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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

ALKANE 1

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Alkane 1

1. APPLICANT

Chevron Chemical Australia of Level 22, 385 Bourke St MELBOURNE VIC 3000 has applied for a standard notification of Alkane 1. The notified chemical will be used in dielectric and heat transfer fluids, and in synthetic automotive and industrial lubricants.

2. IDENTITY OF THE CHEMICAL

According to Worksafe's *Approved Criteria for the Classifying of Hazardous Substances* (1), Alkane 1 considered harmful due to its inhalation toxicity levels exceeding the lowest relevant concentration cutoff, thereby classing it as a type 1 ingredient by National Model Regulations (2). In the interests of commercial confidentiality the chemical identity and spectral data have been classed as exempt from the Full Public and Summary reports. The conditions of this being granted are:

- A descriptive generic name be used to identify the substance in public reports and the Material Safety Data Sheet,
- The relevant employee unions shall be informed of the conditions of use of Alkane 1,
- The full chemical name shall be provided to any health professionals in the case of a legitimate need where exposure to the chemical may involve a health risk,
- The full chemical name shall be provided to those on site who are using the chemical and to those who are involved in planning for safe use, etc. in the case of a legitimate need,
- The Director of NICNAS will release the full chemical name etc in the case of a request from a medical practitioner,
- Confidentiality will expire after a 3 year period,
- The chemical be identified as toxic by inhalation in the Health Effects Section of the MSDS,
- These conditions shall be published in the Chemical Gazette.

2. IDENTITY OF THE CHEMICAL

Other name(s):	Branched C20-24 alkane; Polyalphaolefin; XS 101; Alkane 1
Trade name(s):	PAO 2 cSt (C12 content ≤ 10% - also known as XS 101) PAO 2.5 cSt (C12 content ≤ 98%)

Method of detection and determination:

1. Infrared spectroscopy analysis
2. High Performance Liquid Chromatography and Gas Chromatography:
   The dimer is trapped on a C_{18} reverse-phase HPLC column before being eluted off with hexane, and then analysed by GC (detection limit of 10 ppb)

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	clear colourless liquid
Odour:	not provided
Melting Point/boiling point:	220-380°C
Specific gravity/density:	0.797 kg/m^3 at 15°C
Vapour pressure:	4.7 x 10^{-4} mm Hg at 25°C
Water solubility:	< 10 ppb - OECD 105 (run to SOP standards)
Partition co-efficient (n-octanol/water) log P_{ow}:	log P_{ow} > 8.0 (HPLC)
Hydrolysis as a function of pH:	stable under all conditions
Adsorption/desorption:	the PAO hydrogenated dimer probably will not associate with either soil or water; due to its very low water solubility, it will migrate slowly through soil before biodegrading.
Dissociation constant pK_a:	will not dissociate
Flash point:	> 180°C

Flammability limits:	will burn in the presence of enough heat and oxygen
Combustion products:	complete combustion products are carbon dioxide and water
Decomposition temperature:	> 300
Decomposition products:	incomplete combustion products are carbon dioxide, water, carbon monoxide, olefinic hydrocarbons, and oxygenated hydrocarbon fragments.
Autoignition temperature:	> 200°C
Explosive properties:	not known to be explosive
Reactivity/stability:	will react in the presence of strong oxidising agents; stable to acid and base.
Particle size distribution:	viscous liquid; will not form particles.

Comments on Physico-Chemical Properties

Water solubility was determined for a similar chemical, a C10 trimer (a low molecular weight fraction of the notified chemical in NA/255) following the method of OECD Guideline 105. The notifier claims that the water solubility of the dimer, Alkane 1, will be < 10 ppb because of the trimer's very low water solubility. This claim has been verified by calculating water solubility using a Structural Analysis Relationship according to the method of Irmann (3).

The calculation of P_{ow} was based on the calculated water solubility of 10 ppb, and the known octanol solubility of about 1.

The notifier claims that Alkane 1 will not hydrolyse It is agreed that the chemical contains no functionalities that would be subject to hydrolysis, or dissociate, under the expected environmental conditions of use.

