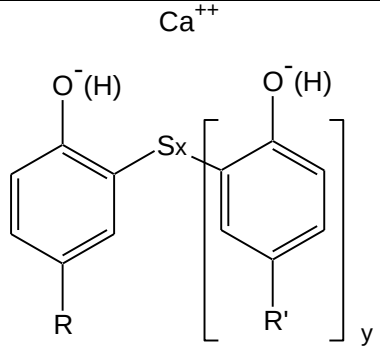
SIDS INITIAL ASSESSMENT PROFILE

Category name	Combined Alkyl Phenol Sulfide and Alkyl Phenate Sulfide category
CAS Nos.	Sponsored Substances 68815-67-8 68855-45-8 122384-85-4 68784-25-8 122384-86-5 68784-26-9 122384-87-6 73758-62-0 122384-84-3 Supporting Substance 68515-93-5
Chemical Names	Sponsored Substances Phenol, thiobis[tetrapropylene-] Phenol, tetrapropenyl-, sulfurized, calcium salts Phenol, tetrapropenyl-, sulfurized, calcium salts, carbonates Phenol, tetrapropenyl-, sulfurized, carbonates, calcium salts, overbased Phenol, tetrapropenyl- and C18-30 alkyl derivatives, sulfurized, calcium salts, overbased Supporting Substance Phenol, nonyl derivatives, sulfides

Structural Formulae	 R, R' = median carbon chain length (see text) x = 1-3 bridging sulfur molecules y = 1-3 alkyl phen(ol)ate molecules Sponsored Substances C36H46O2S1-2 C36H58Ca2O4S1-3 C36H58Ca4O10S1-3 C42-54H70-94Ca4O10S1-3 Supporting Substance C30H46O2S1-2

SUMMARY CONCLUSIONS OF THE SIAR

Category/analogue Rationale

The substances that make up the Combined Alkyl Phenol Sulfide and Alkyl Phenate Sulfide are complex mixtures that can vary in a number of generally predictable ways, and their structural similarities and predictability allow their assessment as a "continuum" category. The members of this category are mixtures of oligomers of alkyl phenol or alkyl phenate molecules that are linked by one to three sulfur atoms. The alkyl phenoxy group that is common to all the members of the category can contain saturated branched chain C10-C15 (predominantly tetrapropenyl) or saturated linear C18-C30 (alpha-olefin) alkyl groups (R and R') attached primarily at the para ring position. Alkyl phenate sulfides are made when the alkyl phenol group is reacted with calcium hydroxide or oxide to form the corresponding calcium salt. Alkyl phenol sulfides are not neutralized with calcium hydroxide during their manufacture.

The category members are produced using highly refined lubricant base oil as solvent. It must be emphasized that the CAS number assigned to each substance refers to the active alkyl phenol sulfide or calcium alkyl phenate sulfide ingredient, but that these substances are never isolated from the highly refined lubricant base oil (present at 40 – 50%); isolation is not technically possible without incurring degradation of the phenate sulfide. Consequently, the measured data presented represent the results of tests conducted with the test substance as manufactured, and the purity of the test substances and amount of highly refined lubricant base oil varies based on the manufacturing processes used by the different manufacturers of these substances. However, calculated data (e.g. QSAR estimates) represent the results of the theoretically purified substance without highly refined lubricant base oil. In general, highly refined lubricant base oils used in the manufacture of alkyl phenol sulfides and alkyl phenate sulfides may cause slight skin irritation, but otherwise have a low order of acute and chronic toxicity. However, the presence of highly refined lubricant base oil can have an impact on the results of aquatic toxicity tests and environmental fate tests where the alkyl phenol sulphide or alkyl phenate sulphide would tend to remain in the lubricant base oil fraction of the mixture and enter the water column to a limited degree in accordance with the log Kow of the substance.

