

Appendix H

Fish Bioconcentration Factors

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Fish Bioconcentration Factors (BCF)

Table H.1. Summary of Recommended Default Fish Bioconcentration Factors (BCFs)

4,4'-Methylene dianiline	11.1
Arsenic	4
Cadmium	366
Chromium	2
Dioxins and Furans	19,000
Hexachlorocyclohexanes	456
Hexachlorobenzene	13,130
Lead	155
Mercury (Inorganic)	5,000
PAH as benzo[a]pyrene	583
Polychlorinated biphenyls	99,667
Diethylhexylphthalate	483.1

4,4'-Methylene dianiline

Bioconcentration factors of 12.6 and 9.5 are calculated using a water solubility of 1000 ppm and a log Kow of 1.59 using regression equations (HSDB, 1996). OEHHA is recommending that the arithmetic mean of 11.1 be used.

Arsenic

A fish BCF of 4 for arsenic is recommended based on Clement Associates (1988).

Cadmium

Vertebrate fish species exposed to cadmium have shown a BCF of <20 (Taylor, 1983). A wider range of BCF values ranging from 130 to “several thousands” in Atlantic salmon exposed to cadmium has also been reported (John et al., 1987). BCF values ranging from 22 to 200 have also been reported in brook trout (Sangalang and Freeman, 1979 as cited in US EPA., 1985 and Atchison et al., 1977). Studies of cadmium bioconcentration among saltwater fish produce BCF value estimates ranging from 40-300 (Middaugh et al., 1975). Other reports have identified BCF of 3-2213 (ATSDR., 1993). The default BCF for cadmium in fish was established as the mean of the reported values from the studies identified in the literature. The eight values identified above produce an arithmetic mean of 366, which we recommend as the default BCF estimate for cadmium.

Chromium

Fish BCF values ranging from 1-3.4 have been reported for chromium (Clement Associates, 1988). The arithmetic mean of these values, 2, is recommended as the default BCF for chromium.

Dioxins and Furans

Six studies were identified which report on the bioconcentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in fish (cited in Hsieh et al., 1994). From these studies, seven BCF values were reported ranging from 2.67×10^3 to 6.35×10^4 . (Isensee, 1978; Adams et al., 1986; Branson et al., 1985; Opperhuizen et al., 1986; Mehrle et al., 1988; Sijm et al., 1989). As cited in the Hsieh *et al.* (1994) document, the arithmetic mean fish BCF from these studies is 1.9×10^4 , is recommended as the fish BCF for TCDD.

Hexachlorocyclohexanes

A BCF of 319 is listed for the rainbow trout (ATSDR, 1994). A BCF of 560 is reported for fish by Howard (1991). A BCF of 490 for the sheepshead minnow also reported by Howard (1991). OEHHHA will use the arithmetic mean of these three values, 456.

Hexachlorobenzene

A BCF value of 7760 for rainbow trout exposed for 4 days and a value of 18500 in fathead minnows exposed for 32 days (Bysshe, 1982; Veith et al., 1980 also cited). Fish BCFs of 1610 and 10610 have been reported in mosquitofish (*Gambusia affinis*) and catfish (*Ictalurus punctatus*), respectively (Isensee et al., 1976; as reported in ATSDR., 1994). BCF values ranging from 172 to 15800 have also been reported (SCAQMD., 1988, citing Laska et al., 1976; Isensee et al., 1976). The arithmetic mean of 13,130 is therefore recommended as the fish BCF for hexachlorobenzene.

Lead

Fish BCFs ranging from 5.1 to 300 have been reported for lead (SCAQMD., 1988). The arithmetic mean of these values (155) is recommended as the default BCF for lead.

Mercury (inorganic)

A fish BCF of 5000 for inorganic mercury is recommended based on Clements Associates, 1988.

PAH as Benzo[a]pyrene

Several studies have reported BCFs in fish for benzo[a]pyrene. BCF values of 224 and 282 were reported among bluegill sunfish exposed to ^{14}C -labelled benzo[a]pyrene at 23°C in a flow through chamber containing humic matter (McCarthy and Jimenez, 1985). A BCF of 480

was reported among Golden Ide exposed to benzo[a]pyrene for 3 days in the presence of humic matter (Freitag et al., 1985). A BCF of 920 was reported in rainbow trout (Gerhart and Carlson, 1978). Bioconcentration based upon the relative uptake and depuration rates in Bluegill sunfish produced a BCF of 490 for benzo[a]pyrene (Spacie et al., 1983). A BCF value of 1100 has also been reported (Cohen et al., 1994, as reported by the SCAQMD., 1988). Northern pike exposed for 10 or 21 days to benzo[a]pyrene in water produced a measured BCF ranging from 50 to 80000 in internal organs, with the greatest bioconcentration occurring in the gallbladder and bile (Balk et al., 1984).

The arithmetic mean of the 6 reported BCF values for whole fish is 583, which is recommended as the fish BCF for benzo[a]pyrene.

Polychlorinated biphenyls

Aroclor 1254 is used as a surrogate for the other Aroclor mixtures. Mackay et al., (1992) list values of 164, 000, 111,000 and 25,000 for the fish oyster and shrimp respectively. OEHHA is recommending the arithmetic mean of the these three values, 99,667.

Diethylhexylphthalate

Bluegill fish have a reported BCF of 114.8 (Howard et al., 1991). The fathead minnow has a BCF of 851.4 (Howard et al., 1989). OEHHA will use the arithmetic mean of the two values, 483.1.

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