Adsorption/desorption was not determined. The notifier expects that Alkane 1 will not adsorb to soil, nor associate with water, because of its low water solubility. Further, it is expected to migrate slowly through soil before biodegrading. It is agreed that mobility through soil would be slow, but this would be due to its expected strong adsorption to soil because of its high P_{ow}.

4. PURITY OF THE CHEMICAL

Degree of purity : 100%

Toxic or hazardous impurities: none

Non-hazardous impurities: none

Additives/Adjuvants: none

5. INDUSTRIAL USE

It is estimated that approximately 10 tonnes of the notified chemical will be imported every year. The notified chemical will be used in industrial products such as dielectric fluids or heat transfer oils in its pure form, or as a base fluid to blend synthetic automotive and industrial lubricants at a level of about 80%.

6. OCCUPATIONAL EXPOSURE

There is likely to be exposure of workers involved in the transfer and transportation of the notified chemical, workers who blend the hydrogenated dimer into finished lubricants, and mechanics or technicians who may come into contact with PAO containing lubricants while working on or repairing equipment. The most likely route of exposure for this dimer is skin and eye contact which would be minimised in manufacturing and transportation workers by engineering controls and protective clothing, but mechanics or technicians repairing equipment wear protective clothing but often do not wear gloves or eye protection.

Alkane 1 will be shipped to Australia in bulk or isotanker and stored in bulk storage tanks. The notified chemical will arrive at a typical Australian customer's blending plant by rail car or tank truck. Alkane 1 is transferred to a storage tank through a four inch hose. One worker, wearing full protective clothing, gloves, and eye protection, spends 10 minutes fastening the end of the hose to the tank car, and a further 10 minutes uncoupling the hose following transfer of the substance. Procedures exist to ensure that there is no spillage due to loose connections between hose and tank car.

Finished oil blending is done by pumping the lubricating oil blend stocks and the additive package from their storage tanks through computer controlled valves that meter the precise delivery of the components into a blending tank. The finished automotive and industrial lubricants are prepared by pumping the notified chemical and the additive package from their storage facilities through computer controlled valves which meter the precise delivery of the components into a blending tank where more additives may be added depending on formulation to be prepared for specific uses. Exposure to workers can occur after blending during sample removal for laboratory analysis. One or two workers wearing eye protection, coveralls, and gloves remove samples of the product from the blend tank to ensure that the specifications of the finished lubricant are met. One to two workers will be potentially exposed to an 80-100% formulation for 30 minutes, 50 days a year at both the sampling and analysis stage. During the cleaning process of

the blending tank and drums, 1 worker may be exposed to an 80-100% formulation of the notified chemical for 1 hour, 50 days a year. This exposure may be to lube oil used to clean the blending tanks or to the wastewater from the cleaning of the drums. Exposure to the wastewater should be minimised as the treatment process is part of engineering control processes to minimise exposure.

The finished products, or the notified chemical itself are packaged into 1 L, 40 L, or 200 L drums. Workers will be potentially exposed to the finished lubricant during the packaging of the drums. The level of exposure should be minimal as the drumming facility used automated weight scales to fill the drums and potential worker exposure occurs as the operator watches from 1-2 metres away to ensure the drum filling mechanism properly enters the drum before the drum is filled. The bungs and labels are applied by the operators. The packaging of 1 L and 4 L jugs is automated and there is minimal human exposure.

Mechanics may be exposed to the notified chemical at a concentration of approximately 80% while changing automobile engine oil. Dermal exposure is likely to occur, and accidental eye contact may also occur, particularly while mechanics are working under vehicles. Inhalational exposure is unlikely due to the low vapour pressure of the notified chemical.

7. PUBLIC EXPOSURE

About 40-50% of the total volume imported will be used as dielectric and heat transfer fluids. Filling of transformers and capacitors occurs at manufacturing or overhaul plants. The used 200 L drums will be recycled by sending back to the suppliers and any spills or leaks will be cleaned up. The used oil is either recycled or disposed by incineration. Therefore, public exposure to the notified chemical is not expected to occur when used as dielectric and heat transfer fluids.

