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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

Polymer in EP 7690

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Director
NICNAS

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1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Afton Chemical Asia Pacific LLC (ARBN: 109 644 288)
Level 9, 20 Berry Street
NORTH SYDNEY NSW 2060

NOTIFICATION CATEGORY
Limited: Polymer with NAMW ≥ 1000 (greater than 1 tonne per year).

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication:
Chemical name;
Molecular formula;
Structural formula;
Purity;
Polymer identity and composition;
Residual monomers and impurities; and
Import volumes.

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
Variation to the schedule of data requirements is claimed as follows:
Melting point/Boiling point;
Specific gravity/Density;
Vapour pressure;
Hydrolysis as function of pH;
Partition coefficient;
Absorption/Desorption;
Dissociation constant;
Flash point;
Flammability limits; and
Autoignition temperature.

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
None

NOTIFICATION IN OTHER COUNTRIES
None

2. IDENTITY OF CHEMICAL

OTHER NAME(S)
Polymer in EP 7690

MARKETING NAME(S)
Polymer in EP 7690

CAS NUMBER
None allocated

METHODS OF DETECTION AND DETERMINATION

METHOD Gel Permeation Chromatography

3. COMPOSITION

DEGREE OF PURITY
<60% (the polymer manufactured in highly refined lubricating base oil)

DEGRADATION PRODUCTS
Polymer is stable and not expected to degrade under normal storage conditions.

LOSS OF MONOMERS, OTHER REACTANTS, ADDITIVES, IMPURITIES
No loss of any component of the notified polymer is to be expected by volatilisation, exudation or leaching by water. By design the notified polymer is associated with oil and is expected to remain with the organic phase.

4. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS
The notified polymer will not be manufactured in Australia. It will be imported in 200 L steel drums as a component (20-25% w/w) of a lubricant additive package.

MAXIMUM INTRODUCTION VOLUME OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	3-10	3-10	3-10	3-10	3-10

USE
The notified polymer is intended for use as a dispersant component in lubricant additive packages of which it will constitute 20-25% (w/w). Dispersants inhibit colloidal particle-to-particle aggregation via an adsorbed film mechanism, and assist in solubilising oil insoluble liquids. The lubricant additive package containing the notified polymer will be sold to petroleum companies where it will be blended with other petrochemicals and additives for the production of finished engine oils. It is expected that typically the notified polymer will constitute 2.5-3.5% (w/w) of the final lubricant product.

5. PROCESS AND RELEASE INFORMATION

5.1. Distribution, transport and storage

PORT OF ENTRY
Sydney, Melbourne and Brisbane.

IDENTITY OF MANUFACTURER/RECIPIENTS
Major lubricating oil manufacturers.

TRANSPORTATION AND PACKAGING
The notified polymer will be imported in 200 L steel drums as a component of a lubricant additive package. Immediately following import, the drums will be transported by road or rail to lubricating oil manufacturers. The lubricant additive will be reformulated to finished engine oil which will be packaged into 1 L bottles, 4 L bottles, or 200 L drums.

5.2. Operation description

After importation, the lubricant additive package containing the notified polymer is transported by road or rail to major lubricating oil manufacturers throughout Australia. The 200 L drums of lubricant additive will be stored in warehouses or blending facilities until the blending of the finished engine oil is scheduled.

During the blending process, the additive package containing the notified polymer will be transferred to a blending tank via automated pumps. The charging of the blending tank with the additive takes approximately 10 minutes. The blending process is automated, occurs in a closed system at 20°C to 60°C and takes up to one hour. QC sampling may occur during or immediately after blending. Once the blending is finished, the lubricant is automatically transferred to a storage tank using hard piped lines or filled into drums. Drumming of the finished product directly from the blending tank or from storage tanks can be automated or can involve the manual connection and disconnection of filling lines.

The finished oil is packaged into 1 L bottles, 4 L bottles or 200 L drums (if not directly drummed from the blending tank). The filling of the 1 L and 4 L bottles is highly automated and drums are typically filled using automated weight scales.

The majority of the finished engine oil lubricant (80-90%) containing the notified polymer will be sold into the industrial market for use by automotive mechanics and 10-20% will be sold to the consumer market for use by do-it –yourself enthusiasts. The blended oil products will be added to and drained from systems during these operations.

5.3. Occupational exposure

Number and Category of Workers

Category of Worker	*Number*	*Exposure Duration*	*Exposure Frequency*
Transport and storage	6	1-2 hours/day	Not given
Blending/transfer operations	1-2/site	0.2-2 hours/days	25 days/year
Blending/blending operations	2-3/site	0.5-1 hour/days	75 day/year
Laboratory Staff	1-2/site	0.25 hours	75 days/year
End Users	>1000	1-8 hours	200 days/year

Exposure Details

Transport and Storage

Transport and storage workers handling the lubricant additive package, containing 20-25% (w/w) notified polymer, are not expected to be exposed to the notified polymer during transport except in the case of an accidental spill.

The finished lubricant product, containing 2.5-3.5% (w/w) of the notified polymer, will be transported to numerous sites since the oil products will have widespread use. The notified polymer will be used by professional motor mechanics and DIY enthusiasts.

Dermal exposure will be main route of exposure for transport and storage workers. These workers are likely to wear overalls, safety boots, and gloves when handling containers.

Reformulation

At reformulation sites, the notified polymer will be transferred from drums into the blending tank by automated dosing systems. The transfer process takes approximately 10 minutes. During the connection and disconnection of lines, incidental dermal contact from splashes, drips, and spills is possible.

The blending process occurs in an automated closed system, thereby excluding the potential for occupational exposure. The blended lubricant is transferred automatically to a storage tank through hard piped lines or directly drummed into 200 L drums. The drumming can be either automated or involve the connection and disconnection of lines.

From storage, the finished engine oils are packaged in 1L bottles, 4 L bottles, or 200 L drums. The filling of the 1 L and 4 L bottles is highly automated. The drumming facilities typically uses automated weight scales to fill the drums and workers observes the filling from 1-2 metres away to ensure drum filling apparatus properly enters the drum before filling. Once filling is completed workers are required to insert bungs and label the containers as required. Dermal contact with contaminated drum surfaces may occur.

The blending tank and the transfer lines are cleaned by rinsing with clean lubricating oil. Maintenance workers handling the equipment used for blending and filling may come into dermal contact with residues containing the notified polymer.

Empty drums are sent to drum recyclers where they are steam cleaned.

The blending facilities are well ventilated, with control systems for accidental spills and wastewater treatment. Workers involved in the blending activities receive training in the handling of additive packages, and wear personal protective equipment such as gloves, eye protection, protective clothing and hard hats.

Laboratory Staff
Laboratory staff will take samples of the notified polymer in the additive package as well as the blended oil products for testing. During sampling and analysis of the additive package there may be dermal contact. The laboratory testing will take a few minutes per batch.

End Users
Occupational exposure to the products containing the notified polymer will also occur at motor manufacturing and repair facilities throughout Australia. End users may be exposed to the blended oil products containing 2.5-3.5% (w/w) of the polymer. Exposure may occur during the transfer the blended oil products from the storage containers into the vehicle being serviced and during cleaning of equipment. There is potential for exposure when oils are added to and drained from systems and while handling automotive components that have been in contact with the oil.

A large number of motor mechanics (>1000) may be exposed to the products under a wide range of conditions. However, as it is anticipated that these workers have been trained in the proper handling of lubricants and oil products, the low exposure is expected..

Workers will wear overalls, cotton hats, and safety boots when using products containing the notified polymer.

5.4. Release

RELEASE OF CHEMICAL AT SITE
There will be no environmental exposure associated with the manufacture of the notified polymer in Australia as this does not take place here.

During the blending and repackaging of the lubricant additive package there is the potential for release due to spills, equipment cleaning and import container residues. The containers, with up to 3% of the notified polymer, will be sent to certified drum recyclers. Spills are expected to be minor and contained and adsorbed with earth or sand, drummed and disposed of to a licensed site.

