

SCREENING LEVEL CALCULATIONS AND DATA SOURCES

1. BIOACCUMULATION SLV DERIVATION

Bioaccumulation SLVs represent COI concentrations in sediment which are not expected to result in tissue residue levels that could adversely affect the health of humans or piscivorous wildlife. The details of their derivation are discussed below.

1.1 WILDLIFE RECEPTORS

Bioaccumulation SLVs were calculated as follows:

Organic chemicals

$$SLV_{BW} = f_{oc} \cdot (ATL_W / (BSAF \cdot f_L)) \quad (1-1)$$

$$SLV_{BW} = ATL_W / BAF \quad (1-2)$$

where:

SLV _{BW}	Sediment bioaccumulation SLV for piscivorous wildlife receptors (mg/kg)
BSAF	Biota-sediment accumulation factor for organic COIs (kg sediment organic carbon / kg organism lipid); Table 3 .
BAF	Bioaccumulation factor for organometallic COIs (L/kg); Table 1 .
ATL _W	Acceptable tissue level for wildlife receptors (mg/kg); NOAEL-based for individuals, LOAEL-based for populations; calculated using equations 1-10 and 1-11
f _{oc}	Fraction of total organic carbon in surface sediment (unitless); default = 0.01
f _L	Fraction of organism lipid content of fillet or whole-body dry weight (unitless); default = 0.088

Inorganic chemicals

$$SLV_{BW} = K_d \cdot (ATL_W / BCF) \quad (1-3)$$

where:

SLV _{BW}	Sediment bioaccumulation SLV for piscivorous wildlife receptors (mg/kg)
K _d	Metal distribution coefficient (L/kg); Table 1

ATL_W Acceptable tissue level for wildlife receptors (mg/kg); NOAEL-based for individuals, LOAEL-based for populations; calculated using equations **1-10** and **1-11**

BCF Bioconcentration factor (L/kg); **Table 1**

1.2 HUMAN RECEPTORS

Values represent chemical concentrations in sediment at and below which chemicals would not be expected to accumulate in tissues of food items (i.e., fish / shellfish) above tissue levels acceptable for humans. These values were calculated as follows:

Organic chemicals

$$SLV_{BH} = f_{oc} \cdot \left(\frac{\min(ATLh_C, ATLh_N)}{BSAF \cdot f_L} \right) \quad (1-4)$$

$$SLV_{BH} = \frac{\min(ATLh_C, ATLh_N)}{BAF} \quad (1-5)$$

where:

SLV_{BH} Sediment bioaccumulation screening level value for human population (mg/kg)

BSAF Biota-sediment accumulation factor for organic COIs (kg sediment organic carbon / kg organism lipid); **Table 3**.

BAF Bioaccumulation factor for organometallic COIs (L/kg); **Table 1**.

ATL_{h_C} Acceptable tissue (carcinogens) level for general population (mg/kg); calculated using **Equation 1-8**.

ATL_{h_N} Acceptable tissue (non-carcinogens) level for general population (mg/kg); calculated using **Equation 1-9**.

f_{oc} Fraction of total organic carbon in surface sediment (unitless); default = 0.01

f_L Fraction of organism lipid content of fillet (unitless); default = 0.03

Carcinogenic PAHs (which undergo metabolism)

$$SLV_{BH} = f_{oc} \cdot K_{oc} \cdot \left(\frac{ATLh_c}{BCF} \right) \quad (1-6)$$

where:

SLV_{BH} Sediment bioaccumulation screening level value for human populations

	(mg/kg)
f_{oc}	Fraction of total organic carbon in surface sediment (unitless); default = 0.01
K_{oc}	Organic carbon-water partition coefficient (L/kg); geometric mean of published values from McKay et al. 1992.
$ATLh_C$	Acceptable tissue (carcinogens) level for general population (mg/kg); calculated using Equation 1-8 .
BCF	Bioconcentration factor (L/kg); geometric mean of published values from McKay et al. 1992.

Inorganic chemicals

$$SLV_{BH} = K_d \cdot \left(\frac{\min(ATLh_C, ATLh_{nc})}{BCF} \right) \quad (1-7)$$

where:

SLV_{BH}	Sediment bioaccumulation screening level value for human populations (mg/kg)
K_d	Metal distribution coefficient (L/kg); Table 1
$ATLh_C$	Acceptable tissue (carcinogens) level for general population (mg/kg); calculated using Equation 1-8 .
$ATLh_N$	Acceptable tissue (non-carcinogens) level for general population (mg/kg); calculated using Equation 1-9 .
BCF	Bioconcentration factor (L/kg); Table 1

1.3 DERIVATION MODEL

Acceptable tissue levels for carcinogens and noncarcinogens are back-calculated from acceptable risk levels, in accordance with federal guidance for establishing fish consumption limits and for conducting human health risk assessments (USEPA, 1989, 1997a), as follows:

Carcinogens

$$ATLh_C = \frac{ARL_C \cdot BW \cdot AT}{SF_O \cdot IR_P \cdot ED} \quad (1-8)$$

Noncarcinogens

$$ATLh_N = \frac{RfD \cdot BW \cdot ARL_N}{IR_p} \quad (1-9)$$

where:

ATLh _C	Acceptable carcinogen tissue level for human receptors (mg/kg)
ATLh _N	Acceptable noncarcinogen tissue level for human receptors (mg/kg)
ARL _C	Acceptable risk level for carcinogens (unitless; 1×10^{-6})
ARL _N	Acceptable risk level for noncarcinogens (unitless; 1)
AT	Averaging time (years)
ED	Exposure duration (years)
SF _O	Oral slope factor (mg/kg·d) ⁻¹
RfD	Reference dose (mg/kg·d)
BW	Body weight (kg)
IR _P	Fish and/or shellfish ingestion rate for the p th population (kg/day), per

Table 4.

