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August 2000

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Z-40

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Z-40

1. APPLICANT

Lubrizol International Ltd. of 28 River Street, Silverwater, NSW 2128 has submitted a standard notification statement in support of their application for an assessment certificate for Z-40.

2. IDENTITY OF THE CHEMICAL

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

3. PHYSICAL AND CHEMICAL PROPERTIES

The following properties refer to the notified chemical alone without solvent. Tests were performed according to EEC/OECD test guidelines at facilities complying with OECD Principles of Good Laboratory Practice (Hogg, 1999; Tremain, 1999).

Appearance at 20°C & 101.3 kPa:	White solid
Particle Size:	Not applicable. Chemical is manufactured and imported in solvent eg. kerosene.
Melting Point:	Not determined. As assessed by differential scanning calorimetry using ASTM E537-86 and Methods A1 and A2 of Commission Directive 92/96/EEC, the chemical decomposes at 246°C before melting.
Density:	1.17 at 20°C
Vapour Pressure:	$<8.3 \times 10^{-5}$ Pa at 25°C determined by the vapour pressure balance method, Method A4 of Commission Directive 92/96/EEC. The notified chemical may be considered very slightly volatile.
Water Solubility:	23.9 g/L at 20°C determined by the shake flask method,

	Method A3 of Commission Directive 92/96/EEC.
Partition Co-efficient (n-octanol/water):	log P_{ow} = > 1.9 (estimated). See comments below.
Hydrolysis as a Function of pH:	Not determined. Although stable under acidic conditions, hydrolysis of the carboxylic ester groups will occur under alkaline conditions.
Adsorption/Desorption:	Not determined. Using QSAR, $\log_{10} K_{oc}$ = 3.1 (estimated). See comments below.
Dissociation Constant:	Not determined. The notified chemical should be soluble in water and dissociate completely.
Flash Point:	Not determined. Chemical is not flammable.
Flammability Limits:	Not flammable.
Autoignition Temperature:	Determined not to have a self-ignition temperature below melting/decomposition temperature.
Explosive Properties:	Not expected.
Reactivity/Stability:	Chemical has high surface activity and is stable up to decomposition temperature of 240°C.

Comments on Physico-Chemical Properties

Neither the flask shaking nor HPLC methods could determine the partition coefficient of the notified chemical. For the flask shaking method, significant emulsification of phases was reported to occur and so the HPLC method is claimed to be not a valid technique for use with salts of strong acids. Therefore, the partition coefficient was calculated by both solubility estimation and atom/fragment contribution software to be >1.9 and 3.95 respectively. The notified chemical may be considered as relatively hydrophilic.

For the above reasons, the HPLC method could not be used to determine the adsorption coefficient of the notified chemical and the adsorption coefficient was calculated using QSAR. The notifier claims that details of QSAR are provided in technical guidance documents in support of Commission Directive 93/96/EEC. The notified chemical may be considered as having low mobility in soil (McCall et al., 1980).

4. PURITY OF THE CHEMICAL

Degree of Purity:	>95%
Hazardous Impurities:	None

Non-hazardous Impurities (> 1% by weight):	None
Additives/Adjuvants:	None

5. USE, VOLUME AND FORMULATION

The notified chemical is a component of a fuel additive package for unleaded petrol. The chemical is present in the imported package at less than 60% w/w. Less than 200 tonnes/year of the notified chemical will be imported for 5 years. No manufacture will occur in Australia. The chemical will be present in petrol at < 0.1%.

6. OCCUPATIONAL EXPOSURE

Import, Transport and Storage

The notified chemical will be imported in steel drums or ISO containers and transferred to customer depots or terminals by road or rail. Occupational exposure of dockside or transport workers is not expected except in the event of a spill. No repackaging of drums or ISO containers is required as these are delivered directly to the customer sites.

Refinery/Terminal Facilities

Despite the use of automated processes and dedicated delivery lines, worker exposure may occur during transfer of the additive from import drums or containers to a storage tank and during the transfer of the additive package from storage to fuel in tankers. These operations will occur at up to 20 depots or terminals. Exposure is expected to be confined to dermal contamination with drips and spills during the connection and disconnection of transfer lines and equipment. Chemical goggles and chemical resistant gloves are recommended by the notifier for workers when handling the additive package and the worker environment is expected to be well ventilated.

