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ALKANES, C_{10-13}, CHLORO
(Short chain length chlorinated paraffins)

CAS-No.: 85535-84-8

EINECS-No.: 287-476-5

Summary risk assessment report

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SUMMARY RISK ASSESSMENT REPORT

Final report, October 1999

United Kingdom

The UK rapporteur for the risk evaluation of C_{10-13} chloroalkanes is the Environment Agency and the Health & Safety Executive acting jointly. The scientific work on the environmental part was prepared by the Building Research Establishment (BRE), by order of the rapporteur.

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PREFACE

This report provides a short summary with conclusions of the risk assessment report of the substance alkanes, C_{10-13}, chloro that has been prepared by the United Kingdom in the context of Council Regulation (EEC) No. 793/93 on the evaluation and control of existing substances. For detailed information on the risk assessment principles and procedures followed, the underlying data and the literature references, the reader is referred to the original risk assessment report that can be obtained from the European Chemicals Bureau[1]. The present summary report should preferably not be used for citation purposes.

[1] http://ecb.ei.jrc.it

CONTENTS

1 GENERAL SUBSTANCE INFORMATION

The EINECS substance "C_{10-13} chloroalkanes" - more generally known as short chain length chlorinated paraffins (or SCCPs) - is actually a complex mixture due to the range of molecular chain lengths and degrees of chlorination. General substance information and some typical physico-chemical properties are shown in **Table 1.1**.

Table 1.1 Identification and physico-chemical properties

Property	Chlorine content (%w/w)	Value/remark	
Molecular formula		$C_xH_{(2x-y+2)}Cl_y$, where x = 10 to 13 and y = 1 to x	
Molecular weight		~320-500 g/mole	
Synonyms		Alkanes, chlorinated; alkanes (C_{10-13}), chloro-(50-70%); alkanes (C_{10-12}), chloro-(60%); chlorinated alkanes; chlorinated paraffins; chloroalkanes; chlorocarbons; polychlorinated alkanes; paraffins-chlorinated; short chain length chlorinated paraffins; SCCPs.	
Physical state at ntp	49-70	Viscous liquid	
Pour point	49	-30.5°C (commercial mixtures - no distinct melting point)	
	70	+20.5°C (commercial mixtures - no distinct melting point)	
Boiling point		>200°C (decomposition with release of hydrogen chloride) at 101.3 kPa	
Density	49-70	1.2-1.6 g/cm^3 (at 25°C)	
Vapour pressure	50	0.021 Pa (at 40°C)	
Water solubility	59	0.15-0.47 mg/l (at 20°C)	
Log octanol-water partition coefficient (log K_{ow})	49	4.39-6.93	measured by a high performance thin layer chromatography method
	60	4.48-7.38	
	71	5.37-8.01	
Flash point	50	166 °C (closed cup)	
	56	202 °C	
Autoflammability		Not stated (decomposes above 200°C)	
Explosivity		Not explosive	
Oxidising properties		No oxidising properties	

Classification according to Annex I of 67/548/EEC:
Carcinogen Category 3: R40, with the symbol Xn; and
Dangerous for the Environment, with the symbol N

Risk phrases:	R40	Possible risk of irreversible effects
	R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

2 USE PATTERN

≤15,000 tonnes/year of SCCPs are currently manufactured by two producers in the EU. The main uses in Europe are as extreme pressure additives in metal working fluids (~70%), flame retardants in rubbers (~10%), plasticisers/flame retardants in paints and coatings (~9%) and sealants/adhesives (~5%), fat liquoring agents in leather processing (~3%) and flame retardants in textiles (~1.5%). There has been a general decline in the amounts of SCCPs used within Europe, particularly for metal working and leather processing.

3 ENVIRONMENTAL RISK ASSESSMENT

3.1 ENVIRONMENTAL EXPOSURE

The major characteristics of SCCPs relevant for the exposure assessment are:
- no hydrolysis in water;
- not readily or inherently biodegradable;
- high log K_{ow} values (4.4-8); and
- an estimated atmospheric half-life of 1.9-7.2 days.

The high log K_{ow} values imply a high potential for bioaccumulation, strong sorption to sewage sludge, soils and sediments and very low mobility in soil. High bioconcentration factors (whole body values ranging from 1,000 to 50,000, with high values for individual tissues) have been reported with a variety of freshwater and marine organisms. SCCPs are taken up rapidly, although most studies report moderate loss of bioaccumulated material on return to clean water.