The automotive and industrial lubricants will be prepared in a blending tank by the oil companies. There will be low potential for public exposure to the notified chemical during blending operations. The blending equipment is cleaned with steam and a typical 5 000 kg blending tank would have about 1 kg of residue which will be sent to a waste water treatment facility. After further separation of the oil from water, less than a gram will be emulsified in the water and released to the municipal sewer.

Industrial use of the lubricants in food packaging and processing equipment may result in contamination of food with the product when incidental contact with food occurs. It is the end user's responsibility to ensure that any contamination is kept to the absolute minimum to ensure minimal public exposure.

The automobile engine oil containing approximately 80% of the notified chemical packaged in 4 or 1 L containers will be available to the general public. Thus, the public can be exposed to the notified chemical by skin contact during oil changes, but the exposure is short and occurs infrequently. Accidental splashing into the eye may also occur. Inhalational exposure will be negligible because of its low vapour pressure.

Disposal of the used oil is not expected to result in public exposure if it is disposed of according to government regulations.

When used in automobile engine oil, the notified chemical may be decomposed in the combustion chamber, and the decomposition products may be emitted into the air via the automobile tailpipe. Complete combustion of decene/dodecene hydrogenated dimer produces carbon dioxide and water. In the case of incomplete combustion or decomposition, a mixture of carbon dioxide, water, carbon monoxide, olefinic hydrocarbons, and oxygenated hydrocarbon fragments are produced. The notifier claimed that the decomposition products emitted from an automobile will be very limited and not distinguishable from the fuel derived combustion products, which will dominate the hydrocarbon emissions. Therefore, public exposure to the decomposition products from incomplete combustion of the notified chemical in automobile engines is expected to be low.

In the case of accidental spillage during transport, the public may be exposed to the notified chemical. However, the exposure will be minimal if the spills are contained and cleaned up by the recommended practices such as application of absorbent materials or pumping as outlined in the MSDS.

8. ENVIRONMENTAL EXPOSURE

. Release

The formulation of synthetic automotive and industrial lubricants will involve an automated blending process. The notifier estimates that on steam-cleaning of the equipment and drums, about 1 kg from a 5 tonne batch of finished product (0.02%) might be released in the waste water. After oil separation of the waste water, only 5% of the 1 kg of oil (50 g) released is expected to be left emulsified in waste water. The waste water is further treated by pond aeration, in which oil is skimmed from the surface, and sand filtration, leading to a further reduction of greater than 2% (ie < 1 g). The filling of containers is also highly automated and the equipment cleaned with lube oil. Any spillage in filling containers will be cleaned up with sawdust or rags.

The filling of transformers or capacitors will be automated, with spills expected to be minimal and cleaned up with sawdust or rags.

Oil that can be reclaimed in the above processes will be recycled, while contaminated solids will either be burnt or landfilled. Any used drums will be recycled and steam cleaned for re-use.

. Fate

Alkane 1 used as a dielectric fluid or heat-exchange oil will be recycled or incinerated when the equipment is overhauled or no longer operational. Some may be released to the environment from spills and leaks, but will be widely dispersed and expected to adsorb to soils or sediments adjacent the equipment.

When Alkane 1 is used as an automotive or industrial oil, some will be combusted and destroyed in use, while the majority will share the fate of recycled oil. Also, a minor component will be released to the environment from spills and leaks, but will be widely dispersed and expected to adsorb to soils or sediments adjacent the road. A small amount may volatilise.

The notifier estimates that about 20% of the expected volume to be used in automotive and industrial oils (ie 20% x 5 tonne = 1 tonne) will be used by home users for "do-it-your-self" purposes. It has estimated from an ANZEC report (4) on used lubricating oil, that 35% of the oil used for automotive purposes will not be collected and could be disposed of in an inappropriate manner[1]. A worst case scenario would be if all of this uncollected oil was dumped into a sewer in some country centre. This, however, would give a concentration of only about 1 mg/L per day[2]. For a major city, the amount would only be about 10 µg/L per day. However, with its use Australia wide, and with good industrial and public practice, significant aquatic exposure to the polymer is not expected.