The substances in this category contain the unreacted alkyl phenol and its calcium salts in varying amounts as an unintended residual resulting from the processes involved in manufacture. One example is unreacted tetrapropenyl phenol (TPP, CAS # 74499-35-7) previously assessed in the OECD HPV programme) and its calcium salt (CaTPP), which has been shown to be present in representative samples of the tetrapropenyl phenate sulfide and carbonates (at 3 – 14%). TPP has low solubility in water, high log Kow, and low vapour pressure. It is highly toxic to aquatic organisms, and it causes adverse systemic effects in repeated-dose toxicity studies in mammals. It also causes adverse effects on reproduction parameters and reproductive organs and adverse effects on the developing fetus in mammals. These effects are discussed further below.

The physico-chemical data indicate that the category members demonstrate an orderly progression of changes as one goes from lower molecular weight to higher molecular weight in the category. The physico-chemical information provided indicates that boiling point and log Kow increases across the category, and vapour pressure and water solubility decrease across the category. These physico-chemical properties indicate that the group members are likely to have limited mammalian bioavailability. This is supported by the findings from the single and repeated exposure mammalian toxicity studies indicating minimal general toxicity. All category members have a low vapour pressure indicating that inhalation of vapours is not a likely route of exposure for humans or in the environment. Based on the physico-chemical properties of low water solubility and high octanol-water partition coefficient, these substances are likely to partition largely to sediment and suspended solids in the aquatic environment.

A saturated branched C9 (nonyl) chain substance (CAS 68515-93-5) is used as a supporting substance. This substance is closely related to the category members, differing only in the length of the alkyl chain. Measured data from this supporting substance are used for water solubility and acute inhalation toxicity endpoints.

Physico-Chemical Properties

The substances that are members of the Combined Alkyl Phenol Sulfide and Alkyl Phenate Sulfide Category are complex reaction mixtures. As stated above, the measured data presented represent the results of tests conducted with the test substance as manufactured, which contains up to 50% highly refined mineral oil that cannot be removed. Calculated data represent the results of the theoretically purified substance without highly refined lubricant base oil, based on the neutral phenol compounds. Therefore calculated values should be viewed as indicative rather than prescriptive. They are liquids with low water solubility (less than 0.206 mg/L, measured, for the supporting substance nonyl phenol sulfide – CAS No. 68515-93-5) and low vapour pressure (calculated range 3 x 10-12 – 6.2 x 10-29 Pa at 25^{o}C). The octanol-water partition coefficient for these substances is high (log Kow > 6.6, measured). Calculated log Kow values range between 8.5 and 14.

Human Health

It is known that these materials have varying levels of residual TPP present and that this substance has demonstrated the potential for toxicity to human health in its own right. This information should therefore be borne in mind as the dataset for this group of materials is considered as it is likely to have some impact for certain endpoints. At this time, however, it is not possible to say with any certainty for which endpoints TPP is a major contributing factor as the evidence is not sufficient to warrant such a statement. It can be stated with some confidence that it is likely to play at least some role in several of the endpoints (e.g. reproductive toxicity) and so considerations to this effect have been included within these sections as a potential explanation for some of the results. Without further testing it would be unwise to speculate on the association between this substance and other endpoints for human health. A summary of the toxicity of TPP is provided in the Appendix to the main SIAR document for reference and comparison.

No experimental data on toxicokinetics of category members are available. The high lipophilicity, high molecular weight, low aqueous solubility, and the lack of adverse findings following oral and dermal dosing indicate that intestinal absorption or absorption through the skin and distribution in the body is likely to be limited. The low vapor pressures of these substances indicate that very little if any absorption occurs via inhalation. Metabolism to (non-toxic) metabolites is predicted to occur mostly in the liver. Excretion is expected to be mainly via the urine and feces.

