要　旨

試験委託者

環境庁

表　題

p-クロロトルエンの藻類（*Selenastrum capricornutum*）に対する生長阻害試験

試験番号

９Ｂ４４４Ｇ

試験方法

本試験は，OECD 化学品テストガイドライン No. 201「藻類生長阻害試験」（1984年）に準拠して実施した。

1) 被験物質:　*p*-クロロトルエン

2) 暴露方式：　止水式（密閉），振とう培養（100rpm）

3) 供試生物:　*Selenastrum capricornutum* (ATCC22662)

4) 暴露期間：　72時間

5) 試験濃度（設定値）：

対照区，助剤対照区，1.00，1.70，2.90，5.00，8.55，14.6，25.0 mg/L

（公比：1.7，助剤濃度一定：50 mg/L，2-ﾒﾄｷｼｴﾀﾉｰﾙおよびHCO-40使用）

6) 試験液量：　100 mL（ＯＥＣＤ培地）／容器

7) 連数：　３容器／濃度区

8) 初期細胞濃度：1×10^{4} cells/mL

9) 試験温度：　23±2 ℃

10) 照明：　4000 lux （±20％の変動内，フラスコ液面付近）で連続照明

11) 分析法:　ＨＰＬＣ法

結　果

1) 試験液中の被験物質濃度

被験物質の測定濃度が開始時において設定値の±20％を超えたものがあったため，下記の生長阻害濃度の算出には測定値を採用した。

2) 生長曲線下面積の比較による阻害濃度

50％生長阻害濃度 EbC50(0-72)：　4.91　mg/L（95％信頼区間：4.10～5.87 mg/L）

最大無作用濃度 NOECb(0-72)：　1.71　mg/L

3) 生長速度の比較による阻害濃度

50％生長阻害濃度 ErC50(24-48)：　6.40　mg/L（95％信頼区間：算出不可）