RELEASE OF CHEMICAL FROM USE
The finished lubricants for use in engine oils will be sold in various sized containers. No information was available on whether the notified polymer is altered during use as a crankcase lubricant in internal combustion engines and therefore it is assumed to be unaffected. There may be some accidental losses when lubricant is added to new, or changed in, vehicle engines, which may be about every 5000-10000 kilometres for passenger car petrol engines. These are expected to be minor spills, which would be mostly left on the ground or cleaned up and sent to landfill. Spills are not expected to amount to more than 1% of the product. In the closed system of an engine, there is no expected release of the polymer to the environment under normal conditions of use, except for unintended oil leaks, which would mostly drip onto road and pavement surfaces. Spills/leaks from engines may potentially comprise 1% of the oil formulation containing the notified polymer. Since the use of the lubricating oils will occur throughout Australia, any releases from use of oils containing the notified additive would be diffuse.

5.5. Disposal

Imported drums

The import drums are typically recycled and reused. At drum recycling facilities, drums are typically steam cleaned with wastewater and sent to wastewater treatment. Assuming 3% remains in emptied containers up to 300 kg per annum of the notified polymer may enter the onsite aqueous treatment plant at the maximum proposed import rate (10 tonnes per annum).

Lubricant containers

A proportion of the finished lubricant products are sold to consumers (eg. garages and DIY consumers) in a range of container sizes (1, 4 and 200 L) containers. The smaller containers are likely to be sent to landfill for disposal. Assuming 3% remains in the containers after use, a worst case of ~300 kg per annum of the notified polymer would be sent to landfills.

Used oils

The greatest potential for environmental exposure is through disposal of oil product wastes containing the notified polymer. A survey by the Australian Institute of Petroleum (AIP 1995) indicates that of the annual sales of automotive engine oils in Australia, some 60% are potentially recoverable (ie. not burnt in the engines during use). This report also indicates that around 86% of oil changes take place in specialised automotive service centres, where old oil drained from crankcases is disposed of responsibly either to oil recycling or incineration. Assuming this is the case, negligible release of the notified polymer should result from these professional activities. The remaining 14% of oil (up to 1,400 kg of the estimated maximum 10 tonnes of notified polymer imported per annum) are removed by "do it yourself" (DIY) enthusiasts, and in these cases some of the used oil would be either incinerated, left at transfer stations where it is again likely to be recycled, or deposited into landfill. Meinhardt (2002) estimated that DIY activities account for 7-10% of the unaccounted used oil.

According to a survey tracing the fate of used lubricating oil in Australia (Snow, 1997), only around 20% of used oil removed by DIY enthusiasts is collected for recycling, approximately 25% is buried or disposed of in landfill, 5% is disposed of into stormwater drains and the remaining 50% is used in treating fence posts, killing grass and weeds or disposed of in other ways. In a worst case scenario of 14% of the used oil removed by DIY enthusiasts, the notified polymer could be collected for recycling (≤280 kg per annum), buried or disposed of in landfill (≤350 kg per annum), disposed of in stormwater drains (≤70 kg per annum) and used in treating fence posts, to kill weeds or disposed of in other ways (≤700 kg per annum). A proportion of the latter may be disposed of to sewer.

Therefore, about 0.7% (up to 70 kg per annum) of the total import volume of the notified polymer could potentially enter the aquatic environment via disposal into the stormwater system. Considering the unknown fate of some of the oil used by DIY operator, up to 7% (<700 kg per annum) may also potentially be sent to sewer for disposal. In wastewater, hydrolysis to simpler compounds is likely to occur, and wastewater treatment plant efficiency is expected to be high. Since the use of the lubricating oils will occur throughout Australia, all releases resulting from use or disposal of used oil will be very diffuse, and release of the notified polymer in high concentrations is very unlikely except as a result of transport accidents.

5.6. Public exposure

The pure notified polymer will not be available to public. Between 80 and 90% of the finished engine oil lubricants containing the notified polymer will be sold into the industrial market for use by automotive mechanics and 10-20% will be sold into the consumer market for use by do-it-yourself enthusiasts. Exposure of the public is only likely while working on automotive components which have been in contact with the oil, and this is expected to be confined to very few members of the public.

6. PHYSICAL AND CHEMICAL PROPERTIES

The notified polymer is prepared in a highly refined lubricating base oil and is never isolated. Therefore, a number of physical and chemical properties could not be determined. The physical and chemical properties provided below are based on modelling data or are those of the fuel additive package containing the notified polymer (EP 7690).

Appearance at 20ºC and 101.3 kPa	Highly viscous dark brown liquid.
Boiling Point	> 800ºC

Remarks The polymer is a liquid at normal use and environmental temperatures. It is a high molecular weight polymer and is not easily volatilised. Modelling data of similar polymers used in succinimide dispersants indicates that the boiling temperature will be in greater than 800ºC. Modelling data were not provided.

Density 947 kg/m^3 at 15ºC (for EP 7690)

Remarks Test report not provided.

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Vapour Pressure <1 x 10^{-13} kPa at 25ºC

Remarks The vapour pressure of the notified polymer is expected to be very low due to its ionic form and high molecular weight. The estimated vapour pressure provided is based on the vapour pressure of the petroleum base stock in which the polymer is manufactured.

Water Solubility < 0.005 g/L at 20ºC

METHOD OECD TG 105 Water Solubility. Column Elution Method
Remarks Analytical Monitoring: HPLC.

Test material was dissolved in toluene and coated onto glass beads used for the column. Calibration standards containing between 6.2-25 ppm of the test substance were prepared with 10-20% tetrahydrofuran as an auxiliary solvent to maintain solubility.
TEST FACILITY Ethyl Research Center (2003)

Hydrolysis as a Function of pH Not determined.

Remarks The notified polymer is not expected to hydrolyse in strong acid or base due to low water solubility and lack of hydrolysable functional groups.

Partition Coefficient (n-octanol/water) Not determined.

Remarks The notifier estimates the log Pow for the polymer to be >4 at 20ºC. The notifier has provided a reference (HPVCP, 2002) which quotes a log Pow for an analogous polymer as 6.7.. However, based on the low water solubility of the polymer the log Pow would be expected to be high.

Adsorption/Desorption Not determined.

Remarks The notifier estimates the Koc for the polymer to be ~3000 (log Koc ~ 3.48) based on its low water solubility. The low water solubility of the polymer is consistent with the polymer adsorbing strongly to soils and sediments.

Dissociation Constant Not determined.

Remarks Determination of the dissociation constant is difficult due to the low water solubility of the notified polymer. The notifier estimates the pKa to be greater than 10.

Particle Size Not applicable.

Remarks The notified polymer is a liquid manufactured in a highly refined lubricating base oil.

Viscosity 875 cSt at 100ºC (for EP 7690)

Remarks From the MSDS for the product EP7960. Test report not provided.

Flash Point 150ºC (for EP 7690)

Remarks Flashpoint measured using the closed cup method.

From the MSDS for the product EP7960.Test report not provided.

Flammability Limits Not determined.

Autoignition Temperature Not determined.

Explosive Properties Not explosive.

Remarks From the MSDS for the product EP7960. Test report not provided.

Reactivity

Remarks The notified polymer is expected to be stable under normal environmental conditions.

7. TOXICOLOGICAL INVESTIGATIONS

No toxicity data were submitted for the notified polymer. Toxicity data on three analogous polymers were provided. The product MSDS indicates the notified polymer is a modified polyolefin amide alkyleneamine. Two other similar materials subject to US EPA High Production Volume (HPV) Challenge Program (HPVCP, 2002) study were supplied and these are names as 2,5 pyrrolidinedione and bis alkenyl succinimide derivatives. These analogues have similar chemical functionality as the notified polymer. Full toxicity studies for E-644, which is related to the notified polymer by structure and physicochemical properties were provided.

