague-Dawley rat liver S9 fraction.

Dosing schedule:

Metabolic Activation	*Experiment Number*	*Test concentration (μg/mL)*	*Controls*
-S9	1	treatment time = 6 hours, harvest time = 24 hours 0*, 4.88, 9.77, 19.53, 39.06*, 58.60*, 78.13 microgram/mL	Positive: mitomycin C, 0.1 microgram/mL
	2	treatment time = 24 hours = harvest time 0*, 2.44, 4.88, 9.77*, 19.53*, 29.29 39.06*, 78.12, 156.24 microgram/mL	Positive: mitomycin C, 0.05 microgram/mL
		treatment time = 48 hours = harvest time 0*, 2.44, 4.88, 9.77*, 19.53*, 29.29, 39.06*, 78.12, 156.24 microgram/mL	Positive: mitomycin C, 0.025 microgram/mL Negative for all cultures: acetone
+S9	1	treatment time = 6 hours, harvest time = 24 hours 0*, 4.88, 9.77, 19.53*, 39.06*, 78.13*, 117.19* microgram/mL	Positive: cyclophosphamide, 10 microgram/mL Negative: acetone
	2	treatment time = 6 hours, harvest time = 24 hours 0*, 19.53, 39.06*, 78.13*, 117.19, 156.25* microgram/mL	

* - cultures selected for metaphase analysis

Test method:	OECD TG 473
Comment:	The test material did not produce statistically significant increases in the incidence of chromosomal aberrations with or without S9.
Result:	The notified chemical was non clastogenic under the conditions of the test.

9.3.3 Micronucleus Assay in the Bone Marrow Cells of the Mouse (Safepharm Laboratories, 2000j)

Species/strain:	mouse/ CD-1
Number and sex of animals:	7 males per dose group.
Doses:	0, 30, 60 and 120 mg/kg.
Method of administration:	Intraperitoneal (IP) for treated groups, gavage (oral) for controls; vehicle: arachis oil.
Test method:	OECD TG 474
Comment:	For the IP-dosed mice, one group from each dose level was terminated 24 hours post-treatment; a second group dosed at 120 mg/kg was terminated at 48 hours. Two groups were administered the vehicle only by gavage and one group the positive control, cyclophosphamide at 50 mg/kg. There were no statistically significant decreases in the polychromatic/normochromatic erythrocyte ratio but clinical signs indicated systemic absorption had occurred. Positive controls responded appropriately.
Result:	The notified chemical was non clastogenic under the conditions of the test.

9.4 Overall Assessment of Toxicological Data

The notified chemical was of very low acute oral toxicity (LD50 > 2000 mg/kg), low acute dermal toxicity (LD50 > 2000 mg/kg) and no organ toxicity was observed in a 28-day repeated dose oral toxicity study in rats (NOAEL = 500 mg/kg/day).

The notified chemical was a slight to moderate skin irritant and a slight to moderate eye irritant in rabbits and was a skin sensitiser in guinea pigs. It was neither mutagenic in bacteria nor clastogenic in CHL cells (chromosomal aberration test) or mouse bone marrow cells (micronucleus test).

The notified chemical is determined to be a hazardous substance according to the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999) and is assigned the risk phrase R43: Sensitising to skin.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The following ecotoxicity data was supplied by the notifier.

Test	*Species*	*Results*
Acute Toxicity [OECD TG 203]	Rainbow Trout *Oncorhynchus mykiss*	LLR50 (96 h) = 56 mg/L WAF NOEC (96 h) = 32 mg/L WAF
Acute Immobilisation [OECD TG 202]	Water Flea *Daphnia magna*	EL50 (48 h) = 15 mg/L WAF NOEC (48 h) = 3.2 mg/L WAF
Reproduction Test [OECD TG 211]	Water Flea *Daphnia magna*	ECR50 (21 d) = 2.5 mg/L WAF NOEC (21 d) = 1.0 mg/L WAF
Growth Inhibition [OECD TG 201]	Algae *Scenedesmus subspicatus*	EbL50 (72 h) = 5.1 mg/L WAF ErL50 (0-72 h) > 6.4 mg/L WAF NOEC (72 h) = 0.8 mg/L WAF
Respiration Inhibition [OECD TG 209]	Activated Sewage Sludge	EC50 (3 h) = 560 mg/L NOEC (3 h) = 100 mg/L

* NOEC - no observable effect concentration

The ecotoxicity tests were performed on the Water Accomodated Fraction (WAF) of the notified chemical. The WAF was prepared by adding an amount of Z-45 to water to give the required loading rate and the resulting solution was then stirred for 23 hours. The mixture was allowed to stand for 1 hour prior to removal of undissolved test material by filtration then further diluted.

