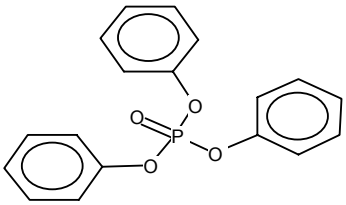
SIDS INITIAL ASSESSMENT PROFILE

CAS No.	115-86-6
Chemical Name	Triphenyl phosphate
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR

Human Health

Triphenyl-phosphate (TPP) is degraded by hydrolysis in rat liver homogenate to diphenyl-phosphate as the major metabolite. Acute toxicity after oral and dermal administration is very low: acute oral administration in rats, mice, rabbits and guinea pigs produced LD50 values in a range of 3000 to above 20 000 mg/kg bw. Only one study in mice with limited documentation gave a value of 1320 mg/kg bw. After dermal application an LD50 of above 7900 mg/kg bw was established in rabbits. No valid studies are available regarding the inhalation of triphenyl phosphate. Triphenyl phosphate is not irritant to the skin. The irritation potential of triphenyl phosphate on the mucous membrane of the eye is very low. No animal data regarding skin sensitisation are available. There are few human case reports showing evidence of skin sensitisation. The incidence of skin sensitisation is very low.

Based on the available data the toxicity after repeated oral treatment of rats with triphenyl phosphate was low. A 35 day study using doses of up to 350 mg/kg bw/day produced a slight depression of body weight gain and an increase of liver weights at the highest dose. An estimated dose of ~ 70 mg/kg bw/day was without any effect. Three studies for 4 month with doses of up to 1% in the diet (~ 700 mg/kg bw/day) confirmed the effect on growth. Whereas in two studies body weight gain was depressed only at the highest dose of 1 %, in another study a decrease was observed even at 0.5 %. The general well being as well as neurotoxic or immunotoxic parameters were not affected in all dose groups. Therefore the overall NOEL for these studies is 161 mg/kg bw/day due to reduced body weight gain. The low toxicity was confirmed also after dermal exposure of 100 and 1000 mg/kg bw/day in rabbits for 15 days without any sign of toxicity besides a depression of acetylcholinesterase as the only dose related effect. The toxicological relevance of this effect is hard to evaluate since quantitative data as well as the purity of the test material are not available.

Neurotoxicity is a potential adverse effect of many organophosphates. In available studies in hens and cats pure triphenyl phosphate did not induce immediate nor delayed neuropathy. The findings of a decreased activity of choline esterase and paralysis predominantly in cats in older studies indicating a neurotoxic potential were not reproduced in later studies and may be due to contamination of the tested samples by other organophosphorus esters. At the high doses of triphenyl phosphate used even small concentrations of impurities might have sufficient activity.

Tests for gene mutations in bacterial as well as yeast and mammalian cells did not reveal any sign of mutagenicity. An UDS-test in syrian hamster fibroblast cells showed no genotoxic effect. There is no test concerning chromosomal aberration.

There are no findings indicating any adverse effects on fertility or the development of the fetus up to the highest tested dose level of 1% in the diet (~ 700 mg/kg bw/day) in the rat treated for 4 months during gametogenesis prior to mating and throughout mating and gestation.

The mouse lung adenoma assay gave no indication of a carcinogenic potential.

Environment

Triphenyl phosphate has a solubility in water between 0.2 mg/l (river water) and 1.9 mg/l (distilled water) at 20 °C, a vapour pressure of 0.000835 Pa at 25 °C and a log Kow of 4.6. According to a Mackay Level I model calculation, triphenyl phosphate is mainly distributed to soil (43.9 %) and sediment (41.0 %), and to a lesser extent to water (14.3 %) and air (0.7 %). Triphenyl phosphate is hardly volatile from aqueous solution (calculated Henry constant: 0.018 - 0.036 Pa · m³/mol). The substance is strongly adsorbed to soil and sediment (measured Koc-values in the range of 2514 – 3561). In the atmosphere rapid degradation of triphenyl phosphate via indirect photolysis occurs ($t_{1/2air}$: ca. 12 h). While triphenyl phosphate is relatively stable under neutral and acidic conditions ($t_{½}$ = 19 d at pH 7; $t_{½}$ > 28 d at pH 5), it undergoes hydrolysis under alkaline conditions ($t_{1/2}$ = 7.5 d at pH 8.2; $t_{1/2}$ = 1.3 d at pH 9.5). In soil DT_{50} for primary degradation is 37 and 21 days under aerobic and anaerobic test conditions, respectively. Triphenyl phosphate is readily biodegradable (83 - 94% degradation after 28 d). Under anaerobic conditions with river sediment ca. 90 % triphenyl phosphate were primary degraded after 40 days of incubation. Mineralisation was about 22 % after 40 days. Measured bioconcentration factors in fish were in the range of 110 - 144, indicating a moderate bioaccumulation potential. As the BCF values are related to the parent compound, there is no information on possible accumulation of stable metabolites. BCFs for *Lemna minor* and *Typha sp*. are stated to be < 50. As the substance was found in dolphins collected in the Gulf of Mexico, accumulation via the food chain may occur.

The acute toxicity has been determined for fish (*Oncorhynchus mykiss*: 96 h-LC_{50} = 0.4 mg/l) and invertebrates (*Mysidopsis bahia:* 96 h-EC_{50} > 0.18 - 0.32 mg/l, *Daphnia magn*a: 48 h-EC_{50} = 1.0 mg/l). In tests with algae (*Selenastrum capricornutum, Scenedesmus subspicatus, Chlorella vulgaris*) NOEC values in the range of 0.25 - 2.5 mg/l were obtained after exposure periods of 96 h. In long term tests with fish (*Oncorhynchus mykissi*) a 30 d - EC10 of 0.037 mg/l was found. A PNECaqua = 0.74 µg/l is derived from the aforementioned long term NOEC using an assessment factor of 50.

Exposure

The world wide (excluding East Europe) production of triphenyl phosphate is estimated to about 20 000 to 30 000 tonnes by approx. 15 producers in the year 2000. Major application areas for triphenyl phosphate are the use as a flame retardant in PVC (about 50 %) where it has also plasticizing properties, but also as a flame retardant in other polymers (about 22 %) and printed circuit boards (about 11 %), and in photographic films (about 7 %). Minor areas (about 10 %) are covered by the use of triphenyl phosphate in hydraulic liquids (main area), and adhesives, inks, and coatings (minor area).

RECOMMENDATION

Human Health: The chemical is currently of low priority for further work.

Environment: The chemical is a candidate for further work.

RATIONALE FOR THE RECOMMENDATION AND NATURE OF FURTHER WORK RECOMMENDED

Human Health: The chemical is currently of low priority for further work based on a low hazard potential.

Environment: Triphenyl phosphate has a wide dispersive use as flame retardant. Environmental releases are likely to occur during production, during the use as flame retardant e.g. in polymer applications as well as during the service life and the disposal of products containing the substance. Also accidental spill and leakage of hydraulic liquids in different application areas can be a source of environmental release. However, no exposure information is available, except for the production at the sponsor company. Triphenyl phosphate is highly toxic to aquatic organisms (LC50 < 1 mg/l for fish, PNECaqua = 0.74 µg/l) and has a potential to accumulate in biota. Therefore, an exposure assessment and, if then indicated, an environmental risk assessment is recommended. Environmental exposure during production at the Sponsor company is adequately controlled.