FOREWORD INTRODUCTION

PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)-

CAS N°: 140-66-9

SIDS Initial Assessment Report

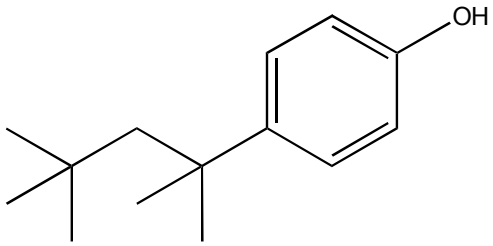
For

SIAM 3

Williamsburg, Virginia, 13 – 16 February 1995

1. Chemical Name:	PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)-
2. CAS Number:	140-66-9
3. Sponsor Country:	SWITZERLAND National SIDS Contact Point in Sponsor Country: Mr Georg KARLAGANIS-MEYER
4. Shared Partnership with:	
5. Roles/Responsibilities of the Partners:	
• Name of industry sponsor /consortium	
• Process used	
6. Sponsorship History	
• How was the chemical or category brought into the OECD HPV Chemicals Programme ?	SIDS Dossier& Testing Plan were reviewed at SIDS Review Meeting in September 1993, where the following SIDS Testing Plan was agreed: no testing ( ) testing (**x**) Environmental Fate: Photodegradability Toxicology: Repeated Dose Toxicity Reproductive Toxicity
7. Review Process Prior to the SIAM:	
8. Quality check process:	
9. Date of Submission:	24 November 1994
10. Date of last Update:	
11. Comments:	

SIDS INITIAL ASSESSMENT PROFILE

CAS No.	140-66-9
Chemical Name	Phenol, 4-(1,1,3,3-tetramethylbutyl)-
Structural Formula	

CONCLUSIONS AND RECOMMENDATIONS

The chemical is currently considered as requiring further work.

SHORT SUMMARY WHICH SUPPORTS THE REASONS FOR THE CONCLUSIONS AND RECOMMENDATIONS

In 1993 (Switzerland), produced or imported 377t Phenol, 4-(1,1,3,3-tetramethylbutyl)- (OP) (of this, 129 t was imported). In the US conservative production volume estimates indicate 5400-32200 t/year. OP is manufactured by catalytic reaction of Phenol with Diisobutylene. The OP is directly transferred from the reactor to a reservoir via pipes and from there to heated railway tankers. Most of OP appears to be used as an intermediate for the production of resins, non-ionic surfactants and rubber additives.

OP is biodegradable. In the surface layer of natural waters 30% of OP can be degraded within one day. OP is acutely very toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment. The environmental hazard assessments with the available exposure data shows that OP may represent a risk to the hydrosphere. The main reason for this risk is not the use of OP itself, but the use of Octylphenol-ethoxylates which may be degraded back to OP in the aquatic environment.

OP is not acutely toxic to human health, but is slightly irritating to the skin and highly irritating to the eyes. It is not genotoxic, but may cause depigmentation of the skin. *In vitro* studies showed that OP may displace 17-β-estradiol from its receptors in a competitive manner and can promote cell proliferation in estrogen dependent cells.

The available data indicate that OP does not give cause for concern for human health.

NATURE OF FURTHER WORK RECOMMENDED

Further testing or analysis of exposure information to assess identified concerns. The assessment of nonylphenol (CAS Nos 84852-15-3 & 25145-52-3) within the OECD HPV Chemicals Programme should be taken into account.

FULL SIDS SUMMARY

CAS NO: 140-66-9		SPECIES	PROTOCOL	RESULTS
PHYSICAL-CHEMICAL				
2.1	Metting Point	NA	not specified	79 – 82 °C
2.2	Boiling Point	NA	not specified	280 – 283 °C
2.3	Density	NA	not specified	950 kg/m^3
2.4	Vapour Pressure	NA	not specified	0.001 kPa at 20 °C
2.5	Partition Coefficient (Log Pow)	NA	other: HPLC method	3.7
2.6A.	Water Solubility	NA	other: HPLC method	19mg/l at 22°C
2.6 B	pKa	NA	other: calculated	10.33 at 25°C
ENVIRONMENTAL FATE / BIODEGRADATION				
3.1.1	Photodegradation	NA	other	In water T ½ = 13.9 h
3.1.2	Stability in Water			Not available
3.2	Monitoring Data	NA	background (???)	In Surface water: 1-2 ug/l (in winter) In Surface water: 0.2-2 ug/l (in summer)
3.3	Transport and Distribution	NA	Calculated (Fugacity Leverl I Type)	In Air 29.4% In Water 12.7% In Soil 56.5% In Sediment 1.3% In susp. Sed. <0.1% In Fish <0.1%
3.5	Biodegradation	Act. sewage sludge organisms	other: ISO 10708	20% after 28 days
ECOTOXICOLOGY				
4.1	Actute/Prolonged Toxicity to Fish	Pimephales promelas	other: EPA 1984	LC50(24hr) = 0.29mg/l LC50(48hr) = 0.25 mg/l LC50(72hr) = 0.25 mg/l LC50 (96hr) = 0.29 mg/l NOEC (96hr) = 0.077 mg/l
4.2	Acute Toxicity to Aquatic Invertebrates	Daphnia magna	EPA method	LC50(24hr) = 0.26mg/l LC50(48hr) = 0.27mg/l NOEC(48hr) = 0.11mg/l
4.3	Toxicity to Aquatic Plants e.g. Algae	Selenastrum capricornutrum Printz	static	EC50(96hr) = 1.9mg/l NOEC(96hr) =<1.0mg/l

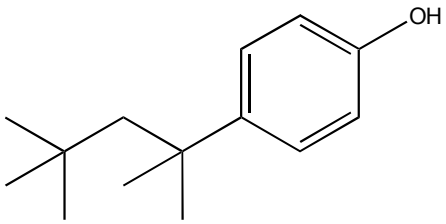
CAS NO: 140-66-9		SPECIES	PROTOCOL	RESULTS
4.4	Toxicity to Bacteria	activated sewage sludge organisms	OECD 209	EC50(3hr) => 10mg/l
4.5.1	Chronic Toxicity to Fish	Salmo gairdneri	EPA method	LC50(6d) = 0.17mg/l LC50(14d) = 0.12mg/l NOEC(14d) = 0.084mg/l
			no data	NOEL(60d) = 0.0061 mg/l
4.5.2	Chronic Toxicity to Aquatic Invertebrates	Daphnia magna	EPA method	EC50(21d) = 0.34mg/l 0.037<MATC<0.062 mg/L
TOXICOLOGY				
5.1.1	Acute Oral Toxicity	Sprague-Dawley Strain Rat	OECD 401	LD50 >2000mg/kg b.w.
		Mouse	other: no data	LD50 = 3210 mg/kg b.w.
5.1.2	Acute Inhalation Toxicity	Rat	other: no data	LD100(24hr) =< 116mg/l
5.1.3	Acute Dermal Toxicity	Rabbit	no data	LD50 = 1880mg/kg b. w.
5.1.4	Acute Intra-Peritoneal Toxicity	Mouse	no data	LD50 = 25mg/kg
5.2.1	Skin Irritation/Corrosion	New Zealand White Rabbit	OECD 404	mild irritating
5.2.2	Eye Irritation/Corrosion	New Zealand White Rabbit	OECD405	severe irritant
5.3	Skin Sensitisation	Guinea Pig	OECD406	not sensitising
5.4	Repeated Dose Toxicity	Rat BOR/WISW	no data	NOEL = 30ppm LOEL = 300ppm
		Rat Crj:CD(SD)	Japanese Guideline	NOEL = 15mg/kg b.w./day
		Rat (Sprague_Dawley)	OECD407	LOAEL = 150mg/kg bw/day NOEL = 15mg/kg bw/day
5.5	Genetic Toxicity in Vitro			
A.	Bacterial Test	Salmonella typhim.	Directive 84/449/EEC	negative
		Salmonella typhim.	other: Ames Test	negative
		Salmonella typhim.	other: Japanese Guidelines	neg. with metab. active. neg. without activation
		E. coli	other: Japanese Guidelines	neg. with metab. activ. neg. without activation
B.	Non-Bacterial Tes	Chinese Hamster CHL Cells	other: Japanese Guidelines	neg. with metab. activ. neg. without activation
5.8	Toxicity to Reproduction	Rat	OECD 421 (final draft dated 12 January 1993)	NOAEL parental: 125mg/kg NOEL offspring: 250mg/kg
5.10	Other Relevant Information			
A.	Specific Toxicities: Depigmentation Study	Black C57 Mice	other: subcutaneous Injections	Depigmentation 9 weeks after starting
5.11	Human Experiences	Homo sapiens sap.		causes Depigmentation of skin, Vitiligo. Measured Conc. in urine of workers ~4.8 mg/l

SIDS Initial Assessment Report

1 IDENTITY

1.1 Identification of the Substance

CAS Number: 140-66-9
IUPAC Name: Phenol, 4-(1,1,3,3-tetramethylbutyl)-
Molecular Formula: $C_{14}H_{22}O$
Structural Formula:



Molecular Weight: 206.33 g/mole
Synonyms: p-(1,1,3,3-Tetramethylbutyl)phenol
p-Octylphenol
4-tert-Octylphenol
p-tert-Octylphenol
Octylphenol pt
In this report the abbreviation OP (Octylphenol) is used for 4-(1,1,3,3-Tetramethylbutyl)-phenol.

1.2 Purity/Impurities/Additives

Degree of purity: 99.2%

Major impurities: 0.2% 2-tert.-Octylphenol
0.1% 4-tert.-Butylphenol
0.2% unknown

Essential additives: none

A closely related chemical to octylphenol is nonylphenol for which data of numerous surveys are available. (Giger, Ahel, Brunner et al.)

See Annex 1 of the SIDS DOSSIER for details on nonylphenol.

2 GENERAL INFORMATION ON EXPOSURE

2.1 General Discussion

2.1.1 Production and Import

In Switzerland	1987:	1’744 t
	1989:	1’058 t
	1991:	887 t
	1992:	547 t

1993: 377 t (129 t of which imported)

Remark: In the 1980s the dangers of alkylphenolethoxylates for the environment became obvious, and in some countries their use was restricted. In Switzerland, the application of octylphenol- and nonylphenolethoxylates in detergents is prohibited since August 31st, 1987.

In 1992 PARCOM adopted recommendation 92/8. Contracting parties to the convention agreed that the use of nonylphenolethoxylates used as cleaning agents be phased out by the year 1995 for domestic uses and by the year 2000 for industrial uses.

As can be seen the amount of OP sold by the Swiss manufacturer dropped from 1744 t in 1987 to less than 1100 t in 1989, and continued to decrease further.

In the USA: 5400-32200 t/year (1977; according to reference [38] current production volumes are assumed to be above this level)

2.1.2 Manufacturing and Distribution

OP is manufactured by the catalytic reaction of phenol with diisobutylene at temperatures of 80 to 100°C in a closed system. The mean batch size is 4.5 t, the maximum 7.2 t. In the Swiss plant OP is produced on about 30 days per year. Most of the octylphenol sold by Schenectady Pratteln AG, the only distributor in Switzerland, is delivered in a liquid state. The OP is directly transferred from the reactor to a reservoir via pipes and from there to heated (melting point of OP: 79-82°C) railway tankers. Some OP is converted to granulate and filled in sacks of 25 kg. In 1993 346t OP were shipped in liquid state, where just 76t were sold as granulate.