Endpoint and Result	*Assessment Conclusion for analogous polymers*
Rat, acute oral LD50 >4300 mg/kg bw (E-644)	low toxicity
Rat, acute oral LD50 >5000 mg/kg bw (bis alkenyl succinimide derivative)	low toxicity
Rat, acute oral LD50 >5000 mg/kg bw (2,5-pyrrolidinedione derivative)	low toxicity
Rat, acute dermal LD50 >7940 mg/kg bw (E-644)	low toxicity
Rat, acute dermal LD50 >2000 mg/kg bw (bis alkenyl succinimide derivative)	low toxicity
Rat, acute dermal LD50 >5000 mg/kg bw (2,5 pyrrolidinedione derivative)	low toxicity
Rabbit, skin irritation (E-644)	slightly irritating
Rabbit, eye irritation (E-644)	non-irritating
Rat, repeat dose dermal toxicity – 28 days (2,5-pyrrolidinedione derivative)	NOEL = 80% analogue polymer in mineral oil
Rat, repeat dose oral toxicity (combined developmental and reproductive effects and neurotoxicity – 28 days (bis alkenyl succinimide derivative)	NOEL = 1000 mg/kg bw/day
Genotoxicity – bacterial reverse mutation (2,5-pyrrolidinedione derivative)	non mutagenic
Genotoxicity – bacterial reverse mutation (bis alkenyl succinimide derivative)	non mutagenic
Genotoxicity – *in vitro* mammalian cell gene mutation test (2,5-pyrrolidinedione derivative)	non genotoxic
Genotoxicity – *in vivo* mammalian erythrocytes micronucleus (bis alkenyl succinimide derivative)	non genotoxic

7.1. Acute toxicity – oral

7.1.1 Acute toxicity – oral

TEST SUBSTANCE E-644

METHOD In house method similar to OECD 401 Acute Oral Toxicity.

Species/Strain Rat/Sprague-Dawley.

Vehicle Corn oil.

Remarks – Method In a range finding study 10 rats (5/sex) were dosed with E-644 60% (v/v) at 1000 mg/kg bw (actual dose 450 mg/kg bw). At 24 hours no deaths were observed.

RESULTS

Group	*Number and Sex of Animals*	*Nominal Dose mg/kg bw*	*Actual Dose mg/kg bw*	*Mortality*
I	4/sex	1585	700	0
II	4/sex	2512	1100	0
III	4/sex	3981	1700	0
IV	4/sex	6311	2700	0
V	4/sex	10003	4300	0

LD50	>4300 mg/kg bw
Signs of Toxicity	No clinical signs of toxicity were observed in any animal during the observation period. Body weight gains were within the normal limits for rats of the size and strain used in the study.
Effects in Organs	No deleterious changes were observed at gross necroscopy.
CONCLUSION	E-644 is of low toxicity via the oral route.
TEST FACILITY	GSRI (1980a)

7.1.2. Acute toxicity – oral

TEST SUBSTANCE	bis alkenyl succinimide derivative
METHOD	OECD TG 401 Acute Oral Toxicity – Limit Test.
Species/Strain	Rat/Cr1:CD (SD) BR
Vehicle	None.
Remarks – Method	None.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
I	5/sex	0	0
II	5/sex	5000	0

LD50	> 5000 mg/kg bw
Signs of Toxicity	Dark staining of the anal region was observed in three males from day 1 to day 5. All animals were normal by day 6. Body weight data were unremarkable.
Effects in Organs	No visible lesions were observed in any animal at necroscopy
CONCLUSION	The analogous polymer is of low toxicity via the oral route.

7.1.3. Acute toxicity – oral

TEST SUBSTANCE	2,5-pyrrolidinedione derivative
METHOD	OECD TG 401 Acute Oral Toxicity – Limit Test.
Species/Strain	Rat/Sprague-Dawley.
Vehicle	None.
Remarks – Method	None.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
I	5/sex	0	0
II	5/sex	5000	0

LD50	> 5000 mg/kg bw
Signs of Toxicity	Diarrhoea was observed in two treated males and two treated females on the day of dosing and the following day. There was no significant difference in mean body weight between the treated and control groups.
Effects in Organs	No significant necroscopy findings were evident.
CONCLUSION	The analogous polymer is of low toxicity via the oral route.

7.2. Acute toxicity – dermal

7.2.1. Acute toxicity – dermal

TEST SUBSTANCE	E-644
METHOD	In house method similar to OECD TG 402 Acute Dermal Toxicity.
Species/Strain	Rabbit/New Zealand White.
Vehicle	None.
Type of dressing	Occlusive.
Remarks – Method	Half of the male and female rabbits of each dose level had the skin at the exposure site abraded. When the dressing was removed no unabsorbed test substance was observed at the 1000 and 1995 mg/kg bw dose levels while 1-3 mL of the test substance was unabsorbed at the two higher doses.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
I	2/sex	1000	0
II	2/sex	1995	0
III	2/sex	3980	0
IV	2/sex	7940	0

LD50	>7940 mg/kg bw
Signs of Toxicity - Local	The test substance produced no to very slight erythema and no oedema at the end of the 24-hour exposure period.
Signs of Toxicity - Systemic	No abnormal clinical observations were noted in any animals at any dose level during the study. In general, normal weight gains were noted for all test animals. However, one male in the 1995 mg/kg bw (abraded skin) dose group lost approximately 550 grams during the course of the study
Effects in Organs	No deleterious changes were observed at gross necropsy.
CONCLUSION	E-644 is of low toxicity via the dermal route.
TEST FACILITY	GSRI (1981)

7.2.2. Acute toxicity – dermal

TEST SUBSTANCE	bis alkenyl succinimide derivative
METHOD	OECD TG 402 Acute Dermal Toxicity – Limit Test.
Species/Strain	Rat/Cr1:CD (SC)BR
Vehicle	None.
Type of dressing	Semi-occlusive.
Remarks – Method	None.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
I	5/sex	2000	0

LD50	>2000 mg/kg bw
Signs of Toxicity - Local	No dermal findings were observed at the application site.
Signs of Toxicity - Systemic	Clinical observations were unremarkable. All animals exhibited body weight gains during the study.
Effects in Organs	There were no treatment related macroscopic findings.
CONCLUSION	The analogous polymer is of low toxicity via the dermal route.

7.2.3. Acute toxicity – dermal

TEST SUBSTANCE	2,5-pyrrolidinedione derivative
METHOD	OECD TG 402 Acute Dermal Toxicity – Limit Test.
Species/Strain	Rabbits/New Zealand White
Vehicle	None.
Type of dressing	Occlusive.
Remarks - Method	None.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
I	5/sex	0	0
II	5/sex	5000	0

LD50	>5000 mg/kg bw
Signs of Toxicity - Local	Slight erythema of the treated skin was observed in for all animals one hour after treatment. Slight to well defined erythema was observed for males and females from day 1 to day 7. Three females had well defined erythema at day 7, but all had normal skin by day 14. Dermal pustules or abscesses developed at the treatment area and lip in two treated males and one control female between days 7 and 14.
Signs of Toxicity - Systemic	The mean body weight of the treated females was 5% lower than the control animals at termination.
Effects in Organs	Reddened depilated or flaky skin was observed at previously abscessed sites at necroscopy. The dermal lesions observed in the treated males appeared histologically as trace or moderate hyperkeratosis, mild dermatitis and mild acanthosis. The skin of all treated females was histologically normal.
CONCLUSION	The analogous polymer is of low toxicity via the dermal route.

7.3. Irritation – skin

TEST SUBSTANCE	E-644
METHOD	In house method – similar to OCED 404 Acute Dermal Irritation/Corrosion.
Species/Strain	Rabbit/New Zealand White
Number of Animals	3/sex
Vehicle	None.
Observation Period	72 hours.
Type of Dressing	Occlusive.

Remarks - Method: Two test sites (each approximately 3 cm^2) were prepared on the dorsal trunk area on each animal. The left site remained intact and the right was abraded. The sites were only scored at 24 and 72 hours.

RESULTS

Lesion	*Mean Score**	*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
Erythema/Eschar	0.33	2	24 hours	0
Oedema	0	0	-	0

*Calculated on the basis of the intact site scores at 24, and 72 hours for ALL animals.

Remarks - Results: At the 24-hour reading no to well defined erythema was observed at both the abraded and intact test sites. No oedema was noted at 24 hours. At the 72-hour reading no erythema or oedema was observed in any animal.

CONCLUSION: E-644 is slightly irritating to the skin.