End Use - Service Stations

At service stations, the additised fuel will be transferred to underground tanks. Exposure of transport drivers, service station personnel and mechanics to very low concentrations of the notified polymer in the final fuel may occur due to spillage. Exposure is expected to be confined to dermal contamination with drips and spills during the connection and disconnection of transfer lines and dipping of tanks.

7. PUBLIC EXPOSURE

The notified chemical is present in unleaded petrol at < 0.1%. The public may be exposed to the notified chemical in unleaded petrol during vehicle refilling, however, the potential for exposure is minimised by the use of automatic shut-off valves in fuel pumps and the low concentration of the additive package in unleaded petrol.

8. ENVIRONMENTAL EXPOSURE

Release

The chemical will be transported via road in closed containers; potential release would only be through accidental spills. The MSDS details procedures to protect the environment in these cases. Once received by the customers, the fuel additive package containing the chemical will be blended into the petrol to a maximum concentration of < 0.1% at their facilities. This is an automatic process using dedicated delivery lines and equipment and the emission of the notified chemical due to spills during this formulation process is expected to be small.

The ISO tank containers used to transport and store the fuel additive will be continually refilled without rinsing. For drum containers, the notifier estimates that a maximum of 1% of the fuel additive package will remain as residues in empty drums. This corresponds to < 180 kg of notified chemical waste will be generated per year. The notifier indicates that the empty drums and their residues will be properly disposed of at reconditioning facilities with residues being incinerated.

Up to 1000 service stations may store fuel containing the notified chemical at < 0.1%. The notifier indicates that the initial market for unleaded fuel containing the notified chemical would be about 200 000 cars. The notifier assumes that on average 10 mL of petrol will be spilled at the service station for every fill up. Assuming each car needs to be filled with fuel 50 times a year then the total loss of petrol for 200 000 cars per year amounts to 100 000 L. At a concentration of < 0.1% the total loss of notified chemical per year due to spills at fill ups is < 20 kg.

The chemical and additive package will not be directly marketed to the public, but preblended into the petrol sold at service stations.

Fate

If the notified chemical is released to soil in either a spill or leak from either a storage tank or transport container, it is expected to have low mobility due to its surface activity even though it is water soluble. If released to an aquatic environment, the polymer would tend to partition out of water and into sediment. Once adsorbed to soil/sediment, the fate of the chemical is unknown. However, a number of biodegradation studies have been carried out on the sodium salt analogue of the notified chemical. The most notable study indicates that the sodium salt of the notified chemical biodegrades in surface waters under actual environmental conditions (Hammerton, 1955). In a river die-away screening test the sodium salt analogue of the notified chemical was treated with river water in closed bottle tests at 22ºC. Some water samples were boiled prior to treatment and some were pre-treated with the addition of phenylmercuric acetate to inhibit bacteria. On average the chemical was found to biodegraded in all samples between 91% and 95% over the 17 day period of the tests.

The notifier mentions briefly 2 other biodegradation studies that have been carried out on the sodium salt analogue of the notified chemical. The first, a ready biodegradation closed bottle test determined a biodegradation of 74% in 28 days according to test methods outlined in OECD 301D. The second, an inherent biodegradation Zahn Wellens test determined a biodegradation of 100% in 7 days according to test methods outlined in OECD 302B. The notified chemical does not meet the > 60% degradation in 10 days criterion for the closed

bottle test and, therefore, may not be designated as readily biodegradable. However, inherent biodegradation Zahn Wellens test clearly indicates that the sodium salt analogue of the notified chemical is relatively biodegradable.

Less than 180 kg of notified chemical waste from drum recycling is expected to be disposed of by incineration.

The notifier supplied data on the notified chemical with respect to tail pipe emissions. The data supplied was for a fuel additive package that contains less than 10% of Z-40 that contains the notified chemical. The data indicates that there is no negative effect of the chemical with regard to tailpipe emissions. Test results provided show that the addition of Z-40 to petrol does not adversely affect: the levels of regulated emissions and particulates, fuel consumption, the chemical composition of the particulates and semi-volatile emissions, the biological activity of the particulates and semi-volatile emissions, and the levels of biological active dioxins.