- *biodegradation*

A biodegradation study (closed bottle test using activated sludge, OECD guideline 301D) resulted in 66% biodegradation after 28 d, with the compound therefore able to be classified as readily biodegradable. Other information provided by the notifier (5) also indicated that the compound was readily biodegradable with a primary degradation result of 85%, although ultimate degradation of only 30% after 28 d was achieved (ie mineralisation to CO_2). When the test period was increased to 56 d, ultimate degradation increased to 72%.

- *bioaccumulation*

The bioaccumulation potential of Alkane 1 was not determined. The notifier claims that as its log P_{ow} is greater than 8, it is not likely to bioaccumulate because the material is practically water insoluble. Noting the literature (6), it is agreed that its low water solubility (<< 0.002 mol/m^3) and high log P_{ow} (>> 6), as well as its ready biodegradation, is likely to limit bioaccumulation.

9. EVALUATION OF TOXICOLOGICAL DATA

The toxicity studies were conducted using PAO 2 cSt. PAO 2.5 cSt (Alkane 1), with a higher C12 content is chemically very similar to PAO 2 cSt. The toxicity profile for PAO 2 cSt can be used to assess the toxicity of PAO 2.5 cSt, which has a relatively higher molecular weight.

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[1] No figures are available for how much automotive oil was collected for re-use, but an estimate of about 35% of all oil sold is not collected and possibly disposed of in an inappropriate manner. Therefore, this percentage will be specifically applied to automotive oils.

[2] Given 35% of oil not collected, then of the 5 tonne imported for automotive use, 1 750 kg of the additive would also not be collected (ie. 35% x 5 000 kg). This would be 5 kg/d (ie 1 750 kg/365 d). The dilution at a rural town could reasonably be expected to be about 5 ML, while for a major city, say Melbourne, it would be 500 ML. This would give final concentrations of the oil of 1 000 and 10 µg/L per day, respectively.

9.1 Acute Toxicity

Table 1 Summary of the acute toxicity of decene/dodecene hydrogenated dimer (PAO 2 cSt)

Test	Species	Outcome	Reference
Acute oral toxicity	rat	LD_{50} > 5 000 mg/kg	(7)
Acute dermal toxicity	rat	LD_{50} > 2 000 mg/kg	(8)
Acute inhalational toxicity	rat	LC_{50} = 1 170 mg/m^3	(9,10,11)
Skin Irritation	rabbit	slight irritant	(12)
Eye irritation	rabbit	moderate irritant	(13)
Skin sensitisation	guinea pig	non-irritant	(14)

9.1.1 Oral Toxicity (7)

Fasted SD rats (5/sex) were administered 5 000 mg/kg of undiluted PAO 2 cSt by a single oral gavage and observed for 14 days. No deaths, clinical signs of toxicity or treatment-related macroscopic lesions were observed. The oral LD_{50} of PAO 2 cSt was > 5 000 mg/kg.

9.1.2 Dermal Toxicity (8)

Young adult SD rats (5/sex) were dermally treated with 2 000 mg/kg of PAO 2 cSt under occlusive dressing (plastic film) for 24 hours. A control group was similarly dressed with plastic film without applying the test substance. The observation period was 14 days. No deaths or signs of systemic toxicity were observed. Skin irritation including erythema, cracking and scarring was seen in both control and treated animals; however, irritation was more severe and persistent in treated animals than in the controls. The dermal LD_{50} of PAO 2 cSt in rats was > 2 000 mg/kg.

9.1.3 Inhalation Toxicity (9,10,11)

In one inhalation study (7), the chemical was identified as SF-0203-41 with a purity of 99. The composition was a mixture of polyalphaolefin. Polyalphaolefin is an alternative name for the notified chemical. In a conference report of the same study (8), the chemical was identified as Synfluid 2 cSt, ie the notified chemical.