Information from other manufacturers in other countries are not available.

2.1.3 Uses

Most of the 4-(1,1,3,3-tetrametylbutyl)-phenol appears to be used as an intermediate for the production of resins, non-ionic surfactants and rubber additives. OP is also used for the manufacturing of antioxidants, fuel oil stabilizers, adhesives, dyestuffs, fungicides, bactericides, and for vulcanizing synthetic rubber (a sulphide complex of OP). Ref. [38]

At least 95-98 % of the octylphenol used in the United States is chemically altered before reaching the consumer market. Ref. [40] The remaining 2-5 % are supposed to be used in fuel for aeroplanes. Ref. [42]

In 1993 less than 10 t octylphenolethoxylates were used in Switzerland. Ref. [46]

2.1.4 Natural Occurrence

No natural occurrence of octylphenol is known. (Ref. [38])

2.2 Environmental Exposure and Fate

2.2.1 Exposure Relevant Properties

Water solubility: 19 mg/l at 22°C

Partition coefficient

log Pow: 3.7

Vapour pressure: 1 Pa (0.0075 mm Hg) at 20°C

Biodegradation: 0% biodegradation after 28 days
(OECD 302C, modified MITI II test)
20% biodegradation after 28 days at 27.5 mg/l
(BODIS test with activated sludge):

Photodegradation: In the surface layer of natural waters 30% of the octylphenol can be degraded within one day. The half-life of OP in a shallow (20-25 cm depth) creek at a sunny day is 13.9 h. Ref. [42]

2.2.2 Releases, Sources and Potential Environmental Concentrations

Manufacturing

At the manufacturing plant in Pratteln (Switzerland), a total of 200 l waste water (water for the reaction, neutralisation of the catalyst, cleaning of the manufacturing equipment) results from the conversion of 30 t of raw material.

The joint sewage resulting from all processes in the plant (200 – 400 m^3 sewage weekly) are analyzed regularly, the measured OP concentrations ranging from <0.1 mg/l to 0.6 mg/l. The STP clearing capacity amounts to 80'000 – 240'000 m^3 / week leading to a dilution factor of at least 200.

Assuming that no degradation and no elimination takes place in the STP and a dilution of at least factor 10 occurs by release of the secondary sewage to the environment, the concentration in a river near the manufacturing plant should not exceed 0.0003 mg/l.

As the average flow of the river Rhine near the production site in Pratteln (CH) is 620'000'000 m^3/week (Ref. [48]), the realistic dilution factor is 2600, leading to a Predicted Environmental Concentration of $1.15 * 10^{-6}$ mg/l.

Distribution of octylphenol

Octylphenol is shipped either as liquid or as granulate in closed containers, hence no release should occur during distribution.

Processing of octylphenol

Octylphenol-polyethoxylates are manufactured by the addition of ethylene oxide to octylphenol under pressure. The explosivity and toxicity of ethylene oxide make it necessary that all operations and equipment are closed to the atmosphere. Thus no release to the environment should occur during this process. (Ref. [40])

For the synthesis of other derivatives no information was available on production processes and emission rates.

The application of the endproducts

OP derivatives used as resins, rubber additives, fuel oil stabilizers, antioxidants, adhesives, dyestuffs, fungicides and bactericides do not lead to OP releases to the environment, because waste of these substances are either incinerated or they are not degraded to OP when dumped. Therefore no special attention is paid to such products in this report. Based on experiences with nonylphenol-

ethoxylates it is known, that octylphenol-ethoxylates (OPEO) used as surfactants in detergents and cleaning agents behave differently. They end up in sewage treatment plants, where a considerable amount is degraded back to OP, which partly leaves the STP via effluent.

For estimating possible environmental OP concentrations resulting from the use of OP-ethoxylates, different scenarios are considered.

First scenario: worst-case assumption

OPEO are released to wastewater and quantitatively converted to OP. No elimination or degradation of OP takes place. The concentration of OP in the effluent is then calculated as

$$C_{Eff} = \frac{W * (100 - P)}{100 * Q} * \frac{Mr_{OP}}{Mr_{OPEO}}$$

CEff = concentration of the chemical in STP effluent

W = daily emission rate
= 27.4 kg/day
calculated from the total annual use in Switzerland (10t)

P = removal rate in the STP in %
= 0

Q = daily volume of waste water
= 5.2 * 106 m3/day
calculated from the annual Swiss waste water volume of 1.9 * 1012 l

MrOP = molecular weight OP
= 206 g/mole

MrOPEO = molecular weight of average OP Ethoxylates (OP9EO)
= 602 g/mole

⇨ CEff = 1.80 * 10-3 mg/l
A dilution of factor 10 leads to an OP concentration in the receiving water of 1.80 * 10-4 mg/l.

Second scenario: realistic assumptions

10t OP-ethoxylates are released to waste water. Elimination and degradation in STPs take place similarly to the results of field studies for nonylphenolethoxylates (ANNEX 1). It is assumed that the OPnEO and OPnEC (carboxylic acids) leaving the STP are completely degraded to OP in the environment.

W, Q = as in the first scenario

P = 60
Based on field studies for nonylphenol ethoxylates, assuming that OPEO behave identically in STPs (for details see ANNEX 1).

⇨ CEff = 7.21 * 10-4 mg/l
A dilution of factor 10 is assumed in rivers, hence the OP concentration is 7.21 * 10-5 mg/l

The OP concentration in sewage sludge may be calculated according to the following equation:

$$C_{sludge} = \frac{W * T}{S} * \frac{Mr_{OP}}{Mr_{OPEO}}$$

T = Transferrate primary sewage → sludge
= 0.2
derived from field studies on Nonylphenol-Ethoxylates (see ANNEX 1)

S = daily volume of sewage sludge
= 740 t
calculated from the annual sewage sludge volume in Switzerland of 2.7 * 105 t (dry substance)

⇨ Csludge = 2.54 mg/kg

The concentration in agricultural soils may be calculated as follows:

$$C_{soil} = \frac{C_{sludge} * app}{md * d}$$

app = maximum amount of sewage sludge used as fertilizer
= 2500 kg/ha
(maximum permissible amount according to the Swiss law)

Md = mixing depth
= 0.2 m
according to EC

d = density of soil
= 2500 kg/m3
according to EC

⇨ csoil = 1.26 * 10-3 mg/kg

2.2.3 Partitioning and fate

According to Mackay Level III calculations (with FUGMOD computer model) octylphenol will, after release to a specific compartment, be distributed in the environment as follows:

	release to air		release to water		release to soil	
Mass %						
air	26.0 %		1.2 %		<0.1 %	
water	5.1 %		**77.9 %**		0.3 %	
soil	**67.7 %**		3.1 %		**99.6 %**	
sediment	1.2 %		17.8 %		0.1 %	

	release to air		release to water		release to soil	
Relative concentrations						
air	1		1		1	
water	100		33’000		6’000	
soil	**15’000**		15’000		**23’000’000**	
sediment	9’000		**3’000’000**		545’000	

Releases to water, which is the most realistic case, lead mainly to an accumulation in the water compartment. A considerable amount of the OP will be adsorbed to the sediment and only small quantities are expected in the air. OP released to the soil by application of contaminated sewage sludge will remain in the soil and not be washed out.

2.2.4 Monitoring Data

Monitoring data are available for OP concentrations in the Delaware river (USA 1976): 1-2 µg/l were measured in winter and 0.2-2 µg/l in summer. (Ref. [19])

2.3 Human Exposure

2.3.1 Occupational Exposure

Occupational exposure may occur while manufacturing OP, especially during packing operations. Urinary monitoring data from workers employed in a Japanese factory producing the chemical indicated that it is absorbed and that at least part of the OP is excreted in the urine. (Ref. [44])

The filling of the railway tankers happens directly via pipes, therefore no occupational exposure is expected. The OP granulate however is filled manually in sacks. People occupied with this process are instructed to wear light protection masks. The air in the room where packing operations take place contains less than 0.23 mg OP per m^3 (in 1992; Ref. [42]). In general, the exposure through inhalation will be small and the concenration low due to the bad volatility, the closed manufacturing process and the safety measures taken.

2.3.2 Consumer Exposure

There are four possible ways for consumers to be exposed to octylphenol:

Intake of contaminated drinking water

Food intake

Inhalation of air near an STP or a production site

Dermal contact with consumer products.

Philadelphia's drinking water supply showed concentrations of 0.01 ppb OP, leading to a daily OP intake of 2 * 10^{-5} mg/day or 2.86 * 10^{-7} mg/kg bodyweight/day (assuming an average human drinking water consumption of 2 l).

A simulation with the computer model USES V1.0 (provided by OECD) using Swiss production volumes and transfer coefficients in STPs yields the following human OP intake ratios:

42% through root of plants

29% through stem of plants

19% through fish

10% through drinking water

The detailed assumptions and results may be found in ANNEX 2, Scenario 2.

The high concentrations in plants originate from the use of sewage sludge as a fertilizer on farmland. The overall human intake in this simulation is calculated to be 1.57 * 10^{-5} mg/kg bodyweight/day for the local area of STPs.

The estimated intake through air amounts according to USES to 7.17 * 10^{-8} mg/kg b.w./day.

The known uses of nonylphenol indicate that OP could also be used as formulating agent for pesticides and as an additive with spermicidal properties. However it was not possible to include the contribution resulting from such uses in the exposure calculation because of the lack of information.

3 HUMAN HEALTH HAZARDS

3.1 Effects on Human Health

3.1.1 Acute Toxicity

Oral:	LD50: >2000 mg/kg (rat)	
	LD50 3210 mg/kg (mouse)	
Inhalation:	LD100 (24h): =<116 mg/l (rat, 89% OP)	
Dermal:	LD50: 1880 mg/kg (rabbit)	
Intra-peritoneal:	LD50: 25 mg/kg (mouse)	
Skin irritation:	slightly irritating index 4.5/8	(rabbit)
Eye irritation:	highly irritating 63.0 scores in 24h	(rabbit)
Sensitization:	not sensitizing according to Magnussen & Illigman protocol (guinea pig); OP concentration: 20% in corn oil.	

3.1.2 Repeated Dose Toxicity

Three repeated dose toxicity tests in rat are available. One of them is a fully documented 28 days repeated dose toxictiy study according to OECD 407 done in full compliance with GLP.

From these tests, the following results were reported:

1) 3 month repeated dose (oral gavage daily), method unknown:

NOEL: 30 ppm
LOEL: 300 ppm

2) 28 days repeated dose (oral gavage, daily), Japanese Guideline:

NOEL: 15mg/kg/day

3) OECD 407 repeated dose 28 days oral toxicity study:

The test substance was administered at dosages of 15, 150 and 250 mg/kg/day, once daily for a period of 29 days. Target organs were liver and kidney.

Kidney: In the kidneys of high dosages group rats, microscopic changes seen were basophilic epithelium with occasional mitotic figures in proximal tubules (males: 4 of 5, females 5 of 5; control: females: 1 of 5, males 0 of 5) and interstitial inflammation (males: 4 of 5, females 1 of 5, compared to control: males: 1 of 5, females: 2 of 5). Associated with these findings were increased kidney weights for females. For male rats of the intermediate dosage group, basophilic epithelium with occasional mitoses were also seen. Increased water consumption for rats of the high dosage group was considered to be related to the kidney effects.

