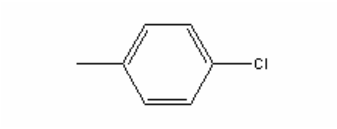
SIDS INITIAL ASSESSMENT PROFILE

CAS No.	106-43-4
Chemical Name	p-Chlorotoluene
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR

Human Health

Since there is no developmental toxicity study with p-chlorotoluene, the data from o-chlorotoluene are taken into account to fill the data gap. The comparison of the two isomers showed a rather high degree of qualitative similarity with respect to available data on absorption, excretion and metabolism, toxicity after acute and repeated exposure, Overall o-chlorotoluene and p-chlorotoluene have a similar toxicity profile. o-Chlorotoluene (CAS No 95-49-8) was already discussed and concluded at SIAM 11, 2001; and the initial assessment was published by UNEP in 2004.

Specific toxicokinetic studies with p-chlorotoluene are not available. The available information indicates that absorption of p-chlorotoluene is rapid via gastrointestinal tract or respiratory tract but is limited via dermal contact. Excretion occurs mainly via urine as p-chlorobenzoic acid derivatives by rabbits or as the corresponding hippuric acid by dogs. Exact data on tissue distribution are not available. Thus, p-chlorotoluene as well as o-chlorotoluene are absorbed via the gastrointestinal tract, the lungs and to a lesser extent via skin. For both isomers excretion takes place principally via urine, and in small amounts with faeces and exhaled air. In the metabolism o- and p-chlorotoluene are oxidized at the methyl group leading to chlorobenzyl alcohol glucuronide, chlorobenzoic acid and mercapturic acid.

The LC_{50} of p-chlorotoluene was not determined but an Inhalation Hazard test showed that exposure of rats against 4183 ppm (approximately 22 mg/m³) for 4 hours was not lethal, but signs of intoxication were observed. Exposure for 8 hours resulted in the death of all exposed rats within the 14-day observation period. The dermal LD_{50} (rabbit) is > 2000 mg/kg bw and LD_{50} (rat) is > 5000 mg/kg bw. Following oral application to rats the LD_{50} values ranged between 2100 mg/kg bw and 2389 mg/kg bw. The predominant symptoms were body tremor, accelerated breathing rate, cyanosis, decreased motor activity and palmospasms. With regard to o-chlorotoluene the acute oral toxicity is LD_{50} (rat, male): 3227 mg/kg bw; the acute inhalation toxicity is LC_{50} (rat): 37,517 mg/m³ (4 hrs) and the acute dermal toxicity LD_{50} (rat) is > 1083 mg/kg bw and LD_{50} (rabbit): > 2165 mg/kg bw. Based on the available data of o- and p-chlorotoluene it can be concluded that the acute toxicity of monochlorotoluene in general is low.

p-Chlorotoluene is slightly irritating to the skin when 0.5 ml undiluted substance is applied to intact and abraded skin of rabbits under occlusive conditions for 24 hours. p-Chlorotoluene is slightly irritating to eyes of rabbits when 0.1 ml undiluted substance was applied into the conjunctival sac. o-Chlorotoluene, tested according to OECD TG 404, is slightly irritating to the skin. However, when tested under occlusive conditions, the substance is corrosive. o-Chlorotoluene, tested according to OECD TG 405, was irritating to the eye in 1 out of 3 animals. Based on the available data it can be concluded that monochlorotoluene in general is slightly irritating the skin and eyes of rabbits. However, o-chlorotoluene seems to be a stronger skin irritant under occlusive conditions.

p-Chlorotoluene is a skin sensitizer when tested in the guinea pig maximization test according to OECD TG 406. o-Chlorotoluene, tested according to OECD TG 406, is not sensitizing to the skin of guinea pigs. However the higher

sensitizing potential for para-substituted substances is a known effect.

Repeated dose toxicity of p-chlorotoluene was examined in sub-acute (29 days) and sub-chronic (90 days) gavage studies with rats using dosages of 50, 200 and 800 mg/kg bw/day. The liver and the kidney are the main target organs. Based on liver impairment in the sub-acute as well as in the sub-chronic study, which also revealed an increase in chronic progressive nephropathy at the highest dose level of 800 mg/kg bw/day, the NOAEL for both studies was determined to be 200 mg/kg bw/day.