Five groups of Charles River CD albino rats (5/sex/group) were exposed to an aerosol of SF-0203-41 at 770, 940, 1 100, 1 400 or 5 100 mg/m^3 for 4 hours. The average aerosol particle size was 2.9 ± 2.07 mm. A control group was similarly exposed to air only. The animals were observed for 14 days after exposure.

Clinical signs observed during and after exposure included dyspnoea and nasal discharge. Deaths occurred within the first 2 days after exposure in all female groups and the male groups exposed to 1 100 mg/m^3 or more of test substance. The high dose groups gained less body weight during the first week after exposure, but the body weight gain was normal in the second week post-exposure. Macroscopic changes were

observed in the animals that died on study and included red nasal discharge and congested lungs.

Microscopic examination was not conducted in the rats exposed to 770 - 1 400 mg/m^3. In the 5 100 mg/m^3 group, pulmonary congestion was observed in all the animals. Mural protein casts were observed in the terminal and respiratory bronchioles. The control animals were normal. The LC_{50} for the combined sexes was 1 170 mg/m^3.

In the second inhalation study (9), a group of 10 CD rats (5/sex) were exposed to an aerosol of Oronite Synfluid PAO 2 cSt at 5170 mg/m^3 (maximum practical concentration) for 1 hour. A control group (5/sex) was similarly exposed to room air only. The animals were observed for 14 days after exposure.

The average aerosol particle size was 1.9 ± 1.8 mm. Only one treated female survived during the study and other treated animals died or were sacrificed on days 1 - 3 after exposure. Clinical signs of toxicity included reduced activity, partly closed eyes, hunched back, lateral prostration, increased respiratory rate, laboured and irregular breathing, and muzzle and abdominal staining. The surviving female was clinically normal by day 9. No clinical signs were observed in the controls.

Gross pathological examination revealed an increased incidence of fluid in the trachea, uncollapsed lungs and discolouration of the lungs in the animals that died or were sacrificed during the study and increased lung and trachea weights in the surviving female. Microscopical examination showed acute pneumonia and/or haemorrhage in the lungs, and slight focal or multifocal degeneration and/or necrosis of the epithelium of the nasal septum in the treated animals. The surviving female had mild interstitial pneumonia of a chronic nature and slight focal hyperplasia of the respiratory epithelium. Myocardial degeneration and/or fibrosis were also observed in this animal and was considered possibly related to the treatment.

9.1.4 Skin Irritation (12)

Six young adult NZW rabbits were dermally treated with 0.5 mL of PAO 2 cSt. Each animal received treatment at 3 areas on the back and covered with a gauze patch for 4 hours. The primary irritation score was 0.9. Slight to well-defined erythema without oedema was observed at one through 72 hours after patch removal, and cleared by day 7. Flaky skin was seen at 48 hours through 7 days and disappeared by day 14. The test substance was considered a slight skin irritant in rabbits.

9.1.5 Eye Irritation (13)

Nine young adult NZW rabbits were treated with 0.1 mL of PAO 2 cSt by instillation into the conjunctival sac of one eye. The eyes of 3 rabbits were washed with 250 mL distilled water for one minute after 30 sec exposure.

Moderate to severe conjunctival redness (Draize scores of 2 or 3) was observed in the unwashed eyes, and moderate conjunctival redness (Draize scores of 2 or 3) in the washed eyes 1 hour after treatment. All the treated eyes were normal by 48 hours. No

irritation effects on the cornea or iris were observed. The test substance was considered a moderate eye irritant in rabbits.

9.1.6 Skin Sensitisation (14)

The skin sensitisation potential of Oronite Synfluid PAO 2 cSt was studied in guinea pigs using a modified Buehler test.

In the irritation screening test, the test substance was diluted to 50, 25, 10, 5, 2.5, 1, and 0.5 %w/v in Spectrum Mineral Oil Light USP. An aliquot of 0.3 mL of the undiluted PAO 2 cSt and all diluted solutions were applied to the clipped skin of 8 guinea pigs (4 application sites/animal, 4 animals/dilution) for 6 hours using a 25 mm Hill Top Chamber. The animals were examined at 24 and 48 hours after the 6-hour treatment period. The undiluted test material caused slight but confluent or moderate patchy erythema (grade 1). Slight, patchy erythema (grade 0.5) to confluent erythema or moderate patchy erythema (grade 1) was observed at the sites treated with 5 % w/v or less test material.