Liver: In the liver of high dosage group female rats, minimal centrilobular hepatocyte enlargement with associated increased liver weight. These findings were considerd to be adaptive and related to the metabolism of the test substance.

The finding in the kidney at the high and intermediate dosages was considered to be an andverse effect. There were no treatment related effects on the low dosage of 15 mg/kg bw/day.

Based on these findings, a **LOAEL of 150 mg/kg bw/day** and a **NOEL of 15 mg/kg bw/day** was derived.

3.1.3 Mutagenicity

Results: No genetic toxicity (Ames Test with Salmonella typhimurium)

3.1.4 Toxicity for Reproduction

A reproduction/developmental screening test has been conducted in the rat. The test substance was administered at dosages of 125, 250 or 500 mg/kg/day, once daily by gavage for two weeks prior mating, throughout the two weeks mating period and until litters reached day 4 post partum.

Slight impairment of the mating performance and development of the conceptus, observed as a reduced conception and implantation rate, a prolonged duration of pregnancy and a developmental delay, only occured at 500 mg/kg/day. This dosage produced a marked parental toxic effect resulting in the death of 13 out of 24 adult animals during the treatment period.

There was a clear, though less marked, treatment-related effect at 250 mg/kg/day upon the treated adults, although reproductive performance and development of the offspring was unaffected.

The only changes noted at 125 mg/kg/day were post dose salivation and slightly elevated water consumption.

The NOAEL for parental toxicity was 125 mg/kg bw/day. The NOEL for reproductive performance and development of the offspring was 250 mg/kg bw/day.

3.1.5 Depigmentation study

Subcutaneous injections (6 times a week/7 months) of o-tert.-octylphenol in black mice (0.05 ml of a 0.01 M solution in olive oil) caused depigmentation of the skin 9 weeks after starting.

3.1.6 Experience with human exposure

Two female workers suffered depigmentation of the skin after they were exposed to two alkaline detergents containing polyoxyethylene alkylphenylether. Analysis of the detergents revealed the contamination with free alkylphenol, possibly octylphenol.

Some cases of vitiligo are reported among workers exposed to resins and detergents containing octylphenol (Russian and Japanese experiences).

3.1.7 Estrogenic effects of octylphenol on human cells

Experiments show that octylphenol may displace 17-beta-estradiol (a natural estrogen) from its receptors in a competitive manner and can promote cell proliferation in estrogen dependent cells.

OP was able to stimulate these biological responses to the same extent as 17-beta-estradiol itself, albeit at a 1000-fold greater concentration.

3.2 Initial Assessment for Human Health

Octylphenol is not acute toxic, but is slightly irritating to the skin and highly irritating to the eyes. It is not geotoxic, but may cause depigmentation of the skin. In vitro studies showed that OP may displace 17-beta-estradiol (a natural estrogen) from its receptors in a competitive manner and can promote cell proliferation in estrogendependent cells. Chronic ingestion via food may cause adverse effects at concentrations higher than 15 mg/kg b.w./day. Thus the estimated dose of low concern (EDLEC) may be calculated using an uncertainty factor in the range of 100-300 (according to the OECD provisional guidance for the initial assessment of health effects).

EDLC (worst case) = 15 mg/kg b.w./day/300

= 0.05 mg/kg b.w./day

= Acceptable Daily Intake (ADI)

The simulation with the computer program USES V1.0 for the conditions in Switzerland (see annex 2 for a detailed description) gives an overall daily OP intake of $1.57 * 10^{-5}$ mg/kg b.w./day for worst case assumptions, a value far below the EDLC. The margin of safety for men is 3200 (=Intake/ADI).Thus no common toxic effects should be caused by octylphenol. These figures do not cover possible estrogenic effects which are now under discussion.

Workplace esposure may occur, but concentrations will be very low because of the closed system used for the production of the chemical, the fact that OP is not continuously produced, the standard safety measures taken (eye protection and light mask) and the physical-chemical properties of this substance (very low volatility).

No data were available on the use of OP in consumer products.

4 HAZARDS TO THE ENVIRONMENT

4.1 Aquatic Effects

a) Toxicity to Fish

Acute toxicity to Fathead minnows (Pimephales promelas):

LC50	96h:	0.25 mg/l
LC50	72h:	0.25 mg/l
LC50	48h:	0.25 mg/l
LC50	24h:	0.29 mg/l
NOEC	96h:	0.077 mg/l

Prolonged toxicity to Rainbow trout (Salmo gairdneri):

LC50	6d:	0.17 mg/l
LC50	14d:	0.12 mg/l
NOEC	14d:	0.084 mg/l
NOEC	60d:	0.0061 mg/l
MATC	60d:	0.0061 < c < 0.011 mg/l

These tests have been performed under flow-through conditions. The values are based on measured concentrations, and a solvent control has been carried out. In the latter experiments acetone has been used as a cosolvent.

Acute toxicity to Leuciscus idus:

LC50 48h: 0.6 mg/l

This test has been performed under static conditions.

Acute toxicity to Leuciscus idus:

LC0	96h:	0.21 mg/l
LC50	96h:	0.26 mg/l
LC100	96h:	0.39 mg/l

The test has been carried out under semi-static conditions.

b) Toxicity to aquatic Invertebrates

Acute toxicity to Daphnia magna:

LC50	24h:	0.26 mg/l
LC50	48h:	0.27 mg/l
NOEC	48h:	0.11 mg/l

Prolonged toxicity to Daphnia magna:

EC50	21d:	0.34 mg/l
MATC	21d:	0.037 < c < 0.062 mg/l

The tests have been performed under flow-through conditions and the results are based on measured concentrations. A solvent control has been carried out. Acetone has been used as a cosolvent.

c) Toxicity to algae

Acute toxicity to Selenastrum capricornutum Printz:

EC50	96h:	1.9 mg/l
NOEC	96h:	<1.0 mg/l

Acute toxicity to Scenedesmus subspicatus:

EC10	72h:	0.3 mg/l
EC50	72h:	1.1 mg/l
EC90	72h:	4.2 mg/l

The tests have been carried out under static conditions for Selenastrum and triethyleneglycol has been used as a cosolvent.

In the case of Scenedesmus another method has been used (see Huels report No. AW 176, 1989).

d) Toxicity to micro-organisms

Acute toxicity to Pseudomonas putida (Bacteria):

EC10 6h: >1700 mg/l

Acute toxicity to activated sewage sludge microorganisms:

EC50 3h: >10 mg/l

For Pseudomonas the Huels-method was used and the respiration inhibition test was done according to OECD Guideline 209. Bacteria and sewage sludge organisms show a tendency of higher resistance to OP, the latter having an EC50 (3h) of 10 mg/l.

4.2 Additional Remarks

An estrogenic potential of octylphenol has been reported in several publications. The following estrogenic effects have been observed experimentally:

Octylphenol stimulates the secretion of vitellogenin in cultivated hepaocythes of rainbow trout.

It may displace 17-beta-estradiol (a natural estrogen) from its receptors in a competitive manner and can promote cell proliferation in estrogen dependent cells.

Octylphenol has been able to stimulate these biological responses to the same extent as 17-beta-estradiol itself, albeit at a 1000-fold greater concentration.

4.3 Initial Assessment for the Environment

OP is acutely very toxic for water organisms. Acute tests for three species from two taxonomic groups are available. Acute toxicity is similar for both fish and daphnids ranging from 0.25 to 0.27 m/l:

Fish:

- LC50 (72h) Pimephales promelas 0.25 mg/l

- LC50 (48 h) Leuciscus idus 0.60 mg/l

Crustaceans:

- LC50 (48 h) Daphnia magna 0.27 mg/l

Chronic NOECs are available for three species form three taxonomic groups. In long-term tests rainbow trout is more sensitive than Daphnia magna.

Fish:

- NOEC (60d) Salmo gairdneri 0.006 mg/l

Crustaceans:

- MATC (21d) Daphnia magna $0.037 < c < 0.062$ mg/l

Algae:

- NOEC (96h) Selenastrum capr. <1.0 mg/l

According to the "OECD provisional guidance for the initial assessment of aquatic effects" an assessment factor of 10 must be applied to the lowest NOEC for calculating a predicted no effect concentration (PNEC) in this case.

The most sensitive species for octylphenol is Salmo gairdneri (rainbow trout) with a NOEC (60d) of 0.006 mg/l.

PNEC = 0.006 mg/l/10 = 0.0006 mg/l

The estimated OP concentration (originating from the application of ethoxylates) in Swiss rivers is 0.00007 mg/l, therefore PEC/PNEC = 0.117.

The manufacturing leads to an OP concentration of 0.000001 mg/l, and the ratio PEC/PNEC = 0.002.

Therefore no concern for the aquatic flora and fauna has to be expected in Switzerland.

Under less favorable conditions, however, a considerable higher PEC/PNEC ratio has to be expected. Reasons that could result in a higher PEC/PNEC value in other countries are:

a lower dilution factor at the production site. In Basle the dilution factor in the receiving river is 2900. If a dilution of only 10 is used to estimate PEC, a PEC/PNEC ratio of 0.5 is calculated.

not all households might be connected to a STP, as this is the case in Switzerland.

the consumption of OP-ethoxylates may be higher because their use in detergents is not restricted.

The measured OP concentrations in the Delaware river (0.0002-0.002 mg/l in 1976) lead to a PEC/PNEC ratio of 0.3-3.3. Adverse effects on the aquatic environment may not be excluded.

It is even possible that the PEC/PNEC was higher in Switzerland before 1987:

Measured average concentrations of nonylphenol in Swiss STP effluents in 1983 (worst case 0.03 mg/l; see ANNEX Nonylphenol of SIDS DOSSIER), indicate that octylphenol may have occurred at concentrations up to 0.003 mg/l assuming a nine-fold higher consumption of NPnEO than OPnEO (Ref. [45], [46]).

The possibility that estrogenic effects could occur at concentrations below the derived PNEC values can not be excluded at the time.

The main source for OP in the environment is the degradation of octylphenol-exhoxylates to octylphenol in STPs, following either release with polluted secondary effluents or sewage sludge used in agriculture.

Octylphenol shows a moderate tendency to bioaccumulate, having a calculated BCF of 331. The possibility that OP accumulates in river sediments must also be taken into account.

From measured nonylphenol concentrations in sediments of Swiss rivers (4.075 mg/kg dry weight; Ref. [49]) it can be concluded, that octylphenol may occur in concentrations up to 0.45 mg/kg (assuming a nine-fold higher release of NP than of OP; Ref. [45], [46]).

5 CONCLUSIONS

Octylphenol is acutely very toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment. The environmental hazard assessments with the available exposure data shows that OP may represent a risk to the hydrosphere. The main reason for this risk is not the use of OP itself, but the use of octylphenol-ethoxylates which may be degraded back to OP in the aquatic environment. The best measure to minimize this risk is therefore the reduction of the use of these ethoxylates. In Switzerland, this has been achieved by prohibiting the use of octylphenol-ethoxylates in detergents in 1987. The hazard assessment with Swiss figures showed that OP does not give cause for concern.

It must be emphasized that there are still data gaps with respect to the amounts of OP used in consumer products and for the production of resins, rubber additives, etc.

