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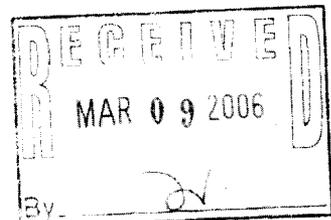
**TOXICOLOGICAL PROFILE FOR
POLYCHLORINATED BIPHENYLS (PCBs)**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry**

November 2000



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6. POTENTIAL FOR HUMAN EXPOSURE

biota. PCBs accumulate more in higher trophic levels through the consumption of contaminated food, a process referred to as biomagnification. PCBs in soil are unlikely to migrate to groundwater because of strong binding to soil. Volatilization from soil appears to be an important loss mechanism; it is more important for the lower chlorinated congeners than for the higher chlorinated congeners. Vapor-phase PCBs accumulate in the aerial parts of terrestrial vegetation and food crops by vapor-to-plant transfer.

Wania and Mackay (1996) report that most PCBs are volatile enough to cycle between the air, water, and soil at environmental temperatures, and that atmospheric transport is the most important mechanism for the global movement of PCBs. These authors further categorized the transport and partitioning behavior of PCB congeners according to the number of chlorines present on the biphenyl molecule. Volatile mono-Bs remain primarily in the atmosphere. PCBs that have 1–4 chlorines and are *ortho*-rich (i.e., number of *ortho* chlorines >1) congeners tend to migrate toward polar latitudes by a series of volatilization/deposition cycles between the air and the water and/or soil. PCBs with 4–8 chlorines remain in mid-latitudes, and those with 8–9 chlorines remain close to the source of contamination. The more heavily chlorinated and *ortho*-poor (i.e., number of *ortho* chlorines <1)/*para*-rich (i.e., number of *para* chlorines >1) PCBs are less volatile and more readily condensed from the atmosphere. Thus, these PCBs are considered less mobile (Macdonald et al. 2000; Wania and Mackay 1993, 1996).

The atmosphere is a net recipient of PCBs from soil, water, and (indirect) sediment fluxes (Hansen 1999). These fluxes are the highest in summer as a result of warmer temperatures (Hoff et al. 1992). The importance of volatilization to atmospheric concentrations of PCBs is well established. This conclusion is also supported by the estimated Henry's law constants for Aroclors and PCB congeners, which range from 2.9×10^{-4} to 4.6×10^{-3} atm-m³/mol and 1.5×10^{-4} to 2.8×10^{-4} atm-m³/mol, respectively (see Tables 4-3 and 4-7) (Thomas 1982). The Great Lakes in particular appear to be a source of PCBs to the atmosphere (Arimoto 1989; Hornbuckle et al. 1993; Swackhamer and Armstrong 1986). The estimated PCB gas fluxes out of the Great Lakes to the atmosphere in 1994 were 1,700, 2,700, 420, and 440 kg/year for Lakes Superior, Michigan, Erie, and Ontario, respectively (Hoff et al. 1996). A pseudo first-order rate constant for the volatilization of total PCBs from Lake Superior is estimated to be 0.4/year ($t_{1/2} = 2$ years) (Jeremiason et al. 1994). This latter estimated rate indicates that approximately one-half of the total water-borne mass of PCBs in Lake Superior enters the atmosphere over a 7-month period.

PCBs are transported from soil and sediment to the atmosphere. In the absence of water, the rate of movement of PCBs from the soil surface to the atmosphere is controlled by diffusive transfer (Cousins and Jones 1998). For example, Agrell et al. (1999) demonstrated that diffusive exchange from soils is the