

Polychlorinated Biphenyls (PCBs) are a class or family of 209 synthetic organic compounds, called congeners, with one to ten chlorine atoms attached to each biphenyl molecule (U.S. EPA 2005). PCB mixtures (e.g. Aroclor®) were commercially produced and sold between the 1930s and 1977 as dielectric fluids in capacitors, plastic products, dyes, pesticides, and other applications due to their extremely stable chemical properties (e.g. low flammability, slow rates of degradation, high boiling point) (Durfee et al. 1976). Also due to their physicochemical characteristics (e.g. very high K<sub>ow</sub>, lipophilicity), PCBs have a strong tendency to adsorb to sediment particles and partition into tissues, such as human, fish, invertebrate, and mink (Erickson 1997). Prior to 1977, the Missouri-based Monsanto Corporation produced greater than 600 million kg of PCBs under the trade name of Aroclor® (Erickson 1997).

In South Carolina, Sangamo-Weston, a capacitor manufacturer, discharged an estimated 400,000 lbs of the Aroclor® mixtures (1016, 1254, and 1242) into the Twelve Mile Creek Arm of Lake Hartwell between 1955 and 1977 (Brenner 2004). Lake Hartwell is a 22, 660 ha reservoir that borders the States of South Carolina and Georgia. The Lake Hartwell dam was constructed in 1955 by the U.S. Army Corp of Engineers to create Lake Hartwell.

Due to the recalcitrant nature of PCBs, these contaminants can still be found in sediment and fish in sections of Lake Hartwell. This research evaluated a potentially significant pathway for PCB movement from Lake Hartwell sediment using a sediment-dwelling midge, *Chironomus* sp., in field and lab experiments. Part of a chironomid's life cycle consists of a larval stage with intimate sediment contact and another part consists of emergence into a fly life stage. Therefore, chironomids have been used in

experiments to estimate direct movement of contaminants out of the aquatic environment. Emergent chironomids and surficial sediment were collected from Lake Hartwell and from a reference lake site and analyzed for total PCBs. In addition, Lake Hartwell sediment and reference lake sediment were used in 56-day emergent experiments in the laboratory with *Chironomus dilutus* (10 d post-hatch). These two-month long laboratory experiments were designed to help support and corroborate the fate of these contaminants in the environment. For this study, emergent chironomids (field and lab), exposed to Lake Hartwell sediment, had total PCB concentrations approaching 1 mg/kg (997ug/kg  $\pm$  158ug/kg). PCBs were not detected in emergent chironomids exposed to the reference lake sediment.

Understanding the chiral chemistry of certain PCB congeners helps to follow these contaminants up the aquatic food chain. In the past, individual chiral PCB congeners were released into the environment as racemic mixtures, a one to one ratio of each enantiomeric isomer. The two enantiomeric isomers of each chiral PCB are chemically identical, but may be toxicologically very different. If an organism, for example *C. dilutus*, preferentially takes up one of the two isomers, the one to one ratio will subsequently change leaving a “chiral signature.” This chiral signature can help track the PCB congener up food chain. Comparisons of the chiral PCB signatures, analyzed from the chironomids and sediment (in the field and lab studies), will also be presented.

Due to the significantly high PCB concentrations in the emergent chironomids, future Lake Hartwell research should focus on PCB bioaccumulation in swallows, bats, and other terrestrial consumers of these sediment – associated organisms. Next, consumption of chironomids prior to emergence by pelagic fishes may result in an

additional route of PCB exposure and should be investigated. Finally, by better understanding individual and significant routes of PCB movement in the Lake Hartwell ecosystem, we can more confidently estimate the true ecological risk due to polychlorinated biphenyls.