OP is acutely not toxic but slightly irritating to the skin and highly irritating to the eyes. It is not genotoxic but may cause depigmentation of the skin. The available data indicate that OP does not give cause for concern for the human health. This assessment does not consider the possible estrogenic effects of the substance which are currently under discussion.

6 RECOMMENDATIONS

More work is required, for example further testing or analysis of exposure information to assess identified concerns (Post SIDS Work).

No further studies are required to evaluate the potential environmental effects of octylphenol. The substance may give cause for concern for the aquatic environment depending on the existing regulations with respect to the use of octylphenol-ethoxylates. As a consequence the PEC/PNEC ratio may be close to or above unity. The identified concern should be assessed more accurately by using monitoring data rather than estimated exposure scenarios. Therefore the collection of more environmental monitoring data is recommended.

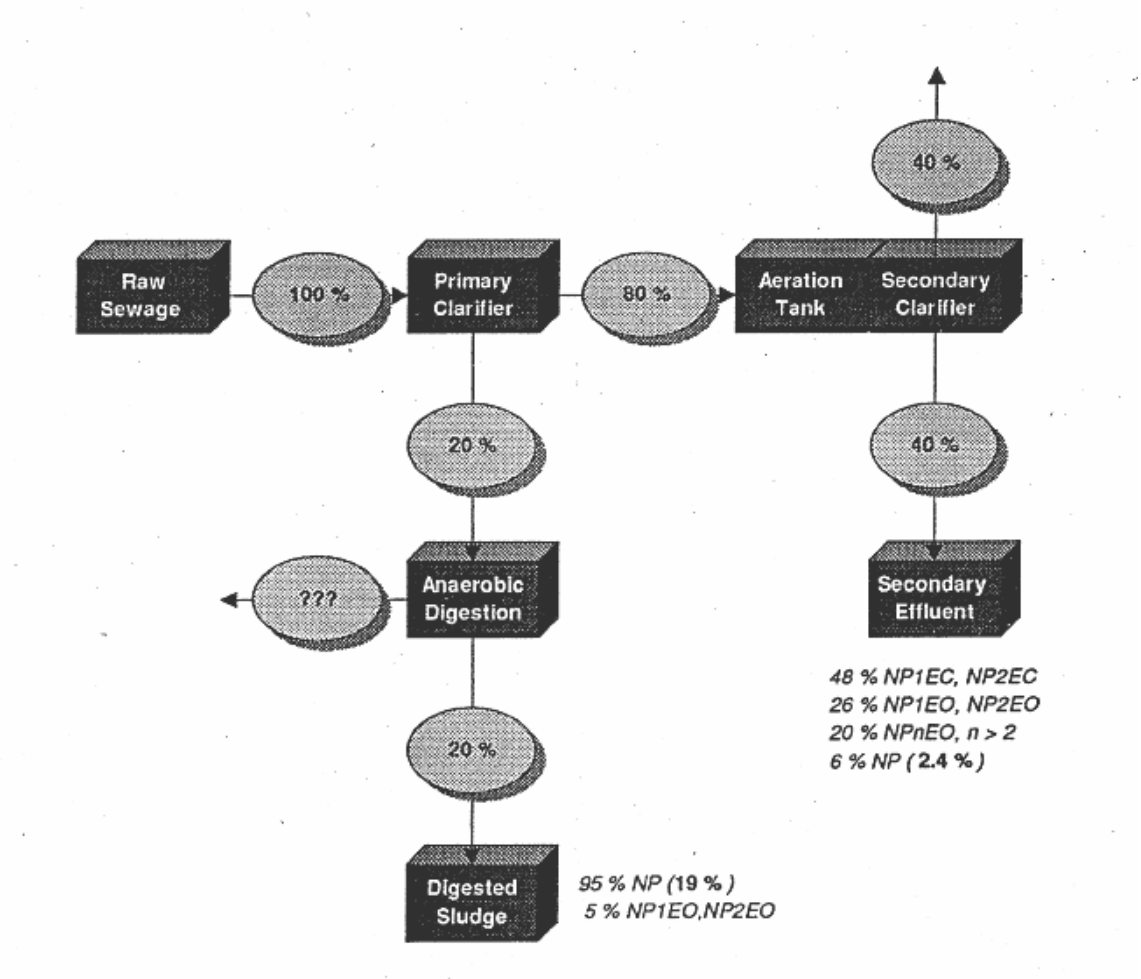
In addition there is a need for exposure informations with respect to the use of octylphenol in consumer products.

The ongoing discussions regarding potential estrogenic effects of octylphenol (and other chemicals) have to be followed carefully.

ANNEX 1

Nonylphenol-Ethoxylates in Sewage Treatment

Estimated relative mass flows of surfactant-derived nonylphenolic compounds of 11 sewage treatment plants in Switzerland are shown (calculated on a molar base)



Numbers in **bold** are relative mass flows (calculated on a molar base), whereas numbers in italics are average compositions in specific compartments.

Abbreviations used:

NP	Nonylphenol
NP1EO,NP2EO	Nonylphenol mono- and di-Ethoxylates
NP1EC,NP2EC	Nonylphenol mono- and di-Carboxylic Acids
NPnEO	Nonylphenol-Ethoxylates with more than two Ethoxy groups

It is visible that jus 40% of all nonylphenolic compounds (on a molar base) are completely degraded in a sewage treatment plant. The remaining 60% are transformed to short-chain Nonylphenol-Ethoxylates, Nonylphenol, and short-chain Nonylphenol-Carboxylic-Acids. 19% of the NPEO end as Nonylphenol in sewage sludge, and 2.4% are released as NP via STP effluent to the environment.

As the degradation of the short-chain NPEO and NPEC continues in the environment, it can be assumed, that the only nonylphenolic compound in STP effluents is Nonylphenol itself. For all calculations in chapter 2.2 and ANNEX 2, it was therefore assumed, that the sum of all NP compounds in the secondary effluents (=40%) be NP itself.

Because of the close chemical relationship of Nonyl- and Octylphenol it was postulated in the submitting report that Octylphenol-Ethoxylates act identically to Nonylphenol-Ethoxylates in STPs.

Reference: Ahel et al.: Behaviour of Alkylphenol Polyethoxylate Sufactants in the Aquatic Environment - I. Occurrence and Transformation in Sewage Treatment. Wat. Res. Vol. 28 No. 5,pp. 1131-1142; 1994

ANNEX 2

Simulation-Results obtained with USES V1.0 for different Scenarios

All Scenarios have the following assumptions in common:

- The number of emission days per annum is 300, expect in scenario 3 where it is 30.
- The amount of sludge applied is 2500 kg/ha/year (this value corresponds to the Swiss law)
- The surplus sludge per inhabitant equivalent is 0.07 kg/d/eq
- The dilution factor for STP effluents is 10.

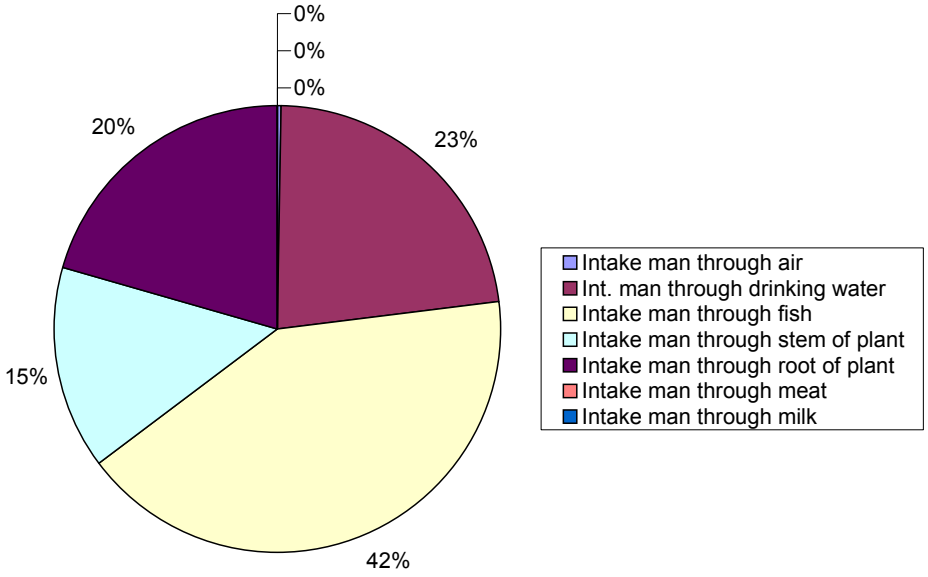
The following scenarios have been used:

Scenario 1: it is assumed, that the 10t Octylphenol-Ethoxylates (OPEOSs) used in Switzerland per annum as a component of cleaning agents reach the wastewater in the form of Octylphenol. The production-volume has been modified to fit the relations in the STP implemented in the USES environment: Wastewater volume in Switzerland is about 2900 times higher than in USES. Therefore a release of OP to wastewater of (10t/2900)/300 days= 0.012 kg/d has been entered.

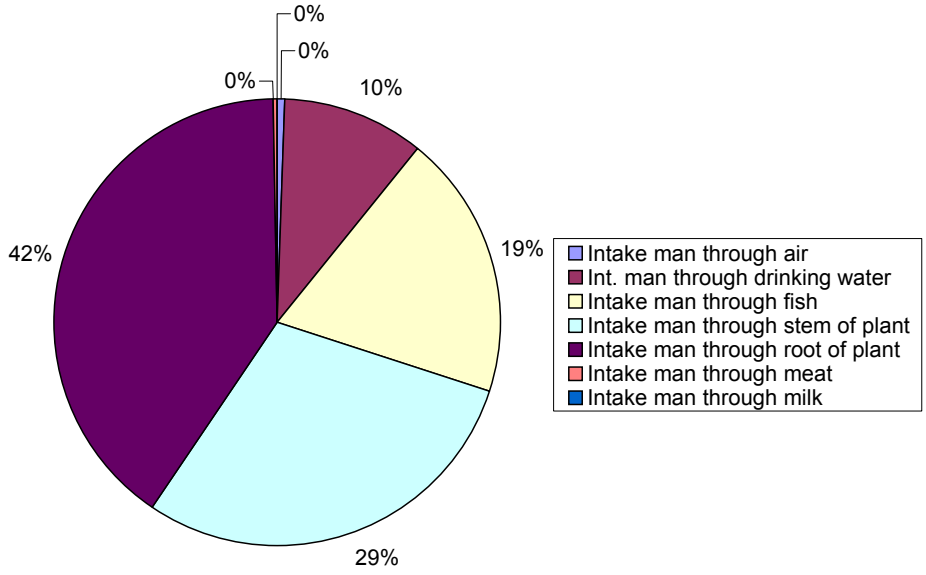
Scenario 2: 10t Octylphenol-Ethoxylates (OPEOSs) end in the wastewater and finally the STP. The OPEOs are there distributed and transformed according to the values measured by Ahel et al. in field studies (see Annex 1 for details). This leads to calculated concentrations in the STP effluent of $4.52 * 10^{-5}$ mg/l and in sewage sludge of 2.52 mg/kg dry weight.