With respect to o-chlorotoluene the NOEL for repeated dosing (3 months) by gavage in rats is 20 mg/kg bw/day. In higher dosages (80 or 320 mg/kg bw/day) unspecific signs of toxicity were observed, e.g. reduced body weight gain in male animals as well as elevated BUN, elevated WBC count, reduced prothrombine time in both sexes.

The NOEL for repeated dosing via capsule (3 months) in dogs is 20 mg/kg bw/day. In higher dosage (80 mg/kg bw/day) one animal showed vomiting, and red blood was detected in faeces which might be due to the slightly irritating property of o-chlorotoluene.

In range finding study tests, the LOAECs after inhalation were 4 mg/l (4000 mg/m³, 14 d) in rats and 8 mg/l (8000 mg/m³, 23 d) in rabbits. There is no NOEC from these data.

Based on the test conditions in the repeated dose toxicity studies which were taken into account for comparison, o-chlorotoluene is at least as toxic as p-chlorotoluene after repeated dosing.

p-Chlorotoluene was not mutagenic in the *Salmonella typhimurium* TA97, TA98, TA100, TA1535, TA1537, TA102, and TA104 and in *Escherichia coli* WP2uvrA, *Escherichia coli* WP2uvrA/pKM101 with and without a metabolic activation system nor did it induce micronuclei in mice after a single intraperitoneal injection in a study according to OECD TG 474. o-Chlorotoluene showed no mutagenic activity in bacterial and in mammalian cell test systems *in vitro*. o-Chlorotoluene showed no clastogenic activity (chromosome aberration) *in vitro* and *in vivo*. Based on the available data on o- and p-chlorotoluene it can be concluded that both monochlorotoluenes do not reveal mutagenic activity, neither *in vitro* nor *in vivo*.

There are no studies on the possible carcinogenicity available.

There are no specific studies on reproductive toxicity. However, in the repeated dose-toxicity studies which were taken into account for comparison, o-chlorotoluene is at least as toxic as p-chlorotoluene. Furthermore, in the metabolism o- and p-chlorotoluene are oxidized at the methyl group leading to chlorobenzyl alcohol glucuronide, chlorobenzoic acid and mercapturic acid. Thus, the use of o-chlorotoluene to fill data gaps is justified.

There are no specific studies on reproductive toxicity (fertility assessment) available with p-chlorotoluene or with o-chlorotoluene. Evaluation of the reproductive organs in the available repeated dose toxicity studies with p-chlorotoluene or with o-chlorotoluene give no indication of possible impairment of these organs.

With regard to developmental toxicity conclusion should be drawn from developmental toxicity studies in rats and rabbits with o-chlorotoluene as there is no specific study with p-chlorotoluene available. Developmental toxic effects in rats and rabbits occur mostly in the presence of maternal toxicity and without a clear dose-response relationship, however, as a specific malformation, brachydactyly. Thus, for o-chlorotoluene, the NOAEL (rat) is 1.1 mg/l (1100 mg/m³, maternal toxicity), but no NOAEL for developmental toxicity could be derived, the LOAEL (developmental toxicity, rat) is 1.1 mg/l (1100 mg/m³) In rabbits, the NOAEL (maternal toxicity) is 1.5 mg/l (1500 mg/m³) and the NOAEL (developmental toxicity) is 4 mg/l (4000 mg/m³).

The results of the developmental studies with o-chlorotoluene (brachydactyly mostly in maternal toxic doses and without clear dose-response relationship: 1 rabbit fetus at the highest dose; 1 rat fetus at the lowest dose and 6 rat fetuses at the highest dose) lead to the assumption that monochlorotoluene in general might cause malformations in offspring by high dose treatment (i.e. at 1.1 mg/l = lowest dose tested, and 9.0 mg/l).

