A schematic of the column setup used in the fixed-bed tests is shown in Figure S1. Here, the two source waters were pumped with positive-displacement pumps through columns packed with PCB-laden glass beads followed by the fixed-bed columns containing activated carbon.

**Application of the calibrated PSDM.** The conditions that produced the PSDM model fit in Figure 5F (the “best-fit”) were applied to seven of the PCBs. In the Supplemental Materials (Figure S2), the resultant simulations are shown with the left-hand column simulated B1 using B0 as the influent; the middle column simulated B2 using B1 as the influent, and the right-hand column simulated B2 using B0 as the influent. In Figure S2 A-F (34 and 33’4), the PSDM consistently over predicted the effluent data. This could be a result of the model being calibrated for 22’55’ (a congener with two ortho-chlorines) whereas 34 and 33’4 have no ortho-chlorines, which have been shown previously to attenuate PCB sorption on activated carbon (McDonough et al., 2008). However, the number of chlorines and their positions did not dictate the suitability of the model simulations for all congeners. For example, the PSDM simulation of 22’5 was adequate for Figure S2 G-I. For 23’55’, the PSDM simulation for Figure S2 J was adequate but overpredictive for B1/B2 (Figure S2 K) and B0/B2 (Figure S2 L). The simulation for 22’56’ (Figure S2 M-O) was equally as good as that for 22’5 (Figure S2 G-I). In contrast to all the other congeners, the PSDM simulation for 22’66’ (Figure S2 P-R) was underpredictive of the effluent
data in almost all cases. In summary, the PSDM calibrated for 22’55’ was overpredictive for 34, 33’4, and 23’55’; adequate for 22’5, 22’56’; and underpredictive for 22’66’.

Figure S1. Schematic of the setup used in the fixed-bed tests. PP (peristaltic pump), A0 and B0 (influent sampling ports); A1-2 and B1-2 (effluent sampling ports).
Figure S2. Influent (B0) and effluent (B1 and B2) polychlorinated biphenyl concentrations vs. bed volumes fed in the Suwannee River natural organic matter fixed-bed test. P1 (Phase 1), P2 (Phase 2), P3 (Phase 3), and K_F, Freundlich coefficient, in (mg/g)(L/mg)^1/n. Surface diffusion coefficient, D_s = 2.1 \times 10^{-40} \text{ cm}^2/\text{s} and pore diffusion coefficients, D_p = 5.5 \times 10^{-6} \text{ cm}^2/\text{s} for dichlorobiphenyls, 5.0 \times 10^{-6} \text{ cm}^2/\text{s} for trichlorobiphenyls, and 4.7 \times 10^{-6} \text{ cm}^2/\text{s} for the tetrachlorobiphenyls. Liquid film transfer coefficient, D_f, used from Figure 5F.