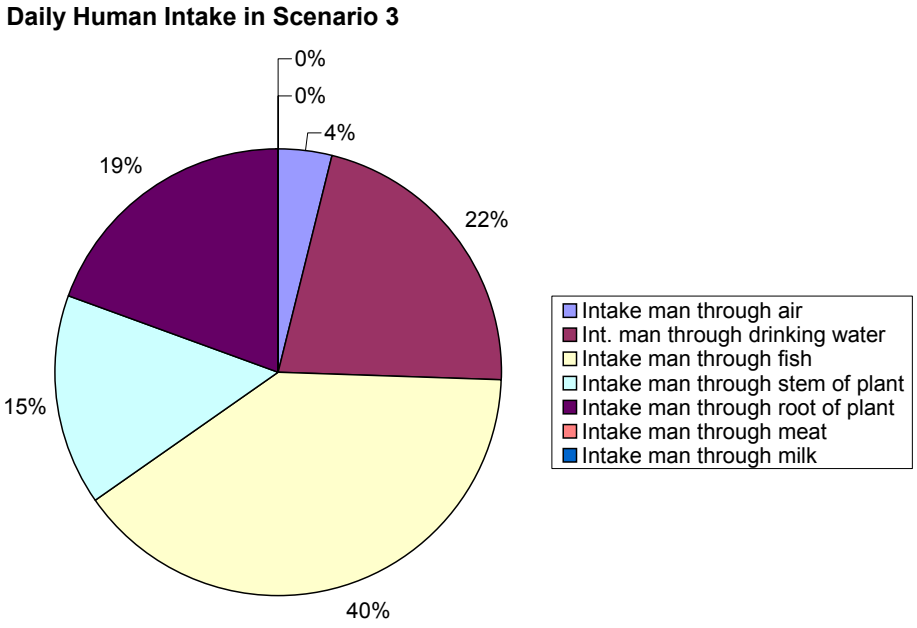
Scenario 3: Here the situation at the production site of Schenectady Pratteln AG in Pratteln, Switzerland is considered. The estimated size of the local STP is 248’000 inhabitant equivalent (the default value for the STP in USES has been changed correspondingly). The production volume in Pratteln amounts to 248t (1993), the daily Octylphenol release to wastewater being 0.088 kg.

Daily Human Intake in Scenario 1



Daily Human Intake in Scenario 2




Daily Human Intake in Scenario 3
0%
0%
4%
19%
22%
15%
40%
Intake man through air
Int. man through drinking water
Intake man through fish
Intake man through stem of plant
Intake man through root of plant
Intake man through meat
Intake man through milk

SIMULATION FOR OCTYLPHENOL WITH USES V1.0

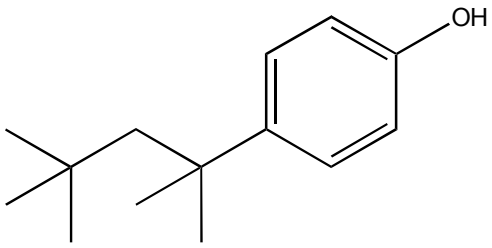
Kind of Data	*Unit*	*Local Model*		
		Scenario 1	**Scenario 2**	**Scenario 3**
Default Values				
Size of the local STP	eq	12000	12000	248000
Dilution factor for STP effluent	-	10	10	10
Distribution factor dilution factor	-	1	1	1
Amount of sludge applied	kg/ha/year	2500	2500	2500
Surplus sludge per inhab.eq.	kg/d/eq	0.0700	0.0700	0.0700
Input Values				
Main category production	-	Ib	Ib	Ib
Main category formulation	-	III	III	III
Main category processing	-	III	III	III
Industrial category	-	3	3	3
Use category	-	33	33	33
Relevant Emissions	-	production only	production only	production only
Bypass STP	-	No	No	No
Release to wastewater	kg/d	0.012	0.012	0.088
Number of emission days	d	300	300	30
Concentration STP effluent	mg/l	0.003	0.00070	no change
Concentration sewage sludge	Mg/kg d.w.	2.786	2.456	no change
Outputdata				
Conc. in air at 100 m from STP	mg/m^3	1.47E-07	3.35E-07	2.43E-07
Conc. in agricultural soil	Mg/kg d.w.	0.003	0.007	2.80E-04
Annual av. conc. in surface water	mg/l	0.0001	5.74E-05	1.00E-05
Conc. in fish	Mg/kg b.w.	0.041	0.019	0.003
Conc. in stem of plants	mg/kg	0.00040	8.10E-04	3.51E-05
Conc. in root of plants	mg/kg	0.002	0.0036	1.50E-04
Conc. in meat	mg/kg	3.67E-06	7.36E-06	3.23E-07
Conc. in milk	mg/kg	1.16E-06	2.33E-06	1.02E-07
Assessed NEC for micro-organ.	mg/l	1	1	1
Assessed NEC for aquat. organ.	mg/l	0.008	0.008	0.008
Intake man through air	mg/kg*/d	3.16E-08	7.17E-08	5.22E-08
Int. man through drinking water	mg/kg*/d	3.54E-06	1.64E-06	2.86E-07
Intake man through fish	mg/kg*/d	6.45E-06	2.98E-06	5.21E-07
Intake man through stem of plant	mg/kg*/d	2.30E-06	4.60E-06	2.01E-07
Intake man through root of plant	mg/kg*/d	3.17E-06	6.35E-06	2.57E-07
Intake man through meat	mg/kg*/d	6.29E-09	1.26E-08	5.53E-10
Intake man through milk	mg/kg*/d	6.27E-09	1.26E-08	5.51E-10
Total human dose	mg/kg*/d	1.55E-05	1.57E-05	1.32E-06
Hazard quotient STP micro-org.	-	0.011	0.011	0.004
probab. PEC/NEC > 1	-	0.027	0.027	0.009
Hazard quotient aquatic species	-	0.045	0.0091	0.016
Probab. PEC/NEC > 1	-	0.013	0.001	0.002
Safety margin for man (base: ADI)	-	3’226	3’190	37’940

Abbreviations: kg* = kg body weight
d.w.= dry weight

SIDS DOSSIER ON THE OECD HPV CHEMICAL

PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)-

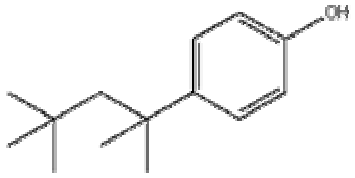
CAS No. 140-66-9



("FULL SIDS DOSSIER")

SPONSOR COUNTRY: SWITZERLAND

1.01 SUBSTANCE INFORMATION

A.	**CAS number:**	140-66-9
B.	**OECD name:**	Phenol, 4-(1,1,3,3-tetramethyl-butyl)-
E.	**EINECS-number**	205-426-2
F.	**Empirical formula:**	$C_{14}H_{22}O$
G.	**Structural formula**	
J.	**Molecular weight**	206.33

1.02 OECD INFORMATION

A.	**Sponsor Country:**	Switzerland
B.	**Lead Organisation:**	Swiss Society of Chemical Industries
	Contact Point:	Dr. G. Karlaganis Federal Office of Environment, Forests and Landscape CH – 3003 Berne Tel. +41 31 322 69 55 Fax. +41 31 324 79 78
C.	**Name of responder:**	Dr. Roland Mislin SANDOZ Chemicals Ltd., Muttenz CH – 4002 Basle

1.1 GENERAL SUBSTANCE INFORMATION

A.	**Type of Substance**	organic
B.	**Physical State**	(at 20°C and 1.013 hPa): solid
C.	**Purity:**	ca. 99.2% w/w

1.2 SYNONYMS

p-Octylphenol
4-tert-Octylphenol
p-tert-Octylphenol
Octylphenol PT
4-(1,1,3,3-tetramethylbutyl)-phenol
p-(1,1,3,3-tetramethylbutyl)-phenol

1.3 IMPURITIES

CAS No:	
EINECS No:	
Name:	2-tert.-Octylphenol
Value:	0.2 %
CAS No:	
EINECS No:	
Name:	4-tert.-Butylphenol

Value: 0.1 %

CAS No:
EINECS No:
Name: unknown
Value: 0.2 %

1.4 ADDITIVES

Remarks no additives

1.5 QUANTITY

Production Switzerland 1000-5000 t (1990-1991)
<1000 t (1991-1993)
Production USA 10000-50000 t (1977)

World's main producer of OP is Schenectady Chemicals Inc. with plants in Rotterdam Junction, Freeport (both in the USA), France, Great Britain and Pratteln (Switzerland), with an annual production level of 5000-27000 t (1977; Ref. [38]).

Remarks: Todays production level of the USA is estimated (Ref. [38]) to be above this value.
Concerning the Swiss production level: not the whole quantity of sale are manufactured in Switzerland; for example in 1993 129t out of 377t sold were imported.

Reference: US-Production: [38]
Swiss Production: [42]

1.6 LABELLING AND CLASSIFICATION

Labelling

Type: Directive 67/548/EEC
Specific limits: no data
Symbols: N, X_n
Nota:
R-phrases 36/38,48/22,50/53
S-phrases: 26,28,35,36,39,56,60,61
Text of S-phrases:

- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
- After contact with skin, wash immediately with plenty of water and polyethylenglykol.
- This material and its container must be disposed of in a safe way.
- Wear suitable protective clothing.
- Wear eye/face protection.
- Dispose of this material and its container at hazardous or special waste collection point.
- This material and its container must be disposed of as hazardous waste.
- Avoid release to the environment. Refer to special

instructions/Safety data sheet
Remarks: -

Classification

Type:	Directive 67/548/EEC
Category of danger:	irritant, corrosive
R-phrases:	36/38,48/22,50/53
Remarks: -	

1.7 USE PATTERN:

A. General

	Type of Use:	**Category:**
(a)	main industrial use	use in closed systems basic chemical industry intermediates
(b)	main industrial use	wide dispersive use personal and domestic use stabilizer
(c)	main industrial use	wide dispersive use personal and domestic use other
(d)	main industrial use	wide dispersive use mineral oil and fuel industry fuel additives

Remarks
(a) Use for the production of non-ionic surfactants, resins and additives to rubbers
(b) stabilizer for oil and emulsions.
(c) Use as an antioxidant and emulsifier
(d) Used as an additive for fuel for aeroplanes

Reference: [38], [42]

B. Uses in Consumer Products

Function	Amonunt present	Physical State

Remarks:
Reference:

1.8 OCCUPATIONAL EXPOSURE LIMIT VALUE

Exposure limit value
Type: 8-h time-weighted average (TWA) exposure limit by the Occupational Safety and Health Administration
Value: 5 ppm for alkylphenols in general (NIOSH 1978)
Reference: [38]

Short term exposure limit value
Value:
Length of exposure period:
Frequency:
Remarks:

1.9 SOURCES OF EXPOSURE

(a)

Source: Media of release: Water from a production site

Quantities per media: <2 kg/y at the production site of Schenectady Pratteln AG in Pratteln Switzerland.