It is estimated that in sewage treatment plants 93% of any discharged SCCPs will be adsorbed on to sludge, and the remaining 7% will remain in the water, based on the results of a Coupled Units Test. Despite the high adsorption potential of the substance onto soil and sediment, a small but not insignificant fraction is predicted to distribute into water and air. This means that SCCPs may be slightly mobile in the environment and so a small fraction of the release may be transported over a wide area away from sources of release.

Release information

Releases from production have been estimated from site specific information. Industry information has also been used to estimate emissions from the manufacture and use of metal working fluids (two different release rates are used to cover the variation in estimates of use). Information from Canadian regulatory sources was used to estimate releases from use in rubber. No specific information was found for use in leather treatment formulations, and so default release factors from the EU Technical Guidance Document (TGD) were used. Releases from use in paints, sealing compounds and textiles are expected to be negligible.

The methods in the TGD were used to estimate predicted environmental concentrations (PECs) for water, sediment, sewage treatment plants, air, soil and biota (fish only - the PEC for earthworms is unrealistic and so has been ignored). **Table 3.1** shows the PECs calculated for the various stages of the lifecycle of SCCPs, including regional concentrations. The calculated levels in air are very low for all life cycle stages and so are not presented here. The majority of the PECs in the regional (and continental) scenarios are consistent with measured data. There are not enough measured data available to make any judgement on the validity of the PECs for the local emission scenarios.

3.2 ENVIRONMENTAL EFFECTS

Aquatic compartment (including sediment and wastewater treatment plant)

Measurements of both short- and long-term toxicity are available for fish, invertebrates and algae. The lowest “no observed effect concentration” from these was 0.005 mg/l for a 21 day

multi-generation study on the water flea *Daphnia magna* using a 58% chlorinated C_{10-12} chloroalkane. In accordance with the TGD, an assessment factor of 10 is applied to this value to give a predicted no effect concentration (PNEC) of 0.5 µg/litre for the aquatic compartment.

There are no toxicity data for sediment-dwelling organisms and so a provisional PNEC has been calculated using the equilibrium partitioning method described in the TGD. Using a representative $\log K_{ow}$ of 6 gives a tentative PNEC of 0.88 mg/kg for the sediment compartment. However, to take account of the ingestion of the sediment-bound substance by sediment-dwelling organisms the calculated PEC/PNEC ratio is multiplied by a factor of 10 for substances with a log K_{ow} greater than 5, in accordance with the TGD.

SCCPs show low toxicity to the anaerobic micro-organisms tested. The lowest concentration reported to be toxic over a 24-hour period was 600 mg/l. Applying an assessment factor of 100 to this gives a $PNEC_{micro\text{-}organisms}$ of 6 mg/l.

Terrestrial compartment

There are no toxicity studies available on soil-dwelling organisms. As for sediment, a provisional PNEC for soil of 0.80 mg/kg has been calculated using the equilibrium partitioning method. Again, the calculated PEC/PNEC ratio has to be increased by a factor of 10 to take account of possible direct ingestion of soil-bound residues.

Atmosphere

No data are available. However, atmospheric concentrations are likely to be very small, and so biotic and abiotic effects are unlikely.

Non-compartment specific effects relevant to the food chain (secondary poisoning)

Slight effects on reproduction were seen at a dose of 1,000 mg/kg food during a 22-week mallard duck reproduction study. The highest concentration without adverse effects from the study is 166 mg/kg food. Applying an assessment factor of 10 to this gives a $PNEC_{oral}$ of 16.6 mg/kg food.

3.3 ENVIRONMENTAL RISK CHARACTERISATION

The realistic worst case PEC/PNEC ratios are summarised in **Table 3.1**. A ratio greater than 1 indicates a potential concern.

Aquatic compartment (including sediment)

The PEC/PNEC ratios indicate a significant risk to aquatic organisms local to release sources from both manufacture and use of metal working fluids and leather processing formulations. Since further information is unlikely to change the PEC/PNEC ratios significantly, risk reduction measures should be considered for these uses (**conclusion iii**).

The PEC/PNEC ratios for sewage treatment are <1 for all scenarios considered, indicating that the risk to wastewater treatment plants from the production and use of SCCPs is low (**conclusion ii**).