Resulting ATL values represent the maximum tissue residue of a given chemical expected (1) to generate a risk no greater than the maximum acceptable risk level (ARL) used for carcinogens and (2) not to cause adverse noncarcinogenic health effects for noncarcinogens based on a lifetime of daily consumption at an exposure scenario-specific ingestion rate (IR). Thus, these ATLh values permit a specific population of humans to safely consume any combination of fish and/or shellfish for an extended period, provided that the combined daily consumption rate remains below IR.

1.4 MODEL PARAMETER VALUES

Acceptable Risk Levels The acceptable risk level for individual carcinogenic contaminants (ARL_C) is defined both by statute (ORS 465.315(1)(b)(A)) and rule (OAR 340-122-115(2)(a)) as $\leq 1 \times 10^{-6}$. In addition, OAR 340-122-115(3)(a) requires that the cumulative risk from exposure to all carcinogenic contaminants combined be $\leq 1 \times 10^{-5}$. The acceptable risk level for noncarcinogens (ARL_N) is defined both by statute (ORS 465.315(1)(b)(A)) and rule (OAR 340-122-115(4)(a)) as a hazard index of ≤ 1 . The ATLh_C and ATLh_N values provided herein were calculated for individual contaminants.

Body Weight Adult male body weights average between 72 and 79 kg, while adult

female body weights average between 58 and 66 kg (DEQ, 1998). The default adult body weight used in these calculations was 70 kilograms (kg), which is a mean body weight based on national data for adult males and females (USEPA 1997c; DEQ 2000).

Exposure Duration and Averaging Time For carcinogenic risk estimates, both DEQ and EPA guidance specify an exposure duration of 30 years (adults) or 6 years (children) within a 70-year lifetime (USEPA, 1989; DEQ, 2000). This represents an upper estimate of the length of time that most people reside or fish in one area. As an alternative, EPA (USEPA, 2000a) allocates 24 years of the total 30 year exposure duration to adults and the remaining 6 years to children; this allocation procedure was here. Use of a 30 year exposure duration (regardless of allocation) produces a slightly lower ATL than does EPA's fish consumption guidance (USEPA, 1997a), which assumes that consumption occurs for 70 years. This is counterbalanced by basing ARLs on protection of children rather than adults. For exposure to carcinogens, EPA guidance specifies an averaging time of 70 years, which equates both to the average human lifespan and the time over which cancer has the potential to develop.

Slope Factors and Reference Doses Oral slope factor (SF_o) and reference dose (RfD) values used in ATL calculations are listed in **Table 2**. Suitable sources for SF_o and RfD values are specified by DEQ rules as follows: (1) The Integrated Risk Information System (IRIS) database (USEPA, 1999) is the preferred source of information because it contains the most recent toxicity values extensively reviewed by EPA; (2) The Health Effects Assessment Summary Table (USEPA, 1997b) will be consulted if a toxicity value is not available on IRIS (USEPA, 1999). EPA compiled these values for use in risk assessments; however HEAST values are not as rigorously reviewed as those presented in IRIS; (3) EPA's National Center for Environmental Assessment (NCEA) values are recommended by Oregon when values are not available in IRIS or HEAST. One source of NCEA values is the EPA, Region 9, PRG table (USEPA, 2000a); (4) Other EPA documents or databases can be used when appropriate; (5) ATSDR Toxicological Profiles and Minimal Risk Levels offer toxicity value information. If toxicity values were not available for a chemical from the sources listed in **Table 2**, reference doses and slope factors of structurally similar compounds were used as surrogates. Target levels for dioxins, furans, and coplanar PCBs were derived in TEC units to account for nondioxin-like carcinogenicity and adverse non-

cancer health effects of PCBs.

Acceptable Tissue Levels for Humans Calculated ATLh values were not calculated for men and women, as differences in consumption rates relative to body weight were minor.

1.5 WILDLIFE ACCEPTABLE TISSUE LEVELS

An acceptable tissue level for wildlife (ATLw) is the dietary level of a contaminant in prey items that would result in a dose equivalent to a given toxicity reference value (TRV), assuming no exposure through other environmental media. It can be calculated given a TRV (either a no-observable-effect-level (NOAEL) for individuals or a lowest-observable-effect-level (LOAEL) for populations) for a chemical and by assuming a receptor's total diet contains that chemical concentration (Sample et al., 1996). When the chemical concentration in all food items is constant, the relationship between dose and the concentration in food items can be represented as follows:

$$ATL_w = \frac{TRV_w}{(IR/BW)} \quad (1-10)$$

Where:

- ATLw Acceptable tissue level for wildlife receptors (mg/kg, wet weight)
- TRV_w Toxicity reference value for wildlife (mg/kg-day, dry weight); NOAEL-based for individuals, LOAEL-based for populations; **Table 2**
- BW Body weight (kg)
- IR Daily food ingestion rate (kg/day)

Mink and Great Blue Heron were chosen as representative piscivorous receptors for mammals and birds, respectively. Their diet was assumed to consist entirely of fish. Toxicological information on bird and mammal responses to various chemicals was obtained primarily from Sample et al. (1996). When necessary, NOAEL and LOAEL values for different test species were allometrically scaled to those for mink or heron as follows (Sample and Arenal, 1999):

$$TRV_W = TRV_T \left(\frac{BW_T}{BW_W} \right)^{1-b} \quad (1-11)$$

Where:

- TRV_W Toxicity reference value for mink or heron (mg/kg-day); **Table 2**
- TRV_T Toxicity reference value for test species other than mink or heron (mg/kg-day); NOAEL-based for individuals, LOAEL-based for populations
- BW_T Body weight test species (kg)
- BW_W Body weight for mink or heron (kg)
- b Generic scaling factor (0.94 for mammals, 1.2 for birds)

Table 1. Default parameter values for estimation of inorganic chemical concentrations in fish tissue consumed by humans and piscivorous wildlife.

CHEMICAL	CASRN	Bioconcentration Factor (BCF, L/kg)	Bioaccumulation Factor (BAF, L/kg)	Metals Distribution Coefficient (K _d , L/kg)
Arsenic	7440-38-2	17 (c)		29 (b)
Cadmium	7440-43-9	38 (d)		6.7 (b)
Chromium VI	18450-29-9	40 (d)		19 (b)
Copper	7440-50-8	290 (c)		22 (b)
Lead	7439-92-1	500 (d)		900 (a)
Mercury (methyl)	22967-92-6	21700 (d)	2.7 × 10 ⁶ (f)	10000 (g)
Nickel	7440-02-0	106 (c)		65 (b)
Selenium	7782-49-2	250 (d)	6800 (c)	5 (b)
Silver	7440-22-4	28 (e)		45 (a)
Zinc	7440-66-6	366 (c)		62 (b)

Notes for Table 1

- (a) Value reported in Figure 2-31 of Baes et al. (1984).
- (b) Value reported in Table 747-3 of WDOE (2001).
- (c) Value reported in Sample et al. (1996), Table 3.
- (d) Value reported in Appendix B, "Substance-specific Input Data", of: Huijbregts, et al. (1999).
- (e) Highest reported for fish, ATSDR.
- (f) Fourth trophic level BAF reported in Table A-9 of: USEPA (2000b).
- (g) Cited in MacIntosh et al. (1994).

Table 2. Slope factors, reference doses, and toxicity reference values used for estimation of acceptable tissue levels for bioaccumulative compounds in fish/shellfish.

CHEMICAL *	CASRN	HUMAN		BIRD		MAMMAL	
		Oral Slope Factor (SF _o) (mg/kg-d) ⁻¹	Reference Dose (RfD) mg/kg-d	IND TRV mg/kg-d	POP TRV mg/kg-d	IND TRV mg/kg-d	POP TRV mg/kg-d
INORGANIC COMPOUNDS							
Arsenic	7440-38-2	1.50 (a)	3.0E-4 (a)	2.5 (u)	7.4 (u)	0.1 (u)	1.3 (u)
Cadmium	7440-43-9	C (c)	1.0E-3 (b)	1.5 (v)	20.0 (v)	1.0 (v)	10.0 (v)
Chromium VI	18450-29-9	C (j)	3.0E-3 (a)	1.0 (w)	5.0 (w)	3.3 (x)	13.1 (x)
Copper	7440-50-8	NC (j)	3.7E-2 (f)	2.3 (v)		6.3 (v)	9.8 (v)
Lead	7439-92-1		100 µg/d (s)	0.2 (v)	1.8 (v)	42.0 (v)	126.0 (v)
Mercury (methyl)	22967-92-6	C (k)	1.0E-4 (a)	0.07 (v)	0.4 (v)	0.02 (v)	0.03 (v)
Nickel	7440-02-0	n/a (l)	2.0E-2 (a)	17.6 (v)	77.4 (v)	5.0 (v)	
Selenium	7782-49-2			0.4 (v)	0.8 (v)	0.2 (v)	0.3 (v)

