

Annex Section (c) – Bioconcentration and Bioaccumulation of PeCB

This annex contains data and references to support the information provided in Section (c) of the WCC Submission for Pentachlorobenzene (PeCB)

1.1 Bioconcentration/Bioaccumulation

Bioconcentration describes a chemical's tendency to be taken up by an animal from water solution. Bioaccumulation is uptake from both water and food. Van de Plassche et al. summarized bioconcentration (BCF) and bioaccumulation factors (BAF) for PeCB with few details given (van de Plassche et al. 2001). Most of the studies are described in more detail below. The reported BAF for PeCB in bluegill sunfish (*Lepomis macrochirus*) was 3400. In rainbow trout (*Oncorhynchus mykiss*) a BAF range from 4000 to 8400 and in guppy a BAF of 13,000 are reported by van de Plassche et al. The much higher BAF values, based on concentration only in lipid, 155,000 to 260,000, also included by van de Plassche et al. should not be compared with the whole body BAF values used for regulatory purposes.

The BCF of chlorobenzenes in guppies (*Poecilia reticulata*) gave a calculated BCF for PeCB of 4,700 from its uptake and elimination kinetics (Van Hoogen and Opperhuizen 1988). The fish were exposed for 5 days without feeding and the uptake of PeCB determined followed by elimination of the PeCB in freshwater for 21 days. Another study of the PeCB BCF in guppies as a function of temperature reported lipid basis BCF values ranging from a log of 5.11 at 286 K to 5.28 at 306 K (Opperhuizen et al. 1988). The guppies were 5±2% lipid so that these BCF values can be compared with the whole fish values above by multiplying by 0.05 to get a range of 6,400 to 9,500.

Detailed studies of PeCB uptake were conducted to determine lethal body burdens of chlorobenzenes in the amphipod *Hyalella azteca* (scuds) and fathead minnows (*Pimephales promelas*) (Landrum et al. 2004; Schuler et al. 2007). The average BCF, derived from the study of scuds at the five lowest concentrations tested, was 1900 with up to 28 days exposure. Higher exposure concentrations yielded lower BCF values for the scuds. Exposure of the minnows to PeCB for 28 days gave an average log of the whole-body BCF of 3.07 which equals 1175.

Bioconcentration of a mixture of chlorobenzenes at low concentrations in 250 g rainbow trout (*Salmo gairdneri*, now *Oncorhynchus mykiss*) was studied (Oliver and Niimi 1983). They reported BCF values of 13,000 and 20,000 after 119 and 105 days exposure, respectively. These results led to predicted concentrations of PeCB in Lake Ontario trout which were close to those found in the field. They stated "These results would strongly suggest that, excluding HCB, the chemical concentrations [of chlorobenzenes] in the water largely control the concentrations in fish for these chemicals."

An extensive field study using samples collected from 1982 to 1986 in Lake Ontario and selected tributaries examined the concentrations of PeCB, HCB and other chlorinated chemicals in a variety of environmental samples and biota (Oliver and Niimi 1988). This study is hard to interpret quantitatively because fish and water samples were collected at different times from different locations. However, bioaccumulation factors (BAF) for PeCB for several aquatic organisms representing different trophic levels, including several trout species, can be calculated from the results presented in their publication. PeCB concentrations were 72±15 pg/L in water, 8.4±6.5 ng/g wet weight in mysids, 5.0±3.7 ng/g ww in amphipods, 2.6 ng/g ww in sculpin, 2.1 ng/g ww in large smelt, and 5.0±3.1 ng/g ww in large trout. The BAF for PeCB in trout can be calculated from this data as (5.0 ng/g)/(72 pg/L) = 69,000. The similar concentrations of PeCB at different levels of the food web shows a minimal effect of PeCB uptake from food.,

A field study of PeCB concentrations in the industrially polluted Bayou d'Inde, Louisiana, USA reported apparent average log BAF values on a lipid basis (Pereira et al. 1988). These lipid basis values have been converted to whole-body BAF values by multiplying by the reported lipid percent in the different species. The calculated whole-body BAF values in fish were: Atlantic croaker (*Micropogonias undulatus*) 18,700; spotted sea trout (*Cynoscion nebulosus*)

2,100; blue catfish (*Ictalurus furcatus*) 12,300. The calculated BAF in blue crab (*Callinectes sapidus*) was 6,600. A later study in the same area using samples collected in 1990 gave similar BAF values but the lipid contents were not reported so that whole-body BAF values could not be calculated (Burkhard et al. 1997).

Carlson and Kosian (1987) studied the bioconcentration and toxicity of PeCB to embryo and juvenile fathead minnows (*Pimephales promelas*). After 31 days exposure to PeCB the average BCF was reported to be 8,400.

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