Table 3.1 Summary of PECs and PEC/PNEC ratios

Media	Release source	PEC	PEC/PNEC
Surface water	Production (site specific)	<0.36 and <0.43 µg/l	<0.72 and <0.86
	Metal working (formulation)	4.3 µg/l	8.6
	Metal working (use)	1.4 or 5.0 µg/l[1]	2.8 or 10
	Rubber formulations	<0.34 µg/l	<0.68
	Paints and sealing compounds	negligible	negligible
	Leather (formulation)	77 µg/l	154
	Leather (use)	77 µg/l	154
	Textile applications	negligible	negligible
	Regional sources	0.33 µg/l	0.66
Sediment	Production (site specific)	<0.71 and <0.84 mg/kg	<8.1 and <9.5
	Metal working (formulation)	8.5 mg/kg	97
	Metal working (use)	2.8 or 9.9 mg/kg[1]	32 or 113
	Rubber formulations	<0.67 mg/kg	<7.6
	Paints and sealing compounds	negligible	negligible
	Leather (formulation)	153 mg/kg	1,740
	Leather (use)	153 mg/kg	1,740
	Textile applications	negligible	negligible
	Regional sources	1.16 mg/kg	13
Sewage treatment plant	Production (site specific)	<3.6 and <4.3 µg/l	<0.01 and < 0.01
	Metal working (formulation)	43 µg/l	<0.01
	Metal working (use)	14 or 50 µg/l[1]	<0.01
	Rubber formulations	<3.4 µg/l	<0.01
	Paints and sealing compounds	negligible	negligible
	Leather (formulation)	770 µg/l	0.13
	Leather (use)	770 µg/l	0.13
	Textile applications	negligible	negligible
Soil	Production (site specific)	negligible	negligible
	Metal working (formulation)	20.1 mg/kg	251
	Metal working (use)	5.1 or 23.2 mg/kg[1]	64 or 290
	Rubber formulations	<0.073 mg/kg	<0.92
	Paints and sealing compounds	negligible	negligible
	Leather (formulation)	385 mg/kg	4,813
	Leather (use)	385 mg/kg	4,813
	Textile applications	negligible	negligible
	Regional sources	10.8 mg/kg	135
Secondary poisoning (concentration in fish)	Production (site specific)	2.6 mg/kg	0.16
	Metal working (formulation)	15.5 mg/kg	0.96
	Metal working (use)	5.9 or 17.6 mg/kg[1]	0.37 or 1.1
	Rubber formulations	<2.64 mg/kg	<0.17
	Paints and sealing compounds	negligible	negligible
	Leather (formulation)	41.2 mg/kg	2.6
	Leather (use)	41.2 mg/kg	2.6
	Textile applications	negligible	negligible
	Regional sources	2.6 mg/kg	0.16

[1] two different release factors were used to estimate the exposure

For the sediment compartment, the screening assessment gives PEC/PNEC ratios >1 for all scenarios except for use in paints, sealing compounds and textiles. Further information and/or testing could refine both the PEC and PNEC (e.g. monitoring data, or toxicity studies on sediment-dwelling organisms), although this should await the outcome of the proposed risk reduction strategy (**conclusion i**).

Terrestrial compartment

The screening assessment for soil gives PEC/PNEC ratios >1 for formulation and use for both metal working fluids and leather processing fluids, and for regional releases. Again further information and/or testing could refine both the PEC and PNEC (e.g. monitoring data, or toxicity studies on soil-dwelling organisms), although this should await the outcome of the proposed risk reduction strategy (**conclusion i**).

Atmosphere

Biotic and abiotic risks are unlikely because of limited atmospheric release and low volatility. One possible area of concern is long range atmospheric transport. This is currently being discussed within the appropriate international fora.

Non-compartment specific effects relevant to the food chain (secondary poisoning)

Based on the screening approach, the PEC/PNEC ratios indicate a risk of secondary poisoning of predators through the food chain from use in metal working (where the higher release factor is used), and both manufacture and use of leather processing fluids. Risk reduction measures for these use areas are required for the aquatic compartment and these should also reduce the risk of secondary poisoning (**conclusion iii**).

4 HUMAN HEALTH

4.1 HUMAN HEALTH (TOXICITY)

4.1.1 Exposure assessment

Occupational exposure

SCCPs are viscous non-volatile liquids and therefore skin contact is the predominant occupational route of exposure. However, there is a potential for significant inhalation exposure during the formulation of hot melt adhesives, in the use of metal working fluids and during the spraying of paints, coatings and adhesives containing SCCPs. Although there is no information available on the extent of absorption of SCCPs following their inhalation, toxicokinetic data indicate that they are likely to be poorly absorbed via the dermal route.

The number of persons potentially exposed within the EU is expected to be in the order of one million, largely in the metal working fluids sector. The potential exposure scenarios and resulting exposures are summarised in **Table 4.1**.