TEST FACILITY: GSRI (1980b)

7.4. Irritation – eye

TEST SUBSTANCE: E-644

METHOD: In house method – similar to OECD TG 405 Acute Eye Irritation/Corrosion.

Species/Strain: Rabbit/New Zealand White.
Number of Animals: Six (3/sex).
Observation Period: 72 hours.
Remarks – Method: None.

RESULTS

Lesion	*Mean Score**	*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
Conjunctiva: redness	0	0	-	0
Conjunctiva: chemosis	0	0	-	0
Conjunctiva: discharge	0	0	-	0
Corneal opacity	0	0	-	0
Iridial inflammation	0	0	-	0

*Calculated on the basis of the scores at 24, 48, and 72 hours for ALL animals.

Remarks – Results: No abnormal clinical observation was noted in any animal and no signs of ocular irritation were observed at 24, 48 and 72 hours in the treated eyes

CONCLUSION: The analogous polymer is non-irritating to the eye.

TEST FACILITY: GSRI (1980c)

7.5. Repeat dose toxicity
7.5.1 Repeat dose toxicity

TEST SUBSTANCE: 2,5-pyrrolidinedione derivative

METHOD: OECD TG 410 Repeated Dose Dermal Toxicity: 28-day Study.

Species/Strain: Rats/Sprague-Dawley
Route of Administration: Dermal – non-occluded.

Exposure Information	Total exposure days: 28 days; Dose regimen: 5 days per week; Duration of exposure (dermal): 6 hours/day; Post-exposure observation period: none
Vehicle	Mineral oil.
Remarks - Method	A plastic collar was placed around each animal's neck to prevent ingestion rather than using a gauze patch over the treatment site secured to the trunk with non-irritating tape and wrapped with an elastic sleeve as suggested by OECD TG 410.

RESULTS

Group	*Number and Sex of Animals*	*Dose (% in mineral oil)*	*Mortality*
I (control)	12/sex	0	0
II (low dose)	12/sex	10	0
III (mid dose)	12/sex	40	0
IV (high dose)	12/sex	80	0

Mortality and Time to Death

No deaths occurred during the study.

Clinical Observations

Physical observations made during the study included ocular and nasal discharge, alopecia on the forepaw and scabs and sores on the neck. Normal pupil responses were observed in all animals throughout the study.
Slight to well-defined erythema with no to slight oedema was seen in both sexes of the treated and control groups. Dry, flaky, and/or abraded skin was observed sporadically in all but the high dose animals. Body weights and body weight gains were unremarkable. The mean food consumption of mid dose males was slightly (statistically significant) elevated compared to control animals during the second week of the study. The food consumption data was unremarkable in all groups at the remaining evaluation intervals.

Laboratory Findings – Clinical Chemistry, Haematology, Urinalysis

There were no treatment related differences observed in the haematology data of the treated animals when compared to control animals. Statistically significant differences in several serum chemistry parameters were observed. These included decreases in mean glucose (mid dose males) and sodium (males - doses not given), increased direct bilirubin (high dose males) and uric acid (low dose females).

Effects in Organs

The mean brain weight of the low dose males was slightly lower (statistically significant) than control. Gross pathological observations made included red, thickened or scabbed skin in four control males, dilated renal pelvis in three low dose males, in mid dose females and one high dose female. A fluid filled kidney was observed in one low dose male, red salivary nodes in one control female and mottling or multiple red/purple foci on the thymus in one control and one mid dose male. Red foci in the lungs were seen in one mid dose male and a diaphragmatic hernia was noted in one mid dose female. These findings were not considered treatment related.

Microscopic examination of treated skin sites showed acanthosis in both high dose and control animals. Necrosis and ulceration of treated skin were observed only in the controls. There was no increase in the incidence or severity of skin lesions in the high dose animals compared to the controls.

Remarks – Results

The physical observations made during the study were attributed to the use of collar during treatment and were not considered compound related. The incidence and severity of the skin irritation observed were not dose related and hence not considered treatment related. The erythema and oedema were attributed to a vehicle effect.

The elevated food consumption in mid dose males in the second week was attributed to a slight decrease in food consumption in control animals and was not considered to be treatment related.

The changes in serum chemistry observed were found not to be dose related and all of these findings were within the range of corresponding historical data. Thus, these changes were not considered treatment related.

The decrease in mean absolute brain weight in low dose males was judged not to be treatment related as the brain to body weight ratios were comparable.

The gross pathological and histopathological changes observed were found to be sporadic and were not likely to be treatment related.

CONCLUSION
The No Observed Effect Level for the 2,5-pyrrolidinedione derivative was established as 80% in mineral oil in this study, based on the absence any treatment related effects at any dose.

7.5.2. Repeat dose toxicity

TEST SUBSTANCE	bis alkenyl succinimide derivative
METHOD	OECD TG 407 Repeated Dose 28-day Oral Toxicity Study in Rodents. OECD TG 421 Reproduction/Developmental Toxicity Screening Test.
Species/Strain	Rat/Sprague-Dawley CD.
Route of Administration	Oral – gavage.
Exposure Information	Total exposure days: 28-Day Repeat Dose Toxicity Phase: 29 or 30 days Reproduction phase: F0 males 29-day premating period, plus mating and postmating period (70 days). F0 females 29-day premating period through day 4 of lactation (54-68 days). Neurotoxicity phase: 29 days Dose regimen: 7 days per week. Post-exposure observation period: 28-Day Repeat Dose Toxicity Phase: 14 days Neurotoxicity phase: 14 days
Vehicle	Corn oil.
Remarks – Method	A dose range finding study was undertaken to determine the dose levels for the main study. Three rats/sex/group were dosed at 0, 100, 500 and 1000 mg/kg bw/day for 7 days. Treatment related effects were observed during the range finding study. The NOEL was 1000 mg/kg bw/day.

RESULTS

Group (28 day repeat dose toxicity)	*Number and Sex of Animals*	*Dose mg/kg bw/day*	*Mortality*
I (control)	6/sex	0	0
II (low dose)	6/sex	100	0
III (mid dose)	6/sex	500	0
IV (high dose)	6/sex	1000	0
V (control recovery)	6/sex	0	0
VI (high dose recovery)	6/sex	1000	0

Group (reproductive toxicity)	*Number and Sex of Animals*	*Dose mg/kg bw/day*	*Mortality*
I (control)	12/sex	0	0
II (low dose)	12/sex	100	0

III (mid dose)	12/sex	500	0
IV (high dose)	12/sex	1000	0

Group	*Number and Sex Of Animals*	*Dose mg/kg bw/day*	*Mortality*
I (control)	6/sex	0	0
II (low dose)	6/sex	100	0
III (mid dose)	6/sex	500	0
IV (high dose)	6/sex	1000	0
V (control recovery)	6/sex	0	0
VI (high dose recovery)	6/sex	1000	0

Mortality and Time to Death

28 Day Repeat Dose, Reproductive and Neurotoxicity

No mortality was observed during the studies.

Clinical Observations

28 Day Repeat Dose and Neurotoxicity

Body weight and body weight change data for all groups were unremarkable. Food consumption data for the low and mid dose groups were comparable to the control group during treatment and recovery. Food consumption in the high dose group was significantly higher than the control group during treatment and continued to be elevated in females during recovery. Feed efficiency in this group was generally comparable to the control group however values were lower in the high dose group males in week 4 and the first week of the recovery period in females. Landing foot splay distances in the high dose group were slightly shorter than the control group during treatment and recovery.

Reproductive study

Mean body weight, body weight change, food consumption, and feed efficiency were unremarkable during premating. In some instances, the food consumption was slightly elevated in the treated animals compared to controls, but these were not considered toxicologically significant. Some mid and high dose animals exhibited a slight weight loss during the last two weeks of the study. The postmating period food consumption of the treated males was higher, (frequently statistically significant) than the controls. Feed efficiency was reduced for the mid and high dose males during the last two weeks of the study. This reduction coincided with the reduced body weight observed in some animals in these groups.

The female mating indices were comparable to the controls. The male mating indices were slight lower (83.3%) than controls at the high dose only.

Mean maternal body weights during gestation were unaffected by treatment. Body weight gains over days 7-14 of gestation in the mid and high dose groups were significantly higher than controls. Body weight, body weight gain, and maternal food consumption during gestation and lactation were comparable to the control.