After the irritation screening test, 20 guinea pigs (10/sex) were induced with the undiluted test material applied as described above in the screening test once a week for 3 weeks. The animals were challenged with 5 % w/v of the test material in Spectrum Mineral Oil Light USP 2 weeks after the last induction exposure. A naive control group of 10 animals (5/sex), which had never been exposed to the test material, was concurrently treated with 5 % w/v test material.

The skin reactions following induction were not reported. After challenge exposure, the incidence of grade 1 responses in the test group was 5 of 20, and in the naive control group was 4 of 10. The average grade of reaction at 24 hours was 0.6 and 0.7 in the treated and control groups, respectively. In a historical positive control study using a-hexylcinnamaldehyde in acetone, a second challenge produced sensitisation reactions.

Oronite Synfluid PAO 2 cSt was not a skin sensitiser in guinea pigs.

9.2 Repeated Dose Toxicity (15)

Young adult SD rats (6/sex/group) were orally administered PAO 2 cSt at 0, 200, 500 or 1 000 mg/kg/day for 29 days by gavage. Two additional groups were similarly dosed with 0 and 1 000 mg/kg/day, respectively, and recovered for two weeks after cessation of administration before being sacrificed.

No deaths or treatment-related clinical signs were observed in the control and test animals. There were no changes in body weight gain, feed consumption, haematology or clinical chemistry. Organ weights were not affected by treatment. No treatment-related macroscopic or microscopic changes were detected. The test compound was of low toxicity in rats by repeated dosing for up to 29 days.

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium* and *Escherichia coli* Reverse Mutation Assays (16)

Salmonella typhimurium TA 98, TA 1537, TA 100 and TA 1535 and *Escherichia coli* WP2 uvrA were cultured with 0.1 - 10 mg/plate of PAO 2 cSt with and without metabolic activation using rat liver S9. At the highest concentration, the test material was suspended in the vehicle (acetone), but at all lower concentrations, the test material appeared to be miscible with the solvent. All dose levels were plated in triplicate. Solvent and positive controls were run concurrently. In the positive controls, 2-aminoanthracene was used in the presence of S9 in all the strains. In the absence of S9, 2-nitrofluorene was used in strain T98, sodium azide in strains TA 100 and TA 1535, and ICR-191 in strains TA 1537 and WP2 uvrA.

No reproducible increases in mutant frequency were observed in the treated groups. The positive controls produced marked increases in mutant frequency in all the test strains. The test concentrations were not cytotoxic to any strain. Under the condition of the assay, PAO 2 cSt was not mutagenic in the *Salmonella typhimurium* and *Escherichia coli* reverse mutation assays.

9.3.2 Micronucleus Assay in the Bone Marrow Cells of the Mouse (17)

Young adult Swiss albino mice (18-21/sex/group) were intraperitoneally administered 1 250, 2 500 or 5 000 mg/kg (the highest practical dose) of PAO 2 cSt, suspended in peanut oil. A vehicle control group (18/sex) received 4 000 mg/kg of peanut oil only, and a positive control group (5/sex) was treated with 0.25 mg/kg of triethylenemelamine. Bone marrow was collected from 10 animals (5/sex) from each treatment and vehicle control group at approximately 24, 48 and 72 hours after administration. Positive controls were sampled at 24 hours. Two bone marrow smears were made from each animal and 1 000 polychromatic erythrocytes were scored for micronuclei.

No clinical signs of toxicity were observed during the study. Cytotoxicity was detected in males in the positive control and at the 1 250 mg/kg dose level sampled at 24 hours and in females at the 2 500 and 5 000 mg/kg dose levels sampled at 48 hours. No significant increase in the number of micronucleated polychromatic erythrocytes was observed in the treated animals. The positive control induced micronuclei as expected. PAO 2 cSt did not cause chromosomal damage in bone marrow cells of the mouse *in vivo*.