Table 4.1 Summary of worst-case exposures to workers

Scenario	Inhalation		Dermal	
	Duration	Concentration	Duration	Concentration
Manufacture	8-hour TWA	0.1 ppm (2.1 mg/m^3)	8-hour day	1 mg/cm^2
Formulation low temperature	8-hour TWA	0.1 ppm (2.1 mg/m^3)	8-hour day	1 mg/cm^2
Formulation high temperature	8-hour TWA	3 ppm (63 mg/m^3)	8-hour day	1 mg/cm^2
Metal working fluids	8-hour TWA	1.15 mg/m^3 *	8-hour day	0.1 mg/cm^2
Leather and textile treatment	8-hour TWA	Negligible	8-hour day	0.3 mg/cm^2
Leather and textile use	8-hour TWA	Negligible	8-hour day	Negligible
Paints, adhesives & sealants	8-hour TWA	0.32 mg/m^3	8-hour day	0.1 mg/cm^2
Rubber products, processing and use	8-hour TWA	Negligible	8-hour day	Negligible

* Based on data; all other figures are modelled estimates

Exposure to Consumers

Consumer exposure may arise from the use of treated finished products or following their application (leather, textiles, plastics and rubber, paints, adhesives and sealants) during the application process (paints, adhesives, sealants) and during the process of use (metal working fluids). The potential exposure scenarios and resulting exposures are summarised in **Table 4.2**.

Table 4.2 Summary of exposure to consumers

Scenario	Inhalation		Dermal	
	Duration	Concentration (dose)	Duration	Concentration (dose)
Leather slippers		Negligible	Daily	(<10 mg)
Leather clothing		Negligible	Daily	(137 mg)
Textiles		Negligible		Negligible
Metal working fluids	Per event, over two hours	0.115 mg/m^3 (0.3 mg)	Per event, over two hours	0.1 mg/cm^2 (200 mg)
Paints, sealants & adhesives		Negligible		Negligible
Rubber products		Negligible		Negligible

Exposure to Man via the Environment

SCCPs have several uses that can result in releases into surface water, for instance use in metal working fluids. They have been shown to bioconcentrate in aquatic organisms and have been detected in some items of food. Very low levels are expected to occur in air. The main source of exposure of humans via the environment is therefore likely to be via food and, to a lesser extent, drinking water.

The EUSES predictions considerably overestimate human exposure via the environment, specifically in the predictions for root crops. However, real data clearly indicate the potential for human uptake. The value of 20 µg/kg/day is considered to be a reasonable worst case prediction based upon real data and has been used in the risk assessment to represent both local and regional exposure.

4.1.2 Effects assessment: Hazard identification and dose (concentration) - response (effect) assessment

Very little toxicological information is available from studies in humans, although there is a reasonable database for chlorinated paraffins as a group from animal studies. The available animal data do not allow a direct comparison for every toxicological endpoint of the effects of SCCPs, with differing chain length and degree of chlorination. However, the information available from acute studies and skin irritation studies indicates that the intensity and nature of effects for these endpoints are independent of chain length and degree of chlorination.

There is very limited information on toxicokinetics. No information is available on absorption via the inhalation route. A study in animals via the oral route indicates that significant absorption (60%) does occur. Studies in animals (on a longer chain substance) and humans indicate that absorption via the dermal route will be low.

For the purposes of risk assessment, when calculating the systemic dose, absorption via the inhalation route was assumed to be 100% of the inhaled amount, via the oral route 100% of the swallowed amount and via the dermal route 1% of the amount applied to the skin. These are considered to be very conservative assumptions.

Assessment of the available data clearly indicates that SCCPs are of low acute toxicity in animals. Limited information indicates that they do not cause skin irritation in humans and in animal studies, at most, minimal skin and mild eye irritation were reported. More pronounced skin irritation was observed in animals following repeated exposure presumably because of defatting. No conclusions can be drawn from the information available on skin sensitisation in humans. However, well-conducted studies in animals have shown that SCCPs do not have the potential to produce skin sensitisation. Although there is no information on respiratory sensitisation in humans or animals, it is significant that no such effects have been reported in humans despite their widespread use. There is no information on the health effects in humans of repeated exposure. The principal signs of toxicity in animals were effects in the liver and thyroid. However, mechanistic information has indicated that these effects are probably not relevant to human health. NOAELs of 100 and 1000 mg/kg/day were identified in rats and mice respectively for other signs of toxicity, such as decreased body weight gain and increased kidney weight, which may be relevant to human health.