The tests on rainbow trout (Safepharm Laboratories, 2000k) were performed using a semi-static methodology in which test preparations were renewed daily to ensure that concentrations of test material were maintained near nominal and to prevent the accumulation of nitrogenous wastes. Observations were performed at 3, 6, 24, 48, 72 and 96 hours. The test was performed using ten specimen fish per loading rate at a temperature of 14ºC. The tests were conducted using a WAF of the test substance made up at nominal concentrations of 10, 18, 32, 56 and 100 mg/L. Mortalities after 24 hrs at 100 mg/L increased to 100% by day 3. Deaths were also observed at 56 mg/L after 72 hrs, with an overall death rate of 50% by the end of the study. The LLR50 (96 h) and NOEC (96 h) were determined to be 56 mg/L (WAF) and 32 mg/L (WAF) respectively.

Z-45 consists of two main components, a phosphate ester mix and a hexyl amine component. The test material was used as the analytical standard, therefore the concentration of each principal component was calculated using the whole weight of the test material. Analysis of the test media at 0 hrs indicated that the measured concentrations for the hexyl amine component in the nominal solutions were: 5.32, 11.1, 21.3, 37.0 and 68.9 mg/L. The

measured concentrations for the phosphate ester component were: below detection (BD), 2.04, 3.79, 4.48 and 4.99 mg/L. Over the study, the component concentrations were found to be stable.

The immobilisation tests with daphnia (Safepharm Laboratories, 2000l) were also performed under static conditions with observations at 24 and 48 hours. The test was performed in duplicate using 10 daphnids per flask at a temperature of 21°C. The tests were conducted using a WAF of the test substance made up at nominal concentrations of 1.0, 1.8, 3.2, 5.6, 10, 18, 32, 56 and 100 mg/L. After 48 h, immobilised daphnids were observed in the test vessels at 5.6 mg/L and above and 100% mortality was observed at 56 and 100 mg/L. The 48-hour EL50 for the notified chemical to *Daphnia magna* is 15 mg/L and the no observed effect concentration being 3.2 mg/L.

Analysis of the test media at 0 hrs indicated that the measured concentrations for the hexyl amine component in the nominal solutions were: 1.22, 2.69, 9.42, 27.2 and 96.1 mg/L for the nominal solutions of 1.0, 3.2, 10, 32 and 100 mg/L. The measured concentrations for the phosphate ester component were: 0.783, 1.23, 3.48, 5.23 and 4.88 mg/L. Over the study, the component concentrations were found to be stable.

The reproduction tests with daphnia (Safepharm Laboratories, 2000m) were performed for a period of 21 days. The test was performed on 10 replicates using 1 daphnid per flask at a temperature of 21°C. The tests were conducted using a WAF of the test substance made up at nominal concentrations of 0.1, 0.32, 1.0, 3.2 and 10 mg/L. 50% and 100% mortality were observed by 21 days in the 3.2 and 10 mg/L concentrations respectively. There was no apparent impairment on reproduction in the 0.1, 0.32 and 1.0 mg/L concentrations. The ECR50 was found to be 2.5 mg/L WAF based on mortality, while the no observed effect concentration being 1.0 mg/L WAF. The EL50 (immobilisation) for 21 days was 3.2 mg/L.

Analysis of the test media at 0 hrs indicated that the measured concentrations for the phosphate ester component in the nominal solutions were: BD, 0.124, 0.188, 0.786 and 1.74 mg/L. The measured concentrations for the hexyl amine component at day 7 were: BD, BD, 0.152, 1.19 and 6.80 mg/L. Over the study, the component concentrations were found to be stable.