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CHEMICAL *	CASRN	HUMAN		BIRD		MAMMAL	
		Oral Slope Factor (SF _o) (mg/kg-d) ⁻¹	Reference Dose (RfD) mg/kg-d	IND TRV mg/kg-d	POP TRV mg/kg-d	IND TRV mg/kg-d	POP TRV mg/kg-d
Silver	7440-22-4	NC (i)	5.0E-3 (a)				
Zinc	7440-66-6	NC (i)	3.0E-1 (a)	14.5 (v)	131.0 (v)	160.0 (v)	320.0 (v)
ORGANOTINS							
Tributyltin oxide (TBTO)	56-35-9	NC (i)	3.0E-4 (a)	12.4 (v)	31.0 (v)	23.4 (v)	35.0 (v)
ORGANIC COMPOUNDS							
Chlorobromo phenyl ether, 4-	101-55-3						
Chlorophenyl phenyl ether, 4-	7005-72-3						
Dichlorobenzene, 1,2-	95-50-1	NC (i)	9.0E-2 (a)				
Dichlorobenzene, 1,3-	541-73-1						
Dichlorobenzene, 1,4-	106-46-7	0.02 (g)	3.0E-2 (f)				
Hexachlorobenzene (HCB)	118-74-1	1.6 (a)	8.0E-4 (a)	0.6 (x)	2.3 (x)		
Hexachlorobutadiene	87-68-3	0.08 (a)	2.0E-4 (h)				
Hexachlorocyclopentadiene	77-47-4						
Hexachloroethane	67-72-1	0.01 (a)	1.0E-3 (a)				
Pentachloroanisole	1825-21-4						
Pentachlorobenzene	608-93-5						
Pentachlorophenol	87-86-5	0.12 (a)	3.0E-2 (a)			0.2 (x)	2.4 (x)
Tetrachlorobenzene, 1,2,3,4-	634-66-2						
Tetrachlorobenzene, 1,2,4,5-	95-94-3						
Tetrachloroethane	25322-20-7						
Trichlorobenzene, 1,2,4-	120-82-1						
PESTICIDES							
Aldrin	309-00-2	17.0 (a)	3.0E-5 (a)			0.2 (v)	1.0 (v)
Chlordane, technical	57-74-9	0.4 (a)	5.0E-4 (a)	2.1 (x)	10.7 (x)	4.6 (x)	9.2 (x)
Chlorpyrifos	2921-88-2						
DDD	72-54-8	0.3 (d)	5.0E-4 (e)	0.009 (v)		0.8 (v)	4.0 (v)
DDE	72-55-9	0.3 (d)	5.0E-4 (e)	0.009 (v)		0.8 (v)	4.0 (v)
DDT	50-29-3	0.3 (d)	5.0E-4 (e)	0.009 (v)		0.8 (v)	4.0 (v)
Diazinon	333-41-5						
Dicofol	115-32-2						
Dieldrin	60-57-1	16.0 (a)	3.0E-5 (a)	0.08 (x)		0.02 (x)	0.2 (x)
Disulfoton	298-04-4						
Endosulfan	115-29-7	n/a (a)	6.0E-3 (n)	10.0 (x)		0.2 (x)	
Endosulfan sulfate	1031-07-8						
Endosulfan, alpha	959-98-8						
Endosulfan, beta	33213-65-9						
Endrin	72-20-8	NC (i)	3.0E-4 (a)	0.01 (x)		0.09 (x)	0.9 (x)
Ethion	563-12-2						
Ethalfuralin	55283-68-6						
Heptachlor	76-44-8	4.5 (a)	5.0E-4 (a)			0.2 (v)	1.0 (v)
Heptachlor epoxide	1024-57-3						

Table 2. Slope factors, reference doses, and toxicity reference values used for estimation of acceptable tissue levels for bioaccumulative compounds in fish/shellfish.

CHEMICAL *	CASRN	HUMAN		BIRD		MAMMAL	
		Oral Slope Factor (SF ₀) (mg/kg-d) ⁻¹	Reference Dose (RfD) mg/kg-d	IND TRV mg/kg-d	POP TRV mg/kg-d	IND TRV mg/kg-d	POP TRV mg/kg-d
Hexachlorocyclohexane, α-BHC	319-84-6						
Hexachlorocyclohexane, β-BHC	319-85-7	1.6 (a)	8.0E-4 (a)				
Hexachlorocyclohexane, δ-BHC	319-86-8						
Hexachlorocyclohexane, Lindane	58-89-9	1.3 (f)	3.0E-4 (a)	5.7 (v)	8.6 (v)	8.0 (v)	
Methoxychlor	72-43-5	NC (i)	5.0E-3 (a)			4.0 (v)	8.0 (v)
Mirex	2385-85-5						
Nitrofen	1836-75-5						
Oxyfluorfen	42874-03-3						
Pentachloronitrobenzene	82-68-8			7.1 (x)	70.7 (x)		
Permethrin	52645-53-1						
S-fenvalerate	66230-04-4						
Terbufos	13071-79-9						
Toxaphene	8001-35-2					8.0 (x)	
Trifluralin	1582-09-8						
POLYCYCLIC AROMATICS							
Acenaphthene †	83-32-9	n/a (a)	6.0E-2 (a)			0.001 (p)	0.01 (p)
Acenaphthylene †	208-96-8	NC (i)	n/a (a)			0.001 (p)	0.01 (p)
Anthracene †	120-12-7	NC (i)	3.0E-1 (a)			0.01 (p)	0.1 (p)
Benzo[a]anthracene †	56-55-3	0.7 (p)	n/a (a)			0.1 (p)	1.0 (p)
Benzo[a]pyrene †	50-32-8	7.3 (a)	n/a (a)			1.0 (v)	10.0 (v)
Benzo[b]fluoranthene †	205-99-2	0.7 (p)	n/a (a)			0.1 (p)	1.0 (p)
Benzo[g,h,i]perylene	191-24-2	NC (i)	n/a (a)			0.01 (p)	0.1 (p)
Benzo[k]fluoranthene †	207-08-9	0.07 (p)	n/a (a)			0.1 (p)	1.0 (p)
Chrysene †	218-01-9	0.007 (p)	n/a (a)			0.01 (p)	0.1 (p)
Dibenz[a,h]anthracene †	53-70-3	1.5 (p)	n/a (a)			5.0 (p)	50.0 (p)
Fluoranthene †	206-44-0	NC (i)	4.0E-2 (a)			0.001 (p)	0.01 (p)
Fluorene †	86-73-7	NC (i)	4.0E-2 (a)			0.001 (p)	0.01 (p)
Indeno[1,2,3-cd]pyrene †	193-39-5	0.7 (p)	n/a (a)			0.1 (p)	1.0 (p)
Phenanthrene †	85-01-8	NC (i)	n/a (a)			0.001 (p)	0.01 (p)
Pyrene †	129-00-0	NC (i)	3.0E-2 (a)			0.001 (p)	0.01 (p)
PCB (Aroclors)							
Aroclor 1016	12674-11-2					1.4 (x)	3.4 (x)
Aroclor 1221	11104-28-2						
Aroclor 1232	11141-16-5						
Aroclor 1242	53469-21-9	2.0 (g)	2.0E-5 (g)	0.4 (x)		0.07 (x)	7.0 (x)
Aroclor 1248	12672-29-6	2.0 (g)	2.0E-5 (g)			0.01 (x)	0.1 (x)
Aroclor 1254	11097-69-1	2.0 (a)	2.0E-5 (a)	0.09 (x)		0.07 (x)	7.0 (x)
Aroclor 1260	11096-82-5	2.0 (g)	2.0E-5 (g)				
Aroclor 1268	11100-14-4						
PCB (Congeners)							