A literature bioaccumulation and elimination study of the 14C labelled sodium salt of the notified chemical was provided by the notifier which studied 36 Rainbow trout and their exposure to the chemical under static conditions for 72 hours (Goodrich et al, 1990). The initial concentration of the chemical was 5.5 μg/L and there was no significant change in concentration throughout the test. Tissues of 3 fish were sampled after 2, 4, 12, 24, 48 and 72 hours of exposure. The concentration of the chemical in bile and blood after 72 hours was found to be 27232 and 18 ng/L, respectively. However, the concentration of the chemical in the bile had not reached a steady state. The concentration of the chemical in viscera and carcass after 12 hours was found to be 28 and 26 ng/L, respectively. However, the concentration of the chemical in the viscera had not reached a steady state by 72 hours. Bioconcentration factors were, therefore, calculated for the blood and carcass to be 3.47 and 3.78, respectively. It is unclear what guidelines were followed in the study and what was the length of the elimination period. However, elimination of the chemical from the carcass and viscera of the fish was found to be second order kinetics, while elimination from the blood and bile followed first order kinetics.

The sodium salt of the notified chemical can be considered as only slightly concentrating when considering the steady state concentrations attained in the blood and carcass of Rainbow trout (Mensink et al., 1995).

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological data for the notified chemical (a potassium salt) have been generated. However, review studies for a sodium salt analogue of the notified chemical were provided. The analogue is expected to possess a similar toxicity profile to the notified chemical. The analogue has been the subject of review (BIBRA, 1989; JECFA, 1991).

9.1 Acute Toxicity

Summary of the acute toxicity

Test	*Species*	*Outcome*	*Reference*
acute oral toxicity	rat	LD_{50} 1.8 g/kg	Olson et al (1962)
skin irritation	rabbit	Irritant	Draize et al (1944); Swentzel (1976)
eye irritation	rabbit	Irritant	Draize et al (1944)
skin sensitisation	guinea pig	Sensitiser	Swentzel (1976)

9.1.1 Oral Toxicity (Olson et al, 1962)

Seven acute rat oral toxicity studies are cited in review (JECFA, 1991) with LD_{50} values ranging from 1.8 to 7.5 g/kg. The study in which the lowest LD_{50} was obtained is summarised below.

Species/strain:	Rat, Wistar
Number/sex of animals:	5 females/group
Observation period:	14 days
Method of administration:	10% aqueous emulsion by gavage.
Test method:	Groups of 5 animals given doses from 0.25 – 8.0g/kg body weight. Mortality was established over a two week post-feeding period.
Comment:	No morphological data were provided.
LD_{50}:	1.8g/kg
Result:	The analogue chemical was of low acute oral toxicity in rats.

9.1.2 Dermal Toxicity

No data are available.

9.1.3 Inhalation Toxicity (Nieman and Bredenberg, 1985)

Species/strain:	Dogs, Mongrel
Number/sex of animals:	56, sex not specified
Observation period:	4 hours
Test method:	Direct tracheal administration over 30-45 minutes of an aerosol consisting of a 1% solution of 15mg/kg body weight of test substance suspended in equal volumes of 95% ethanol and isotonic saline.

Mortality: None

Clinical observations: Following administration, a decrease in lung volume, partial lung collapse and fluid accumulation were observed.

Morphological findings: The lungs appeared microscopically normal at 4 hours following aerosol. No grossly destructive effects on alveolar cells were observed. However, in minced lung extracts, a loss of surfactant activity and increased alveolar surface tension were demonstrated by a fall in static compliance and observations of atelectasis.

LC_{50}: Not determined.

Result: The analogue chemical was irritating and of low acute inhalational toxicity in dogs.

9.1.4 Skin Irritation (Draize et al, 1944)

Species/strain: Rabbits, Albino

Number/sex of animals: 3, sex not specified

Observation period: 72 hours

Test Method: 0.5ml of a 2% w/v aqueous solution was applied to intact, depilated skin under occlusive dressing.

