Attachment 6 Sediment Toxicity Reference Values for Chlordane and DDTs

Analyte	Test Species	Marine or Fresh-water	NOAEL (µg/kg dw)	LOAEL (µg/kg dw)	Exposure Duration	Endpoint	Source	Notes
Chlordane	amphipod AET	marine	2.8	na	10 days	AET	Gries and Waldow (1996)	AET values for chlordane amphipod 2.8, echinoderm >4.5 µg/kg dw or 0.16 >0.26 mg/kg OC.
Chlordane	all components of the aquatic ecosystem (e.g., bacteria, algae, macrophytes, invertebrates, fish) were considered, if data were available	freshwater	4.5	8.87	na	ISQG for NOAEL PEL for LOAEL	Canadian environmental quality guidelines (CCME 2002)	Sediment guidelines published by Environment Canada. A comprehensive review of the scientific literature performed for each substance. Each toxicological study retrieved from the scientific literature was evaluated for its overall acceptability to ensure that high-quality data were used in developing SQGs.
Chlordane	all components of the aquatic ecosystem (e.g., bacteria, algae, macrophytes, invertebrates, fish) were considered, if data were available	marine	2.26	4.79	na	ISQG for NOAEL PEL for LOAEL	Canadian environmental quality guidelines (CCME 2002)	Sediment guidelines published by Environment Canada. A comprehensive review of the scientific literature performed for each substance. Each toxicological study retrieved from the scientific literature was evaluated for its overall acceptability to ensure that high-quality data were used in developing SQGs.
Chlordane	varied	freshwater	na	17.6	na	consensus-based PEC	Ingersoll et al. (2000)	Consensus-based PEC based on PEL 8.9, SEL 60, TEL 30, and ERM 6 µg/kg dw.
p,p-DDE	benthic AET	marine	9	na	na	AET	Gries and Waldow (1996)	AET values for p,p-DDE amphipod 62, echinoderm 9.3, benthic 9.0 µg/kg dw or 6.0, >7.3, 0.31 mg/kg OC
DDE (sum of p,p and o,p isomers)	all components of the aquatic ecosystem (e.g., bacteria, algae, macrophytes, invertebrates, fish) were considered, if data were available	freshwater	1.42	6.75	na	ISQG for NOAEL PEL for LOAEL	Canadian environmental quality guidelines (CCME 2002)	Sediment guidelines published by Environment Canada. A comprehensive review of the scientific literature performed for each substance. Each toxicological study retrieved from the scientific literature was evaluated for its overall acceptability to ensure that high-quality data were used in developing SQGs.
DDE (sum of p,p and o,p isomers)	all components of the aquatic ecosystem (e.g., bacteria, algae, macrophytes, invertebrates, fish) were considered, if data were available	marine	2.07	374	na	ISQG for NOAEL PEL for LOAEL	Canadian environmental quality guidelines (CCME 2002)	Sediment guidelines published by Environment Canada. A comprehensive review of the scientific literature performed for each substance. Each toxicological study retrieved from the scientific literature was evaluated for its overall acceptability to ensure that high-quality data were used in developing SQGs.
sum DDE	varied	freshwater	na	31.3	na	consensus-based PEC	Ingersoll et al. (2000)	Consensus-based PEC based on PEL 6.75, SEL 190, TEL 50, and ERM 15 µg/kg dw.