In general, members of the category are not acutely toxic. In the key acute oral toxicity study (OECD TG 401) for each category member, the LD_{50} ranged from >5000 to >16000 mg/kg. No deaths occurred in these studies, and signs of toxicity included dirty ruffled fur, soft feces, dark-stained urogenital areas, and red-stained feces at dose levels >5000 mg/kg. The LD_{50} in the key acute dermal toxicity studies (OECD TG 402) available for all the

category members (except CAS # 68815-67-8) plus the supporting substance (CAS # 68515-93-5) ranged from 2000 to 5000 mg/kg, No deaths occurred in these studies, and signs of toxicity included a decrease in food consumption and clear ocular discharge at dose levels >4000 mg/kg. In two acute inhalation studies (similar to OECD 403) in rodents with CAS # 122384-87-6 and supporting substance CAS # 68515-93-5, no signs of toxicity occurred at concentrations of up to 1.67 mg/L

In the key eye irritation studies (OECD TG 405) for each category member, animal data indicate that these substances cause slight reversible conjunctival irritation: corneal opacity was observed in only one animal in one study (with CAS # 122384-85-4) and cleared by 24 hours.

Slight reversible irritation to the skin was observed in the key skin irritation studies (OECD TG 404) for each member of the category following a 4-hour application to the skin. In general, skin irritation scores were slightly higher in studies where the test substance was applied to the skin for 24 hours in older studies. In two repeated-dose dermal toxicity studies in rats (CAS # 122384-87-6) and rabbits (supporting substance CAS # 68515-93-5), application of the test substances over a 28-day period resulted in skin irritation at the application site). However, in 2 human repeated-insult patch tests in which the same test substances were applied three times per week for three weeks, no evidence of skin irritation was observed.

Several skin sensitization studies (OECD TG 406) in guinea pigs have been conducted for each member of the category. Findings in animal studies present a contradictory profile, with positive and negative results in some instances obtained with the same substance following identical protocols. However, negative findings were obtained in two human repeated-insult patch tests with CAS # 122384-87-6 and supporting substance CAS # 68515-93-5. Overall, these substances are not considered to be sensitisers in humans.

The repeated-dose toxicity of the members of this category has been evaluated in two 28-day repeated-dose oral (gavage) toxicity studies (OECD TG 422), one repeated-dose dermal toxicity studies (OECD TG 410), two oral (gavage) developmental toxicity studies (based on OECD TG 414), and a 2-generation oral (gavage) reproductive toxicity study (OECD TG 416).

The 28-day repeated-dose oral (gavage) toxicity study with CAS # 122384-85-4 was conducted in rats with dose levels of 0, 50, 300, and 1000 mg/kg bw/day for 7 days/week for 4 weeks. The sample of the test substance used in this study was a commercial sample that contained 54% alkyl phenate sulphide oligomers, 43% highly refined lubricant base oil, and 3% unreacted tetrapropenyl phenol (TPP) and the calcium salt of TPP (CaTPP). Consequently, the animals in the high-dose group were administered 30 mg/kg bw/day of TPP and CaTPP. No deaths occurred, and no signs of toxicity were observed in this study. At study termination, increased mean adrenal weights (absolute and relative to brain weights) were observed at the high dose of 1000 mg/kg bw/day in females only. These changes were accompanied by an increase in the severity of fine vacuolar changes in the cells of the zona fasciculate in the adrenal cortex in the high-dose females. The NOAEL for this study was 300 mg/kg bw/day. Although TPP caused an increase in mean adrenal weights in a 28-day repeated-dose oral (gavage) toxicity study and a 1-generation oral (gavage) reproductive toxicity study, those changes occurred at dose levels >180 mg/kg bw/day in the 28-day study and at the high dose of 125 mg/kg bw/day in the reproductive toxicity study, these changes occurred only in males and was accompanied by a decrease in mean body weight gain. The TPP concentration in the high-dose group in this study was well below the dose levels of TPP that caused adverse effects on the adrenal gland. Hence these findings do not support a possible relationship between the toxicity of TPP and the adverse effects on the adrenal glands observed in this study.

