

Sources and Sinks of Polychlorinated Biphenyls

References:

McCarthy J. F. G. R. Southworth, K. D. Ham, and J. A. Palmer. 1999. [Time-integrated, flux-based monitoring using semipermeable membrane devices to estimate the contribution of industrial facilities to regional PCB budgets.](#) Environ. Toxicol. Chem. (in press).

Palmer, J. A., J. F. McCarthy and G. R. Southworth. 1998. [Sources and sinks of PCBs in Upper East Fork Poplar Creek.](#) Annual Meeting of the Society of Environmental Toxicology and Chemistry, Charlotte, NC, November 1998.

Abstracts:

Time-Integrated, Flux-Based Monitoring Using Semipermeable Membrane Devices to Estimate the Contribution of Industrial Facilities to Regional PCB Budgets

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Passive monitoring of polychlorinated biphenyls (PCB) using semipermeable membrane devices (SPMD) was employed to evaluate the contribution of point and nonpoint sources to the flux of PCB in a drainage system encompassing three Department of Energy (DOE) industrial and research facilities in eastern Tennessee (USA). PCB concentrations were highest at outfalls containing process waste from the DOE industrial facilities. The significance of these releases was evaluated by calculating the PCB flux (mass per unit time) at different monitoring locations. The flux was calculated from the time-integrated estimates of the aqueous concentrations of PCB and estimates of the volumetric flow rates of discharges and receiving streams during the deployment period. DOE discharges accounted for most of the flux of PCB entering the Clinch River from the DOE drainage areas, but these sources constituted only 10% of the flux in the Clinch River about the DOE sources. Principal components analysis was helpful in attributing sources of PCB. In a stream receiving multiple inputs of PCB, congener profiles from upstream sources and discrete discharges were consistent with a mixture of those congener profiles in the downstream receiving water. In another stream with a single upstream

source of PCB, changes in PCB flux and congener profiles suggested an apparent steady-state distribution between dissolved PCB and PCB adsorbed to organic matter on the stream bed. The flux of dissolved PCB along different stream reaches reflected changes in the sediment organic content. Subtle alterations in congener profiles moving downstream suggested preferential desorption of less-chlorinated congeners and sorption of more highly-chlorinated congeners to sediment. Time-integrated, flux-based monitoring can be useful across a range of spatial scales for evaluating the significance of point and nonpoint contaminant sources and can help identify and prioritize feasible remedial alternatives. [Go to top](#)

Sources and Sinks for PCBs in Upper East Fork Poplar Creek

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Passive monitoring of polychlorinated biphenyls (PCB) using semipermeable membrane devices (SPMD) was employed to identify and evaluate the contribution of point- and nonpoint sources to the total PCB flux in Upper East Fork Poplar Creek (UEFPC), a drainage system located within the Department of Energy's Oak Ridge Y-12 Plant. SPMDs were deployed at nine discrete discharges and seven locations within the stream. The contributions of PCB sources was evaluated by estimating the PCB flux (mass per unit time) at different monitoring locations calculated from the time-integrated estimates of the aqueous concentrations of PCB and estimates of the volumetric flow rates of discharges and the receiving stream during the deployment period. Two discrete discharges released almost ten-times more PCBs than the combined contribution of remaining discharges. However, these discrete discharges were not the principal sources of PCBs in UEFPC. The overall flux of PCBs in the stream quadrupled from 75 mg/d at the uppermost station to 321 mg/d at downstream boundary of the Y-12 Plant, a net increase of almost 250 mg/d. Discrete discharges into the stream could account for only 100 mg/d, demonstrating that the principal sources of PCBs in UEFPC are from historic releases, not current discharges. Buried storage tanks for PCB-containing oil were once located near the two stream reaches implicated as the likely sources, suggesting that the releases may originate through diffusion of in-place contaminants from the sediment or by advection of shallow groundwater sources beneath or adjacent to the stream. The passive monitoring of PCB flux thus identified two discharges as the principal point sources, but clarified the significance and location of nonpoint sources originated from historic contamination. [Go to top](#)

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