Remarks: Octylphenol is produced in batches of 4.5 t in only one factory in Switzerland. From each 30 t raw material used, sewage water of the size 200 l results, contaminated with OP. The maximum concentration of OP in the sewage water of the whole production site is 0.6 mg/l

Reference: [42]

(b)

Source: Media of release: Air from a production site
Quantities per media: negligible at the production site in Pratteln, Switzerland

Remarks: Octylphenol is produced by the catalytic alkylation of phenol with diisobutylene. Due to the flammable and/or toxic nature of the educts, the manufacturing operation is carried out in a totally closed system. The contaminated air from the reactor is directly transferred to an incinerator, where it is burnt, leading to CO_2 and H_2O. Thus no occupational exposure and environmental release through air should occur during production

Reference: [42]

(c)

Source: Media of release: Water from an STP
Quantities per media: 7.22E-04 mg/l. This value has been calculated for Swiss conditions using the equation

$$C_{River} = \frac{\text{Annual Input} * \text{Transformation-Rate} * m_{OP}}{\text{Annual Wastewater-Volume} * \text{Dilution Factor} * m_{OPEO}}$$

average m_{OPnEO} (=OP9EO; Ref.[43]): 602 g/mole
m_{OP}: 206.3 g/mole
Annual OPEO-Input: 10 t
Transformation-Rate: 0.4
Annual Wastewater-Volume: 1.9E12 l
Dilution Factor: 10
(Equation may also be found in SIDS I.A. Report at 2.2.2.d.)

Remarks: Main source of OP in the environment is degradation of octylphenol-polyethoxylates (used as detergents) in sewage treatment plants and in rivers. 20 % of all octylphenolic compounds (on a molare base) stay in the sewage sludge,

whereas 40 % are in the STP effluent. The remaining 40 % are completely degraded.

Reference: [43]

(d)

Source: Media of release: sewage sludge from a STP used as fertilizer on agricultural soil
Quantities per media: 2.54 mg/kg d.w.

Remarks: In Switzerland the allowed amount of sludge applied is 2500 kg/ha/year, leading to an OP exposition of 6350 mg/ha/year.

Reference: Calculation in SIDS I.A. Report 2.2.2 d

(e)

Source: Media of release: contaminated food
Quantities per media:
- drinking water: 1.6E-06 mg/l
- milk: 1.3E-08 mg/l
- stems of plants: 4.6E-06 mg/kg
- root of plants: 6.4E-06 mg/kg
- meat: 1.3E-08 mg/kg
- fish: 3.0E-06 mg/kg

Remarks: Those results were obtained using the local model of computer simulation USES with the transfer coefficients for the STP of nonylphenol, a closely related chemical, and the production volume of Switzerland
According to this model overall human intake of OP was 1.57E-05 mg/kg bodyweight/day, being 3200 times lower than the ADI (allowed daily intake; see SIDS I.A. Report ANNEX 2 Scenario 2).

Reference: [39]

(f)

Remarks: No exposure information for other countries is available

Reference:

1.10 ADDITIONAL REMARKS

A. Options for disposal

Remarks: Incineration is the most adequate mode of disposal. The substance is free of heavy metals, nitrogen, sulphur and contains only C, H and O leading to CO_2 and H_2O.

2.1 MELTING POINT

Value: 79 - 82°C
Decomposition:
Sublimation:
Method: not specified
GLP: NO
Reference: [1]

2.2 BOILING POINT

Value: 280 - 283°C
Pressure: at 1013 hPa
Decomposition:
Method: not specified
GLP: NO
Reference: [2]

2.3 DENSITY

Type: relative density
Value: 0.95 g/cm^3
Temperature:
Method: not specified
GLP: NO
Reference: [22]

2.4 VAPOUR PRESSURE

Value: 1 Pa
Temperature: at 20°C
Method: not specified
GLP: NO
Reference: [3]

2.5 PARTITION COEFFICIENT $log_{10}P_{OW}$

(a) preferred result
Log Pow: 3.7
Temperature: not indicated
Method: measured by HPLC method
GLP: NO
Remarks: Analytical method: UV-absorbency
Reference: [4]

(b)
Log Pow: 4.12
Temperature: at 20.5°C
Method: OECD 107
GLP: NO
Reference: [20]

2.6 WATER SOLUBILITY

A. Solubility

(a) preferred result
Value: deionized test water: 17 mg/l
aquatic test water: 19 mg/l

Temperature: at 22°C
Description: very low solubility
Method: HPLC at 220 nm
GLP: YES
Reference: [5]

(b)
Value: 12.6 +/- 0.5 mg/l
Temperature: at 20.5°C
Description: very low solubility
Method: generator column technique
GLP: NO
Reference: [21]

B. pKa Value
Value: 10.33
Temperature: 25°C
Method: calculated according to Hammet
GLP: NO
Reference: [41]

2.7 FLASH POINT
Value: 145°C
Type of test:
Method: DIN 51.376
GLP: NO
Reference: [6]

2.8 AUTO FLAMMABILITY
Value: 410°C
Pressure:
Method: unknown
GLP:
Reference: [22]

2.13 ADDITIONAL DATA
A. Partition coefficient between soil/sediment and water (Kd)
Value: 197.27
Method: calculated with FUGMOD V1.0
GLP: NO
Reference:

B. Other data
Results: K_H : 11. 46 Pa*m^3/mole
Remarks Calculated using FUGMOD V1.0

3.1 STABILITY

3.1.1 PHOTODEGRADATION

Type:	air
Light source:	no data
Light spectrum:	no data
Relative intensity:	no data
Spectrum of substance:	no data
Concentration of substance:	no data
Temperature:	no data
Indirect photolysis:	
Type of sensitizer:	OH
Concentration of sensitizer:	500'000 molecules/cm^3
Rate constant:	
Degradation	50 % after 0.7 days
Method:	Calculated; Year: 1994
GLP:	NO
Test substance:	purity:
Reference:	[36]

Type:	water
Light source:	sunlight
Light spectrum:	natural spectrum
Relative intensity:	1 (0.705 kW/m^2)
Spectrum of substance:	no data
Concentration of substance:	0.48 µmol/l
Temperature:	14.5-17°C
Direct photolysis:	
Half life:	13.9 h
Degradation:	0.05 h-1
Quantum yield:	
Method:	measured

other: 50 ml quartz tubes were stored at a depth of 20-25 cm in Chriesbach creek. The solutions of OP were prepared in filtered (0.45 um) lake water (DOC=4mg/l; pH=8.4). The total sunlight irradiation was determined by integrating the values which were recorded in intervals of 10 min.
Year: September 1985

GLP:	
Test substance:	Purity:95%, provided by Fluka Switzerland
Reference:	[41]

3.1.2 STABILITY IN WATER

Type:	
Half life:	
Degradation:	
Method:	
GLP:	
Test substance:	
Reference:	

3.2 MONITORING DATA (ENVIRONMENTAL)

Type:	background (?)
Test substance:	p-(1,1,3,3-tetramethyl-butyl)phenol
Media:	surface water
Results:	1-2 µg/l in winter, 0.2-2 µg/l in summer in Delaware river, USA in 1976
Remarks:	No definite source could be identified
Reference:	[19]

3.3 TRANSPORT AND DISTRIBUTION BETWEEN ENVIRONMENTAL COMPARTMENTS INCLUDING ESTIMATED ENVIRONMENTAL CONCENTRATIONS AND DISTRIBUTION PATHWAYS

3.3.1 TRANSPORT

no data

3.3.2 THEORETICAL DISTRIBUTION (FUGACITY CALCULATIONS)

(a)

Media: Air-water-soil-sediment-suspended sediment-fish

Method: Fugacity Level I

Results:

Mass%

- air	29.4 %
- water	12.7 %
- soil	56.5 %
- sediment	1.3 %
- susp. sediment	<0.1 %
- fish	<0.1 %

relative concentrations

- air	1
- water	200
- soil	21'000
- sediment	43'000
- susp. sediment	133'000
- fish	54'000

Remarks: Generic model

Input parameters used:

molecular mass:	206.33 g
melting point:	80.5°C
vapour pressure:	1 Pa at 20°C
solubility:	18 g/m^3
log_{10} Pow:	3.7

Reference: FUGMOD V1.0

(b)
Media: air-water-soil-sediment
Method: Fugacity Level III
Results:

	Release to air	release to water	release to soil
mass%			
- air	26.0 %	1.2 %	<0.1 %
- water	5.1 %	**77.9 %**	0.3 %
- soil	**67.7 %**	3.1 %	**99.6 %**
- sediment	1.2 %	17.8 %	0.1 %

	Release to air	release to water	release to soil
rel. conc.			
- air	1	1	1
- water	100	33'000	6'000
- soil	**15'000**	15'000	**23'000'000**
- sediment	**9'000**	**3'000'000**	545'000

Remarks: Generic model has been used. Input parameters see (a)
Reference: FUGMOD V1.0

3.4 IDENTIFICATION OF MAIN MODE OF DEGRADABILITY IN ACTUAL USE

No information available

3.5 BIODEGRADATION

Test type: aerobic
Inoculum: **non-adapted, mixed population of activated sewage sludge organisms**
Concentration of the chemical: 30mg/l, equivalent 100mg/l d.w.
Medium: sewage treatment
Degradation: 0% biodegradation after 28 days
Results: the substance is not inherently biodegradable
Kinetic:
Method: OECD 302C (modified MITI II test)
Temperature: 25+/-1°C
Reference substance: Aniline 100mg/l
Results: 74% biodeg. after 14 days
87% biodeg. after 28 days
GLP: NO
Test substance: p-Octylphenol, purity not specified
Reference: [7]

Type: aerobic
Inoculum: non-adapted
Concentration of the chemical:
Medium: **activated sludge microorganisms**
Degradation: 20% biodegradation after 28 days
Results: no evidence for biodegradability

Kinetic:	
Method:	BODIS test (ISO 10708)
GLP:	YES
Test substance:	p-Octylphenol, purity 95%
Reference:	[23]

3.7 BIOACCUMULATION

Species:	**Salmo salar**
Exposure period:	4 days
Temperature:	no data
Concentration:	no data
BCF:	331
Elimination:	?
Method:	Closely related para-substituted phenols (sec butyl-, hexyl-, nonyl- and dodecylphenol) were tested in 4-day uptake and excretion studies with juvenile Atlantic salmon. Based on the data from these studies, McLeese et al. (1981) developed an equation to predict the bioconcentration factor for TMBP: log BCF = 0.61 * log Pow + 0.26
Type of test:	calculated
GLP:	NO
Test substance:	para-substituted phenols, purity not specified
Reference:	[38]

3.8 ADDITIONAL REMARKS

A. Sewage treatment

No information available. Based on the result of the biodegradability test a degradation in a WTP is unlikely to occur except perhaps with adapted microorganisms (not tested).