The 28-day repeated-dose oral (gavage) toxicity study with CAS # 122384-87-6 was conducted in rats with dose levels of 0, 50, 200 and 1000 mg/kg bw/day also for 7 days/week for 4 weeks. The sample of the test substance used in this study was a commercial sample that contained 43% alkyl phenate sulphide oligomers, 50.3% highly refined lubricant base oil and calcium carbonate and 6.7% TPP and CaTPP. Consequently, the animals in the high-dose group were administered 67 mg/kg bw/day of TPP and CaTPP. No deaths occurred in this study. Signs of toxicity observed one hour after dosing were limited to salivation, clear material around the mouth, red or yellow staining around the mouth and/or red material around the nose in males and females receiving 1000 mg/kg bw/day. Mean body weight gain was decreased in males and mean adrenal weights (absolute and relative to brain weights) were increased in males and only slightly in females. There were no microscopic changes in any tissues attributable to treatment, and the NOAEL for this study was 200 mg/kg bw/day. The decrease in mean body weight gain and the increase in mean adrenal weight in this study are qualitatively similar to those findings in the repeated-dose studies with TPP. Hence these findings would tend to support a possible relationship between the toxicity of TPP and the

adverse effects on the adrenal glands observed in this study.

The 28-day repeated-dose dermal toxicity study with CAS # 122384-87-6 in rats was conducted with dose levels of approximately 0, 20, 100 and 250 mg/kg bw/day administered for six hours/day, 5 days/week for 4 weeks. The concentration of TPP was not measured in the test sample. No deaths or systemic toxicity was observed in this study, and the systemic NOAEL was 250 mg/kg bw/day.

In the two oral (gavage) developmental toxicity studies in rats, CAS # 122384-87-6 was dosed at levels of 0, 50, 300, 1000 mg/kg bw/day from Days 6-16 of gestation. The TPP concentration was not measured in the sample of commercial test substance used in the screening study. The sample of the test substance used in the definitive study was a commercial sample that contained 43% alkyl phenate sulphide oligomers, 50.3% highly refined lubricant base oil and calcium carbonate and 6.7% TPP and CaTPP. The test substance was administered to 14 or 15 inseminated females at each dose level in the screening study and to 25 inseminated females at each dose level in the definitive study. No deaths or signs of toxicity attributable to the test substance were observed in the screening study, and treatment-related signs of toxicity observed in the definitive study were limited to clear, red, yellow and/or tan staining/matting/material around the nose and mouth in the high-dose group. In both studies, there was a decrease in mean maternal body weight gain on Days 6-16. The NOAEL for systemic toxicity in both studies was 300 mg/kg bw/day.

The 2-generation oral (gave) reproductive toxicity study in rats with CAS # 122384-87-6 was conducted using dose levels of 0, 50, 200 and 1000 mg/kg bw/day for 7 days/week for 10 weeks prior to mating and all through mating, gestation and lactation for two generations. The sample of the test substance used in this study was a commercial sample that contained 43% alkyl phenate sulphide oligomers, 50.3% highly refined lubricant base oil and calcium carbonate and 6.7% TPP and CaTPP. There were no deaths in this study that could be attributed to the test substance. The predominant signs of toxicity included yellow, red, brown, tan, and/or clear staining/matting/material on various body surfaces, salivation, and red discharge from the vaginal opening at the high dose of 1000 mg/kg bw/day. A decrease in mean body weights in F0 and F1 males in the high-dose group and F1 (but not F0) males in the mid-dose group were observed. There were no effects on mean body weights in females at any dose at any time in the study, except at gestation in the high-dose group. Mean pituitary weights (absolute and relative to final body weight) were increased at the high-dose level in both F0 and F1 males and females and at the mid-dose level in the F0 males only. Mean liver weights (absolute and relative to final body weight) were also increased in the F0 and F1 females at the high dose level. No microscopic lesion attributable to the test substance was observed in these or any other tissue in either sex. The NOAEL for systemic toxicity in this study was 50 mg/kg bw/day.