Table 2. Slope factors, reference doses, and toxicity reference values used for estimation of acceptable tissue levels for bioaccumulative compounds in fish/shellfish.

CHEMICAL *	CASRN	HUMAN		BIRD		MAMMAL	
		Oral Slope Factor (SF _o) (mg/kg-d) ⁻¹	Reference Dose (RfD) mg/kg-d	IND TRV mg/kg-d	POP TRV mg/kg-d	IND TRV mg/kg-d	POP TRV mg/kg-d
PCB 8 ‡	34883-43-7						
PCB 18 ‡	37680-65-2						
PCB 28 ‡	7012-37-5						
PCB 44 ‡	41464-39-5						
PCB 52 ‡	35693-99-3						
PCB 66 ‡	32598-10-0						
PCB 77 †	32598-13-3	1.5E+1 (r)	1.0E-5 (r)	2.8E-4 (x)	2.8E-3 (x)	0.01 (r)	0.1 (r)
PCB 81 †	70362-50-4	1.5E+1 (r)	1.0E-5 (r)	1.4E-4 (r)	1.4E-3 (r)	0.01 (r)	0.1 (r)
PCB 101 ‡	37680-73-2						
PCB 105 † ‡	32598-14-4	1.5E+1 (r)	1.0E-5 (r)	0.14 (r)	1.4 (r)	0.01 (r)	0.1 (r)
PCB 118 † ‡	31508-00-6	1.5E+1 (r)	1.0E-5 (r)	1.4 (r)	14.0 (r)	0.01 (r)	0.1 (r)
PCB 126 †	57465-28-8	1.5E+4 (r)	1.0E-8 (r)	1.4E-4 (r)	1.4E-3 (r)	1.0E-5 (r)	1.0E-4 (r)
PCB 128 ‡	38380-07-7						
PCB 138 ‡	35065-28-2						
PCB 153 ‡	35065-27-1						
PCB 156 †	38380-08-4	7.5 (r)	1.0E-5 (r)	0.14 (r)	1.4 (r)	2.0E-3 (r)	2.0E-4 (r)
PCB 169 †	32774-16-6	1.5E+3 (r)	1.0E-7 (r)	1.4E-2 (r)	0.14 (r)	1.0E-4 (r)	1.0E-3 (r)
PCB 170 ‡	35065-30-6						
PCB 180 ‡	35065-29-3						
PCB 187 ‡	52663-68-0						
PCB 189 †	39635-31-9	15 (r)	1.0E-5 (r)	1.4 (r)	14.0 (r)	0.01 (r)	0.1 (r)
PCB 195 ‡	52663-78-2						
PCB 206 ‡	40186-72-9						
PCB 209 ‡	2051-24-3						
DIOXINS							
[4] TCDD, 2,3,7,8- (dioxin) †	1746-01-6	1.5E+5 (q)	1.0E-9 (t)	1.4E-5 (x)	1.4E-4 (x)	1.0E-6 (x)	1.0E-5 (x)
[5] PeCDD, 1,2,3,7,8- †	40321-76-4	1.5E+5 (r)	1.0E-9 (r)	1.4E-5 (r)	1.4E-4 (r)	1.0E-6 (r)	1.0E-5 (r)
[6] HxCDD, 1,2,3,4,7,8- †	39227-28-6	1.5E+4 (r)	1.0E-8 (r)	2.8E-4 (r)	2.80E-3 (r)	1.0E-5 (r)	1.0E-4 (r)
[6] HxCDD, 1,2,3,6,7,8- †	57653-85-7	1.5E+4 (r)	1.0E-8 (r)	1.4E-3 (r)	1.40E-2 (r)	1.0E-5 (r)	1.0E-4 (r)
[7] HpCDD, 1,2,3,4,6,7,8- †	35822-46-9	1.5E+4 (r)	1.0E-8 (r)	1.4E-2 (r)	0.14 (r)	1.0E-4 (r)	1.0E-3 (r)
FURANS							
Dibenzofuran	132-64-9	NC (i)	4.0E-3 (f)				
[4] TCDF,2,3,7,8- †	51207-31-9	1.5E+4 (r)	1.0E-8 (r)	1.0E-6 (x)	1.0E-5 (x)	1.0E-5 (r)	1.0E-4 (r)
[5] PeCDF, 1,2,3,7,8- †	57117-41-6	7.5E+3 (r)	5.0E-8 (r)	1.4E-4 (r)	1.4E-3 (r)	1.0E-4 (x)	1.0E-3 (x)
[5] PeCDF, 2,3,4,7,8- †	51207-31-4	7.5E+4 (r)	2.0E-9 (r)	1.4E-5 (r)	1.4E-4 (r)	1.0E-6 (x)	1.0E-5 (x)
[6] HxCDF, 1,2,3,4,7,8- †	70648-26-9	1.5E+4 (r)	1.0E-8 (r)	1.4E-4 (r)	1.4E-3 (r)	1.0E-5 (r)	1.0E-4 (r)

