Hydrophobic compounds like PAHs, PCBs, dioxins, and chlorinated pesticides are widespread in sediments, and this causes us to ask 'do those contaminants pose unacceptable hazards?' But unlike air and water quality standards, establishing values for sediment quality standards is quite difficult due to the spatially variable and multiphasic nature of such deposits. Hence, it is necessary to establish methods for quantifying the chemical activities (= degree of saturation in all those equilibrated phases) of contaminants in sediment beds. To do this, we have been pursuing two approaches: (a) investigating the impact of black carbon (BC), a prominent sorbent, affecting the phase distributions of such organic contaminants in sediments, and (b) utilizing polymeric samplers that absorb contaminants in proportion to chemical activities when these materials are incubated in sediments. In both cases, these methods have allowed us to make much better predictions of the bioaccumulation of organic contaminants than has been possible using sediment concentration data and EPA’s equilibrium partitioning approach. Further, we believe such improved understanding will substantially enhance the ability to design site-specific remediation as the spatial extent of contamination, mapped as chemical activities, will (a) identify locations where contaminants are being introduced to overlying waters and to aquatic food webs and (b) characterize substrate activities that limit the rates of in situ treatments such as bioremediation.