SCCPs were not mutagenic in bacterial cell systems. No standard in vitro cytogenetics studies were available but a gene-mutation assay was negative. Well-conducted in vivo studies indicate that SCCPs do not produce mutagenicity in somatic or germ cells. Overall the evidence indicates that SCCPs are not mutagenic.

No information is available on carcinogenicity studies in human populations potentially exposed to exclusively SCCPs. In rodent carcinogenicity studies, dose-related increases in the incidence of adenomas and carcinomas were observed in the liver, thyroid and kidney. Other cancers seen were dismissed as not significant. The characteristic patterns in the results and the probable underlying mechanisms indicate that in the liver chronic tissue damage was caused by peroxisome proliferation and that in the thyroid there was long-term hormonal stimulation, potentially consequent to the liver effects. Consideration of the likely underlying mechanisms for these tumours suggests that they are not relevant to human health.

The kidney adenomas (benign) were seen exclusively in male rats. It is considered likely that the underlying mechanism is the male rat-specific phenomenon of hyaline droplet nephropathy, although this has not been clearly demonstrated. The Specialised Experts concluded that there was insufficient evidence to conclude a male rat specific event and that the consequences for humans could not be ruled out. Given that SCCPs are not genotoxic, it is considered that there would be no risk of kidney tumour development associated with exposures lower than those required to produce chronic toxicity in this target organ. The NOAEL for kidney toxicity in male rats, identified at 100 mg/kg/day was therefore used as the NOAEL for kidney carcinogenicity [N.B. this appraisal of carcinogenicity data reflects the position at the time the risk assessment was agreed (1997)].

There are no data available in humans or animals on fertility although no changes were seen in the reproductive organs in rats and mice treated for 13 weeks with up to 5000 and 2000 mg/kg/day, respectively. There are no data available on developmental effects in humans. Developmental effects were produced in rats at a dose which also caused maternal toxicity (2000 mg/kg), but no developmental effects at lower doses (500 mg/kg and below). No developmental effects were observed in a study in rabbits, although maternally toxic doses were not tested. For the purposes of risk assessment, an NOAEL of 500 mg/kg/day has been used for developmental effects.

Overall, SCCPs are of low toxicity with the principal toxicological issue being for general non-specific toxicity following repeated exposure. NOAELs for general toxicity of 100 and 1000 mg/kg/day were identified in rats and mice respectively.

There are several gaps in the database, particularly with regard to differing chain length and degree of chlorination. However, taking into account the low toxicity observed in all available studies and the generally unreactive nature of SCCPs, it would appear unnecessary to attempt to fill these gaps with further testing.

4.1.3 Risk Characterisation

Occupational exposure

At the exposure levels presented, the only effects that are likely to be of concern are those arising from repeated exposures (doses), that is general toxicity, kidney carcinogenicity and developmental effects. When compared to the relevant NOAELs, in all but one case, the margin of safety is considered to be adequate, that is at least two orders of magnitude. While it is important not to read too much into simple ratios, this does suggest that, in general, the use of the substance is appropriately controlled. While certain uses imply a narrower margin of safety, these are not considered to be a cause for concern (**conclusion ii**).

Exposure to Consumers

At the exposure levels presented in **Table 4.2**, the only effects that are likely to be of concern are those arising from repeated exposures (doses), that is general toxicity, kidney carcinogenicity and developmental effects. When compared to the relevant NOAELs, the margins of safety are well over three orders of magnitude and, given the conservative nature of the exposure calculations, in all probability considerably more. While it is important not to read too much into simple ratios, this does suggest that the use of the substance poses no significant risk for consumers (**conclusion ii**).

Exposure to man via the environment

At the predicted level of exposure, the margins of safety are 5000 and 25000 for repeat dose/ carcinogenicity and developmental effects respectively. This suggests that the use of the substance poses no significant risk for man exposed via the environment (**conclusion ii**).

Combined Exposure

During occupational exposure to SCCPs, the highest potential uptake is estimated to occur during their formulation in hot melt adhesives (up to 9.3 mg/kg/day). An individual formulating hot melt adhesives may also be exposed as a consumer (0.02 mg/kg/day) and via the environment (0.02 mg/kg/day). A combined uptake of up to 9.3 mg/kg/day is therefore estimated for a very conservative worst case situation. Other occupational sources of exposure contribute to much lower systemic doses. This indicates that the risk from combined exposure is low (**conclusion ii**).