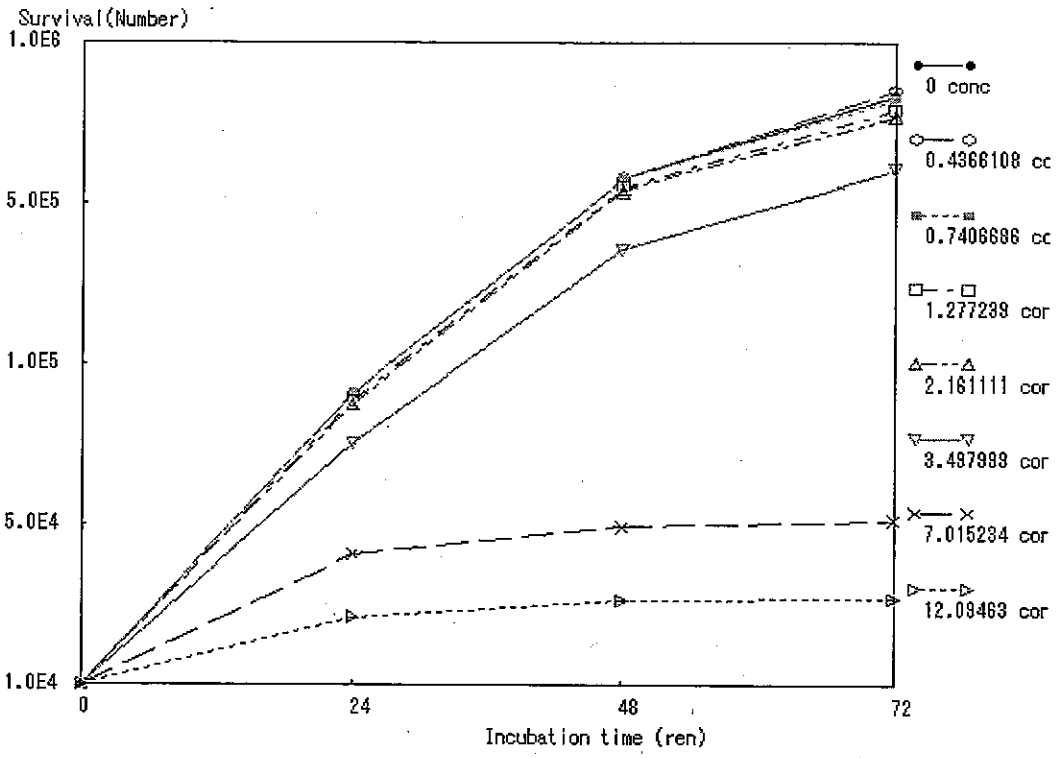
最大無作用濃度 NOECr(24-48)：　2.78　mg/L

50％生長阻害濃度 ErC50(24-72)：　6.38　mg/L（95％信頼区間：算出不可）

最大無作用濃度 NOECr(24-72)：　2.78　mg/L

p-クロロトルエン（CAS.106-43-4）

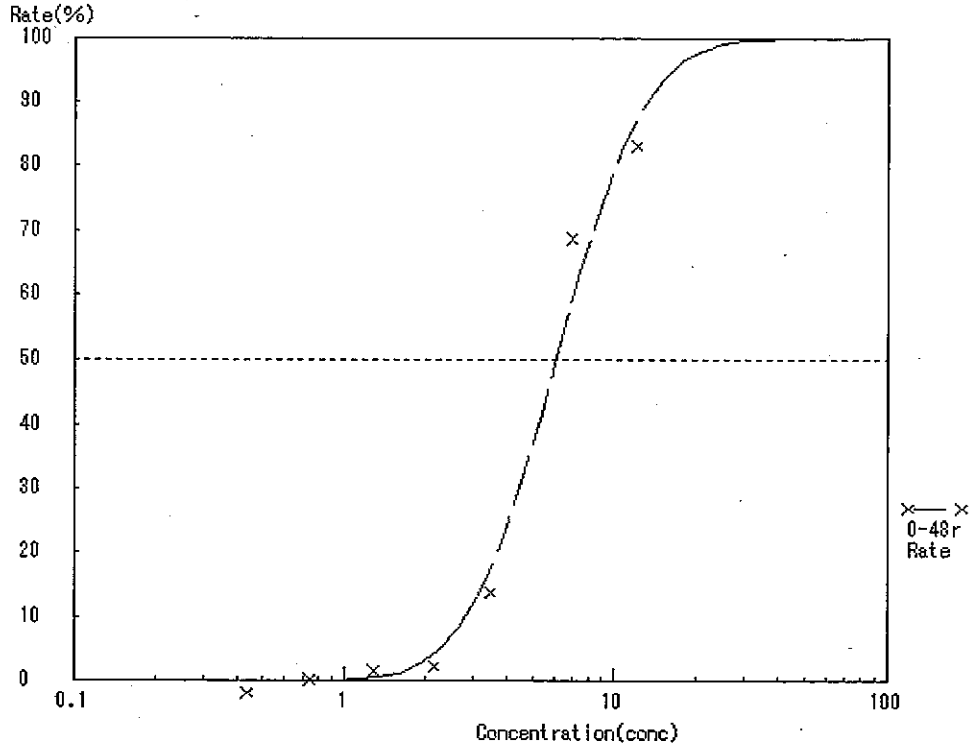
① 生長曲線



Time course pattern of Algae Growth Test
106434

②

阻害率曲線



Dose-response curve for EC50 of Algae Growth Test (Probit method)
106434

③ 毒性値

0-48hErC50（実測値に基づく）＝6.1 mg/L
0-48hNOECr（実測値に基づく）＝2.2 mg/L

要　旨

試験委託者

環境庁

表　題

p-クロロトルエンのオオミジンコ (*Daphnia magna*) に対する急性遊泳阻害試験

試験番号

９Ｂ４６６Ｇ

試験方法

本試験は，OECD 化学品テストガイドライン No. 202「ミジンコ類，急性遊泳阻害試験および繁殖試験」（1984年）に準拠して実施した。

1) 被験物質：　*p*-クロロトルエン

2) 暴露方式：　半止水式（24時間後に試験液の全量を交換），水面をテフロンシートで被覆

3) 供試生物：　オオミジンコ (*Daphnia magna*)

4) 暴露期間：　48時間

5) 試験濃度(設定値)：

対照区，助剤対照区，0.500，0.900，1.60，2.80，5.00 mg/L

公比：1.8

助剤濃度一定：40.0mg/L (HCO-40 および 2-ﾒﾄｷｼｴﾀﾉｰﾙ使用)