No treatment effects were seen in parturition data.

Pup body weights, and pup viability indices and sex ratios were unremarkable. There was slight increase in the number of female pups in the mid dose groups. No malformations were seen in the stillborn pups or in dead pups found during days 0-4 of lactation in the control or treated groups.

Laboratory Findings – Clinical Chemistry, Haematology, Urinalysis

28 Day Repeat Dose and Neurotoxicity

No treatment related changes in clinical chemistry, haematology, and urinalysis were observed.

Effects in Organs

28 Day Repeat Dose and Neurotoxicity

No treatment related effects on organ weight, brain size, or macroscopic data were observed in the treated animals. Microscopic examination of gross lesions did not indicate any treatment related effects.

Reproductive study
No treatment effects were observed in absolute organ weights; organ to body and organ to brain weight ratios in parental males and females. There were no treatment related microscopic and macroscopic abnormalities observed in the reproductive study phase. The mean number of uterine implantation scars and corpora lutea were comparable between treated and control animals.

No treatment related macroscopic findings were observed in the pups.

Remarks – Results
28 Day Repeat Dose and Neurotoxicity
Due to the lack of a consistent trend in the clinical observations, the observed effects in treated animals were considered not to be of toxicological significance.

The shorter landing splay distances observed in the high dose animals were similar to pre-test values and did not change during treatment. A lengthening of this distance is considered evidence of neurological insult. Thus, the effects were not considered of toxicological significance.

Reproductive toxicity
The slightly elevated body weight gains and food consumption values observed in treated animals were not considered toxicologically significant. The cause of the slight weight loss observed in some mid and high dose males in last two weeks of the study was unclear, however the absence of any body weight effects during the first eight weeks and the absence of body weight gains tends to suggest that the effect was not treatment related. The increased food consumption observed in the treated males in postmating period was not considered toxicologically significant. The slightly decreased mating indices in high dose males, were within the range of historical control data and were not statistically significant. The significantly higher body weight gains in mid and high dose over days 7-14, were not considered treatment related or toxicologically significant.

CONCLUSION
The No Observed Effect Level (NOEL) for the 2,5-pyrrolidinedione derivative was established as 1000 mg/kg bw/day in the combined 28 day repeat dose study and neurotoxicity study and the reproductive study, based on absence of any toxicological significant treatment related effects at any dose.

7.6. Genotoxicity – bacteria
7.6.1. Genotoxicity – bacteria

TEST SUBSTANCE	2,5-pyrrolidinedione derivative
METHOD	OECD TG 471 Bacterial Reverse Mutation Test. Plate incorporation procedure.
Species/Strain	*Salmonella typhimurium*: TA1535, TA1537, TA98, TA100
Metabolic Activation System	S9 fraction of livers of Aroclor 1254 treated Sprague-Dawley rats.
Concentration Range in Main Test	a) With metabolic activation: 33.3, 100, 333.3, 1000, 3333 µg/plate. b) Without metabolic activation: 33.3, 100, 333.3, 1000, 3333 µg/plate.
Vehicle	Tetrahydrofuran diluted with 1:10 dimethylsulphoxide (DMSO).
Remarks - Method	None.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/plate) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1	>3333	>3333	>33.3	-
Test 2	>3333	>3333	>33.3	-
Present				
Test 1	>3333	>3333	>33.3	-
Test 2	>3333	>3333	>33.3	-

Remarks - Results In the main study the test material was completely miscible with

tetrahydrofuran and partially miscible in subsequent dilutions with DMSO, but was not completely miscible with the top agar at >33.3 µg/plate. The test material was not cytotoxic to any strain nor was it mutagenic to any strain. No reproducible increase in mutation frequency was observed in any tester strain with or without metabolic activation. The tester strain responded to the positive controls as expected.

CONCLUSION

The analogue polymer was not mutagenic to bacteria under the conditions of the test.

7.6.2. Genotoxicity – bacteria

TEST SUBSTANCE

bis alkenyl succinimide derivative

METHOD

OECD TG 471 Bacterial Reverse Mutation Test.
Plate incorporation procedure.

Species/Strain

S. typhimurium: TA1535, TA1537, TA98, TA100.
E. coli: WP2*uvr*A

Metabolic Activation System

S9 fraction from livers of Aroclor 1254 pretreated Sprague-Dawley rats.

Concentration Range in Main Test

a) With metabolic activation: 100, 250, 500, 1000, 5000µg/plate.
b) Without metabolic activation: 100, 250, 500, 1000, 5000µg/plate.

Vehicle

Pluronic F127 (25% (w/w) in ethanol).

Remarks - Method

None.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/plate) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1	>10000	>10000	>500	-
Test 2	>10000	>10000	>500	-
Present				
Test 1	>10000	>10000	>500	-
Test 2	>10000	>10000	>500	-

Remarks - Results

In a dose range finding study no cytotoxicity was observed with tester strain TA100 and WP2*uvr*A at dose levels up to 10000 µg/plate with and without metabolic activation. Test article precipitation was observed on plates at 3330 µg/plate and above with and without metabolic activation.

In the initial assay, all data were acceptable and no positive increases in the number of revertants/plate were observed. In the confirmatory assays, all data were acceptable and no positive increases in the number of revertants/plate were observed with any of the tester strains with or without metabolic activation. The vehicle control values for three of the tester strains (TA98, TA1535 and 1537) were higher than routinely expected. These were retested and the results were found to be acceptable.

No cytotoxicity was observed in either strain up to 10000 µg/plate. Test material precipitation was observed on plates at and above 500 µg/plate.

CONCLUSION

The analogue polymer was not mutagenic to bacteria under the conditions of the test.

7.7. Genotoxicity – in vitro

TEST SUBSTANCE	2,5-pyrrolidinedione derivative
METHOD	OECD TG 476 In vitro Mammalian Cell Gene Mutation Test.
Cell Type/Cell Line	L5178Y mouse lymphoma cells.
Metabolic Activation System	S9 fraction from Aroclor 1242/1254 induced rat liver.
Vehicle	5% pluronic F-68 (w/w with distilled water)
Remarks - Method	None.

Metabolic Activation	*Test Substance Concentration (µg/mL)*	*Exposure Period*	*Expression Time*	*Selection Time*
Absent				
Test 1	0, 333, 667, 1000	4 hrs	48 hours	10-12 days
Test 2	0, 500, 1000, 1333, 1667, 2000	4 hrs	48 hours	10-12 days
Present				
Test 1	0, 333, 667, 1000, 3330, 6670	4 hrs	48 hours	10-12 days
Test 2	-	-	-	-

*Cultures selected for metaphase analysis.

RESULTS

Remarks - Results	Percent total growth ranged from 48% to 89% with activation and 10% to 50% without activation. The positive controls responded appropriately. None of the cultures treated with test materials at range of concentration up to the limit of solubility with or without metabolic activation exhibited a mutation frequency that was twice that of the average mutation frequency of the negative controls.
CONCLUSION	The analogue polymer was not mutagenic to L5178Y cells treated in vitro under the conditions of the test.

7.8. Genotoxicity – in vivo

TEST SUBSTANCE	bis alkenyl succinimide derivative
METHOD	OECD TG 474 Mammalian Erythrocyte Micronucleus Test.
Species/Strain	Mouse/ Swiss albino Crl:CD-1
Route of Administration	Intraperitoneal.
Vehicle	Peanut oil.
Remarks – Method	The doses for the main study were based on the results of range finding studies in which the maximum tolerated dose was estimated to be 5000 mg/kg

Group	*Number and Sex of Animals*	*Dose Mg/kg bw*	*Sacrifice Time hours*
I (vehicle control)	15/sex	60	24, 48, 72
II (low dose)	15/sex	1250	24, 48, 72
III (mid dose)	15/sex	2500	24, 48, 72
IV (high dose)	15/sex	5000	24, 48, 72
V (positive control, CP)	5/sex	60	24

CP=cyclophosphamide. M=mitomycin C.

