File No: NA/727

January 2001

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Notified Chemical in PDN 5203

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Director
Chemicals Notification and Assessment

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Notified Chemical in PDN 5203

1. APPLICANT

Infineum Australia Pty Ltd of Level 2, 6 Riverside Quay, Southbank VIC 3006 has submitted a standard notification statement in support of their application for an assessment certificate for Notified Chemical in PDN 5203.

2. IDENTITY OF THE CHEMICAL

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

Marketing Name:	Notified Chemical in PDN 5203
Method of Detection and Determination:	infrared and UV/visible absorption spectroscopy reference spectra have been provided

3. PHYSICAL AND CHEMICAL PROPERTIES

The physical and chemical properties reported below are for PDN 5203, a solution of the notified chemical in a high proportion of mineral oil.

Appearance at 20°C and 101.3 kPa:	dark red liquid
Boiling Point:	211 - 596°C
Specific Gravity:	0.983 at 37°C
Vapour Pressure:	4.99×10^{-3} Pa at 21°C
Water Solubility:	2.19 mg/L at 20°C
Fat Solubility:	13 g/kg at 37°C
Particle Size:	Not applicable as the notified chemical is not isolated from solution

Partition Co-efficient (n-octanol/water):	log P_{ow} > 6 (see comments below)
Hydrolysis as a Function of pH:	not likely to hydrolyse (see comments below)
Adsorption/Desorption:	log K_{oc} > 5.63 (see comments below)
Dissociation Constant:	no dissociation (see comments below)
Flash Point:	> 150°C
Flammability Limits:	not determined (see comments below)
Autoignition Temperature:	not determined (see comments below)
Explosive Properties:	not expected to be explosive
Reactivity/Stability:	stable at elevated temperatures

3.1. Comments on Physico-Chemical Properties

The boiling point and vapour pressure measurements reported for PDN 5203 measure the properties of the mineral oil in the product; the notified chemical is not expected to be measurably volatile at ambient temperatures.

The water solubility is stated as 2.19 mg/L as measured according to the flask method described in OECD Test Guideline C 105. An excess of the test material was added to each of three flasks containing distilled water and stirred at 30°C for periods of 24, 48 and 96 hours respectively. Each flask was then equilibrated to 20°C for at least 24 hours, and the contents filtered through a 45 micron filter. The dissolved organic carbon (DOC) concentration of dissolved material in the filtrate was then determined, and the corresponding concentration of the compound determined through multiplication of the DOC concentration by the factor 1.146. There was no significant difference between the concentrations of the material stirred for 24, 48 and 96 hours. It is likely that the measured value is a good measure of the solubility of the notified chemical, as the water solubility of the mineral oil component is likely to be much lower than that of the notified chemical.

The notifier indicated that the low water solubility precluded a study of hydrolytic degradation as a function of pH, but stated that hydrolysis of this type of compound is considered unlikely. While it is probable that under extreme pH conditions hydrolytic cleavage may occur, significant hydrolysis in the environmental pH region where $4 < pH < 9$ is unlikely. The very low water solubility would also not favour hydrolysis due to the limited contact between susceptible groups and the aqueous environment.

The n-octanol/water partition coefficient was determined using the HPLC method described in OECD test guideline 117. In this method the elution time for the test compound is used to derive K_{ow} from a calibration curve prepared by plotting the elution time of a series of

reference compounds of known K_{ow}. A number of distinct elution times were observed for the new compound, indicating the presence of different molecular congeners within the substance. The K_{ow} values for all three components were all > 6 indicating the new material would partition strongly into the oil phase. It should be noted that the constituents of the notified chemical contain a high proportion of long chain saturated hydrocarbon, and consequently would be expected to exhibit some affinity for the organic phase.

Although no specific data was provided, the notified chemical carries ionic charge in addition to large hydrocarbon moieties, and so could be expected to be surface active. In respect of this, it was noted in the reports dealing with the ecotoxicity tests that mixtures of the notified chemical and water (at nominal loadings of 100 mg/L) appeared to contain emulsion droplets.

The adsorption/desorption data was also determined by HPLC. The retention time of the test compound on a C18 column was compared with those for a range of reference compounds with known values for Log K_{oc}. The high Log K_{oc} determined indicates that the material would adsorb strongly to, and become associated with, the organic component of soils and sediments. This is in general accord with the high hydrocarbon content of the compound, which is reflected in the high n-octanol/water partition coefficient.

A test to determine dissociation constant data through a titration curve was provided, and no discernible dissociation was observed.

The flammability properties for PDN 5203 apart from the flash point were not determined. It is expected that the flammability would be chiefly due to the mineral oil content, rather than the notified chemical. The notifier states that the notified chemical will release toxic fumes of hydrogen sulphide if overheated.

4. PURITY OF THE CHEMICAL

Degree of Purity: > 99.5 % based on notified chemical

Hazardous Impurities:

Chemical name:	ammonia
CAS No.:	7664-41-7
Weight percentage:	below hazardous cutoff, exact concentration confidential
Toxic properties:	on the NOHSC *List of Designated Hazardous Substances* (NOHSC, 1999b) R20 Harmful by inhalation R36/37/38 Irritating to eyes, respiratory system and skin NOHSC exposure standard 25 ppm TLV, 35 ppm STEL (NOHSC, 1995)
Chemical name:	hydrogen sulphide
CAS No.:	7783-06-4
Weight percentage:	below hazardous cutoff, exact concentration confidential

Toxic properties:	on the NOHSC *List of Designated Hazardous Substances* (NOHSC, 1999b) R20 Harmful by inhalation NOHSC exposure standard 10 ppm TLV, 15 ppm STEL (NOHSC, 1995)

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

Additives/Adjuvants:

Chemical name:	distillates (petroleum), solvent refined heavy paraffinic
Synonyms:	mineral oil
CAS No.:	64741-88-4
Weight percentage:	exact concentration confidential

5. USE, VOLUME AND FORMULATION

The notified chemical will be used as an additive in engine crankcase lubricating oils for general automobile use.