6) 試験液量：　100 mL／容器

7) 連数：　４容器／濃度区

8) 供試生物数：　20頭／濃度区（5頭／容器）

9) 試験温度：　20±1℃

10) 照明：　16時間明／8時間暗

11) 分析法：　ＨＰＬＣ法

結　果

1) 試験液中の被験物質濃度

被験物質の測定濃度が設定値の±20％を超えたものがあったため，各影響濃度の算出には実測値（幾何平均値）を採用した。

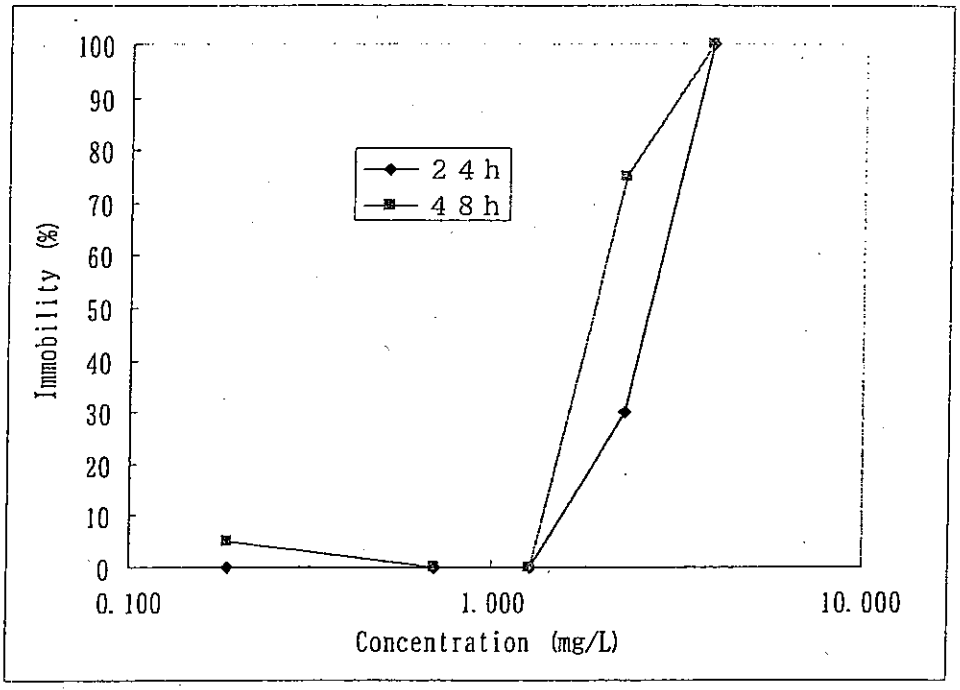
2) 24 時間暴露後の結果

半数遊泳阻害濃度（EiC50）：	2.59 mg/L	(95％信頼限界 ： 1.28～3.93 mg/L)
最大無作用濃度(NOECi)：	1.28 mg/L	
100％阻害最低濃度：	3.93 mg/L	

3) 48 時間暴露後の結果

半数遊泳阻害濃度（EiC50）：	1.96 mg/L	(95％信頼限界 ： 1.28～2.30 mg/L)
最大無作用濃度(NOECi)：	1.28 mg/L	
100％阻害最低濃度：	3.93 mg/L	

Figure 1 Concentration-Response (Immobility) Curve



要　旨

試験委託者

環境庁

表　題

p-クロロトルエンのオオミジンコ（*Daphnia magna*）に対する繁殖阻害試験

試験番号

９Ｂ４８８Ｇ

試験方法

本試験は，OECD 化学品テストガイドラインNo. 211「オオミジンコ繁殖試験」（1998年）に準拠して実施した。

1) 被験物質：　*p*-クロロトルエン
2) 暴露方式：　半止水式（24時間毎に試験液の全量を交換），水面をテフロンシートで被覆
3) 供試生物：　オオミジンコ（*Daphnia magna*）
4) 暴露期間：　21日間
5) 試験濃度(設定値)：
   対照区，助剤対照区，0.060，0.160，0.420，1.10，3.00mg/L
   公比：2.7
   助剤濃度一定：60.0mg/L（HCO-60 およびジメチルホルムアミド使用）
6) 試験液量：　80 mL／容器
7) 連数：　10容器／濃度区
8) 供試生物数：10頭／濃度区（1頭／容器）
9) 試験温度：　20±1℃
10) 照明：　16時間明／8時間暗
11) 分析法：　ＨＰＬＣ法