RESULTS

Doses Producing Toxicity	No abnormal clinical observations were of the vehicle and positive controls and low dose animals after dosing and until the appropriate harvest times. The high dose males and females were slightly hypoactive at 19 and 42 hours post dosing. Hypoactivity was also observed in the

	high dose animal at 66 hours. At 42 and 66 hours postdosing the high dose males also exhibited rough hair coats. The mid dose males were slightly hypoactive at 42 and 66 hours post dosing. At 66 hours post dosing the mid dose males also displayed rough hair coats. Some evidence of bone marrow toxicity was observed as the test substance induced a statistically significant decrease in PCE:NCE ratio at the mid dose and high dose in females at 72 hours and the high dose males at 48 and 72 hours.
Genotoxic Effects	A statistically significant increase in micronucleated PCEs was observed in the high dose males at 24 hours.
Remarks – Results	An apparent increase in micronucleated PCEs found in high dose males at 24 hours was attributed to an abnormally low number of micronucleated PCEs in the concurrent control group. No dose-response relationship was observed and the value was within historical control range for the laboratory. The positive controls induced a statistically significant increase in the micronucleated PCEs in both sexes compared to the vehicle controls.
CONCLUSION	The analogue polymer was not clastogenic under the conditions of this in vivo micronucleus test.

8. ENVIRONMENT

8.1. Environmental fate

8.1.1. Ready biodegradability

The following data are taken from a summary provided for an analogue submitted to the High Production Volume (HPV) Challenge Program run by the US EPA (HPVCP 2002). Robust summaries only are available and the original test report was not provided.

TEST SUBSTANCE	bis alkenyl succinimide derivative
METHOD	OECD TG 301 B Ready Biodegradability: CO_2 Evolution Test.
Inoculum	Activated sludge from a domestic waste water treatment plant.
Exposure Period	28 days.
Auxiliary Solvent	None specified.
Analytical Monitoring	CO_2 evolution – $Ba(OH)_2$ downstream of test vessels. CO_2 produced was determined through back titration of unreacted $Ba(OH)_2$.
Remarks - Method	None.

RESULTS

Test substance		*Sodium benzoate*	
Day	*% Degradation*	*Day*	*% Degradation*
28	16	28	88

Remarks - Results	Degradation of reference material met criteria for test validation.
CONCLUSION	The analogue polymer is not readily biodegradeable.

8.1.2. Bioaccumulation

No bioaccumulation data were submitted. However due to its low water solubility and high molecular weight, the notified polymer is not likely to bioaccumulate.

8.2. Ecotoxicological investigations

No ecotoxicity data have been provided for the notified polymer. The notifier has provided analogue data in the form of one report for fish toxicity and a report summarising data for this class of polymer (HPVCP 2002). Again the latter only contains robust summaries.

8.2.1. Acute toxicity to fish

TEST SUBSTANCE	bis alkenyl succinimide derivative
METHOD	Semi-static test conditions according to unspecified guidelines.
Species	Sheepshead minnow (*Cyprinodon variegates*)
Exposure Period	96 hours
Auxiliary Solvent	None specified.
Water Hardness	None specified.
Analytical Monitoring	None specified.
Remarks – Method	Test solutions were prepared by direct dispersion of the test material into the water with the aid of shielded propeller stirrers. The test material was present as a foaming oily scum on the surface, adhering to the mess screens and tank walls. Only limited amounts were in the water column. Test solutions were renewed daily. Environmental parameters of pH, dissolved oxygen and temperature were not recorded in vessels containing test material. They were measured for the blank solution, and were within normal limits.

RESULTS

Concentration mg/L		*Number of Fish*	*Mortality*				
Nominal	*Actual*		*1 h*	*24 h*	*48 h*	*72 h*	*96 h*
0	0	20	0	0	0	0	0
100		20	0	0	0	0	0
500		20	0	0	0	0	0
1000		20	0	0	0	0	0

LC50	>1000 mg/L at 96 hours.
NOEC (or LOEC)	1000 mg/L at 96 hours.
Remarks – Results	No mortality or sublethal effects were observed throughout the study.
CONCLUSION	The analogue polymer is not toxic to fish at a concentration exceeding its water solubility
TEST FACILITY	Huntingdon Research (1988)

8.2.2. Summary Data

The following data was provided as surrogate data and presented as robust summaries in a report submitted to the High Production Volume (HPV) Challenge Program run by the US EPA (HPVCP 2002). The original reports were not presented.

8.2.2.1 Acute toxicity to fish

TEST SUBSTANCE	bis alkenyl succinimide derivative
METHOD	OECD TG 203 Fish, Acute Toxicity Test – semi-static. US EPA Toxic Substances Control Act Test Guideline 797.1400 (1985/1987/1989)
Species	Rainbow Trout (*Oncorhynchus mykiss)*
Year Study Performed	1997
Exposure Period	96 hours
Auxiliary Solvent	None specified.

Water Hardness	40-48 mg $CaCO_3$/L
Analytical Monitoring	Total organic carbon (TOC) measurements were taken of initial (0-h) test solution and at test termination (48-h). Water samples were passed through 0.45 micron filter prior to TOC analysis.
Remarks – Method	Individual water accommodated fractions (WAFs) were prepared for each test level and renewed daily. A measured weight of test substance was added to a measured volume of dilution water in a glass vessel and stirred for 20 hours. Stirring was accomplished using a Teflon coated magnetic stir bar. The vortex of the WAF was approximately 10%. Following the mixing period, the test solutions were allowed to stand for 4 hours before the water phase was removed. To avoid removing non-soluble test material from the surface, a siphon was used to remove the exposure solutions from the mixing vessels. The siphoned aqueous phase (WAF) was then used in the aquatic toxicity test. Test Levels: Control, and 1000 mg/L WAF. About 80% of the solution in each test level was renewed daily after 24, 48, and 72 hours. Test Temperature: 11.6 to 13.1ºC. Dissolved oxygen ranged from 5.8 - 9.9 mg/L; pH ranged from 7.0 - 7.7; conductivity ranged from 160 - 180 µmhos/cm; alkalinity was not reported. There were three 15 L replicates per treatment, 10 fish per replicate (30 fish per treatment).
RESULTS	LL50 >1000 mg/L at 96 hours. NOEL = 1000 mg/L at 96 hours.
Remarks – Results	where LL is lethal loading rate Loading Level (mg/L) — TOC range (mg/L) Control — 2.8-3.0 1000 — 3.4-4.2 TOC levels were very low (<5 mg/L) and therefore not considered to be indicative of actual test material concentrations and results are therefore based on nominal loading rates. A thin film of insoluble test material was observed in the 1000 mg/L loading throughout the test in which 97% of organisms survived. No sublethal effects were noted during the test.
CONCLUSION	The analogue polymer is not toxic to fish at concentration exceeding its water solubility

8.2.2.2 Acute toxicity to aquatic invertebrates

TEST SUBSTANCE	bis alkenyl succinimide derivative
METHOD	OECD TG 202 Daphnia sp. Acute Immobilisation Test and Reproduction Test – static. US EPA Toxic Substances Control Act Test Guideline 797.1300 (1993)
Species	Cladoceran (*Daphnia magna*)
Year Study Performed	1996
Exposure Period	48 hours
Auxiliary Solvent	None specified.
Water Hardness	160-180 mg $CaCO_3$/L
Analytical Monitoring	Total organic carbon (TOC) measurements were taken of initial (0-h) test solution and at test termination (48-h). Water samples were passed through 0.45 micron filter prior to TOC analysis.
Remarks – Method	Individual water accommodated fractions (WAFs) were prepared for each test level. Each of the five WAFs was prepared by combining the appropriate amount of test substance and dilution water in a mixing vessels equipped with a magnetic stir bar and stirred for approximately 20 hrs. Mixing speed was adjusted such that a vortex formed that was approximately 25% of the distance to the bottom of the mixing vessel.

Following the mixing period, the test solutions were allowed to stand for 4 hrs before the water phase was removed. The water phase (i.e., WAF) was used for the aquatic toxicity test. WAF loading rates: Control, 130, 220, 360, 600, and 1,000 mg/L WAF loading rates. Ten daphnids per replicate (20 per treatment).