The notified chemical will be manufactured as part of the product PDN 5203. The formulation will be imported as an engine oil additive package containing < 5 % (w/w) PDN 5203. This will be reformulated by engine oil blenders in Australia to produce the finished engine oil, containing < 1 % (w/w) notified chemical.

The additive package will be imported in bulk shipments of between 300 and 500 tonnes, and also in marine isotanks of 20,000 L capacity. The notifier indicated that, when imported in bulk, the additive package would be pumped directly from the ship to an on shore storage tank, then transferred to road tankers for delivery to the lubricant blending facilities. If imported in isotanks, these would be transhipped directly to flat bed trucks for delivery to the oil companies. There are expected to be approximately 20 to 40 truck deliveries per year.

The notifier has estimated that between 50 and 100 tonnes of notified chemical will be imported per annum during the next five years.

6. OCCUPATIONAL EXPOSURE

Transport and Storage
The notifier estimates that 2 dock workers and 1 – 2 transport workers will be involved in handling each shipment of the additive package containing the notified chemical. For shipments in isotanks, these workers are not expected to be exposed to the notified chemical

except in the case of an accident involving spillage. It is also possible that the additive package will be imported in bulk, and will be transferred from the ship to a holding tank, and then to road tankers. Dermal exposure of the waterfront and transport workers to drips and spills of the additive package is possible during the connection and disconnection of the transfer hoses during these procedures. No details of the exposure control measures or personal protective equipment to be employed at these facilities was provided by the notifier.

Reformulation
The additive package containing the notified chemical will be reformulated by blending with oils and other additives, such as viscosity modifiers, foam inhibitors and pour point depressants, into completed lubricants for both petrol and diesel engines. This will be a batch process, generally producing between 5000 and 50000 L of finished lubricant. The blending will be mostly an automated process. For additive package shipped in isotanks, the process will involve a flexible transfer hose to the container by the operator, the additive being pumped out and blended in an enclosed automated system, the hoses and pumps being flushed with clean mineral oil, and the hose being disconnected. During the connection and disconnection of hoses, dermal contact with the notified chemical is possible. Maintenance workers handling the equipment used for blending may also come into dermal contact with residues containing the notified chemical.

The notified chemical has a very low vapour pressure and, as a mineral oil based product, a high viscosity, minimising the possibility of vapour and aerosol formation. Inhalation is therefore not expected to be an important exposure route.

Following blending, the notified chemical will be present at a low concentration, below 1 %. The blended oil will be packaged using an automated filling line into consumer size packages, generally of between 2 and 200 L. At each site, 1 – 4 workers are expected to be involved in the entire process for each batch, and the maximum duration of potential exposure is estimated as 10 minutes. Workers are also stated to be protected by protective gloves, protective glasses and suitable industrial clothing. The notifier also indicates that the operations would be conducted with adequate workplace ventilation, including local exhaust ventilation.

Distribution
The finished lubricant will have very widespread use, and will be used by both professional and home motor mechanics. The transport, storage and retail sale of the lubricants will involve a large number of workers, but should involve little risk of exposure to the notified chemical, except in the case of an accidental spill.

End Use
Occupational exposure to the products containing the notified chemical will occur at a large number of motor repair facilities throughout Australia. A large number of motor mechanics will be exposed to the products under a wide range of conditions, and dermal and ocular exposure to the notified chemical at a concentration of < 1 % is possible. The notifier states that the workers would be expected to use appropriate protective gloves while performing oil changes.

7. PUBLIC EXPOSURE

Members of the public may come into contact with used engine oil containing the notified chemical. However, exposure is expected to be low because of the low concentration of notified chemical in oil and negligible vapour pressure under normal conditions of use.

8. ENVIRONMENTAL EXPOSURE

8.1. Release

The notifier indicates that the blending operations are performed at specially constructed sites, all of which are owned and operated by petroleum companies. The additive packages containing the new material will be delivered to, and stored at the blending facilities in isotanks or be pumped to storage facilities from bulk tankers. It is anticipated that very little of the additive package will be released during transport operations or in transfer from the storage containers to the blending tanks. All transfer operations are controlled automatically, and the blending tanks are cleaned with lube oil which is recycled for use in preparing subsequent batches of product. Any spills incurred in the blending operations are contained within concrete bunds and the notifier indicates that the spilt material would be soaked up with absorbant material then incinerated at approved facilities. In some cases, spilt material may be sent to onsite wastewater treatment facilities.

The vapour pressure of the material is low, so release to the atmosphere during formulation of the lubricants, and in transfer and disposal operations involving addition or removal of the lubricant from crankcases, would be negligible.

Some release is likely during transfer of the lubricants from containers to engine blocks. It can be calculated on the basis of figures provided by the notifier that some millions of engine oil changes (using the notified product) take place throughout Australia each year. It is anticipated that on average 20 mL of lubricant, containing < 1 % of the notified substance, would either spilt or left as residues in containers as a result of transfer operations, and consequently a maximum of 500 kg (0.5 % of import quantity) of the notified material could be released annually via this route. Most spills are likely to be adsorbed onto sawdust and incinerated or disposed of to landfill, while residuals left in containers would be disposed of in similar fashion. Irresponsible work practices could lead to spilt oil being washed down driveways and entering stormwater systems, but this is expected to be a minor occurrence.