結　果

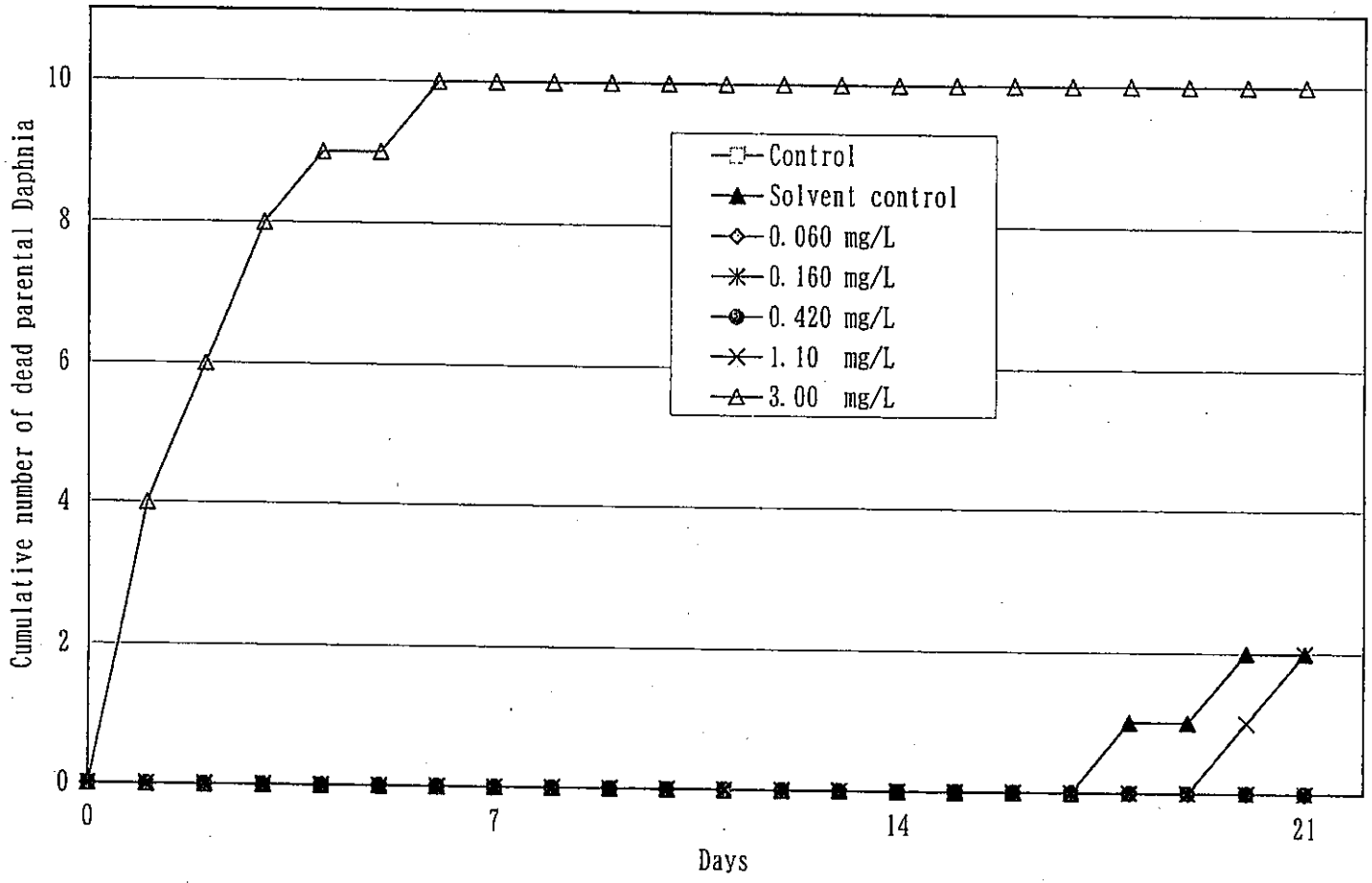
1) 試験液中の被験物質濃度

被験物質の測定濃度が設定値の±20％を超えたものがあったため，各影響濃度の算出には測定値（時間加重平均値）を採用した。

2) 21 日間暴露の各影響濃度結果を以下に示す。

親ミジンコの半数致死濃度（LC50）	：	1.17 mg/L
		(95％信頼限界 ： 0.322～2.31 mg/L)
50％ 繁殖阻害濃度（EC50）	：	1.62 mg/L
		(95％信頼限界 ： 算出不可)
最大無作用濃度(NOEC)	：	0.322 mg/L
最小作用濃度(LOEC)	：	0.853 mg/L