4. ECOTOXICOLOGICAL DATA

4.1 ACUTE/PROLONGED TOXICITY TO FISH

Type of test: flow-through
Species: **Fathead minnows** (Pimephales promelas)
Exposure period: 96 h
Test results: LC50 24h: 0.29 mg/l
LC50 48h: 0.25 mg/l
LC50 72h: 0.25 mg/l
LC50 96h: 0.29 mg/l
NOEC 96h: 0.077 mg/l
Analytical monitoring: unknown
Test method: EPA method Year:1984
GLP: YES
Test substance: p-Octylphenol, purity 99.34%
Remarks: 22°C, pH 8-8.2
values based on measured conc.

nominal conc.: 0.047; 0.091; 0.18; 0.39; 0.70 mg/l
mean measured: 0.041; 0.077; 0.15; 0.34; 0.63 mg/l
Reference: [8]

4.2 ACUTE TOXICITY TO AQUATIC INVERTEBRATES

A. Daphnia

Type of test: flow-through
Species: **Daphnia magna**
Exposure period: 48h
Results: LC50 24h: 0.26 mg/l
LC50 48h: 0.27 mg/l
NOEC 48h: 0.11 mg/l
Analytical monitoring: unknown
Test method: EPA method
GLP: YES
Test substance: p-Octylphenol, purity 99.34%
Remarks: 20±2°C, pH 8.3-8.4
Acetone was used as a cosolvent.
values based on measured conc.
nominal conc.: 0.072; 0.12; 0.25; 0.43; 1.0 mg/l
mean measured: 0.063; 0.11; 0.19; 0.32; 0.94 mg/l
Reference: [11]

B. Other aquatic organisms

No data available

4.3 TOXICITY TO AQUATIC PLANTS

Toxicity to algae

Test species: **Selenastrum capricornutum Printz**
Endpoint:
Exposure period: unknown
Test results: EC50 96h: 1.9 mg/l
NOEC 96h: < 1.0 mg/l
Analytical monitoring: unknown
Test method: static
GLP: YES

Test substance: p-Octylphenol, high purity
Comments: 24-25°C ; triethylene glycol as cosolvent
values based on nominal conc.
nominal concentrations: 1.0;1.8;3.2; 5.6; 10.0 mg/l
Reference: [13]

4.4 TOXICITY TO BACTERIA

Type: inhibition of breath
Test species: **Activat. sewage sludge microorganisms**
Exposure period: 3 hours
Test results: EC50 (3 hrs contact time): > 10 mg/l
Analytical monitoring:
Method: OECD 209
GLP: NO
Test substance: p-Octylphenol, purity not specified
Remarks: 21°C pH 6.9
EC50 of reference substance 3.5-Dichlorophenol: 13 mg/l
Reference: [14]

4.5 CHRONIC TOXICITY TO AQUATIC ORGANISMS

4.5.1 CHRONIC TOXICITY TO FISH

Type of test: flow-through
Test species: **Rainbow trout** (Salmo gairdneri)
Endpoint:
Exposure period: 14 days
Results: LC50 6d: 0.17 mg/l
LC50 14d: 0.12 mg/l
NOEC 14d: 0.084 mg/l
Analytical monitoring: unknown
Method: EPA Year:1984
GLP: YES
Test substance: p-Octylphenol, purity 99.34%
Remarks: 12±1°C, pH 8-8.2
acetone as a cosolvent
values based on measured conc.
nominal conc.: 0.052; 0.100; 0.20; 0.37; 0.70 mg/l
mean measured: 0.035; 0.084; 0.17; 0.32; 0.71 mg/l
a lethal threshold was reached on day 10 and was estimated to be 0.12 mg/l
Reference: [9]

Type of test: flow-through
Test species: **Rainbow trout** (Salmo gairdneri)
Endpoint: fry growth
Exposure period: 60 day post-hatch early life stage
Results: 0.0061 < MATC < 0.011 mg/l
NOEL: 0.0061 mg/l
Analytical monitoring: unknown
Method: unknown
GLP: YES

Test substance: p-Octylphenol, purity 99.22%
Comments: acetone as a cosolvent
values based on measured conc.
nominal conc.: 0.0062; 0.012; 0.025; 0.050; 0.10 mg/l
mean measured: 0.0061; 0.011; 0.022; 0.051; 0.091 mg/l
Reference: [10]

4.5.2 CHRONIC TOXICITY TO AQUATIC INVERTEBRATES

Type of test: flow-through
Test species: **Daphnia magna**
Endpoint: death
Exposure period: 21 days
Results: EC50 21d: 0.34 mg/l
0.037 < MATC < 0.062 mg/l
Analytical monitoring: unknown
Method: EPA method
21-day life cycle toxicity study
GLP: YES
Test substance: p-Octylphenol, purity 99.34%
Comments:
Acetone was used as a cosolvent. T = 20+/-1°C
The mean young/adult/reproduction day for 21 days were significantly affected in the mean measured exposure levels of 0.12 and 0.23 mg/l of Octylphenol.
The MATC (Maximum Acceptable Toxicant concentration) limits were estimated based on the statistical analysis of survival, young/adult/reproduction day, and adult mean length.
All values are based on measured concentrations.
nominal conc.: 0.030; 0.060; 0.12; 0.25; 0.50 mg/l
mean measured: 0.037; 0.062; 0.12; 0.23; 0.51 mg/l
Reference: [12]

4.6 TOXICITY TO TERRESTRIAL ORGANISMS

4.6.1 TOXICITY TO SOIL DWELLING ORGANISMS

no data available

4.6.2 TOXICITY TO TERRESTRIAL PLANTS

no data available

4.6.3 TOXICITY TO OTHER NON MAMMALIAN TERRESTRIAL SPECIES

no data available

4.7 BIOLOGICAL EFFECTS MONITORING

no information available

4.8 BIOTRANSFORMATION AND KINETICS

no data available

4.9 ADDITIONAL REMARKS

Estrogenic effects of octylphenol in experiments

- Octylphenol stimulates the secretion of vitellogenin in cultivated hepatocythes of Rainbow Troult.
- It may displace 17-beta-estradiol (a natural estrogen) from

its receptors in a competitive manner and can promote cell proliferation in estrogen-dependent cells.
OP is able to stimulate these biological responses to the same extent as 17-beta-estradiol (a natural estrogen), albeit at a 1000-fold greater concentration.
Reference: [37]

5. TOXICITY

5.1 ACUTE TOXICITY

5.1.1 ACUTE ORAL TOXICITY

Type:	LD_{50}
Species/strain:	**Sprague-Dawley strain rat**
Value:	LD_{50} > 2000 mg/kg bodyweight
Method:	OECD 401 Year:1991
GLP:	YES
Test substance:	p-Octylphenol, purity not specified
Reference:	[15]

Type:	LD_{50}
Species/strain:	**mouse**
Value:	LD_{50} = 3210 mg/kg
Test method:	other (no data)
GLP:	no data
Test substance:	p-Octylphenol, purity not known
Reference:	[25]

5.1.2 ACUTE INHALATION TOXICITY

Type:	LC_{100}
Species/strain:	**rat**
Exposure time:	1 hour
Value:	LC_{100} 24h =< 116 mg/l
Test method:	Other: no data
GLP:	NO
Test substance:	89% p-octylphenol 2% o-octylphenol 5% dioctylphenol 3% other isomers <1% phenol
Reference:	[26]

5.1.3 ACUTE DERMAL TOXICITY

Type:	LD_{50}
Species/stain:	**rabbit**
Value:	LD_{50} = 1880 mg/kg
Method:	unknown
GLP:	NO
Test substance:	p-Octylphenol, purity not specified
Reference:	[38]

5.1.4 ACUTE TOXICITY: OTHER ROUTES OF ADMINISTRATION

Type:	LD_{50}
Species/strain:	**mouse**
Route of administration:	inter-peritoneal
Exposure time:	unknown
Value:	LD_{50} = 25 mg/kg
Test method:	no data
GLP:	no data
Test substance:	p-octylphenol
Reference:	[27]

5.2 CORROSIVENESS/IRRITATION

5.2.1 SKIN IRRITATION/CORROSION

Test species/strain:	**New Zealand white rabbit** (2 males, 1 female)
Test results:	Erythema/Eschar formation: Total scores after 24 hrs: 3 after 72 hrs: 2 Oedema formation: Total scores after 24 hrs: 2 after 72 hrs: 0
Classification	mild irritating
Method:	OECD 404 Year:1991
GLP:	YES
Test substance:	p-Octylphenol, purity not stated

Comments:
The test material produced a primary irritation index of 1.2 and was classified as a mild irritant to rabbit skin according to the Draize classification scheme. No corrosive effects were noted.
The test material was also classified as non-irritant according to EEC labelling regulations.
Reference: [17]

5.2.2 EYE IRRITATION/CORROSION

Test species/strain:	**New Zealand white rabbit** (1 male)
Results:	max. total score after 24 hrs: 63.0
Classification:	severe irritant
Test method:	OECD 405
GLP:	YES
Test substance:	p-Octylphenol, purity not specified

Comments:
A single application of the test material to the non-irrigated eye of one rabbit produced areas of translucent corneal opacity, iridial inflammation and severe conjunctival irritation. Other adverse ocular reactions noted were white appearance of the nictitating membrane, sloughing of the conjunctival surface, haemorrhage of the conjunctival membrane and blood stained discharge.
The test material was considered to be at least a severe irritant (Class 6 on a 1 to 8 scale) to the rabbit eye according to a modified Kay and Calandra classification system (based on one rabbit only).
The test material was also considered to be irritant according to EEC labelling regulations.
Reference: [18]

5.3 SKIN SENSITISATION

Type:	
Species/strain:	**guinea pig**
Test results:	not sensitizing
Classification:	not sensitizing

Test method: OECD-Guideline 406
GLP: NO
Test substance: p-octylphenol, purity 95%
Remarks: Challenge concentration: 20% in corn oil (1981)
Reference: [28]

5.4 REPEATED DOSE TOXICITY

Species/strain: **rat** BOR/WISW (SPF Cpb)
Sex: 20 male, 20 female
Route of administration: oral
Exposure period: 3 months
Frequency of treatment: daily
Post exp. observation period: unknown
Dose: 0, 30, 300, 3000 ppm
Control group: YES
NOEL: 30 ppm
LOEL: 300 ppm
Results:
Method: no data; Year:1982
GLP: NO
Test substance: p-octylphenol, purity 93.1 %
Reference: [29]

Species/strain: **rat**/Crj:CD (SD)
Sex: 6 male, 6 female/group
Route of administration: oral (gavage)
Exposure period: 28 days
Frequency of treatment: daily
Post exp. observation period: yes
Dose: 0, 15, 70, 300 mg/kg/day
Control group: yes; vehicle
NOEL: 15 mg/kg/day
LOEL: not available
Results: Salivation was observed on test substance administration in the medium- and high-dose females and males. Body weight gain was reduced in the high-dose males. Water intake was increased in males and females of the high dose group. No changes in food consumption and hematological parameters.
Method: Other: Guidelines for 28-day dose toxicity test of chemicals (Japan)
Year: 1994
GLP: YES
Test substance: p-tert-octylphenol, purity 98.24 %
Reference: [35]

Species/strain: **albino rat** (Sprague-Dawley)
Sex: 5 male, 5 female/group
Route of Administration: oral (gavage)
Exposure period: 29 days
Frequency of treatment: daily

Post exp. observation period: no
Dose: 0, 15, 150, 250 mg/kg/day
Control group: Yes, concurrent vehicle (corn oil)
NOEL: 15 mg/kg/day
LOAEL: 150 mg/kg/day
Results: A dose of 250 mg/kg caused the following effects:
- slightly higher food consumption in males and females
- markedly higher water consumption of male and female rats
- lower cholesterol-levels in female rats
- rel. liver and kidney weights were significantly higher in females
- minimal centrilobular hepatocyte enlargement in female rats
- interstitial inflammation in kidneys of males
- basophilic epithelium occasionally with mitotic figures in proximal convoluted tubules in male and female rats

A dose of 150 mg/kg led to the following symptoms:
- slightly higher food consumption in females
- higher water consumption of females
- lower cholesterol levels in female rats
- basophilic epithelium occasionally with mitotic figures in proximal convoluted tubules in male rats