Notes for Table 2

* Chemicals listed in this table are only those considered by U.S. EPA to be “important

bioaccumulative compounds” for sediment assessment (USEPA, 2000b; Table 4-2).

† Chemical for which a toxicity equivalency factor is available (ATSDR, 1998; Table 2-12; ATSDR, 1995; page 168).

‡ NOAA Status and Trends core congener; $\Sigma\text{PCB} = 2 \times \Sigma 18$ core congeners

NC = Noncarcinogen

C = Carcinogen

n/a = No information available

- (a) IRIS data base (USEPA, 1999).
- (b) IRIS, food exposures only.
- (c) IRIS, Group B (probable human carcinogen) but no quantitative estimate of carcinogenic risk for oral exposure.
- (d) U.S. EPA Carcinogenicity Assessment Group recommends CSF = 0.34 for any combination of DDT, DDD, and DDE (USEPA, 1997a; Table 3-1).
- (e) RfD value for DDT.
- (f) U.S. EPA Region 9 Preliminary Remedial Goals (PRG) tables (USEPA, 2000a).
- (g) Value for Aroclor 1254.
- (h) IRIS value withdrawn 1993.
- (i) IRIS, Group D (not classified as to its human carcinogenicity).
- (j) IRIS, Group A (known human carcinogen, inhalation route of exposure) but no quantitative estimate of carcinogenic risk for oral exposure.
- (k) IRIS, Group C (possible human carcinogen) but no quantitative estimate of carcinogenic risk for oral exposure.
- (l) Not evaluated for potential human carcinogenicity.
- (m) reserved
- (n) Not in IRIS; value taken from USEPA, 1997a; Table 3-1.
- (o) reserved
- (p) Calculated using benzo(a)pyrene TEF (ATSDR, 1995; page 168)
- (q) Value from HEAST and USEPA (2000a)
- (r) Calculated using 2,3,7,8-TCDD TEF (ATSDR, 1995; page 168)
- (s) U.S. Food and Drug Administration allowable consumption limit.
- (t) Agency for Toxic Substance and Disease Registry (ATSDR) minimum risk level (MRL) for hazardous substances (February, 2000).
- (u) Value for As III from Sample, Opresko, and Suter (1996).
- (v) Value is “Review of the Navy-EPA Region 9 BTAG Toxicity Reference Values for

Wildlife”, 1997.

(w) Value for Cr³⁺ from Sample, Opresko, and Suter (1996).

(x) Value from Sample, Opresko, and Suter (1996).

Table 3. Default BSAF values for estimation of bioaccumulative chemical concentrations in fish tissue consumed by humans and piscivorous wildlife.