Figure 1 Cumulative Numbers of Dead Parental *Daphnia*



Values in legend are given in the nominal concentration.

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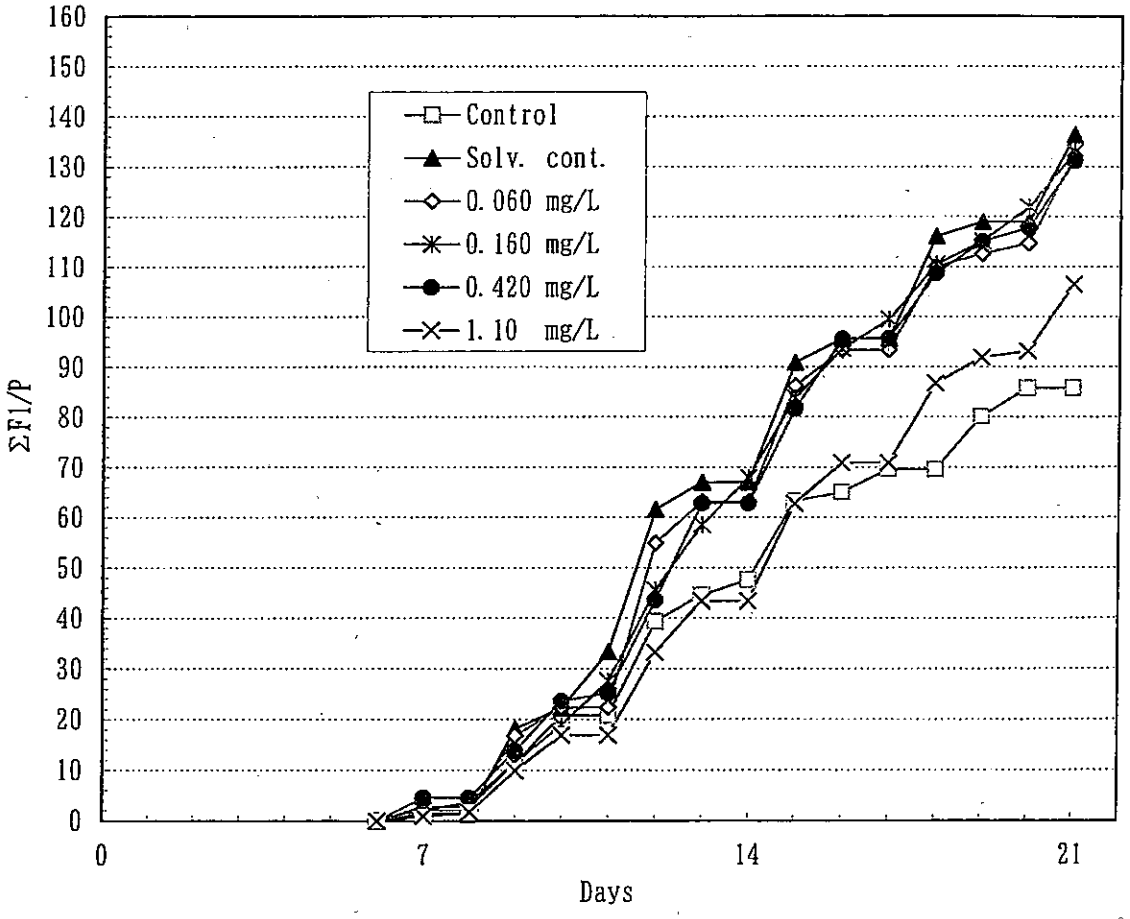
Table 4 Mean Cumulative Numbers of Juveniles Produced per Adult Alive for 21 Days (ΣF1/P)