Test temperature: 19.4 - 21.0°C. Dissolved oxygen: 7.4 -8.8 mg/L; pH: 7.4-8.8; conductivity: 560-610 µmhos/cm.

RESULTS

EL50 >1000 mg/L at 48 hours.
NOEL = 1000 mg/L at 48 hours.

Remarks – Results

where EL is effective loading rate.

Loading Level (mg/L)	TOC (range)
Control	3.7-3.8
130	4.0-3.7
1000	4.2-4.3

TOC levels were very low (<5 mg/L) and therefore not considered to be indicative of actual test material concentrations and results are therefore based on nominal loading rates. No undissolved test material was seen on the surface of the test vessels during the entire test.

CONCLUSION

The analogue polymer is not toxic to Daphnia at concentrations exceeding its water solubility.

8.2.2.3 Algal growth inhibition test

TEST SUBSTANCE

bis alkenyl succinimide derivative

METHOD

OECD TG 201 Alga, Growth Inhibition Test.
US EPA Toxic Substances Control Act Test Guideline 797.1050 (1984)

Species	Freshwater alga (*Pseudokirchneriella subcapitata*)
Year Study Performed	1996
Exposure Period	96 hours
Auxiliary Solvent	None specified.
Water Hardness	None specified.
Analytical Monitoring	Total organic carbon (TOC) measurements were taken of initial (0-h) test solution and at test termination (48-h). Water samples were passed through 0.45 micron filter prior to TOC analysis.

Remarks – Method

Individual water accommodated fractions (WAFs) were prepared for each test level. A measured weight of test material was added to a measured volume of dilution water in a glass vessel and stirred with for approximately 24 hours. Stirring was accomplished using a Teflon coated magnetic stir bar. Mixing speed adjusted such that the vortex extended from the surface approximately 5% of the way to the bottom of the mixing vessel. Following the mixing period, the test solutions were allowed to stand for 4 hours before the water phase was removed. The siphoned aqueous phase (WAF) was then used in the aquatic toxicity test. Test Levels: Control, 33, 65, 130, 250, 500, and 1000 mg/L WAF loading rates. There were three 100 mL replicates per treatment loading, each with an inoculum of 10000 cells/mL.

Test temperature: 23.2 to 24.0ºC.

RESULTS	E_bL_{50} (72 h) = 270 mg/L WAF E_rL_{50} (72 h) = 320 mg/L WAF E_bL_{50} (96 h) = 370 mg/L WAF E_rL_{50} (96 h) = 510 mg/L WAF where EL is effective loading rate. The probit method was used to calculate the 72 and 96-hour effect concentrations.
Remarks – Results	TOC (total organic carbon) levels were <1.0 to 1.1 mg/L and 3.1 to 3.6 mg/L in control vessels at test initiation and at 96 hours, and <1.0 to 1.1 mg/L and 1.5 to 1.8 mg/L in the 1000 mg/L test vessels at test initiation and at 96 hours. Therefore TOC levels were not considered to be indicative of actual test substance concentrations and results are therefore based on nominal loading rates. No undissolved test material was seen on the surface of the test vessels during the entire test. No effects on cell size, shape, colour, adhesion, or aggregation were noted in any of the treated solutions. The test substance was shown to be algistatic rather than algicidal through incubation of a sample of the algal media from the highest loading level in fresh untreated media for 4 days.
CONCLUSION	As no undissolved test substance was observed in the test vessels, the analogue polymer shows some toxicity to algae below the level of its water solubility. This toxicity is reversible when algae are exposed to fresh media.

It should be noted that the US EPA had the following comments on the report, which pertain to the ecotoxicity data (US EPA, 2003).

The data provided for the compounds are inadequate. The tests were conducted above the water solubility limit. It appears that these polymers are dispersible in water and should have been tested at their dispersibility limit. In addition, the polymers were not buffered at pH 7 and the TOC were above the generally accepted 2.0 mg/L limit for low solubility polymers.

9. RISK ASSESSMENT

9.1. Environment

9.1.1. Environment – exposure assessment

Release of the notified polymer will only occur during blending and use since it will not be manufactured in Australia.

Losses during blending are expected to be minimal because the process is highly automated and the equipment used will be cleaned with oil and these washings will be used in the formulation of the next batch. In these situations release would only be through accidental spills that would be recycled or collected for incineration. Losses during addition to motors will also be low.

As indicated in section 5.5, the fate of used oils in Australia has been the subject of a number of surveys with at least 60% of all used oils generated collected for recycling to be resold mainly as fuel oil. The fate of the remaining 40% of used oil could include a substantial portion being reused especially in the mining, agricultural and transport sectors. The Australian Institute of Petroleum survey (AIP, 1995) report indicated no evidence that bulk used oil was being dumped, but suggested there was some uncertainty as to the fate of 40% of used oil not collected for recycling. This improper disposal is however, widespread across Australia. Most oil disposed of improperly or to landfill is likely to become associated with soils or sediments. The notified polymer is not expected to be mobile or to leach from landfill sites because of its poor water solubility. While not readily biodegraded by sewage micro-organisms, the polymer is likely to be slowly degraded in soil environments by soil microbes and abiotic processes.

The main environmental exposure is expected to result from inappropriate disposal of waste lubricant product. Assuming a worst case scenario of about 14% of lubricant in the DIY market, only about 20% of this, ie up to 280 kg of notified polymer, is expected to be collected for recycling, approximately 25% (ie 350 kg notified polymer) will go to landfill and up to 700 kg will be disposed of in other inappropriate ways (to treat fence posts, kill weeds etc.) and 5% (70 kg) is estimated to be released into the stormwater drains.

The amount released to stormwater drains (ie less than 1% of the total import volume) can enter the aquatic compartment and could be expected to become associated with suspended organic material (due to the expected high logPow), settle out into the sediments and eventually will biodegrade.

Stormwater

It is difficult to estimate the Predicted Environmental Concentration (PEC) of the notified polymer released into the stormwater drains, which have the potential to enter the aquatic environment. However, a worst case estimated PEC might be calculated if it is assumed that all of the 70 kg expected to be released into the stormwater drains through inappropriate disposal occurs in a single metropolitan area with a geographical footprint of 500 square kilometres and an average annual rainfall of 50 cm. Spills and leaks from engines potentially comprise 1% of the oil formulation of the notified polymer. These may enter the soil and stormwater compartments, assuming all of this estimated quantity (≤100 kg/annum) is discharged into the stormwater drains in addition to the oil which is inappropriately disposed of. The maximum annual release into this localised stormwater system of 170 kg and the annual volume of water drained from this region estimated to be approximately 250×10^6 m^3, the resultant PEC is approximately 0.7 μg/L.

Sewer

Based on recent information on waste oil disposal, up to 7% (up to 700 kg/y) of the notified polymer may potentially be inappropriately disposed of to the sewer by DIY activities. A predicted environmental concentration (PEC) in the treated effluent, and downstream waterways, has been estimated with a sewage treatment plant (STP) model developed by the Department of the Environment and Heritage (Environment Australia, 2003). The model assumes that the notified polymer is discharged into the sewerage system and none is attenuated or biodegraded within this system. Australia has a population of ~20.1 million people, and an average value for

water consumption of 200 L/person/day has been adopted for this national-level assessment (4020 ML/day for total population). Therefore the concentration of notified polymer in the Australian sewage network may be calculated on the basis of a maximum annual volume of ≤10 tonnes per annum. The approximate sewerage effluent concentration under these assumptions is 0.5 μg/L (700×10^9 μg per annum ÷ 365 days/ year ÷ 4020×10^6 L/day). Based on dilution factors of 1 and 10 for inland river and ocean outfall discharges of STP-treated effluents, respectively, PECs of the notified polymer in freshwater and marine surface waters resulting from sewage discharge may, under these assumptions, approximate 0.5 μg/L ($PEC_{freshwater}$) and 0.05 μg/L (PEC_{marine}), respectively.

Any notified polymer burned in the engine, recycled for fuel, or disposed of by incineration would result in the evolution of water vapour and oxides of carbon. Sludges from waste treatment plants or oil recycling facilities may also be incinerated.