Algae were exposed to the test substance at the nominal concentration of 0.2, 0.4, 0.8, 1.6, 3.2 and 6.4 mg/L for 72 hrs at 24˚C under constant illumination and shaking (Safepharm Laboratories, 2000n). Three replicate test flasks were prepared for each concentration. Samples where taken daily and cell counts made. No abnormalities were detected in all the concentrations except 6.4 mg/L, in which cell debris was observed. Both biomass or growth rate of *Scenedesmus subspicatus* were adversely affected by the test substance, giving an EbL50 (72 hrs) of 5.1 mg/L WAF, ErL50 (0-72 hrs) greater than 6.4 mg/L WAF and a NOEC (72 h) of 0.8 mg/L WAF.

Analysis of the test media at 0 hrs indicated that the measured concentrations for the hexyl amine component in the nominal solutions were: 0.261, 0.388, 0.659, 1.56, 2.69 and 4.38 mg/L. The measured concentrations for the phosphate ester component were: 0.0886, 0.255, 0.427, 0.562, 0.722 and 0.408 mg/L. In this study there was an overall increase in the measured concentrations of both components over 72 hours (the phosphate ester component increased to a range of 0.467-2.60 at 72 h). It is postulated that the increase in phosphate ester could be due to extra cellular enzyme activity. The variability in the hexyl amine were

considered to be due to analytical variability at low loading rates.

The influence of the notified chemical on the respiration rate of activated sludge was investigated according to OECD TG 209 (Safepharm Laboratories, 2000o). The concentrations studied were 100, 180, 320, 560 and 1000 mg/L with an incubation period of 3 hours. The temperature, pH and oxygen concentration were measured and a reference substance (3,5-dichlorophenol) was used. A large increase in respiration rate was observed in the test vessels after 30 mins, possibly due to an initial hormetric response of the activated sewage sludge to the test material, ie the stimulation of biological processes by the test material. Oil globules were observed on the surface or dispersed throughout the test media at all concentrations at various times throughout the test period. The validation criteria for the control and reference material were satisfied so the test was concluded to be valid.

From the ecotoxicity data, it appears that the notified chemical shows some toxicity below the limit of water solubility. It is slightly toxic to fish and daphnia, moderately toxic to algae but practically non-toxic to sewage bacteria.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The environmental hazard from the notified chemical is considered to be small provided that the material is used as indicated, and that disposal of used oil takes place via the routes indicated above. Losses during lubricant formulation would be small. As a component of gear oil, the potential for the notified material to be released to the environment is likely to be low until the end of the useful life of the vehicle. It is expected that approximately 97% of the notified chemical would be destroyed through incineration and/or oil recycling activities. Incineration would produce water vapour and oxides of carbon. About 3% will be lost due to spills and possible disposal to landfill, stormwater drains, and other routes. If deposited into landfill the gear oil containing the notified chemical would ultimately become associated with the soil where the notified chemical is expected to be immobile.

Since the use of the gear oils will occur throughout Australia, all releases resulting from use or disposal of the used oil will be very diffuse, and release of the notified material in high concentrations is unlikely except as a result of transport accidents. The procedures described in the MSDS are adequate to limit the environmental exposure and therefore the environmental effects.

When used as indicated in the notification, the notified chemical is unlikely to present a hazard to the environment.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Hazard Assessment

The notified chemical was of very low acute oral toxicity in rats (LD50 > 2000 mg/kg) and was of low acute dermal toxicity in rats (LD50 > 2000 mg/kg). It was a slight to moderate skin irritant and a slight to moderate eye irritant in rabbits. It was not mutagenic in bacteria and was not clastogenic in CHL cells (chromosome aberration assay) or mouse bone marrow

cells (micronucleus assay). It was a skin sensitiser in guinea pigs. In a 4-week oral repeated dose study organ toxicity was ascribed to adaptive effects in the liver with associated thyroid follicular hypertrophy. The NOAEL was considered to be 500 mg/kg/day.

The notified chemical is determined to be a hazardous substance according to the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999) in terms of skin sensitisation and is assigned the risk phrase R43: Sensitising to skin. The same is true for oil containing the notified chemical at a concentration of greater than 1% (unless contrary test data exist), which is above the cut-off for classification as sensitising to skin.