Nominal Conc.	Days															
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Control	0.0	2.8	2.8	11.4	20.8	20.8	39.4	44.6	47.6	63.3	65.0	69.6	69.6	80.1	85.8	85.8
Solv. cont.	0.0	1.4	1.4	18.1	22.1	33.4	61.6	67.0	67.0	90.9	95.6	95.6	116.1	119.0	119.0	136.4
0.060 mg/L	0.0	2.1	2.1	16.8	22.3	22.4	54.9	63.1	63.1	86.2	93.4	93.4	110.1	112.6	114.7	132.1
0.160 mg/L	0.0	2.1	3.7	11.4	18.9	27.5	45.6	58.5	67.9	83.8	93.6	99.5	110.5	115.1	121.9	132.9
0.420 mg/L	0.0	4.6	4.6	13.8	23.6	25.2	43.6	62.8	62.8	81.6	95.6	95.7	108.7	115.1	117.8	131.1
1.10 mg/L	0.0	0.9	1.8	9.9	16.9	16.9	33.3	43.4	43.4	62.8	70.9	70.9	86.8	91.9	93.1	106.5
3.00 mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

-: All parental *Daphnia* were dead during a 21-days testing period.

Figure 2 Time Course of ΣF1/P for Each Concentration Level



Values in legend are given in the nominal concentration.

要　旨

試験委託者

環境庁

表　題

p-クロロトルエンのヒメダカ（*Oryzias latipes*）に対する急性毒性試験

試験番号

９Ｂ５１０Ｇ

試験方法

本試験は，OECD 化学品テストガイドライン No. 203「魚類毒性試験」（1992年）に準拠して実施した。

1) 被験物質：　*p*-クロロトルエン

2) 暴露方式：　半止水式（24時間毎に試験液の全量を交換），水面をテフロンシートで被覆

3) 供試生物：　ヒメダカ（*Oryzias latipes*）

4) 暴露期間：　96時間

5) 試験濃度（設定値）：対照区，助剤対照区，1.00，2.00，4.00，8.00，16.0mg/L
公比；2.0，最大助剤濃度；96.0 mg/L（ﾒﾁﾙｾﾛｿﾙﾌﾞ，HCO-40使用）

6) 試験液量：　5.0L／容器

7) 連数：　１容器／濃度区

8) 供試生物数：　10尾／濃度区

9) 試験温度：　24±1℃

10) 照明：　室内光，16時間明／8時間暗

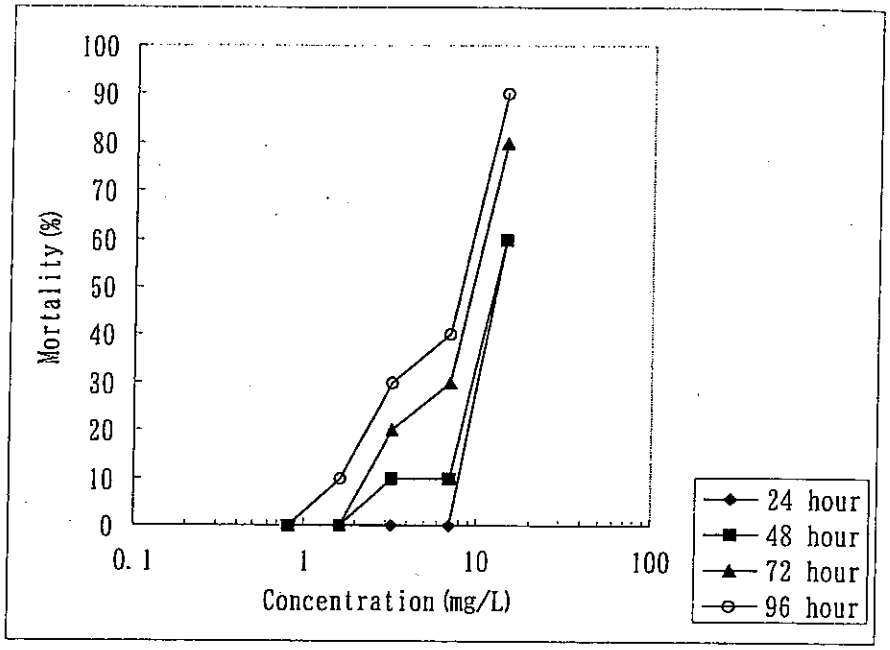
11) 分析法：　ＨＰＬＣ法

結　果

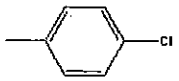
1) 試験液中の被験物質濃度：試験区において設定濃度に対して±20%を超える分析結果があったため，以下の値は測定濃度の幾何平均値を基に示した。