9.4 Overall Assessment of Toxicological Data

The toxicity studies were conducted using a 10% 1-dodecene and 90% decene derived PAO hydrogenated dimer (PAO 2 cSt). PAO 2.5 cSt with a higher C12 content is chemically very similar to PAO 2 cSt. The toxicity profile for PAO 2 cSt can be used to assess the toxicity of PAO 2.5 cSt, which has a relatively higher molecular weight.

Based on the toxicity studies provided by the notifier, decene/dodecene hydrogenated dimer was of low acute oral and dermal toxicity in rats, but of moderate acute inhalational toxicity in the same species. It was a slight skin irritant and caused moderate conjunctival irritation in rabbits, but was not a skin sensitiser in guinea pigs. Repeated

administration of PAO 2cSt at up to 1 000 mg/kg/day for 29 days did not produce any noticeable adverse effects in rats. It was not mutagenic in the bacterial reverse mutation assays *in vitro* and did not cause chromosomal damage in mouse bone marrow cells.

On the basis of inhalational toxicity (LC_{50} = 1.170 mg/L), the notified chemical is classed as hazardous according to Worksafe Australia Approved Criteria for Classifying Hazardous Substances (1)

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

Table 2. Ecotoxicity test results

Species	Test	Result
Rainbow Trout (*Oncorhynchus mykiss*)	96 hour acute	LC_{50} > 1 000 mg/L[a]
Water Flea (*Daphnia magna*)	48 hour acute	EC_{50} = 230 mg/L[a]
Algae (*Selenastrum capricornutum*)	72 hours	For growth stimulation (0-72 hours): EC_{50} > 1 000 mg/L[a]

a. Result based on nominal concentrations, although test was conducted with the water soluble fraction.

Ecotoxicity studies were conducted using Oronite XS 101 (Alkane 1 fraction containing ≤ 10% C12 content) according to US EPA or OECD guidelines (Table 2). The test concentrations are nominal concentrations only, with the water soluble fraction used. Oronite XS101 was added directly to the test water to give the correct concentration if all would dissolve. The solution/emulsion was then stirred for 20 hours, and allowed to settle for 4 hours. The required test solution was then siphoned off into test vessels, avoiding any surface film. The degree to which Oronite XS 101 did not dissolve was not recorded, although all test solutions remained clear for the duration of the test.

The results indicate that the polyolefin is practically non toxic, with the lowest EC_{50} of 230 mg/L for water flea. In fact, mortality seemed to be associated with the presence of an oily film, presumably from partitioning of the polyolefin out of solution at higher concentrations (loadings). The notifier gives a NOEL of 19 mg/L, although the sublethal and lethal effects observed did not appear to follow a dose-response and were of a low level (mortality ≤ 10% at LOEL and higher concentrations). Algae toxicity was associated with all nominal concentrations, but stimulated growth and with the EC_{50} remaining above 1 000 mg/L.

Although there is some uncertainty with actual concentrations used in the tests, it is expected that Oronite XS 101 would be practically non-toxic up to the limit of its solubility.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

Alkane 1 will be used as a base for automotive and industrial oil blends, or as a dielectric fluid or heat transfer oil in capacitors and transformers. The main exposure will be from inappropriate disposal of oil. Calculations show an extremely high dilution for the polymer is still expected even if all of the 35% of oil not collected in Australia was disposed of to a country sewer. Together with its expected distribution through retail

centres across Australia (ie not concentrated in one town or city), and with good industrial and public practice, significant aquatic exposure to the polymer is not expected.

Ecotoxicity tests showed that for a low molecular weight fraction of Alkane 1 (Oronite XS 101), the chemical is expected to be practically non-toxic to aquatic organisms up to the limit of its solubility. For the higher weight molecular fractions of Alkane 1, it is assumed that these would show less toxicity because they would be less soluble and greater molecular weight and size, and possibly greater degree of branching (18).