Environment

p-Chlorotoluene is a clear colorless liquid with a melting point of 7.5 °C, and a boiling point of 162 °C. The density of the liquid is 1.0697 g/cm^3. The vapor pressure is in the range of 310 to 379 Pa at 20 /25 °C. The measured log K_{OW} is 3.33. The solubility in water is 40 mg/l at 20 °C. The flash point is 51.9 °C, the auto-ignition temperature 595 °C.

With regard to the chemical structure, p-chlorotoluene is not expected to hydrolyze under environmental conditions. According to the Mackay fugacity model level I calculation, the favourite target compartment of p-chlorotoluene is air with 99.67 %, followed by water with 0.25 %. A Henry's law constant of 446.8 Pa x m³/mol at 25 °C calculated according to the Bond method indicates that the compound has a high potential for volatilization from surface waters. The calculated half-life of p-chlorotoluene in air due to indirect photodegradation is $t_{1/2}$ = 8.8 days. Due to the low absorption in the UV-B range, no direct photodegradation is expected.

p-Chlorotoluene is not readily biodegradable, but can be eliminated in industrial wastewater treatment plants. In a modified Zahn-Wellens-test, comparable to the OECD TG 302 B, elimination of p-chlorotoluene of 86 % after 28 days occurred, 68 % of which occurred in the first three hours and is attributed to physical-chemical effects (adsorption, stripping). A manometric respirometry test (in accordance with OECD TG 301 F) was performed with a concentration of p-chlorotoluene of 100 mg/l. After 28 days 1 % of the test substance had been degraded. Aerobic ready tests were performed according to the national Japanese MITI test, comparable to the OECD TG 301 C. After a period of 14 days, the %-age biodegradation from the oxygen consumption was zero or did not exceed 30 % after 2 weeks from the beginning of the test, respectively. At a concentration of 200 mg/l p-chlorotoluene was metabolized in 3 days by a blend of microorganisms able to degrade a range of halogen substituted aromatic compounds.

The bioconcentration factor BCF = 73.13 for p-chlorotoluene, calculated from the octanol-water partition coefficient, indicates a moderate potential for bioaccumulation of p-chlorotoluene in fish. The available experimental data concerning bioaccumulation of p-chlorotoluene in *Cyprinus carpio*, confirm potential for bioaccumulation in fish. The BCF values obtained for concentrations of 0.3 and 0.03 mg/l were in the range of 14 - 101.6 and 21.9 - 76.5, respectively.

Experimentally obtained adsorption coefficients (K_{OC}) revealed a mid sorption potential of p-chlorotoluene. The experimentally achieved K_{oc} values following the OECD TG 106 were in the range of 327 to 512 depending on soil properties. In addition, a K_{OC} value of 434 was calculated with PCKOCWIN v. 1.66 .

Concerning the toxicity of p-chlorotoluene to aquatic species reliable acute and chronic experimental results of tests with fish, *Daphnia*, and algae are available. The tests were performed according to standard procedures or similar methods. The lowest effect values from short-term tests, as well as from chronic toxicity test are (n = nominal concentration; m = measured concentration; m* = geometric mean of analytical values ; s = static test type; ss = semistatic test type):

Danio rerio:	28 d-$NOEC_{growth}$	= 1.9 mg/l (m, ss)
Poecilia reticulata:	14 d-LC_{50}	= 5.92 mg/l (n, ss)
Oryzias latipes :	48 h-LC_{50}	= 5.2 mg/l (n, s or ss)
Daphnia magna:	16 d-$NOEC_{reproduction}$	= 0.32 mg/l (n, ss)
Ceriodaphnia dubia:	48 h-EC_{50}	= 1.7 mg/l (n, s)
Desmodesmus subspicatus:	72 h-$EC_{50growth\ rate}$	= > 0.96 mg/l (m*, s)
Desmodesmus subspicatus:	72 h-$NOEC_{growth\ rate}$	= 0.43 mg/l (m*, s)
Desmodesmus subspicatus:	72 h-$EC_{50biomass}$	= > 0.96 mg/l (m*, s)
Desmodesmus subspicatus:	72 h-$NOEC_{biomass}$	= > 0.96 mg/l (m*, s)

Based on the lowest effect concentration observed for *Daphnia* in a semistatic test the Predicted No Effect Concentration ($PNEC_{aqua}$) can be calculated with an assessment factor of 10. Using the effective 16 d-$NOEC_{reproduction}$ of 0.32 mg/l found for the invertebrate *Daphnia magna* a $PNEC_{aqua}$ = 32 µg/l was determined.