A representative concentrate product to be imported containing up to 20% of the notified chemical may be an eye irritant according to the supplied MSDS but would not be assigned the risk phrase R36: Irritating to eyes. The MSDS also states that the product may cause skin irritation on repeated or prolonged exposure.

Occupational Health and Safety

The potential imported product containing the notified chemical is a skin sensitiser from the content of the notified chemical and other components may cause eye irritation or skin irritation on repeated or prolonged contact.

The risk of skin sensitisation, eye irritation or skin irritation in transport or storage workers is considered to be low given that exposure may only occur in the event of accidental spillage.

Skin sensitisation in workers involved in formulating the final products may occur through repeated exposure to residues in piping and on drum bungs and couplings as the additive package is pumped to a blending vessel. There may also be a risk of skin sensitisation should exposure occur during clean up of spills and during sampling for QC testing. However, the risk of adverse health effects, which also includes skin and eye irritation, is lowered by the use of dry couplings, enclosed blending tanks, personal protective equipment and the fact that all exposure scenarios are likely to be of short duration.

Following blending, the final product is normally packaged in a closed system. The system does not require cleanup after each batch. The risk of skin sensitisation and skin and eye irritation to workers involved in these operations or to maintenance workers should be low, given the frequency of handling by workers, the engineering controls and use of safety glasses, long sleeved shirts, apron and nitrile or neoprene gloves (as recommended in the MSDS for Z-45 and the product to be imported) and the low concentration of chemical in the final products. However, it is possible that for some batches, the blend tank may be unloaded into 205 L drums manually. In this case, extensive exposure of the hands to the finished oil may occur and gloves need to be worn to protect against allergic dermatitis.

End use of the formulated products involves factory filling of automotive components. Normally, workers will not be exposed to gear oil in this process and the risk of adverse health effects should be negligible. Refilling automotive components with gear oil is expected to occur rarely at which time there may be a risk of skin sensitisation and nitrile or neoprene gloves and chemical protective clothing should be worn.

Public Health

The potential for public exposure during transport, storage, formulation, use, recycling or disposal is expected to be very low. There is a possibility of limited dermal contact and accidental eye contact. Z-45 is a skin sensitiser and the product will carry a risk phrase to that effect. The public is not expected to be in contact with the product as it is contained within the gear encasement. The notified chemical will pose a negligible hazard to the public.

13. RECOMMENDATIONS

Regulatory controls

- The NOHSC Chemicals Standards Sub-committee should consider the following health hazard classification for the notified chemical:

  – R43: Sensitising to skin

- Use the following risk phrases for products/mixtures containing the notified chemical at or above 1%:

  - R43: Sensitising to skin

Control Measures

Occupational Health and Safety

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified chemical as introduced and in the final gear oil:

  – nitrile or neoprene gloves, chemical impervious clothing, apron, safety glasses or face shields

  Guidance in selection of personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

- Employers should implement the following engineering controls to minimise occupational exposure to the notified chemical as introduced:

  - dry couplings should be employed for transfers between storage and blending tanks and blending tanks should be fully enclosed.

- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified chemical as introduced and in the final gear oil:

  - spillage should be avoided; spillage should be cleaned up using appropriate absorbents and placed into containers for disposal

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

- If products and mixtures containing the notified chemical are classified as hazardous to health in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances*, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

13.1 Secondary notification

The Director of Chemicals Notification and Assessment must be notified in writing within 28 days by the notifier, other importer or manufacturer:

(1) Under Section 64(2) of the Act:
- if any of the circumstances listed in the subsection arise.

The Director will then decide whether secondary notification is required.

No additional secondary notification conditions are stipulated.

14. MATERIAL SAFETY DATA SHEET

The MSDS for a representative additive package was provided in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (National Occupational Health and Safety Commission, 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. REFERENCES

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Attachment 1

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

Erythema Formation	*Rating*	*Oedema Formation*	*Rating*
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

Opacity	*Rating*	*Area of Cornea involved*	*Rating*
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

Redness	*Rating*	*Chemosis*	*Rating*	*Discharge*	*Rating*
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

Values	*Rating*
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

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