Draize scores:

Time after treatment (days)	***24 hours***	***72 hours***
Erythema + Oedema		
1	4[a]	7
2	3	2
3	4	2

[a] see Attachment 1 for Draize scales

Result: The analogue chemical was irritating to the skin of rabbits and humans.

Other Studies: A study is reported by the US Army Environmental Hygiene Agency (Swentzel, 1976) of a single 24 hour application of 0.5g of analogue chemical to the intact and abraded skin of New Zealand White rabbits. The analogue chemical produced very slight erythema and edema at the intact skin sites in 1 of 6 rabbits at 24 hours as well as very slight erythema in 3 of 6 rabbits at 24 and 72 hours. Very slight edema was observed at 72 hours in 1 of 6 rabbits at abraded skin sites.

In human 96-hour contact studies with the analogue chemical, solid undiluted chemical produced irritation in 18 of 24 subjects but 10% or 1% solutions produced no irritation in 18 subjects. (Staniforth and Lovell, 1981 in BIBRA, 1989).

9.1.5 Skin Irritation – Repeated Application (Olson et al, 1962)

Species/strain:	Rabbits, heterogeneous Albino stock
Number/sex of animals:	Not specified
Observation period:	14 days
Method of administration:	1%, 5% and 25% w/w of analogue chemical in water applied to the shaved belly via one inch square cotton pads held by a cloth bandage.
Test method:	Immediately prior to application of the analogue chemical, abrasions were made with a sharp instrument on the caudal area of the shaved belly. Abrasions were sufficiently deep to penetrate the stratum corneum but not deep enough to cause bleeding. Ten applications of 5 ml each were made over 14 days to the intact areas and 3 similar applications were made to abraded areas. Continuous contact was thus maintained for 14 days to intact skin and 3 days to abraded skin. A small amount of material was likewise applied daily to the intact ear. Applications were discontinued at production of a substantial burn or eschar formation.
Mortality:	None
Clinical observations:	None recorded.
Morphological findings:	**Rabbit ears** On rabbit ears, 1% of analogue chemical produced very slight erythema. Five percent produced very slight to slight erythema and 25% produced slight erythema to severe burn. **Rabbit belly** On rabbit belly, 1% of analogue chemical produced very slight to slight erythema. Five percent produced moderate burn and 25% produced moderate to severe burn.
LD_{50}:	Not determined.
Result:	The notified chemical was a severe irritant in rabbits.

9.1.6 Eye Irritation (Draize et al, 1944)

Species/strain: Rabbit, Albino

Number/sex of animals: 6, sex not specified.

Observation period: 24 hours

Test method: 0.1ml of a 0.5%, 2% and 10% solution of test substance was applied to conjunctival sacs.

Weighted Draize scores of unirrigated eyes (n=6):

	Time after Application	
Concentration	***1 hour***	***24 hours***
0.5%	4[1]	2
2%	9	2
10%	26	24

[1] see Attachment 1 for Draize scales

Comment: No data were provided for individual animals nor for individual assessments of cornea, iris or conjunctivae. No data were provided for reversibility of irritation.

Result: The analogue chemical was irritating to the eyes of rabbits.

Other Studies: The following reports are cited in review (BIBRA, 1989).

In opthalmic preparations 0.1% analogue chemical has been associated with conjunctival irritation (Martindale, 1982). Other animal studies have been reported showing various eye effects including severe eye damage in rabbits exposed to neat analogue (Leopold, 1945). A threshold for eye irritation (under undefined conditions) was determined to be 0.2% (Lundholm and Svedmyr, 1959).

9.1.7 Skin Sensitisation (Swentzel, 1976)

Species/strain: Guinea pigs, Hartley

Number of animals: 10 test, 20 control

Induction procedure: Intradermal injections of 0.1ml of a 0.1% solution (w/v) of test substance or 0.1% suspension of dinitrochlorobenzene (DNCB) in a mixture containing 1 volume propylene glycol and 29 volumes of normal saline. Number of injections and injection sites were not specified.

Test group: 10 test guinea pigs received 0.1% test substance.