Kidney	**Control**		**15 mg/kg/day**		**150 mg/kg/day**		**250 mg/kg/day**	
	♂	♀	♂	♀	♂	♀	♂	♀
Basophilic epithelium in descending part of the proximal convoluted tubule	1	0	1	1	5	0	4	5
Occasional mitoses in the basophilic epithelium	0	0	1	1	5*	0	4	5**
Interstitial inflammation	1	2	1	0	1	0	4	1
Total # animals examined	5	5	5	5	5	5	5	5
* P<0.05, ** P<0.01 with Fisher's Exact Test								
Liver								
minimal centrilobular hepatocyte enlargement	0	0	-	0	-	0	0	4*
Total # animals examined	5	5	-	5	-	5	5	5
* P<0.05 with Fisher's Exact Test								

Method: OECD 407; Year: 1994
GLP: YES
Test substance: Octylphenol, purity 98.7%
Reference: [50]

5.5 GENETIC TOXICITY IN VITRO

A. BACTERIAL TEST

Type:	Ames test
System of testing:	**Salmonella typhimurium** TA 98, TA 100, TA 1535, TA 1537, TA 1538
Concentration:	0 – 5000 ug/plate
Metabolic activation:	no data
Results:	Genotoxic effects: negative
Method:	Directive 84/449/EEC
GLP:	YES
Test substance:	p-octylphenol, purity 95%
Remarks:	Solvent: DMSO; Year:1984
Reference:	[30]

Type:	Ames test
System of testing:	**Salmonella typhimurium** TA 98, TA 100, TA 1535, TA 1537
Concentration:	0 – 12500 ug/plate
Metabolic activation:	with and without S-9-mix
Results:	Genotoxic effects: negative
Test method:	other: according to Ames et al, Mutat. Res. 31, 347-364 Year: 1982
GLP:	NO
Test substance:	95 % isooctylphenol, containing 93.1% p-octylphenol
Remarks:	Solvent: ethanol
Reference:	[31]

Type:	Bacterial gene mutation study
System of testing:	**S. typhimurium** TA100, TA1535, TA98, TA 1537 **E.coli** WP2 uvrA
Concentration:	S. typhimurium 0, 1.56, 3.13, 6.25, 12.5, 25, 100, 200 ug/plate E.coli 0, 125, 250, 500, 1000, 2000 ug/plate
Metabolic activation:	with and without
Results:	
Cytotoxicity conc:	with metab. activation: 200 ug/plate without activation: 25 ug/plate
Precipitation conc:	no data
Genotoxic effects:	E.coli and S. typhimurium: with metab. activation: negative without activation: negative
Method	other: Guidelines for Screening Mutagenicity Testing of Chemicals (Japan); Year: 1994
GLP:	YES
Test substance:	p-tert-octylphenol, purity >97%
Remarks:	S9: rat liver, induced with phenobarbital and 5,6-benzoflavone
Reference:	[35]

B. NON-BACTERIAL IN VITRO TEST

Type:	Chromosomal aberration
System of testing:	**Chinese hamster CHL cells**
Concentration:	-S9: 0, 0.004, 0.008, 0.016 mg/ml +S9: 0, 0.010, 0.020, 0.040 mg/ml
Metabolic activation:	with and without
Results:	
Cytotoxicity conc:	with metabol. activation: >0.04 mg/ml without activation: >0.16 mg/ml
Precipitation conc:	not reported
Genotoxic effects:	with metabolic activation: negative without activation: negative
Method:	other: Guideline for Screening Mutagenicity Testing of Chemicals (Japan); Year: 1994
GLP:	YES
Test substance:	p-tert-octylphenol, purity >97%
Remark:	S9: rat liver, induced by phenobarbital and 5,6-benzoflavone
Reference:	[35]

5.6 GENETIC TOXICITY IN VIVO

No test results available

5.7 CARCINOGENICITY

No test results available

5.8 TOXICITY TO REPRODUCTION

Type:	Reproduction/developmental screening test
Species:	rat
Sex:	12 females, 12 males
Route of administration:	gavage
Exposure period:	2 week prior mating, 2 week mating, until day 4 post partum
Frequency of treatment:	daily
Post exposure observation period:	no
Duration of the test:	6 weeks
Doses:	125, 250, 500 mg/kg bw/day
Control group:	Yes
NOAEL parental:	125 mg/kg
NOEL offspring:	250 mg/kg

Results: 500 mg/kg produced severe toxic effects resulting in the death of 13 adult animals (9 males, 4 females) during the treatement period. Other toxicity signs were:
- post dose salivation, wet coats, matted fur, brown stained urogenital region, loose faeces, hunched posture, emaciation, lethargy and abnormal gait.
- bodyweight gain and food consumption reduction, water consumption markedly increased.
- increased number of white blood cells and platelets, increase level of plasma urea nitrogen, creatinine,

bilirubin and GPT. Lower level of electrolytes and circulating albumin.
- increased liver, kidney and adrenal weights.
- decreased weights of specific reproductive organes (testes, epididymes, ovaries and combined prostate/seminal vesicles/coagulating gland).
- minor microscopic changes in the testes and epididymes.

Reproductive effects were:
- impaired mating performance with only 4 of the 8 paired females conceiving.
- amongst females that did conceive, mating performance was unaffected although the duration of pregnancy was langer than expected.
- libido unaffected for males, but fertility lowered.
- reduced implantation rate and increased pre and post natal mortality resulting in lower litter size.
- reduced litter weight and suggestion of impaired pup growth to day 4.
- no grass abnormalities amongst the offspring.

250 mg/kg induced reactions including:
- post dose salivation, wet coats, loose faeces.
- reduced bodyweight gain for all animals, for females bodyweight gain also affected at the end of pregnancy/early lactation.
- increased water consumption.
- no obvious haematological or biochemical changes, but increased liver and slightly increased kidney weights.
- microscopic examinations on testes and epididymides of males revealed no abnormalities.

There were no effects of treatment on mating performance or development of the litter at this dosage.

125 mg/kg induced only post dose salivation and slightly elevated water consumption.

Method: OECD guideline 421 (dated 12 January 1993)

GLP: Yes

Test substance: 4 (1, 1, 3,3-tetramethyl-butyl) phenol; purity 98.7%

Reference: [51]

5.10 OTHER RELEVANT INFORMATION

A. Specific toxicities

Type: Depigmentation study
Test species/strains: **black C57 mice**
Test results: depigmentation of skin 9 weeks after starting
Test method: other: subcutaneous injections of

	0.05 ml solution, 6 times a week, during 7 months.
GLP:	no data
Test substance:	0.01 M solution of p-octylphenol in olive oil

Remark: In vitro studies showed that p-tert.-octylphenol inhibited cresolase activity associated with the enzyme tyrosinase obtained from potato rind.
Reference: [32]

B. Toxicodynamics, toxico-kinetics
No information available

5.11 EXPERIENCE WITH HUMAN EXPOSURE

Octylphenol-polyethoxylates are prepared by the addition of ethylene oxide to octylphenol under pressure. The explosivity and toxicity of ethylene oxide make it necessary that all operations and equipment are closed to the atmosphere. Thus and due to the closed system during manufacturing of OP worker exposure is minimized.

Nevertheless potential exposure to OP exists during filter changing, catalyst bed changing, bulk loading and unloading, reactor sampling and octylphenol flaking, but these operations are carried out only a few times or intermittently during the year and involve only brief periods of potential exposure. These operations involve one or two workers who are wearing protective gloves and eyewear.
Fewer than 200 employees from companies on the octylphenol panel work in positions where exposure to octylphenol may occur, and none of the manufacturers produces OP during the whole year.
Reference: [40]

Two female workers suffered depigmentation of the skin after they had been exposed to two alkaline detergents containing polyethoxylene alkylphenylether. Analysis if the detergents revealed the contamination with free alkylphenol, possibly octylphenol. Concentrations unknown.
Reference: [33]

Some cases of vitiligo are reported among workers exposed to resins and detergents containing octylphenol (Russian and Japanese experiences). Concentrations were not reported.
Reference: [34]

Octylphenol was detected in urinary samples of workers employed in a plant manufacturing this compound. The higher the level of exposure the greater the concentrations found. The most exposed workers had a content of Octylphenol in urine in the range of 1.6 to 4.8 ug/ml during working period.
Reference: [38]

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ANNEX 1

Relevant Data of Nonylphenol

Production range

Worldwide production of alkylphenol polyethoxylates (APnEO) is estimated to be 300'000 t/y out of which **80%** are nonylphenol polyethoxylates (NPnEO) and nearly **20%** octylphenol polyethoxylates (OPnEO). **60%** of all APnEO are supposed to end in the aquatic environment. 1700 t/y of NPnEO were used in Switzerland in 1982 (Reference: [5])

Environmental monitoring data (Switzerland) on NP

Average concentration in untreated wastewater:	0.0033 mg/l [1] (1.5 * 10 $^{-7}$ M)
Average concentration in STP effluents:	0.007 mg/l [1] (3.2 * 10 $^{-8}$ M)
Maximum concentration in STP effluents:	0.030 mg/l [2] (1.5 * 10 $^{-7}$ M)
Average concentration in rivers:	0.002 mg/l [1] (8.5 * 10 $^{-9}$ M)
Average concentration in river Glatt:	0.004 mg/l [4] (1.8 * 10 $^{-8}$ M)
Average concentration in sewage sludge:	82.3 mg/kg d.m. [2]
Average conc. in digested sewage sludge:	1.0 g/kg d.m. [4]
Av. conc. in sludge with aerobic stabilization:	0.3 g/kg d.m. [5]
Effluent from the anaerobic sludge digester:	0.47 mg/l [4] (2.1 * 10 $^{-6}$ M)
Average concentration in sediments:	4.075 mg/kg dryweight [3]

Fate of NPnEO in sewage treatment plants

17% w/w of the NPnEO in raw wastewater are finally transferred to NP in sewage sludge (190t out of 1250 t). By anaerobic sludge treatment, large amounts of NP are formed by the degradation of NP1EO and further educts. (Reference [5]) Average elimination of NP in STPs was measured as **65%** and average elimination of NPc (all NP compounds and degradation products) was 60% (elimination=(conc.prim.effl-conc.sec.effl.)/conc.prim.effl.*100%). The output NP mass flow from STP Zurich-Glatt was 7.5 times higher than the input.
Most of the NP released to the environment (90%) is disposed via sewage sludge, the rest via sewage effluents.
(Reference [6])

Bioaccumulation of Nonylphenol

Concentration measurements [7)]

Cladophora glomerata (algae):	38.0	mg/kg dryweight
Fontinalis antipyretica (algae):	4.2	mg/kg d.w.
Pontamogeton crispus (algae):	2.5	mg/kg d.w.
Salmo gairdneri (fish):	1.6	mg/kg d.w.
Barbus barbus (fish):	1.0	mg/kg d.w.
Squalius cephalus (fish):	1.4	mg/kg d.w.
Anas boscas (duck):	1.2	mg/kg d.w.

Remark: NP showed in fish a tendency to accumulate in the liver, for mostly, the highest concentrations have been found therein. In edible parts of the fish concentrations in the range of 0.15 to 0.78 mg/kg have been detected.

Calculated bioconcentration factors [7)]

Cladophora glomerata:		10'000
Fontinalis antipyretica:		1'100
Potamogeton crispus:		600
Salmo gairdneri:		410
Barbus barbus:		250
Squalis cephalus:		360
Gasterosteus aculeatus (fish)*:	up to	1300
Mytilus edulis (mussel)*:	up to	3400
Field test with caged mussels*:		320

*) in laboratory experiments

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