2) 96 時間の半数致死濃度（LC50）：6.14 mg/L（95％信頼区間：4.07mg/L～10.5mg/L）

Figure 1 Concentration-Response (Mortality) Curve



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/cm³. 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-Chloro-toluene 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.

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).

4 HAZARDS TO THE ENVIRONMENT

4.1 Aquatic Effects

Because of the high volatility from aqueous solutions p-chlorotoluene is difficult to test in aquatic systems. Data on aquatic toxicity of p-chlorotoluene are summarised in Table 9.

Acute Toxicity Test Results

With the fish species *Oryzias latipes* a 48 h-LC_{50} of 5.2 mg/l was obtained in an acute toxicity test according to the national Japanese MITI test (MITI, 1992). In a test with p-chlorotoluene performed with *Poecilia reticulata* under semi-static conditions a 14 d-LC_{50} of 5.92 mg/l was obtained (Koenemann, 1981).

With the invertebrate *Ceriodaphnia dubia* a 48 h-EC_{50} value of 1.7 mg/l, based on initial measured concentrations, was obtained in an acute toxicity test according to US EPA standard methods (Rose et al., 1998). Hermens et al. (1984) evaluated the acute toxicity of p-chlorotoluene to the invertebrate *Daphnia magna* according to the Dutch Standardization Organization Method NEN 6501. For a test period of 48 hours an EC_{50} value of 3.57 mg/l was obtained.

Concerning the algal toxicity, a test with *Desmodesmus subspicatus* in the presence of p-chlorotoluene was performed according to the Directive 92/69/EEC, C.3 (Bayer Industry Services, 2004). At the highest test-concentration of 0.96 mg/l (geometric mean of analytical value at start of incubation [nominal 30 mg/l] and half the detection limit [0.05 mg/l]. Because after the incubation, p-chlorotoluene concentration was below the limit of detection,the geometric mean could still overestimate the exposure concentrations) inhibition of growth rate and biomass was 6.1 % and 10.9 %, respectively. Therefore, the EC_{50} is expected to be above the concentrations which could be attained in experiments due to the limited water solubility of 40 mg/l. NOEC for growth rate and biomass was 0.43 mg/l (geom. mean;nominal 7.5 mg/l) and > 0.96 mg/l (geom. mean; nominal > 30 mg/l), respectively.

Chronic Toxicity Test Results

The chronic toxicity of p-chlorotoluene towards *Danio rerio* (former scientific name: *Brachydanio rerio*) was investigated in an early-life stage toxicity test generally performed in accordance with OECD TG 210, 1992 (Van Leeuwen, Adema, and Hermens, 1990). Retardation of growth was shown to be the most sensitive endpoint. In this test, the test solutions were renewed 3 times a week and analyses were performed before and after renewal of the solutions with HPLC. Since the mean concentrations were below the nominal concentrations, the results are based on mean concentrations. The 28-d NOEC for body length was reported as 1.9 mg/l. The no observed lethal concentration (NOLC) was determined to be 3.4 mg/l and the 28-d LC_{50} is given as 4.4 mg/l.

Chronic toxicity tests towards *Daphnia magna* were performed according to the Dutch Standardization Organization Method NEN 6502 (Hermens et al., 1984, 1985). The first test was carried out regarding the endpoints reproduction and mortality (Hermens et al., 1984). During an exposure period of 16 days under semi-static conditions, a LC_{50} of 1.59 mg/l for mortality was observed. The corresponding 16 d-NOEC was 1.0 mg/l. For the endpoint reproduction an EC_{50} of 0.58 mg/l and a corresponding 16 d-NOEC of 0.32 mg/l was obtained. In the second study the toxicity on inhibition of growth for *Daphnia magna* was observed (Hermens et al., 1985). At the start of the experiments and after 16 days of exposure the lengths of the daphnids were measured. Under semi-static conditions an EC_{50} of 1.71 mg/l with a corresponding 16 d-NOEC of 0.32 mg/l was observed. The stability of the test substance was experimentally determined with GC during the exposure period of 16 days. The recovery rates were in the range between 80 % and 110 %. Therefore, the results are based on nominal concentrations.