A recent survey by the Australian Institute of Petroleum (Australian Institute of Petroleum Ltd, 1995) indicates that of the annual sales of automotive engine oils (around 182 megalitres) in Australia, some 60 % (ie 109 megalitres) are potentially recoverable (ie not burnt in the engines during use). The survey also reports that around 86 % of oil changes take place in specialised automotive service centres, where spent oil drained from crankcases could be expected to be disposed of responsibly, either to oil recycling or incineration. The remaining 14 % (approximately 25 megalitres) is removed by “do it yourself” (DIY) enthusiasts. Further survey data tracing the fate of used lubricating oil in Australia (Snow, 1997) indicates that approximately 20 % of spent oil removed by enthusiasts is collected for recycling, approximately 25 % is buried or tipped into landfill, 5 % is disposed of into stormwater drains and the remainder is used in treating fence posts, killing grass and weeds or disposed of in other ways.

Consequently, if it is assumed that oil removed by professional mechanics is disposed of

appropriately (ie burning as workshop heating oil or sent for recycling), negligible release of the notified chemical should result. However, assuming a 25 % market share, 60 % recovery (ie unburnt) of oil, 14 % DIY use and 80 % disposal through dumping, burying, fence maintenance etc, then the DIY proportion of oil changes could potentially lead to release of up to 6.7 tonnes (ie 6.7 % of the total import volume) of the new chemical. Most of this is likely to become associated with soils or sediments.

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

8.2. Fate

The notified material is not expected to be readily biodegradable in aerobic environments. A CO_2 evolution test (Modified Sturm Test, EEC method C. 4-C/1992) performed on the compound resulted in 23 % degradation after 29 days, while the reference substance (sodium benzoate) was 79 % degraded over the same period (Exxon Biomedical Sciences Inc, 1998m). However, despite the low apparent rate for biodegradation, it is expected that material ending up in landfill would be slowly degraded through the slow biological and abiotic processes operative in these facilities. These processes could be expected to produce carbon dioxide, methane, ammonia, water, hydrogen sulphide and solid compounds.

Leaching from landfill would be slow, because the material has a high K_{oc} (see notes on physico-chemical properties above) and would not be mobile, but would adsorb into and become associated with the organic component of soils and sediments. Similarly, in the event of accidental release into the water compartment, it is likely to become associated with suspended organic material, and eventually be incorporated into sediments.

Although the new compound has a high Log K_{ow}, which would favour incorporation into fatty tissue, the high molecular weight will preclude easy transfer across cell membranes, hence the material is unlikely to bioaccumulate (Connell, 1990).

Incineration of waste oil containing the notified material would destroy the substance with evolution of water vapour and oxides of carbon and nitrogen, together with sulphur dioxide and ash. Sludges from waste treatment plants or oil recycling facilities could also be incinerated.

Relatively large quantities of material placed into landfill as a result of irresponsible disposal practices, or (for example) used in the preparation of wooden fences, would be adsorbed into and become associated with soil material and eventually be slowly degraded as described above.

9. EVALUATION OF TOXICOLOGICAL DATA

All toxicity tests were performed using PDN 5203, which contains of the order of 50 % notified chemical, and the results were not corrected for the concentration of notified chemical present.

9.1 Acute Toxicity

Summary of the acute toxicity of PDN 5203

Test	*Species*	*Outcome*	*Reference*
acute oral toxicity	rat	LD_{50} > 2000 mg/kg	(Exxon Biomedical Sciences Inc, 1998c)
acute dermal toxicity	rat	LD_{50} > 2000 mg/kg	(Exxon Biomedical Sciences Inc, 1998b)
skin irritation	rabbit	mild irritant	(Exxon Biomedical Sciences Inc, 1998l)
eye irritation	rabbit	slight irritant	(Exxon Biomedical Sciences Inc, 1998k)
skin sensitisation	guinea pig	moderate sensitiser	(Exxon Biomedical Sciences Inc, 1998g)

9.1.1 Oral Toxicity (Exxon Biomedical Sciences Inc, 1998c)

Species/strain:	rat/Crl:CDBR
Number/sex of animals:	5/sex
Observation period:	14 days
Method of administration:	gavage, dose level 2000 mg/kg, test material used as received
Test method:	limit test, OECD TG 401
Mortality:	there were no deaths during the study
Clinical observations:	no clinical signs of toxicity were observed during the study
Morphological findings:	no gross abnormalities were observed on day 14
LD_{50}:	> 2000 mg/kg
Result:	PDN 5203 was of very low acute oral toxicity in rats

9.1.2 Dermal Toxicity (Exxon Biomedical Sciences Inc, 1998b)

Species/strain:	rat/Crl:CDBR
Number/sex of animals:	5/sex
Observation period:	14 days

Method of administration: semi-occluded patch; 24 hour exposure
dose level: 2000 mg/kg; test material used as supplied

Test method: limit test, OECD TG 402

Mortality: there were no deaths during the study

Clinical observations: no clinical signs of toxicity were observed during the study, although dermal irritation was observed for the majority of the animals

Draize scores:

Time after	***Animal #***									
	Male					***Female***				
treatment (days)	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Erythema										
1	2[a]	2	1	1	0	1	0	2	0	1
4	0[d]	0[d]	0[d]	0[d]	0[d]	1[d]	1[d]	1[d]	0[d]	0[d]
7	0	0	0[d]	0[d]	0[d]	0[d]	0[d]	4[d,e]	0[d]	0
11	0	0	0	0	0	0[d]	0[d]	4[d,e]	0	0
14	0	0	0	0	0	0	0	4[d,e]	0	0
Oedema										
1	0	1	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	1	0	0
11	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0

[a] see Attachment 1 for Draize scales
d = desquamation e = eschar

Dermal effects: very slight to well defined erythema was observed in 4 males and 3 females on day 1; very slight erythema was seen in 3 females on day 4; very slight oedema was also seen in one male on day 1;

eschar was observed in one female from day 7 to day 14, along with desquamation until day 14 and very slight oedema on day 7;

desquamation was seen in all animals at day 4, persisting in some cases beyond day 11

LD_{50}: > 2000 mg/kg

Result: PDN 5203 was of low dermal toxicity in rats

9.1.3 Inhalation Toxicity

Acute inhalation toxicity data was not provided.

9.1.4 Skin Irritation (Exxon Biomedical Sciences Inc, 1998l)

Species/strain: rabbit/New Zealand White

Number/sex of animals: 3 males

Observation period: 7 days

Method of administration: 0.5 mL of test material as supplied was applied to clipped intact skin of the dorsal flank and secured under a semi-occlusive dressing for 4 hours; at the end of this time, residual material was removed with peanut oil and paper towels; animals were examined for skin lesions 1, 24, 48 and 72 hours and 7 days following application of the test substance

Test method: OECD TG 404

Draize scores:

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

[a] see Attachment 1 for Draize scales

Comment: atonia and desquamation were observed in animal 1 at 72 hours; desquamation was observed in all animals at 7 days

Result: PDN 5203 was a mild irritant to the skin of rabbits

9.1.5 Eye Irritation (Exxon Biomedical Sciences Inc, 1998k)

Species/strain: rabbit/New Zealand White

Number/sex of animals: 6 males

Observation period: 7 days

Method of administration: 0.1 mL of test material applied as supplied into conjunctival sac of the right eye of each animal; the left eye served as the control; animals were examined for eye lesions 1, 24, 48 and 72 hours and 7 days after test substance application

Test method: OECD TG 405

Draize scores of unirrigated eyes:

	Time after instillation														
Animal	***1 hour***			***1 day***			***2 days***			***3 days***			***7 days***		
Cornea	All scores zero														
Iris	All scores zero														
Conjunctiva	***r***	***c***	***d***	***r***	***c***	***d***	***r***	***c***	***d***	***r***	***c***	***d***	***r***	***c***	***d***
1	2	3	3	2	2	3	2	1	0	2	1	0	0	0	0
2	3	2	3	2	1	3	2	1	0	2	1	0	0	0	0
3	3	3	3	2	1	3	2	1	0	2	1	0	0	1	0
4	3	2	3	2	1	3	2	1	0	2	1	0	0	0	0
5	3	2	3	2	1	3	2	1	0	2	1	0	0	0	0
6	3	3	3	2	2	3	3	2	1	3	2	1	0	0	0

[1] see Attachment 1 for Draize scales
r = redness c = chemosis d = discharge

Mean scores: (non-irrigated eyes, 24, 48, 72hour observation)

corneal opacity	0.0
iridal lesions	0.0
redness of conjunctiva	2.1
chemosis of conjunctiva	1.2

Comment: the authors indicated that conjunctival redness and chemosis persisted beyond 72 hours after test substance installation, although no scores were provided; all effects had cleared by 7 days;

no iridal or corneal effects were observed (all individual scores were zero) at any observation time

Result: PDN 5203 was a slight irritant to the eyes of rabbits

9.1.6 Skin Sensitisation (Exxon Biomedical Sciences Inc, 1998g)

Species/strain: guinea pig/Hartley albino

Number of animals: 20 female (test group);
20 female (irritation control)

Test method: OECD TG 406

Induction procedure:

test group:
day 0 — to a clipped area of the scapular dorsal skin, each animal received 3 pairs of 0.1 mL injections as follows –

- 1:1 (v/v) mixture of Freund's Complete Adjuvant (FCA) and water
- the test material diluted to 5 % (w/v) in peanut oil
- the test material diluted to 5 % (w/v) with a 1:1 (v/v) mixture of FCA and water

day 7 — a filter paper patch with 0.5 mL of test material as supplied was placed over the injection area and covered with impervious adhesive tape; this was left in place for 2 days

vehicle control group: The induction procedure was identical to that for the test group, except that peanut oil was used in place of the test substance in both induction phases

Challenge procedure:

day 21 — a 50 % (w/v) solution of test material in peanut oil (0.4 mL) and neat peanut oil were applied via occluded chamber to the left and right flanks, respectively, of both the test group and 10 animals of the control group, for 24 hours

1st Challenge outcome:

	Test animals		***Control animals***	
Challenge concentration	***24 hours****	***48 hours****	***24 hours***	***48 hours***
50 %	**17/19	13/19	4/10	3/10

* time after patch removal
** number of animals exhibiting positive response

Rechallenge procedure:

day 28 — a 1 % (w/v) solution of test material in peanut oil (0.4 mL) and neat peanut oil were applied via occluded chamber to the right and left flanks, respectively, of both the test group and 10 animals of the control group, for 24 hours

2nd Challenge outcome:

	Test animals		***Control animals***	
Challenge concentration	***24 hours****	***48 hours****	***24 hours***	***48 hours***
1 %	**7/19	2/19	0/10	0/10