4.2 HUMAN HEALTH (PHYSICO-CHEMICAL PROPERTIES)

There are no risks from physico-chemical properties arising out of the use of SCCPs.

5 SUMMARY OF CONCLUSIONS

5.1 ENVIRONMENT

The use of SCCPs in paints, sealants and textiles is unlikely to pose a risk to the environment. In addition, risks to the function of sewage treatment plant and the atmosphere are expected to be very low for both production and all uses.

The use of SCCPs in the formulation and use of both metal working fluids and leather finishing fluids has been identified as presenting a risk to aquatic organisms in surface water due to local exposures, and also a risk of secondary poisoning of predators in the food chain (except for metal working fluid manufacture). *Risk reduction measures need to be considered for these uses*.

Possible risks to soil- and sediment-dwelling organisms have been identified for production of SCCPs (sediment only), formulation and use of both metal working and leather finishing fluids, use in rubber (sediment only), and at a regional level. Further information on both releases and toxicity to relevant organisms could refine the PEC/PNEC ratio. However, any risk reduction measures recommended as a result of the assessment of aquatic risks from metal working and leather finishing will also (either directly or indirectly) have some effect on the PECs for sediment and soil. The need for further information and/or testing should therefore be re-evaluated once the outcome of the risk reduction measures recommended for surface water is known.

5.2 HUMAN HEALTH

Under existing risk management controls the production and use of SCCPs present a low risk to human health.

GLOSSARY

Standard term / Abbreviation	Explanation / Remarks and Alternative Abbreviation(s)
Ann.	Annex
AF	assessment factor
BCF	bioconcentration factor
bw	body weight / *Bw, b.w.*
°C	degrees Celsius (centigrade)
CAS	Chemical Abstract System
CEC	Commission of the European Communities
CEN	European Committee for Normalisation
CEPE	European Committee for Paints and Inks
d	day(s)
d.wt.	dry weight / *dw*
DG	Directorate General
DT_{50}	period required for 50 percent dissipation (define method of estimation)
DT_{50lab}	period required for 50 percent dissipation under laboratory conditions (define method of estimation)
DT_{90}	period required for 90 percent dissipation (define method of estimation)
$DT_{90field}$	period required for 90 percent dissipation under field conditions (define method of estimation)
EC	European Communities
EC	European Commission
EC_{50}	median effective concentration
EEC	European Economic Community
EINECS	European Inventory of Existing Commercial Chemical Substances
EU	European Union
EUSES	European Union System for the Evaluation of Substances
f_{oc}	organic carbon factor (compartment depending)
g	gram(s)
gw	gram weight
GLP	good laboratory practice
h	hour(s)
ha	hectares / *h*
HPLC	high pressure liquid chromatography
IARC	International Agency for Research on Cancer
IC_{50}	median immobilisation concentration or median inhibitory concentration 1 / *explained by a footnote if necessary*
ISO	International Standards Organisation
IUPAC	International Union for Pure Applied Chemistry
kg	kilogram(s)
kPa	kilo Pascals
K_{oc}	organic carbon adsorption coefficient
K_{ow}	octanol-water partition coefficient

Kp	solid-water partitioning coefficient of suspended matter
l	litre(s) / *L*
log	*logarithm to the basis 10*
$L(E)C_{50}$	lethal concentration, median
m	meter
µg	microgram(s)
mg	milligram(s)
MOS	margins of safety
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level
OECD	Organisation for Economic Co-operation and Development
OJ	Official Journal
pH	potential hydrogen -*logarithm* (to the base 10) of he hydrogen ion concentration $\{H^+\}$
pKa	-*logarithm* (to the base 10) of the acid dissociation constant
pKb	-*logarithm* (to the base 10) of the base dissociation constant
Pa	Pascal unit(s)
PEC	predicted environmental concentration
PNEC(s)	predicted no effect concentration(s)
$PNEC_{water}$	predicted no effect concentration in water
(Q)SAR	quantitative structure activity relation
STP	sewage treatment plant
TGD	Technical Guidance Document[2]
UV	ultraviolet region of spectrum
UVCB	Unknown or Variable composition, Complex reaction products or Biological material
v/v	volume per volume ratio
w/w	weight per weight ratio

[2] Commission of the European Communities, 1996. Technical Guidance Document in Support of the Commission Directive 93/67/EEC on risk assessment for new substances and the Commission Regulation (EC) No 1488/94 on risk assessment for existing substances. Commission of the European Communities, Brussels, Belgium. ISBN 92-827-801[1234]