Analyte	Test Species	Marine or Fresh-water	NOAEL (µg/kg dw)	LOAEL (µg/kg dw)	Exposure Duration	Endpoint	Source	Notes
4,4- DDE	varied	marine and estuary	2.2	27	na	ERL for NOAEL ERM for LOAEL	Long et al. (1995)	Marine and estuarine data compilation BEDS from lab spike sediment bioassays; field studies, and equilibrium partitioning studies; NOTE- relationship between incidence of effects and the concentration of total DDT and 4,4'-DDE was poor (only 50% incidence of effects were observed above the median concentration; for other chemicals incidence was 80 to 100% above the median concentration).
p,p,-DDD	benthic AET	marine	16	na	na	AET	Gries and Waldow (1996)	AET values for p,p-DDD amphipod 63, echinoderm 28, benthic 16 µg/kg dw or 3.1, 1.6, 1.0 mg/kg OC.
DDD (sum of p,p and o,p isomers)	all components of the aquatic ecosystem (e.g., bacteria, algae, macrophytes, invertebrates, fish) were considered, if data were available	freshwater	3.54	8.51	na	ISQG for NOAEL PEL for LOAEL	Canadian environmental quality guidelines (CCME 2002)	Sediment guidelines published by Environment Canada. A comprehensive review of the scientific literature performed for each substance. Each toxicological study retrieved from the scientific literature was evaluated for its overall acceptability to ensure that high-quality data were used in developing SQGs.
DDD (sum of p,p and o,p isomers)	all components of the aquatic ecosystem (e.g., bacteria, algae, macrophytes, invertebrates, fish) were considered, if data were available	marine	1.22	7.81	na	ISQG for NOAEL PEL for LOAEL	Canadian environmental quality guidelines (CCME 2002)	Sediment guidelines published by Environment Canada. A comprehensive review of the scientific literature performed for each substance. Each toxicological study retrieved from the scientific literature was evaluated for its overall acceptability to ensure that high-quality data were used in developing SQGs.
sum DDD	varied	freshwater	na	28	na	consensus-based PEC	Ingersoll et al. (2000)	Consensus-based PEC based on PEL 8.51, SEL 60, TEL 60, and ERM 20 µg/kg dw
DDD	*Hyalella azteca*	freshwater	1,200	4,000	42 days	survival	Ingersoll et al. (2005)	Sediment concentrations reported as µg/g OC. TOC = 1%.
DDD	*Hyalella azteca*	freshwater	na	30	42 days	growth	Ingersoll et al. (2005)	Sediment concentrations reported as µg/g OC. TOC = 1%.
DDD	*Hyalella azteca*	freshwater	1,200	4,000	42 days	reproduction	Ingersoll et al. (2005)	Sediment concentrations reported as µg/g OC. TOC = 1%.
DDT	*Rhepoxynius abronius*	marine	na	6,180	10 days	survival (LC50)	Murdoch et al. (1997)	Reported as LC50 6.18 mg/kg dw.
DDT (sum of p,p and o,p isomers)	all components of the aquatic ecosystem (e.g., bacteria, algae, macrophytes, invertebrates, fish) were considered, if data were available	marine	1.19	4.77	na	ISQG for NOAEL PEL for LOAEL	Canadian environmental quality guidelines (CCME 2002)	Sediment guidelines published by Environment Canada. A comprehensive review of the scientific literature performed for each substance. Each toxicological study retrieved from the scientific literature was evaluated for its overall acceptability to ensure that high-quality data were used in developing SQGs.