* time after patch removal
** number of animals exhibiting positive response

Comment:

one animal of the treated group was found dead on day 23; the cause of death could not be determined

the authors considered that the results of the initial challenge could not be interpreted due to the severity of the irritation response in the controls, and concluded on the basis of the rechallenge that 2 out of 19 animals showed a response that could be attributed to sensitisation

while all test animals showed responses for the 50 % challenge concentration, the majority of the responses were graded ±, and a similar incidence was observed for the 100 % peanut oil site; a clear increase in the incidence of the higher dermal scores was observed for the test group

for the 1 % rechallenge concentration, the control responses were of similar incidence and severity to those noted for peanut oil alone for the control group during the earlier challenge, and during topical induction; the rechallenge concentration therefore appeared to be lower than the optimal level, although at 24 hours, a 37 % response of higher severity reactions was seen in the treated group compared with the control group

Result: PDN 5203 was moderately sensitising to the skin of guinea pigs

9.2 Repeated Dose Toxicity (Dermal) (Exxon Biomedical Sciences Inc, 1998a)

Species/strain: rat/Crl:CDBR

Number/sex of animals: 5/sex control group;
5/sex per treatment group;
5/sex recovery group

Method of administration:	dermal, test material diluted with peanut oil applied to a clipped, unabraded site on the back of each animal (approximately 10% of total body surface) and held under an occlusive dressing for 6 hours; residual test material was removed with peanut oil and paper towels
Dose/Study duration:	100, 300 and 1000 mg/kg applied daily for 28 consecutive days recovery group animals were dosed with 1000 mg/kg daily for 28 consecutive days, then allowed to recover for 14 days
Test method:	OECD TG 410

Clinical observations:
No deaths or clinical signs of toxicity were observed. The mean bodyweight for the males of the high dose group was 8 % lower and for the males of the intermediate dose group was 4 % lower than that of the controls on day 27; no similar effect was seen for the females. The bodyweight increase for the high dose recovery group was similar to that for the controls. There was no corresponding significant difference in food consumption.

Dermal observations:
On day 4, very slight oedema was observed in 3/10 high dose males, very slight to well defined erythema was observed in 7/10 high dose males, and desquamation in 5/10 high dose males. No oedema or erythema was seen in the other male groups, including controls, and the irritation had generally resolved by day 7. For the females, signs of irritation were observed in all dose groups on day 4, with 8/10 high dose females showing very slight to well defined erythema, compared with 3/10 controls, and 4/10 high dose females showing very slight oedema, compared with 2/10 controls. Oedema and erythema had generally cleared by day 7. Desquamation was also observed in all female groups at day 4, and persisted beyond day 7 in all groups except controls, including 5/10 high dose females.

Clinical chemistry/Haematology
No statistically significant differences in haematology parameters between treated groups and controls were observed on day 27. There was a 16 % decrease in mean white blood cells, and a significant decrease in mean absolute monocytes in the treated group compared with controls following the recovery period. No corresponding findings were made during the main study, and no corroborating findings were made, so these differences were not considered treatment related, but remain unexplained.

There was a statistically significant increase in mean sodium concentration for the intermediate dose females compared with controls, but this was not considered significant in the absence of any clear dose response. A decrease in triglycerides in the treated males was observed following the recovery period, but this was not considered clinically significant no corresponding findings were made during the main study, and no corroborating findings were made.

Gross Pathology:
Discoloured livers were observed across all groups; this was attributed to the wrapping procedure rather than an effect of the test substance. The mean adrenal weight was

significantly increased in the high dose females, but the difference was not considered biologically important in the absence of a clear dose response.

Histopathology:
All groups showed microscopic dermal changes consisting of acanthosis and hyperkeratosis, and associated sebaceous gland hyperplasia; these effects occurred to a greater degree in the high and intermediate dose groups. The degree and incidence had decreased after the recovery period. These changes were considered to be related to the irritating effect of the test substance, and also to the irritation produced by repeated shaving and wrapping. Dermal inflammation was also observed in all groups, although to a higher degree in the intermediate and high dose groups.

Foci of subcapsular necrosis of the liver was observed across all groups, but to a greater extent in the treated groups. This has been reported to be a secondary phenomenon in dermal irritation studies.

Comment:
Decreased weight gain was seen in the males receiving 1000 mg/kg/day and 300 mg/kg/day, although the biological significance of this result is not clear as no similar effect was seen in the females. Increased effects of chronic skin irritation were seen in males and females receiving 1000 mg/kg/day and 300 mg/kg/day.

Result:
Based on chronic skin irritation, a No Observed Effect Level (NOEL) for PDN 5203 of 100 mg/kg/day was established in this study. For systemic toxicity, a NOEL of 1000 mg/kg/day was established.