The notified polymer is not expected to cross biological membranes due to its high molecular weight, and in view of its low water solubility is therefore not expected to bioaccumulate.

9.1.2. Environment – effects assessment

The most sensitive endpoint is the effect on biomass production in the freshwater green algae (*Pseudokirchneriella subcapitata*) at 72 hours. Data for three trophic levels are available which would normally indicate a safety factor of 100. However, as these data are for an analogue with some structural differences, a safety factor of 1000 will be used. Therefore, the Predicted No Effect Concentration (PNEC) is 270/1000 = 0.27 mg/L.

9.1.3. Environment – risk characterisation

The Risk quotient (RQ) value for storm water, where RQ = PEC/PNEC, is 0.7 μg/L ÷ 270 = 0.003, and those from the sewer for freshwater and marine receiving environments are 0.004 (ie. 1.2 μg/L ÷ 270) and 0.0004 (ie 0.12 μg/L ÷ 270), respectively, have been estimated based on the disposal scenarios described in Section 9.1.1. Since these are all <<1, a low risk to the aquatic environment is expected.

Overall, the environmental hazard from the proposed reformulation and use of the notified polymer is expected to be low. However, the potential exists for physical fouling of aquatic organisms by undissolved material in the advent of a sizeable release to waterways. For this reason and the potential and the uncertainty of toxic effects to fish and other aquatic organisms the notified polymer should be prevented from entering waterways.

9.2. Human health

9.2.1. Occupational health and safety – exposure assessment

Transport and Storage

The potential of exposure to the notified polymer during the transport and storage of the imported lubricant additive package (20-25% (w/w) notified polymer) and final lubricant product (2.5-3.5% (w/w) notified polymer) is minimal, except in an accident when the packaging is breached. Worker exposure will be minimised by the use of overalls, safety boots and gloves.

Reformulation

During the reformulation process, there is expected to be minimal worker exposure. Incidental dermal exposure to splashes, drips and spills of the imported lubricant additive package may occur during the connection and disconnection of the lines used to charge the blending vessels. The blending process is automated and occurs in a closed system. Following blending, the final lubricant product will be transferred to storage tanks or directly drummed.

Drum filling is again an automated process and worker intervention is not required unless the filling line operation requires adjustment. However, workers are required to insert bungs and label containers and dermal contact with contaminated surfaces may occur.

Maintenance workers involved in cleaning blending and filling equipment may be dermally exposed to residues containing the notified polymer.

Workers involved in the blending activities receive training in the handling of additive packages, and wear personal protective equipment such as gloves, eye protection, protective clothing, and hard hats.

Laboratory Staff
Laboratory staff are expected to have minimal exposure due to the brief sampling periods and the small quantities involved. Dermal exposure due to drips may occur during sampling. It would be expected that gloves, lab coats and safety glasses would be used by laboratory personnel during testing.

End Users
End users of the finished product may be exposed to notified polymer when the final products are added and drained from systems, handling automotive components that have come into contact with the oil and during cleaning of equipment. Workers will wear overalls, cotton hat and safety boots when using products containing the notified polymer.

9.2.2. Public health – exposure assessment

The finished product will be sold to DYI enthusiasts. Therefore, very limited numbers of the public may have occasional exposure while doing specialised automotive repair work.

9.2.3. Human health – effects assessment

No toxicity data for the notified polymer were submitted with this notification. Data on analogous polymers were provided. Robust summaries for 2,5 pyrrolidinedione and bis alkenyl succinimide derivatives and full toxicity studies for E-644, were provided. The studies indicate that the analogous polymers have low acute oral and dermal toxicity.

E-644 was found to be slightly irritating to rabbit skin. E-644 was not irritating to rabbit eyes.

The NOEL for the 2,5 pyrrolidinedione derivative in a 28-day repeat dose dermal toxicity study in rats was 80% in mineral oil (highest dose) based on the absence of any treatment related effects at any dose. The NOEL for the 2,5 pyrrolidinedione derivative established in a 28-day combined development, reproductive and neurotoxicity repeat dose oral toxicity study in rats was 1000 mg/kg bw/day, based on absence of any toxicologically significant treatment related effects at any dose.

The bis alkenyl succinimide derivative and 2,5 pyrrolidinedione derivative were not mutagenic in bacterial reverse mutation assays. The 2,5 pyrrolidinedione derivative was not genotoxic in an *in vitro* mammalian cell gene mutation test and the bis alkenyl succinimide derivative was not genotoxic in an *in vivo* mammalian erythrocytes micronucleus.

Based on the available data on analogous polymers, the notified polymer is not classified as a hazardous substance in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC 2002).

9.2.4. Occupational health and safety – risk characterisation

The main route of exposure to the notified polymer will be dermal.

During transport, storage and formulation, workers may be exposed to the notified polymer as result of drips and spills during the connection and disconnection of transfer lines during the charging of the blending vessels and drum filling, labelling, and bung insertion. Maintenance workers and laboratory staff may also be exposed to the notified polymer during the cleaning and testing activities, respectively. These workers may be exposed either to the imported additive package containing 20-25% (w/w) or to finished lubricants containing 2.5-3.5% notified polymer. The finished lubricant will not pose a high risk on dermal contact due to the low concentration of notified polymer and its low hazard. However precautions may be required while handling the imported additive package due to other components. Workers handling the notified polymer in the imported product should wear, gloves, overalls, and safety boots to minimise dermal exposure.

Motor mechanics using the products containing notified polymer or handling the automotive components that have been in contact with the oil will be dermally exposed. The concentration of the notified polymer in the oil will be low (2.5-3.5% (w/w)) and therefore the risk of adverse health effects will also be low.

9.2.5. Public health – risk characterisation

Although there may be occasional exposure to the notified polymer for do-it-yourself enthusiasts, the oil residues involved will contain low levels of the notified polymer and the health risk is correspondingly low.

10. CONCLUSIONS – ASSESSMENT LEVEL OF CONCERN FOR THE ENVIRONMENT AND HUMANS

10.1. Hazard classification

Based on the available data the notified polymer not classified as hazardous under the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2002).

and

As a comparison only, the classification of notified polymer using the Globally Harmonised System for the Classification and Labelling of Chemicals (GHS) (United Nations 2003) is presented below. This system is not mandated in Australia and carries no legal status but is presented for information purposes.

The notified polymer is not classified under the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) for environmental endpoints since the available LC_{50}/EC_{50} are greater than 100 mg/L, the polymer is readily biodegradable and it is unlikely to bioaccumulate.

The notified polymer is not classified under the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) for the human health endpoints.

10.2. Environmental risk assessment

The notified polymer is not considered to pose a risk to the environment based on its reported use pattern.

10.3. Human health risk assessment

10.3.1. Occupational health and safety

There is Low Concern to occupational health and safety under the conditions of the occupational settings described.

10.3.2. Public health

There is Negligible Concern to public health when used as described in the notification.

11. MATERIAL SAFETY DATA SHEET

11.1. Material Safety Data Sheet

The MSDS of the product containing the notified polymer provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC 2003). It is published here as a matter of public record. The accuracy of the information on the MSDS remains the responsibility of the applicant.

11.2. Label

The label for the product containing the notified polymer provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Labelling of Workplace*

Substances (NOHSC 1994). The accuracy of the information on the label remains the responsibility of the applicant.

12. RECOMMENDATIONS

CONTROL MEASURES
Occupational Health and Safety

- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified polymer as introduced and the formulated product:
  - Minimise spills and drips

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

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

- If products and mixtures containing the notified polymer 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.

Environment

- The following control measures should be implemented by reformulator to minimise environmental exposure during blending of the notified polymer:
  - Blending should be carried out in bunded areas with no access to stormwater drains.

- The following control measures should be implemented by use to minimise environmental exposure during use of the lubricant:
  - Topping up should done in a suitable area so that spills or used lubricant can be collected and stored in a sealable container for disposal.

Disposal

- The notified polymer should be disposed of to landfill or incineration.

Emergency procedures

- Spills/release of the notified polymer should be handled by containment, absorption with soil, sand or similar material. Collect spilt material and all absorbent, and place in labelled sealable container ready for disposal to landfill or incineration.

12.1. 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.

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