Control group:	10 positive control guinea pigs received 0.1% DNCB. 10 cage control guinea pigs received no sensitising injections.
Challenge procedure:	Ten test guinea pigs were challenged with 0.1% intradermal injections of test substance. Number and timing of injections were not specified. Ten positive control guinea pigs were similarly challenged with 0.1% DNCB. Five cage control guinea pigs without prior sensitising injections were similarly challenged with 0.1% test substance. Five cage control guinea pigs without prior sensitising injections were similarly challenged with 0.1% DNCB.

Challenge outcome:

Challenge dose of test substance produced a sensitisation reaction in 9 out of 10 guinea pigs.

Comment:	Positive control (DNCB) produced sensitisation in 10 out of 10 guinea pigs.
Result:	The analogue chemical was strongly sensitising to the skin of guinea pigs.
Other Studies:	In review (BIBRA, 1989), six patients are reported to have developed vesicular eczema from 4 days to 3 weeks after skin application of an orthopaedic wool containing the analogue chemical. Sensitisation was indicated by 48 or 96 hour covered patch tests. All patients reacted to 10% analogue chemical in petrolatum and 4 also reacted to 1% chemical. Eight normal subjects were unresponsive to either concentration.

9.2 Repeated Dose Toxicity (Benaglia et al, 1943)

Species/strain:	Rats, Wistar
Number/sex of animals:	5 males, 5 females
Method of administration:	Repeated daily feeding with 3% dry weight of analogue chemical in Purina dog meal. Calcuations from semi-weekly weighings established doses from 0.19 – 0.87g/kg/day.
Dose/Study duration:	24 weeks

Clinical observations:

All animals survived the full 24-week experimental period and were reported in good condition. Occasional spells of diarrohea occurred in some animals.

Haematology
Erythrocyte, total and differential leukocyte counts were conducted approximately every 2 weeks in animals receiving doses of analogue chemical. No significant differences in erythrocyte, total or differential leukocyte counts were observed between control and treatment animals.

Histopathology:
No pathological findings were evident at autopsy.

Result:
The analogue chemical is of low oral repeated dose toxicity.

Other Studies by Benaglia et al (1943):
Throughout a similar 24 week study by the same authors, 3 dogs receiving 0.25g/kg/day and 3 monkeys receiving 0.125g/kg/day of the analogue chemical were reported in good health. Autopsy revealed no pathology. Two of 7 rabbits receiving 0.5g/kg/day by gavage survived the full 24 week experimental period. However, 3 rabbits died – two during week 1 and one at week 16. Symptoms were similar in all three – severe diarrohea and anorexia.

Other Studies:
Groups of 12 weanling rats of each sex were given 0, 0.25%, 0.5% and 1.0% analogue chemical in their diet (125-500mg/kg body weight/day) for 2 years. No pathological changes were observed at gross examination or in the histology of lung, heart, liver, spleen, pancreas, stomach and gut, kidney, adrenal, testes, thyroid, parathyroid, lymph nodes, bone, muscle or marrow (Fitzhugh and Nelson, 1948). When fed to rats as 1.0% of the diet, the analogue chemical exhibited no tumour promotional activity after 6 months when accompanied by subcutaneous injections of an established intestinal carcinogen 1,2,-dimethylhydrazine (Karlin, 1980).

In reviews, the analogue chemical is reported used in humans as an oral laxative at divided doses of 50-300 mg/day for adults and 5mg/kg/day for children with few adverse effects up to several weeks (Wilson and Dickinson, 1955; Clayden, 1978; Fain et al, 1978 in BIBRA, 1989 and JECFA, 1991).

Result:
The analogue chemical is of low oral repeated dose toxicity.

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium* Reverse Mutation Assay (Minnich et al, 1976)

Strains:	TA1535, TA1536, TA1537, TA1538
Metabolic activation:	Rat liver S-9 microsome fraction
Concentration range:	Not given

Test method:	Ames et al (1973)
Comment:	No mutagenicity was observed either in the presence or absence or rat liver S-9 metabolic activation. In an additional study, no mutagenic effects were found with the analogue chemical in TA98 and T100 tester strains with and without metabolic activation at concentrations of 1-100 μg/plate (Bonin and Baker, 1980).
Result:	The analogue chemical was non mutagenic under the conditions of the tests.