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium* Reverse Mutation Assay (Exxon Biomedical Sciences Inc, 1998j)

Strains:	*Salmonella typhimurium*: TA98, TA100, TA102, TA1535, TA1537
Concentration range:	initial assay 0, 50, 158, 500, 1580, 5000 μg/plate (diluted in tetrahydrofuran (THF)) repeat assay 0, 125, 250, 500, 1000, 2000 μg/plate (diluted in THF) appropriate strain specific positive control reference substances were used
Metabolic Activation System:	rat liver S9 fraction from animals pretreated with Aroclor 1254

Test method:	OECD TG 471 – plate incorporation method
Comment:	beading of the test substance on the plate was observed for concentrations > 100 μg/plate toxic effects were observed at 5000 μg/plate and above in the absence of metabolic activation in the initial assay and 2000 μg/plate and above (1000 μg/plate for TA100 and TA102) in the absence of metabolic activation in the repeat assay no significant increase in the number of revertant colonies was observed for any strain in the presence or absence of metabolic activation at any dose level tested positive controls were used and produced clear positive results indicating that the test system responded appropriately
Result:	PDN 5203 was not considered mutagenic in the bacterial strains tested in the absence or presence of metabolic activation provided by rat liver S9 fraction

9.3.2 Chromosomal Aberrations in Chinese Hamster Ovary (CHO) Cells *In Vitro* (Exxon Biomedical Sciences Inc, 1998h)

Cells:	Chinese Hamster Ovary (CHO)
Doses:	5, 20, 40, 80, 160, 320, 640 μg/mL (diluted in THF)
Metabolic Activation System:	rat liver S9 fraction from animals pretreated with Aroclor 1254
Treatment Regime:	test material was added to cell cultures in serum free medium with S9 mix or complete medium without S9 mix for 3 hour incubation; the cells were then washed and incubated in fresh complete medium for a total of 19 or 43 hours ; colcemid was added 2-3 hours before harvest to arrest cells in metaphase;
Test method:	OECD TG 473
Comment:	doses for evaluation were chosen on the basis of cell confluency; doses with a reduction of 50 % or greater were

	chosen as the top dose
	The highest doses for evaluation were 320 μg/mL for the first assay (19 hours) with or without S9, 80 μg/mL and 320 μg/mL at 19 hours for the second assay (with and without S9, respectively) and 40 μg/mL and 160 μg/mL at 43 hours for the second assay (with and without S9, respectively)
	clear positive results were obtained with positive controls in both assays indicating that the test system responded appropriately
Result:	PDN 5203 did not induce a significant increase in chromosomal aberrations in Chinese hamster ovary cells *in vitro* with or without metabolic activation

9.3.3 Micronucleus Assay in the Bone Marrow Cells of the Mouse (Exxon Biomedical Sciences Inc, 1998i)

Species/strain:	mouse/CD-1
Number and sex of animals:	5/sex/dose
Doses:	0, 500, 1000, 2000 mg/kg
Method of administration:	gavage; test material and vehicle and positive controls were administered as three treatments at 24 hour intervals
	positive control – cyclophosphamide 20 mg/kg
Test method:	OECD TG 474
Comment:	there were no dose related increases or significant differences in micronuclei formation in any of the test animals compared with controls
	evidence of cytotoxicity in the form of a statistically significant decrease in mean percentage of polychromatic erythrocytes compared with controls was observed at 1000 mg/kg (males and females) and 2000 mg/kg (males only)
	the positive control induced a statistically significant increase indicating that the test system responded in an appropriate manner
Result:	PDN 5203 did not induce a significant increase in micronucleated polychromatic erythrocytes in the bone marrow cells of the mouse

9.4 Overall Assessment of Toxicological Data

The toxicity studies submitted as part of the notification are for the product PDN 5203, rather than for the notified chemical. The product is a mixture of notified chemical and mineral oil, in a proportion of around 50 % (exact proportion confidential).

The acute oral toxicity of PDN 5203 in rats is very low (LD_{50}>2000 mg/kg) and the acute dermal toxicity of PDN 5203 in rats is low (LD_{50}>2000 mg/kg). It is a slight irritant to rabbit eyes.

PDN 5203 is a mild and persistent irritant to rabbit skin, with erythema present 3 days after application. The observed desquamation and atonia appears to be representative of skin dryness and may be related to the anticipated defatting properties associated with the mineral oil adjuvant.

A skin sensitisation study for PDN 5203 was inconclusive, because the initial challenge concentration gave a high level of irritation in the control animals, and the lower concentration chosen for the rechallenge appeared to be too low for optimal results to be obtained. In the initial challenge, the incidence of Draize scores of 1 or greater was 17/19 animals at 24 hours and 13/19 animals at 48 hours, compared with 4/10 controls and 3/10 controls respectively. For the rechallenge, the incidence of Draize scores of 1 or greater was 7/19 test animals at 24 hours and 2/19 test animals at 48 hours, compared with 0/10 controls at both observation times. These results indicate that PDN 5203 should be considered a skin sensitiser in the absence of additional data where the effects of irritation and sensitisation are better separated.

In a 28 day repeat dose dermal toxicity study in the rat, no treatment related systemic toxicity was observed for any of the doses tested, up to 1000 mg/kg/day. The effects observed in the study were generally attributable to chronic skin irritation, exacerbated by the repeated shaving and wrapping procedure. Based on the chronic skin irritation effects, a NOEL of 100 mg/kg/day was established. For systemic toxicity, a NOEL of 1000 mg/kg/day was established.

The notified chemical was not found to be mutagenic in bacteria and did not induce an increase in micronuclei in the *in vivo* mouse micronucleus assay. No clastogenic effects were found in the *in vitro* Chinese hamster ovary cell cytogenic assay.

Hazard Classification of PDN 5203
The results of the acute oral and dermal toxicity and skin and eye irritation studies are below the thresholds for classification as a hazardous substance under the NOHSC *Approved Criteria for Classifying Hazardous Substances* (Approved Criteria) (NOHSC, 1999a). In a 28 day repeat dose dermal study, no organ dysfunction or systemic toxicity was observed. There was no evidence of mutagenicity in vitro or in vivo.