Analyte	Test Species	Marine or Fresh-water	NOAEL (µg/kg dw)	LOAEL (µg/kg dw)	Exposure Duration	Endpoint	Source	Notes
DDT (sum of p,p and o,p isomers)	all components of the aquatic ecosystem (e.g., bacteria, algae, macrophytes, invertebrates, fish) were considered, if data were available	freshwater	1.19	4.77	na	ISQG for NOAEL PEL for LOAEL	Canadian environmental quality guidelines (CCME 2002)	Sediment guidelines published by Environment Canada. A comprehensive review of the scientific literature performed for each substance. Each toxicological study retrieved from the scientific literature was evaluated for its overall acceptability to ensure that high-quality data were used in developing SQGs.
sum DDT	varied	freshwater	na	62.9	na	consensus-based PEC	Ingersoll et al. (2000)	Consensus-based PEC based on SEL 170, TET 50, and ERM 7 µg/kg dw.
sum DDT	varied	freshwater	na	710	na	SEL	Ingersoll et al. (2000)	Compilation of matching sediment chemistry and biological effects data from numerous studies.
sum DDT	varied	freshwater	na	50	na	TET	Ingersoll et al. (2000)	Compilation of matching sediment chemistry and biological effects data from numerous studies.
sum DDT	varied	freshwater	na	7	na	ERM	Ingersoll et al. (2000)	Compilation of matching sediment chemistry and biological effects data from numerous studies.
DDTs	*Neanthes arenaceodentata*	marine	na	308,000	28 days	growth	Lotufo et al. (2000)	Target concentration 18.5 mg/g OC. Measured at test start 13.83 mg/g OC and end 11.59 mg/g OC. TOC 2.66%. Used test end sediment concentration to calculate LOAEL.
DDTs	*Hyalella azteca*	freshwater	na	3,510	28 days	survival (LC50)	Lotufo et al. (2001b)	Reported as 9.9 nmol DDT equivalents/g dw. Molecular weight for DDT 354.51.
DDTs	*Leptocheirus plumulosus*	marine	na	1,985	10 days	survival (LC50)	Lotufo et al. (2001a)	Reported as 5.6 nmol/g dw (5.5 to 5.7 95% confidence interval).
DDTs	*Hyalella azteca*	freshwater	567	1,063	28 days	survival	Lotufo et al. (2001b)	Significant and non-significant difference in survival from control (LOAEL and NOAEL). Reported as 3.0 and 1.6 nmol DDT equivalents/g dw, respectively. Molecular weight for DDT 354.51.
DDTs	*Diporeia* spp.	freshwater	na	2,910	28 days	survival (LC50)	Lotufo et al. (2001b)	Reported as 8.2 nmol DDT equivalents/g dw. Molecular weight for DDT 354.51.
Total DDTs	amphipod AET	marine	24	na	10 days	AET	Gries and Waldow (1996)	AET values for total DDT amphipod 24, echinoderm 37µg/kg dw or 1.4, 8.8 mg/kg OC.
Total DDTs	varied	freshwater	na	572	na	consensus-based PEC	Ingersoll et al. (2000)	Consensus-based PEC based on PEL 4450, SEL 120, TET na, and ERM 350 µg/kg dw.
Total DDT	*Neanthes arenaceodentata*	marine	8510	na	120 days	Full life-cycle toxicity test (survival, growth, fecundity, reproduction)	Chapman (1996)	Based on field collected sediment; alternative predictive approach estimated that above 8.51 mg/kg dw total DDT, adverse effects would be expected to occur; OC normalized concentrations are also provided.

Analyte	Test Species	Marine or Fresh-water	NOAEL (µg/kg dw)	LOAEL (µg/kg dw)	Exposure Duration	Endpoint	Source	Notes
Total DDT	varied	marine and estuary	1.58	46.1	na	ERL for NOAEL ERM for LOAEL	Long et al. (1995)	Marine and estuarine data compilation BEDS (biological effects database for sediment) from lab spike sediment bioassays; field studies, and equilibrium partitioning studies. Note: relationship between incidence of effects and the concentration of total DDT and 4,4'-DDE was poor (only 50% incidence of effects were observed above the median concentration; for other chemicals incidence was 80 to 100% above the median concentration).
Total DDT	marine polychaete (*Heteromastus filiformis*)	marine	na	7,500	28 days	significant reduced feeding rate	Mulsow & Landrum (1995)	Laboratory 28-day bioaccumulation study using spiked sediment; no effect on feeding rate in polychaetes exposed to 4.0 mg/kg dw total DDT.
Total DDT	*Hyalella azteca*	freshwater	na	11,000	10 days	LC50	Nebeker et al. (1989)	Spiked sediment toxicity tests with ranging TOC (3-11%); at 5 mg/kg dw (TOC ranging from 3 to 7.2%) mortality is less than 10%.

AET – apparent effects threshold (highest no-hit value)

BEDS – biological effects database for sediment

ERL – effects range – low

ERM – effects range – medium

ISQG – interim sediment quality guideline

LC50 – concentration that causes the death of 50% of a group of test animals

LOAEL – lowest-observed-adverse-effect level

NOAEL – no-observed-adverse-effect level

na – not available

PEC – probable effect concentration

PEL – probable effects level

SEL – severe effects level

SQG – sediment quality guideline

TEL – threshold effects level

TET – toxic effect threshold

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