9.3.2 Chromosomal Aberration in Chinese Hamster Cells (Cole et al, 1970)

Cells:	Chinese Hamster B14 and Don C cells
Metabolic activation system:	No metabolic activation was employed.
Dosing schedule:	Varying doses up to >1.0 mg/mL test substance, incubation times not given.
Test method:	Cells were grown in culture, mitotically arrested using Colcemid and chromosomes isolated by homogenisation and sucrose gradient sedimentation. Drops of chromosome preparation were placed on microscope slides and subjected to flush or immersion with test substance. Specimens were then prepared for light and electron microscopy.
Comment:	Up to 300μg/mL test substance caused reversible chromosomal swelling but no irreversible damage. >1.0 mg/mL of test substance caused irreversible chromosomal damage. Ability of test method to detect chromosomal abnormalities was confirmed anecdotally by abnormalities observed with a range of test substances at different concentrations. A particularly notable effect was observed with pH where a decrease of one half pH unit from 4.2 to 3.8 caused “implosive” chromosomal condensation.
Result:	The analogue chemical was clastogenic at > 1.0 mg/mL of test substance under the conditions of the test.

9.3.3 Reproductive Toxicity (BIBRA, 1989; JECFA, 1991)

The following studies are quoted in the above reviews of the toxicity profile for the analogue chemical.

Human

The analogue chemical has been used as a faecal softener in humans since 1943 (Wilson and Dickinson, 1955).

Over a total of 1000 pregnancies, the analogue chemical produced no treatment-related increases in the incidence of malformations in babies born to women taking the analogue chemical during the first three months (Aselton et al, 1985; Jick et al, 1981) or during the first four months or at any time during pregancy (Heinonen et al, 1977).

Low blood magnesium levels in both baby and mother and "jitteriness" in the baby were seen with 100-200mg/day of analogue chemical taken during most of pregnancy and after delivery. Low blood magnesium was attributed to intermittent diarrohea (Shindler, 1984).

Dog

Dogs (number not specified) given a calcium analogue at 50 or 200 mg/kg body weight/day on days 14-30 of pregnancy showed maternal toxicity (nature not specified) and delayed bone formation in foetuses (Hoechst, 1978).

Rat

In a three-generation study, groups of 40 rats of each sex were fed 250 or 500mg/kg body weight/day of analogue chemical. Pup survival and weight were reduced when the analogue was fed throughout lactation but not when treatment was discontinued during this period. There was a slight increase in pups with an extra sternum vertebra but this was not attributable to the analogue chemical (American Cyanamid, 1970).

Sprague-Dawley rats received 1-2% of analogue chemical in the diet (approximately 500 or 1000mg/kg body weight/day) on days 6 and 15 of gestation. No effects were observed at the lower level. However, the higher level produced growth retardation in dams and a significantly higher proportion of foetal malformations consisting primarily of exencephaly (Hoechst Roussel Pharmaceuticals, 1976).

In a three generational study of 30 rats of each sex receiving 50-500mg/kg body weight/day, higher levels reduced body weights of parents and offspring, but did not affect growth, development or reproductive performance (American Cyanamid, 1986).

From three generational studies in rats, a no-observed-effect level (NOEL) of 1g/kg in the diet, equivalent to 50mg/kg body weight/day was concluded for the analogue chemical (JECFA, 1991). Applying a safety factor of 200 to the NOEL, an acceptable daily intake (ADI) of up to 0.25mg/kg body weight was allocated to the analogue chemical (JECFA, 1991).

9.4 Overall Assessment of Toxicological Data

The sodium salt analogue of the notified chemical was of low acute oral and inhalational toxicity and low oral repeated dose toxicity in rats. In *in vivo* studies, the analogue chemical possessed low reproductive toxicity. At high doses, the chemical was clastogenic *in vitro*.

The chemical was irritating to the skin in rabbits and humans and to the respiratory system of dogs. It produced eye irritation in rabbits and was sensitising to the skin of guinea pigs and

humans. Six patients are reported to have developed vesicular eczema from 4 days to 3 weeks after skin application of an orthopaedic wool containing the analogue chemical.