However, based on the findings of the skin sensitisation study in guinea pigs, PDN 5203 would be classified as a skin sensitiser according to the Approved Criteria and the risk phrase R43 “May cause sensitisation by skin contact” should be applied. As mineral oil is not classified as a skin sensitiser, the response is attributable to the presence of the notified

chemical, and this risk phrase should therefore also be applied to the notified chemical.

The risk phrase R66 "Repeated exposure may cause skin dryness or cracking" has recently been adopted by the European Commission. Although yet to be adopted by NOHSC, this risk phrase should be provisionally assigned based on the observed defatting properties of the product.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

Test	*Species*	*Results*
acute toxicity [OECD 203]	rainbow trout *Oncorhynchus mykiss*	LL_{50} (96 h) > 1,000 mg/L NOEC (96 h) > 1,000 mg/L
Acute Immobilisation [OECD 202]	Water Flea *Daphnia magna*	EL_{50} (48 h) = 25.6 mg/L NOEC (48 h) = 9.4 mg/L
Growth Inhibition [OECD 201]	Algae *Scenedesmus capricornutum*	ELr_{50} (72 h) = 25.5 mg/L ELb_{50} (72 h) = 3.1 mg/L

* NOEC - no observable effect concentration

The tests on fish were performed using a static methodology with 80 % renewal at 24, 48 and 72 hours (Exxon Biomedical Sciences Inc, 1998d). The tests were conducted using water solubility fractions (WSF) of the test substance made up at nominal concentrations of 62.5, 125, 250, 500 and 1,000 mg/L. The WSF were prepared by filtering the corresponding Water Accommodation Fractions (WAF) through 0.45 μm filters. The tests were performed in duplicate using four specimen fish per replicate at 14.5 ± 0.5°C, pH between 6.5 and 8.1 and dissolved oxygen levels between 6 and 7.5 mg/L. Water hardness was around 220 mg/L as $CaCO_3$. No mortality of the fish was observed over the duration of the tests, and the report made no mention of any other aberrations observed in the behaviour of the fish specimens. The results indicate that the chemical is not toxic to this species of fish up to the limits of its water solubility.

It is worth noting that tests performed with the (unfiltered) WAF gave some mortality at the highest exposure (nominally 1,000 mg/L), but the results were highly variable. The report indicated that these variable results may have been caused by the formation of emulsions. Emulsion formation is consistent with the surface active properties of the notified chemical.

The immobilisation tests with *Daphnia magna* were also performed under static conditions using WSF prepared with nominal loadings of the test substance of 9.4, 18.7, 37.5, 75 and 150 mg/L (Exxon Biomedical Sciences Inc, 1998f). The temperature, pH and dissolved oxygen levels during the tests were respectively 20 ± 0.5°C, 7.3 ± 0.5 and 6.1 ± 0.5 mg/L, while water hardness was around 214 mg/L as $CaCO_3$. The test at each WSF and the control (no test substance) was conducted using four replicates with five daphnia per test vessel. After 48 hours exposure to the WSF containing 18.7 mg/L of test substance, 5 % (ie one animal) immobilisation of the daphnia had occurred, while after 48 hours exposure at the 37.5 mg/L WSF immobilisation was 100 %. The calculated 48 hour LL50 was 25.6 mg/L, while the observed 48 hour NOEL was 9.4 mg/L. The results indicate that the notified chemical is moderately toxic to daphnia.

Tests on algal growth inhibition were also performed with WAF made up at the nominal concentrations of 0 (control), 0.25, 0.5,1.0, 2.0 and 4.0mg/L (Exxon Biomedical Sciences Inc, 1998e). The mean temperature throughout the test was 23.9°C. Both growth of algal biomass and the rate of biomass growth were monitored over the 72 hour test period, with the results tabulated above. The results indicate that the notified chemical is moderately toxic to algae.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The environmental hazard from the notified chemical is considered to be small provided that the material is used as indicated, and that disposal of old oil takes place via the routes indicated above. As a component of automotive lubricants, the notified material has the potential to be released to the environment during lubricant change, but losses during lubricant formulation and transfer to engine crankcases would be small. It is expected that around 86 % of contained material would be destroyed through incineration and/or oil recycling activities. About 14 % of the material will be used by automobile enthusiasts, and it is expected that much of this will be released through disposal into landfill, stormwater drains, and other routes.

If deposited into landfill the material will be immobilised through adsorption onto soil particles, while if released into waterways it would become associated with sediments. The material is not readily biodegradable, but in a landfill is expected to be slowly degraded through micro-biological and abiotic processes. Incineration would produce water vapour and oxides of carbon, nitrogen and sulphur. Some solid compounds would be produced as consequence of both incineration and of landfill biodegradation. The material is moderately toxic to the fish and invertebrate species against which it has been tested up to the limit of its water solubility, and is classified as toxic to green algae.

The material is considered to have low potential for bioaccumulation.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The product, PDN 5203, containing around 50 % notified chemical, is of very low acute oral and low dermal toxicity. The product produced mild but persistent irritation to the skin of rabbits, which may be related to the anticipated defatting properties associated with the mineral oil adjuvant. The product was slightly irritating to the eyes of rabbits. The risk phrase R66 “Repeated exposure may cause skin dryness or cracking” has recently been adopted by the European Commission. Although yet to be adopted by NOHSC, this risk phrase should be provisionally assigned based on the observed defatting properties of the product.

A Magnusson and Kligman skin sensitisation study in guinea pigs was inconclusive due to confounding skin irritation, but based on the results which were obtained, the notified chemical should provisionally be classified as a skin sensitiser and the risk phrase R43 “May cause sensitisation by skin contact” applied. The classification may be changed if further skin sensitisation studies are performed and show clear negative results.