CHEMICAL *	CASRN	Octanol-Water Partition Coefficient log ₁₀ (K _{ow})	Biota-Sediment Accumulation Factor (kg oc / kg lipid)
ORGANOTINS			
Tributyltin oxide (TBTO)	56-35-9	3.19 (j)	0.443 (d)
ORGANIC COMPOUNDS			
Chlorobromo phenyl ether, 4-	101-55-3	n/a	4 (f)
Chlorophenyl phenyl ether, 4-	7005-72-3	n/a	4 (f)
Dichlorobenzene, 1,2-	95-50-1	3.57 (g)	4.394 (d)
Dichlorobenzene, 1,3-	541-73-1	3.55 (h)	4.394 (d)
Dichlorobenzene, 1,4-	106-46-7	3.57 (g)	4.394 (d)
Hexachlorobenzene (HCB)	118-74-1	6.42 (g)	0.66 (d)
Hexachlorobutadiene	87-68-3	4.30 (g)	0.495 (d)
Hexachlorocyclopentadiene	77-47-4	5.31 (j)	0.66 (d)
Hexachloroethane	67-72-1	4.61 (g)	0.084 (d)
Pentachloroanisole	1825-21-4	n/a	4 (f)
Pentachlorobenzene	608-93-5	5.18 (j)	4 (f)
Pentachlorophenol	87-86-5	5.09 (i)	17.44 (d)
Tetrachlorobenzene, 1,2,3,4-	634-66-2	4.50 (j)	0.084 (d)
Tetrachlorobenzene, 1,2,4,5-	95-94-3	4.50 (j)	0.084 (d)
Tetrachloroethane	25322-20-7	2.06 (j)	0.443 (d)
Trichlorobenzene, 1,2,4-	120-82-1	3.98 (g)	4.394 (d)
PESTICIDES			
Aldrin	309-00-2	6.50 (i)	63.2 (d)
Chlordane, technical	57-74-9	2.78 (j)	42.487 (d)
Chlorpyrifos	2921-88-2	4.70 (j)	42.487 (d)
DDD	72-54-8	6.21 (g)	63.2 (d)
DDE	72-55-9	5.69 (g)	71.6 (d)
DDT	50-29-3	6.91 (g)	63.2 (d)
Diazinon	333-41-5	3.81 (j)	42.487 (d)
Dicofol	115-32-2	4.28 (j)	42.487 (d)
Dieldrin	60-57-1	5.37 (i)	63.2 (d)
Disulfoton	298-04-4	4.02 (j)	42.487 (d)
Endosulfan	115-29-7	4.10 (i)	42.487 (d)
Endosulfan sulfate	1031-07-8	4.10 (e)	42.487 (d)
Endosulfan, alpha	959-98-8	3.62 (j)	17.44 (d)
Endosulfan, beta	33213-65-9	3.83 (j)	42.487 (d)
Endrin	72-20-8	5.20 (j)	17.44 (d)
Ethion	563-12-2	5.07 (j)	17.44 (d)
Ethalfuralin	55283-68-6	5.11 (j)	17.44 (d)

Table 3. Default BSAF values for estimation of bioaccumulative chemical concentrations in fish tissue consumed by humans and piscivorous wildlife.

CHEMICAL *	CASRN	Octanol-Water Partition Coefficient log ₁₀ (K _{ow})	Biota-Sediment Accumulation Factor (kg oc / kg lipid)
Heptachlor	76-44-8	5.44 (g)	42.487 (d)
Heptachlor epoxide	1024-57-3	5.40 (g)	42.487 (d)
Hexachlorocyclohexane, α-BHC	319-84-6	3.81 (j)	42.487 (d)
Hexachlorocyclohexane, β-BHC	319-85-7	3.85 (g)	42.487 (d)
Hexachlorocyclohexane, δ-BHC	319-86-8	3.80 (j)	42.487 (d)
Hexachlorocyclohexane, Lindane	58-89-9	4.14 (j)	42.487 (d)
Methoxychlor	72-43-5	4.83 (j)	42.487 (d)
Mirex	2385-85-5	6.90 (j)	63.2 (d)
Nitrofen	1836-75-5	n/a	4 (f)
Oxyfluorfen	42874-03-3	4.47 (j)	42.487 (d)
Pentachloronitrobenzene	82-68-8	5.18 (j)	17.44 (d)
Permethrin	52645-53-1	6.10 (j)	63.2 (d)
S-fenvalerate	66230-04-4	n/a	4 (f)
Terbufos	13071-79-9	3.68 (j)	42.487 (d)
Toxaphene	8001-35-2	5.50 (i)	71.6 (d)
Trifluralin	1582-09-8	5.07 (j)	17.44 (d)
POLYCYCLIC AROMATICS			
Acenaphthene †	83-32-9	4.07 (g)	0.495 (d)
Acenaphthylene †	208-96-8	4.07 (h)	0.495 (d)
Anthracene †	120-12-7	4.54 (g)	0.084 (d)
Benzo[a]anthracene †	56-55-3	5.91 (g)	0.66 (d)
Benzo[a]pyrene †	50-32-8	6.42 (g)	0.66 (d)
Benzo[b]fluoranthene †	205-99-2	6.60 (g)	0.66 (d)
Benzo[g,h,i]perylene	191-24-2	7.10 (h)	0.66 (d)
Benzo[k]fluoranthene †	207-08-9	6.85 (g)	0.66 (d)
Chrysene †	218-01-9	5.79 (g)	0.66 (d)
Dibenz[a,h]anthracene †	53-70-3	6.84 (h)	0.66 (d)
Fluoranthene †	206-44-0	5.22 (g)	0.66 (d)
Fluorene †	86-73-7	4.38 (g)	0.495 (d)
Indeno[1,2,3-cd]pyrene †	193-39-5	7.66 (g)	0.66 (d)
Phenanthrene †	85-01-8	4.46 (h)	0.495 (d)
Pyrene †	129-00-0	5.18 (h)	0.66 (d)
PCB (Aroclors)			
Aroclor 1016	12674-11-2	5.88 (g)	4.027 (d)
Aroclor 1221	11104-28-2	4.09 (h)	1.414 (d)
Aroclor 1232	11141-16-5	4.54 (h)	1.414 (d)
Aroclor 1242	53469-21-9	6.00 (g)	11.077 (d)
Aroclor 1248	12672-29-6	6.11 (g)	11.077 (d)
Aroclor 1254	11097-69-1	6.48 (g)	11.077 (d)
Aroclor 1260	11096-82-5	6.91 (g)	12.172 (d)
Aroclor 1268	11100-14-4	7.00 (e)	4.916 (d)
PCB (Congeners)			
PCB 8 ‡	34883-43-7	5.20 (h)	1.414 (d)

Table 3. Default BSAF values for estimation of bioaccumulative chemical concentrations in fish tissue consumed by humans and piscivorous wildlife.