In accord with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (National Occupational Health and Safety Commission, 1999), the analogue chemical is classified as a hazardous substance and should carry the risk phrases R22: Harmful if Swallowed, R36/37/38: Irritating to Eyes, Respiratory System and Skin and R43: May Cause Sensitisation by Skin Contact. By analogy, the notified chemical is classified similarly.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The following literature acute toxicity studies have been supplied for the sodium salt analogue of the notified chemical.

Test Species	***LC_{50} mg/L***	
	48 h	***96 h***
Fish:		
Oncorhynchus mykiss (Rainbow Trout)	-	28
Pomatoschistus minutus	8.1	8.1
Anguilla anguilla (eel)	9.1	9.1
Mollusk:		
Mytilus edulis	27.5	5.7
Cardium edule	20	4.3
Gasteropoda:		
Purpura lapillus	12	5.8
Gibbula umbilicalis	17	7.5
Littorina littorea	> 100	14
Patelle vulgata	5	5
Crustacea:		
Artemia salina	22	13.5
Clinabarius misantropus	> 100	> 100
Palaemonetes varians	100	40
Crangon crangon	> 100	50
Actinia equina	15	9.2

Fish

A static acute toxicity test of the sodium salt of the notified chemical (Goodrich et al, 1991) was conducted with rainbow trout over a 96 hour period at 12ºC according to APHA method (American Public Health Association, 1985). The test concentrations included 10, 20 40 and 80 mg/L. The test concentrations were renewed after 48 hours and only one set of observations was taken. The test fish were observed at 24 hour intervals and the number dead and those that were exhibiting behavioural changes were recorded at each observation. The 96 hour median LC_{50} was determined to be 28 mg/L.

Aquatic Invertebrates

The notifier did not carry out an acute toxicity study to Daphnia magna. The acute toxicity of the sodium salt of the notified chemical to 15 marine organisms was also investigated in the literature (Maggi and Cossa, 1973). The tests were conducted at 20ºC in glass crystallisers of 4 L capacity, to each of which were added 2 L of test solution, and 10 to 20 animals. It was found that the two fish were more susceptible to the chemical while the crustacea were most resistant, the results are summarised in the table above.

Algae

The notifier did not carry out a growth inhibition test to algae. The toxicity of the sodium salt of the notified chemical to 2 species of plankton algae was also investigated in the literature (Maggi and Cossa, 1973). It was found that *Phaeodactylum tricornutum* and *Gyrosigma spencerii* had 10 day LC_{50} values of 7.9 and 7.7 mg/L, respectively.

Microorganisms

The inhibitory effect of the notified substance on aerobic wastewater bacteria activated sludge from a domestic wastewater treatment plant was not investigated in a respiration test. However, the biodegradability of the sodium salt of the notified chemical was studied in a Closed Bottle Test OECD 301D and a Zahn Wellen Test OECD 302B. The chemical was found in both tests to be biodegradable but no indication was given for the respiration inhibition of the sewage microorganisms. However, it can be reasonably assumed that no inhibition occurred as the chemical was easily biodegraded.

Conclusion

The literature ecotoxicity data for the sodium salt of the notified chemical indicate that it is likely that the notified chemical would be slightly toxic to fish and aquatic invertebrates and moderately toxic to algae.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The intended use pattern of the notified chemical in the fuel additive is not expected to result in a significant release to the environment as it is claimed to be completely destroyed by combustion within the petrol engine, resulting in oxides of carbon, hydrogen and sulfur. There are no direct data to support the claim of complete combustion of the chemical to oxides of carbon, hydrogen and sulfur when the fuel is burnt within the combustion chamber of petrol engines. However, it is evident that the chemical which is made up predominantly of hydrocarbon as are the constituents of the petrol of which it will be a minute part will not survive the temperatures at which the fuel is exploded within the internal combustion engine.

The data suggests that the notified chemical will not increase tailpipe emissions.

In the event of spills, the MSDS of the additive package containing the notified chemical contains adequate information on procedures to reduce release to the environment. However, if for example the contents of a single 200 L drum are accidentally released to sewer then approximately 100 kg of the notified chemical will be liberated to a city sewage treatment plant. The volume of the effluent at a city sewage treatment plant can be assumed to be at least 150 ML which would dilute the notified chemical to give a Predicted Environmental Concentration of 0.67 mg/L. When considering the most sensitive aquatic organism, *Cardium edule* with a LC_{50} of 4.3 mg/L towards the sodium salt of the notified chemical, this would give an environmental safety margin of less than 10. However, if biodegradation, adsorption to soil and sediment as well as dilution at receiving waters were taken into account then the environmental safety margin would be expected to be much greater.