In a 28 day repeat dose dermal rat study, the product showed no systemic toxicity at doses up

to 1000 mg/kg/day. Based on the chronic skin irritation effects observed, a NOEL of 100 mg/kg/day was established. The chronic skin irritation is likely to have been caused by the defatting effects of the mineral oil, rather than being an effect of the notified chemical. For systemic toxicity, a NOEL of 1000 mg/kg/day was established.

The notified chemical was not mutagenic in *in vivo* and *in vitro* test systems.

Occupational Health and Safety
The notified chemical will be imported in bulk vessels as a component (up to 5 % PDN 5203 (w/w)) of a lubricant additive package. The additive package will be reformulated in Australia, by blending with engine oil. The final product is then repackaged into containers, generally of between 2 L and 200 L capacity, for consumer use.

Dermal exposure would be the predominant route of occupational exposure to the notified chemical. Inhalation exposure is expected to be minimal because the product containing the notified chemical and the finished oil are viscous and therefore have reduced potential to generate aerosols. In addition, the notified chemical has a very low vapour pressure, so vapour accumulation in the workplace air is not likely. The notified chemical is a skin sensitiser, and so protective gloves and clothing should be worn when the possibility of exposure to drips and spills exists.

Workers involved in transferring the imported oil additive containing the notified chemical, including bulk oil terminal workers and transport workers, and workers involved in blending the additive into oil may be exposed to drips and spills of the additive package, containing 5 % PDN 5203. Occupational exposure to the drips and spills of the final lubricating oil containing up to 1 % notified chemical is possible for workers handling of the final lubricating oil and during disposal. Workers involved in cleaning and maintenance of tanks and blending equipment may also have general dermal exposure to oil residues. It is recommended that all workers handling the notified chemical and the lubricating oil containing the notified chemical wear gloves when potentially exposed.

Occupational exposure to the products containing the notified chemical will occur at a large number of motor repair facilities throughout Australia. A large number of motor mechanics will be exposed to the products under a wide range of conditions, and dermal and ocular exposure to the notified chemical at a concentration of < 1 % is possible. It is recommended that the workers use appropriate protective gloves and safety glasses while performing oil changes.

Public Health
Members of the public may come in contact with the notified chemical in used engine oil, but it is considered that the risk to the public will be low because skin and eye irritation and skin sensitisation are unlikely to occur at the low concentration at which the notified chemical will be present.

13. RECOMMENDATIONS

- The notified chemical may be recommended to the National Occupational Health and Safety Commission for consideration for inclusion in the NOHSC List of Designated Hazardous Substances.

To minimise occupational exposure to Notified Chemical in PDN 5203 the following guidelines and precautions should be observed:

- Workers who become sensitised to the notified chemical, or to molybdenum polysulphides or dithiocarbamate compounds of any type should not handle the notified chemical in the workplace;

- Safety goggles, chemical resistant industrial clothing and footwear and impermeable gloves should be used while handling the product containing the notified polymer; where engineering controls and work practices do not reduce vapour and particulate exposure to safe levels, an air fed respirator should also be used;

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

- 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* (NOHSC, 1999a), workplace practices and control procedures consistent with State and territory hazardous substances regulations must be in operation.

Guidance in selection of goggles may be obtained from Australian Standard (AS) 1336 (Standards Australia, 1994) and Australian/New Zealand Standard (AS/NZS) 1337 (Standards Australia/Standards New Zealand, 1992); for industrial clothing, guidance may be found in AS 2919 (Standards Australia, 1987) and AS 3765.2 (Standards Australia, 1990); for impermeable gloves or mittens, in AS 2161 (Standards Australia/Standards New Zealand, 1998); for occupational footwear, in AS/NZS 2210 (Standards Australia/Standards New Zealand, 1994); for respirators, in AS/NZS 1715 (Standards Australia/Standards New Zealand, 1994) and AS/NZS 1716 (Standards Australia/Standards New Zealand, 1994).

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* (NOHSC, 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 shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

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Attachment 1

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

Erythema Formation	*Rating*	*Oedema Formation*	*Rating*
No erythema	0	No oedema	0
Very slight erythema (barely perceptible)	1	Very slight oedema (barely perceptible)	1
Well-defined erythema	2	Slight oedema (edges of area well-defined by definite raising	2
Moderate to severe erythema	3	Moderate oedema (raised approx. 1 mm)	3
Severe erythema (beet redness)	4	Severe oedema (raised more than 1 mm and extending beyond area of exposure)	4

The Draize scale (Draize *et al*., 1944) for evaluation of eye reactions is as follows:

CORNEA

Opacity	*Rating*	*Area of Cornea involved*	*Rating*
No opacity	0 none	25% or less (not zero)	1
Diffuse area, details of iris clearly visible	1 slight	25% to 50%	2
Easily visible translucent areas, details of iris slightly obscure	2 mild	50% to 75%	3
Opalescent areas, no details of iris visible, size of pupil barely discernible	3 moderate	Greater than 75%	4
Opaque, iris invisible	4 severe		

CONJUNCTIVAE

Redness	*Rating*	*Chemosis*	*Rating*	*Discharge*	*Rating*
Vessels normal	0 none	No swelling	0 none	No discharge	0 none
Vessels definitely injected above normal	1 slight	Any swelling above normal	1 slight	Any amount different from normal	1 slight
More diffuse, deeper crimson red with individual vessels not easily discernible	2 mod.	Obvious swelling with partial eversion of lids	2 mild	Discharge with moistening of lids and adjacent hairs	2 mod.
		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

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