Also, the concentration of Alkane 1 in the soil or water compartment will be further reduced as it was shown to be readily biodegradable. Also, although not classed as ultimately biodegradable, extended biodegradation tests showed that Alkane 1 continued to mineralise.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Based on the data given for PAO 2 cSt as an analogue for Alkane 1, there is low potential acute oral and dermal toxicity while there is a potential slight skin irritation and moderate eye irritation. It may cause moderate acute inhalational toxicity however there is little potential for sensitisation, repeat dose toxicity, mutation or chromosomal damage.

There exist potentially significant health risks from inhalation and eye exposure. The transfer of Alkane 1 from bulk storage to steel drums, transfer to blending tanks, sampling and analysis of Alkane 1, cleaning and packaging allows the potential for occupational exposure by splashing or spillage to an 80-100% formulation. Expected duration of exposure is at least 30 minutes, 50 days a year. The packaging of the finished blended lubricant is performed by automated machinery and supervised from two metres away, thereby reducing the risk of exposure. Some low exposure to residual Alkane 1 may occur during the application of labels and bungs to the drums. The cleaning of blending vessels and equipment with lube oil and the sampling and analysis of the blended lubricants has also the potential for occupational exposure from splashing or spillage. Adequate personal protection such as gloves, shoes, eye protection, protective clothing and respiratory protective devices is required at this stage to reduce the risk of inhalation or eye contact

When lubricants containing the notified chemical are used in food packaging and processing equipment, incidental contact with food can occur, but contamination of food with the lubricants is minimal. Animal studies showed that the notified chemical is of low toxicity by repeated oral administration and is not genotoxic. Infrequent and slight contamination of food with the notified chemical is not considered a significant hazard to public health.

When used in automobile engine oil which is available to the public through retailers, public exposure can occur. During oil changes, the user may be dermally exposed to the notified chemical at levels about 80% in automobile engine oil, but the contact would be short and infrequent. Animal studies showed that the notified chemical is of low dermal toxicity and a slight skin irritant. Thus, short dermal exposure to the notified chemical

should not have significant adverse health effects. Any accidental splashing into the eye is not expected to result in serious damage to the eyes. In animal studies, redness of the conjunctivae without corneal or iridal injury was produced in rabbits after instillation into the eyes, and the redness disappeared within 48 hours after treatment. Therefore, public use of the engine oil containing approximately 80% of the notified chemical is not expected to result in significant adverse health effects provided contact with eyes can be avoided.

The main occupational health risk posed to automobile mechanics is skin irritation, following repeated exposure to the notified chemical in engine oil. As previously discussed, accidental eye contact is likely to cause discomfort, but no serious damage to eyes.

The incomplete combustion products emitted from automobiles are similar to those from the combustion of gasoline, but the levels are very low and not distinguishable from the fuel derived combustion products, which will dominate the hydrocarbon emissions. Such use of the notified chemical is not expected to pose a health hazard to the public.

13. RECOMMENDATIONS

To minimise occupational and public exposure to Alkane 1 the following guidelines and precautions should be observed:

- The appropriate respiratory device should be selected and used in accordance with Australian Standard/ New Zealand Standard (AS/NZS) 1715 (19) and should comply with AS/NZS 1716 (20) if ventilation is inadequate;

- Eye protection should be selected and fitted in accordance with Australian Standard (AS) 1336 (21) and used in accordance with AS/NZS 1337 (22);

- Industrial clothing must conform to the specifications detailed in AS 2919 (23) and AS 3765.1 (24);

- Industrial gloves should conform to the standards detailed in AS 2161 (25) and AS 3765.1 (24);

- All occupational footwear should conform to the standards detailed in AS/NZS 2210 (26);

- Particular care should be taken to avoid spillage or splashing of the notified chemical;

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

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

- Automobile engine oil containing decene/dodecene hydrogenated dimer should carry the following warning statements:
  Avoid contact with eyes
  Wash hands after use

14. MATERIAL SAFETY DATA SHEET

The attached MSDS for Alkane 1 was provided in an acceptable format (27). This MSDS was provided by Chevron Chemical Australia as part of their notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of Chevron Chemical Australia.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act* 1989, secondary notification of Alkane 1 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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