Table 9 Aquatic toxicity of p-chlorotoluene to fish, *Daphnia*, and algae

Species	Test type	Parameter	Effects	Reference	IUCLID
Oryzias latipes	Static or semi static	48 h-LC_{50}	5.2 mg/l (n)	MITI, 1992	4.1
Poecilia reticulata	Semi static	14 d-LC_{50}	5.92 mg/l (n)	Koenemann, 1981	4.1
Danio rerio	Semi static	28 d-$NOEC_{growth}$	1.9 mg/l (m)	Van Leeuwen, Adema, and Hermens, 1990	4.5.1
Daphnia magna	Static	48 h-EC_{50}	3.57 mg/l (n)	Hermens et al., 1984	4.2
Ceriodaphnia dubia	Static	48 h-EC_{50}	1.7 mg/l (m)	Rose et al., 1998	4.2
Daphnia magna	Semi static	16 d-$NOEC_{reproduction}$ 16 d-$NOEC_{growth}$	0.32 mg/l (n) 0.32 mg/l (n)	Hermens et al., 1984; 1985	4.3
Desmodesmus subspicatus	Static	Growth rate: 72 h-EC_{50} 72 h-NOEC Biomass: 72 h-EC_{50} 72 h-NOEC	 > 0.96 mg/l (m*) 0.43 mg/l (m*) > 0.96 mg/l (m*) > 0.96 mg/l (*)	Bayer Industry Services, 2004	4.3

m: measured concentration

m*: geometric mean of analytical values

n: nominal concentration

Determination of $PNEC_{aqua}$

Since chronic toxicity tests are available for three trophic levels (fish, *Daphnia* and algae), an assessment factor of 10 was applied for the derivation of the $PNEC_{aqua}$ of p-chlorotoluene according to the EU Technical Guidance Document. The lowest of the two available NOEC values was obtained for the species *Daphnia magna*, 16 d-NOEC = 0.32 mg/l, therefore resulting in a

$$PNEC_{aqua} = 32\ \mu g/l.$$

Toxicity to Microorganisms

In a toxicity test of p-chlorotoluene performed with *Spirostomum ambiguum* in which the cell deformation and lethal response were the endpoints, a 48 h-EC_{50} of 95.8 and 110.8 mg/l were obtained, respectively (Nalecz-Jawecki and Sawicki, 2002).

The toxicity to *Pseudomonas putida* was tested in a 18 hours test using the cell multiplication impairment as endpoint. The test was performed according to DIN 38412 part 8 (Trénel and Kuehn, 1982). An EC_{10} of > 25 mg/l was observed. Since the measured concentration in the stock solution was only 15 % of the initial amount weighed in, the estimated EC_{10}-value of > 25 mg/l should be considered rather than the nominal concentration of > 160 mg/l.

Microbial toxicities of p-chlorotoluene are listed in Table 11.

Table 10 Tests on acute toxicity of p-chlorotoluene to microorganisms (IUCLID 4.4)

Species	Endpoint	Parameter	Effects	Reference
Spirostomum ambiguum	Deformation and lethal response (Spirotox test)	48 h-$EC_{50deformation}$ 48 h-$EC_{50lethal\ response}$	95.8 mg/l (n) 110.8 mg/l (n)	Naleczc-Jawecki and Sawicki , 2002
Pseudomonas putida	Cell multiplication	18 h-EC_{10}	> 25 mg/l (m)	Trenel and Kuehn, 1982

(n): nominal concentration
(m): measured concentration

4.2 Terrestrial Effects

No tests to the toxicity of p-chlorotoluene towards terrestrial organisms are available.

4.3 Other Environmental Effects

No data available.

4.4 Initial Assessment for the Environment

p-Chlorotoluene is a clear colourless 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 approximately 310 -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 favorite 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 m^3/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, butcan 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, the 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

$$\mathbf{PNEC_{aqua} = 32\ \mu g/l}$$

was determined.

5 RECOMMENDATIONS

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.

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