All of the members of this category are not mutagenic in vitro based on the results of bacterial reverse mutation tests (OECD TG 471) for each member of the category and two mutation assays in cultured mammalian cells (OECD TG 476) with CAS # 68815-67-8 and CAS # 122384-87-6. No positive evidence of in vivo genotoxicity was found in a mouse micronucleus assay (OECD TG 474) conducted with CAS # 122384-85-4 at dose levels up to 5000 mg/kg via intraperitoneal injection.

There is no information on the carcinogenic potential of the any of the category members.

Two members of the category (CAS # 122384-85-4 and CAS # 122384-87-6) were evaluated for reproductive toxicity in oral (gavage) reproductive toxicity screening studies (OECD TG 422) in rats. A 2-generation oral (gavage) toxicity study (OECD TG 416) in rats was conducted with CAS # 122384-87-6 after adverse effects were noted in the reproductive toxicity screening test with this test substance.

In the oral (gavage) reproductive toxicity screening study with CAS # 122384-85-4, the test substance was administered to male and female rats at dose levels of 0, 50, 300 and 1000 mg/kg bw/day for 7 days/week for four weeks prior to mating. The concentration of TPP in the sample of test substance used in this study, the concentration of TPP in the high-dsoe group, and the systemic toxicity observed in this study have been described above in the repeated-dose toxicity section. There were no adverse effects on any reproductive parameter in this study. The NOAEL for reproductive toxicity is 1000 mg/kg bw/day. The amount of TPP administered in the high dose in this study, 30 mg/kg bw/day, is well below the dose of TPP that caused reproductive toxicity in the 1-generation study.

The oral (gavage) reproductive toxicity screening study with CAS # 122384-87-6 was conducted with dose levels of 0, 50, 200 and 1000 mg/kg bw/day administered to males and females for 7 days/week for 4 weeks prior to mating. The concentration of TPP in the sample of test substance used in this study, the concentration of TPP in the high-dose group, and the systemic toxicity observed in this study have been described above in the repeated-dose toxicity section. The systemic toxicity observed in this study has been described in the repeated-dose toxicity section above.

The test substance caused a decrease in mean live litter size and a decrease in the mean number of corpora lutea for each female at the high dose of 1000 mg/kg bw/day. No other significant effects on reproduction parameters or reproductive organs were observed in this study. The NOAEL for reproductive toxicity was 200 mg/kg bw/day.

In the 2-generation oral (gavage) reproductive toxicity test with CAS # 122384-87-6, the test substance was administered to male and female rats at dose levels of 0, 50, 200 and 1000 mg/kg bw/day for 7 days/week for 10 weeks prior to mating and all through mating, gestation and lactation for two generations. The concentration of TPP in the sample of test substance used in this study, the concentration of TPP in the high-dose group, and the systemic toxicity observed in this study have been described above in the repeated-dose toxicity section. The F0 and F1 fertility indeces (number of pregnant females/number of mated females) and F0 and F1 mean live litter sizes were significantly reduced at the high dose of 1000 mg/kg bw/day. In addition, F0 and F1 mean testes, epididymides, and ovary weights were decreased and F0 and F1 mean pituitary weights were increased in males and females. Qualitative spermatogenesis evaluations were performed on all males that did not sire a litter, but no treatment-related changes were observed in gross sperm morphology, apparent relative numbers or motility in the epididymides. The reproductive NOAEL for this study is 200 mg/kg bw/day.

Although the amount of TPP administered in the high dose group in both reproductive toxicity studies with CAS # 122384-87-6, 67 mg/kg bw/day, is lower than the lowest dose of TPP that caused adverse effects on reproduction parameters and reproductive organs in the one-generation reproductive toxicity study, it is also higher than the dose level that did not cause reproductive toxicity. Consequently, the adverse results on reproduction with CAS # 122384-87-6 are consistent with the adverse effects on reproduction produced by TPP.