CHEMICAL *	CASRN	Octanol-Water Partition Coefficient $\log_{10}(K_{ow})$	Biota-Sediment Accumulation Factor (kg oc / kg lipid)
PCB 18 ‡	37680-65-2	5.60 (h)	4.027 (d)
PCB 28 ‡	7012-37-5	5.69 (h)	4.027 (d)
PCB 44 ‡	41464-39-5	5.75 (h)	4.027 (d)
PCB 52 ‡	35693-99-3	6.09 (h)	11.077 (d)
PCB 66 ‡	32598-10-0	5.98 (h)	4.027 (d)
PCB 77 †	32598-13-3	6.29 (h)	11.077 (d)
PCB 81 †	70362-50-4	6.30 (e)	11.077 (d)
PCB 101 ‡	37680-73-2	6.50 (h)	12.172 (d)
PCB 105 † ‡	32598-14-4	6.50 (e)	12.172 (d)
PCB 118 † ‡	31508-00-6	6.75 (e)	12.172 (d)
PCB 126 †	57465-28-8	6.90 (e)	12.172 (d)
PCB 128 ‡	38380-07-7	6.98 (h)	12.172 (d)
PCB 138 ‡	35065-28-2	6.75 (h)	12.172 (d)
PCB 153 ‡	35065-27-1	7.00 (h)	4.916 (d)
PCB 156 †	38380-08-4	7.00 (e)	4.916 (d)
PCB 169 †	32774-16-6	7.55 (h)	1.53 (d)
PCB 170 ‡	35065-30-6	7.08 (h)	4.916 (d)
PCB 180 ‡	35065-29-3	7.21 (h)	4.916 (d)
PCB 187 ‡	52663-68-0	7.19 (h)	4.916 (d)
PCB 189 †	39635-31-9	7.20 (e)	4.916 (d)
PCB 195 ‡	52663-78-2	7.45 (e)	4.916 (d)
PCB 206 ‡	40186-72-9	7.94 (h)	1.53 (d)
PCB 209 ‡	2051-24-3	8.30 (h)	1.53 (d)
DIOXINS			
[4] TCDD, 2,3,7,8- (dioxin) †	1746-01-6	5.80 (g)	1.056 (d)
[5] PeCDD, 1,2,3,7,8- †	40321-76-4	7.50 (g)	0.23 (d)
[6] HxCDD, 1,2,3,4,7,8- †	39227-28-6	7.80 (g)	0.23 (d)
[6] HxCDD, 1,2,3,6,7,8- †	57653-85-7	7.80 (g)	0.23 (d)
[7] HpCDD, 1,2,3,4,6,7,8- †	35822-46-9	8.20 (g)	0.007 (e)
FURANS			
Dibenzofuran	132-64-9	4.12 (h)	1.056 (d)
[4] TCDF, 2,3,7,8- †	51207-31-9	7.02 (g)	3.03 (d)
[5] PeCDF, 1,2,3,7,8- †	57117-41-6	7.00 (e)	3.03 (d)
[5] PeCDF, 2,3,4,7,8- †	51207-31-4	7.00 (g)	3.03 (d)
[6] HxCDF, 1,2,3,4,7,8- †	70648-26-9	7.50 (g)	3.03 (d)

Notes for Table 3

* Chemicals listed in this table are only those considered by U.S. EPA to be “important bioaccumulative compounds” for sediment assessment (USEPA, 2000; Table 4-2).

† Chemical for which a toxicity equivalency factor is available (ATSDR, 1998; Table 2-12; ATSDR, 1995; page 168).

‡ NOAA Status and Trends core congener; Σ PCB = $2 \times \Sigma$ 18 core congeners.

n/a = Data not available.

- (a) reserved
- (b) reserved
- (c) reserved
- (d) 90th percentile BSAF value from WDOH, 1995; Table 5
- (e) Estimated value based on similarity to chemical with identified Octanol-water partition coefficient value.
- (f) 94th percentile BSAF USACE default value (USEPA, 2000).
- (g) Octanol-water partition coefficient value reported in WDOH, 1995; Table 6.
- (h) Octanol-water partition coefficient value reported in: Mackay et. al., 1992.
- (i) Octanol-water partition coefficient values reported in Sample et al., 1996; Table 3.
- (j) Octanol-water partition coefficient value from miscellaneous sources.

Table 4. Fish/Shellfish Ingestion Rate Assumptions

Population	IR	Reference
[1] General population	20.1 g/d	95 th percentile, USEPA, 1997c; Table 10-81, Section 10.10.1
[2] Recreational angler population	78.0 g/d	90 th percentile, Pacific NW recreational anglers, USEPA, 1997c
[3] Subsistence population (adults)	170.0 g/d	95 th percentile, Native American subsistence, USEPA, 1997c; Table 10-85, Section 10.10.4

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