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Fate and Transport of Cohesive Sediment and HCB in the Middle Elbe River Basin

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Chemical contamination of waterways and floodplains is a pervasive environmental problem that threatens aquatic ecosystems worldwide. Due to extensive historical contamination and redistribution of contaminated sediments throughout the basin, the Elbe River transports significant loads of contaminants downstream, particularly during flood events. This study focuses on Hexachlorobenzene (HCB), a persistent organic pollutant that has been identified as a contaminant of concern in the Elbe Basin. To better understand the fate and transport of cohesive sediments and sediment-sorbed HCB, a hydrodynamic, suspended sediment, and contaminated transport model for the 271-km reach of the Elbe River basin between Dresden and Magdeburg was developed. Additionally, trends in suspended sediment and contaminant transport were investigated in the context of the recent high frequency of floods in the Elbe Basin.

This study presents strong evidence that extreme high water events, such as the August, 2002 floods, have a permanent effect on the sediment transport regime in the Elbe River. Additionally, results indicate that a significant component annual HCB loads are transported downstream during floods. Additionally, modeled results for suspended sediment and HCB accumulation on floodplains are presented and discussed. Uncertainty and issues related to model development are also addressed. A worst case analysis of HCB uptake by dairy cows and beef cattle indicate that significant, biologically relevant quantities of sediment-sorbed HCB accumulate on the Elbe floodplains following flood events. Given both the recent high frequency of floods in the Elbe Basin, and the potential increase in flood frequency due to climate change, an evaluation of source control measures and/or additional monitoring of floodplain soils and grasses is recommended.