In two oral (gavage) developmental toxicity studies in rats, CAS # 122384-87-6 was dosed at levels of 0, 50, 300, 1000 mg/kg bw/day from Days 6-16 of gestation. The TPP concentration was not measured in the sample of commercial test substance used in the screening study. The sample of the test substance used in the definitive study was a commercial sample that contained 43% alkyl phenate sulphide oligomers, 50.3% highly refined lubricant base oil and calcium carbonate and 6.7% TPP and CaTPP. The test substance was administered to 14 or 15 inseminated females at each dose level in the screening study and to 25 inseminated females at each dose level in the definitive study. No deaths or signs of toxicity attributable to the test substance were observed in the screening study, and treatment-related signs of toxicity observed in the definitive study were limited to clear, red, yellow and/or tan staining/matting/material around the nose and mouth in the high-dose group. In both studies, there was a decrease in mean maternal body weight gain on Days 6-16. In the screening study, a significant increase in the incidence of fetuses and litters with 14th rudimentary ribs was observed at the high dose of 1000 mg/kg/day. In addition, there was an increased incidence of fetuses with non-ossified and/or incomplete ossification of the hyoid at the mid- and high-dose levels. However, there was no increased incidence of litters with this skeletal variant at any dose level. In the definitive study, there was an increased incidence of litters with bent ribs in the high dose of 1000 mg/kg bw/day. However, the incidence of fetuses with this skeletal variant was not increased. The findings on the ribs in both studies are regarded as minor variations and not major malformations. The delayed ossification of the hyoid may well represent an increase in a finding with a high spontaneous background incidence. The NOAEL for developmental toxicity in the screening study is 50 mg/kg bw/day, and the NOAEL for developmental toxicity in the definitive study is 300 mg/kg bw/day. Overall, minor developmental variations were noted in rats.

In summary, the members of the Combined Alkyl Phenol Sulfide and Alkyl Phenate Sulfide category, are of a low order of toxicity after acute oral and dermal exposure. These substances cause slight irritation to the eye and skin, and they are not human skin sensitizers. Repeated-dose toxicity studies show some evidence of systemic toxicity at the limit dose of 1000 mg/kg bw/day and at 200 mg/kg bw/day in a 2-generation study. The members of this category are not mutagenic *in vitro*. They are of low concern for developmental toxicity. Alkyl phenate sulfides cause a reduction in fertility in males and female rats, a reduction in mean live litter size, and a reduction in the size of male and female reproductive organs. This may be dependent on the concentration of residual unreacted TPP + CaTPP. Adequate screening-level data are available to characterize the human health hazard for the purposes of the OECD HPV Chemicals Programme.

Environment

It can be concluded that the substances that are members of the category do not readily biodegrade. In two studies conducted with CAS # 122384-85-4, the extent of biodegradation after 28 days ranged from 4.7% to 13.4% (OECD TG 301B). They do not undergo hydrolysis. Atmospheric half-lives ranging from 1. 41 to 3.00 hours can be calculated based on hydroxyl radical interaction, but the low vapour pressure of these substances and their Henry's Law Constants indicate that partitioning into atmosphere will not be a significant pathway. The Equilibrium

Criterion (EQC) model, part of the EPISUITE program, indicates that these substances are likely to preferentially bind to soil in the terrestrial environment and to sediment and suspended particles in the aquatic environment. While the octanol-water partition coefficient for these substances is high (log Kow > 6.6, measured), calculated bioconcentration factors based on calculated log Kow values (range 8.5 - 14) generally suggest that these substances have low bioaccumulation potential (estimated BCF range 3.2 – 656). This is supported by an in vitro membrane transport study and the substances' properties indicating low bioavailability in aqueous media.