Minor spills and leaks of the chemical may occur during customer fill ups at petrol service stations. However, given its low percentage in fuel, the loss of the notified chemical in these spills would be expected to be low.

Less than180 kg of notified chemical waste from drum recycling is expected to be disposed of by incineration. If spills and waste containing the notified chemical are consigned to landfill then the notified chemical is expected to be immobile..

Given the above, environmental exposure and the overall environmental hazard is expected to be low.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Hazard Assessment

The sodium salt analogue of the notified chemical was of low acute oral and inhalational toxicity and low oral repeated dose toxicity in rats. In *in vivo* studies, the analogue chemical possessed low reproductive toxicity. At high doses, the chemical was clastogenic *in vitro*.

The chemical was irritating to the skin in rabbits and humans and to the respiratory system of dogs. It produced eye irritation in rabbits and was sensitising to the skin of guinea pigs and humans.

Using analogue data and in accord with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (National Occupational Health and Safety Commission, 1999), the notified chemical is classified as a hazardous substance and should carry the risk phrases R22: Harmful if Swallowed, R36/37/38: Irritating to Eyes, Respiratory System and Skin and R43: May Cause Sensitisation by Skin Contact.

Occupational Health and Safety

During import and transport of the notified chemical, worker exposure to the notified chemical is unlikely except in the event of a spill. Exposure after a spill would be controlled by use of the recommended practices for spillage clean up outlined in the MSDS supplied by

the notifier.

At refineries and terminals, the handling of fuels and fuel products in general may cause irritation and, in the longer term, sensitisation if adequate precautions are not taken. However, workers at these sites are required to wear personal protective equipment to control exposure. Engineering controls and personal protective equipment for handling the solvent components of the additive package are sufficient to limit exposure to the notified chemical.

The use of automatic, dedicated transfer lines and enclosed, automated injection into fuel will reduce the likelihood of exposure to the additive package. Therefore, the health risk expected for refinery and terminal workers would be assessed as low.

Tanker drivers, service station workers and mechanics will receive negligible exposure to the notified chemical because of the very low concentration (< 0.1%) present in the final fuel. Therefore, the risk of adverse health effects for these workers arising from exposure to the notified chemical is negligible.

Public Health

The public may be exposed to the notified chemical in fuel during vehicle refilling. However, because of the low toxicity of the compound and the low concentration in unleaded petrol, it is considered that the notified chemical will not pose a significant hazard to public health.

13. RECOMMENDATIONS

To minimise occupational exposure to Z-40, the following guidelines and precautions should be observed:

- Safety goggles should be selected and fitted in accordance with Australian Standard (AS) 1336 (Standards Australia, 1994) to comply with Australian/New Zealand Standard (AS/NZS) 1337 (Standards Australia/Standards New Zealand, 1992); industrial clothing should conform to the specifications detailed in AS 2919 (Standards Australia, 1987) and AS 3765.1 (Standards Australia, 1990); impermeable gloves should conform to AS/NZS 2161.2 (Standards Australia/Standards New Zealand, 1998); all occupational footwear should conform to AS/NZS 2210 (Standards Australia/Standards New Zealand, 1994);

- Spillage of the notified chemical should be avoided. Spillages should be cleaned up promptly with absorbents which should be put into containers for disposal;

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

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

If products containing the notified chemical are hazardous to health in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (National Occupational Health and Safety Commission, 1999), workplace practices and control procedures consistent with State and territory hazardous substances regulations must be in operation.

The notified chemical will need to be tested to ensure that it will meet the criteria in the upcoming Australian Standard, *Evaluation of Devices and Additives which Claim to Improve Vehicle Performance*, to be AS 4430.2.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the notified chemical 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).

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 chemical may be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

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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.
		Swelling with lids half-closed	3 mod.	Discharge with moistening of lids and hairs and considerable area around eye	3 severe
Diffuse beefy red	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