Exposure

p-Chlorotoluene is produced by catalytic conversion of toluene with chlorine under moderate temperature and normal pressure. The composition of the crude product, a chlorotoluenes isomers mixture, depends on temperature and the catalyst. The chlorotoluene isomers are separated by fractional distillation.

For 2002, the global monochlorotoluenes output by about a dozen producers is estimated to be approximately 75 000 tonnes (including unseparated isomers). The global p-chlorotoluene production volume in 2002 (tonnes/a) is estimated by region as follows: Western Europe 13 500, Ukraine 1000, Japan 4500, and China 5000 (total 24 000). In the Sponsor country there is one company with a manufacturing volume of 10 000 to 50 000 tonnes/a. Three quarters of the global manufacturing volume stems from OECD member countries.

Pure p-chlorotoluene is solely used as an industrial intermediate for the synthesis of organic chemicals. The main derivatives are intermediates, e.g. in the production of pesticides, pharmaceuticals, and pigments, like 4-chlorobenzotrichloride (ca. 45 %), 4-chlorobenzyl chloride (ca. 21 %), 4-chlorobenzaldehyde (ca. 18 %), 2,4-dichlorotoluene (ca. 6 %), 4-chlorobenzonitrile (ca. 8 %), and 4-chlorobenzoic (ca. 2 %).

Chlorotoluene isomer mixtures, especially those containing a relatively high amount of o-chlorotoluene, are used as solvents in industry. In the USA p-chlorotoluene is listed as "other" (inert) ingredient in pesticide formulations, however, production of chlorotoluene was ceased in 2001. In the Sponsor country, p-chlorotoluene is not used in any pesticide formulation.

For the Sponsor country, use as a solvent is not known. Also, no direct consumer use is known for p-chlorotoluene in the Sponsor country. No products containing p-chlorotoluene are listed in the Danish, Finnish, Norwegian, Swedish, and Swiss Product Registers.

From the manufacturing site of the Sponsor company virtually no p-chlorotoluene (< 25 kg) was emitted into the environment in 2003. In the Sponsor country for occupational settings no workplace limit concentration is laid down. Workplace air sampling shows that the exposure is below 1 mg/m³ at the Sponsor company. Except from the Sponsor company, no exposure data is available.

p-Chlorotoluene was detected in construction and demolition waste in waste recycling facilities in Florida. p-Chlorotoluene occurs in volcanic gases and is formed in the atmosphere. In most recent studies on its occurrence in the environment, p-chlorotoluene was not detectable in environmental media.

p-Chlorotoluene is exclusively used as an intermediate in chemical processes. No consumer use is known for p-chlorotoluene. In products made from p-chlorotoluene by the Sponsor company, no p-chlorotoluene could be detected. Exposure of consumers to p-chlorotoluene via the environment is low.

RECOMMENDATION AND RATIONALE FOR THE RECOMMENDATION AND NATURE OF FURTHER WORK RECOMMENDED

Human Health: The chemical possesses properties indicating a hazard (skin sensitization, indications for reproductive toxicity) to human health. Based on data presented by the Sponsor country, exposure of workers in manufacturing in the only producer in the Sponsor country and of consumers is anticipated to be low. As no worker exposure data except from the producer in the Sponsor country is available, it is recommended to conduct an exposure and if indicated a risk assessment at the workplace apart from the production site. The chemical is a candidate for further work.

Environment: The chemical possesses properties indicating a hazard for the environment. Based on data presented by the Sponsor country (relating to production by one producer which accounts for approx. 44 - 56 % of global production and relating to the use in several OECD countries), exposure is anticipated to be low, and therefore this chemical is currently of low priority for further work. Countries may desire to investigate any exposure scenarios that were not presented by the Sponsor country.