The substances that make up this category are of low concern for acute toxicity to aquatic organisms. Due to the physico-chemical properties of the substances in this category, water accommodated fractions (WAF) were generally used to produce test media in aquatic studies. Results are quoted relative to WAF loading rates. The WAFs, prepared from loading rates of at least 100mg/l, did not exert acute toxic effects on fish, invertebrates, or algae.

CAS 122384-85-4:

OECD TG 203, *Pimephales promelas* 96h LL50 > 1000mg/l (WAF)

OECD TG 203, *Oncorhynchus mykiss* 96h LL50 > 1000mg/l (WAF)

OECD TG 202, *Daphnia magna* 48h LL50 > 1000mg/l (WAF)

OECD TG 201, *Pseudokirchneriella subcapitata* 96h LL50 > 1000mg/l (WAF)

CAS 122384-86-5:

OECD TG 203, *Pimephales promelas* 96h LL50 (growth rate) > 1000mg/l (WAF)

OECD TG 202, *Daphnia magna* 48h LL50 > 1000mg/l (WAF)

OECD TG 201, *Pseudokirchneriella subcapitata* 96h LL50 > 500mg/l (WAF)

CAS 122384-84-3:

OECD TG 203, *Oncorhynchus mykiss* 96h LL50 > 10,000mg/l (WAF)

These substances are not expected to inhibit wastewater treatment plant microorganisms at typical discharge rates (the 3-hr EC50 is greater than 1,000 mg/L (nominal) in activated sludge respiration inhibition tests). No data on chronic toxicity are available.

The data for this group of materials in this section are not easy to interpret for a number of reasons. These include the unavoidable presence of base oil in the mixtures (which may impact the soluble fractions of the category members and have its own effects on organisms), WAF testing (and variations in WAF methods), and lack of analytical methods to measure the levels and composition of the dissolved fraction for such insoluble materials (making determination of actual exposures tested not possible). A further complication is the presence at varying levels of residual TPP (tetrapropenylphenol, branched C12 alkylphenol) which is known to have a number of effects on test organisms. In WAF preparation it is likely that those components present with higher water solubilities will preferentially dissolve, so that the proportions of the components in the test water are not representative of the proportions of the components found in the test material itself. Relative concentrations will be skewed in favour of the more soluble components. The lower molecular weight/shorter alkyl chain constituents, such as TPP, appear to be more water soluble than the larger components. All of these factors, particularly the TPP presence, make the interpretation of toxicity tests with these substances complex. No acute effects were observed in the valid studies conducted using a WAF technique. There is no data for long term exposure; but it is plausible that the more soluble components (that may be over-represented in the WAF test media, such as TPP) may exhibit effects in long term studies. A summary of TPP toxicity is provided in the Appendix to the main SIAR document for reference and comparison. In the environment the substances are likely to partition to sediment in the aquatic compartment and bind to soil in the terrestrial environment; no data for sediment- or soil-dwelling organisms are available.

In summary, while there are a number of potentially confounding variables within the data, the substances in this category do not appear to present an acute aquatic toxicity hazard for the environment. Adequate screening-level data are available to characterize the environmental hazard for the purposes of the OECD HPV Chemicals Programme.

Exposure

The substances that are members of the Combined Alkyl Phenol Sulfide and Alkyl Phenate Sulfide Category are produced in closed processes in France, the United Kingdom, Singapore, and United States of America. The total global production volume is estimated to be greater than 43,000 tonnes/year.

Members of this category are used to formulate finished lubricant oils including all types of automotive and diesel engine crankcase oils, marine and railroad diesel engine oils, and air-cooled two-cycle engine oils. Typical finished oils contain 1 to 10% alkyl phenol sulfide or alkyl phenate sulfide.

Occupation and consumer exposure to the category members is in general expected to be very low based on their physico-chemical properties, use and handling patterns. Some dermal exposure is expected due to the widespread use of these substances in all types of engine oils. Potential releases of the category members to the environment may occur following production, use to make lubricant additive packages, blending lubricant additives into finished oils, and use and disposal of used lubricants.