Evaluation of Activated Carbon Treatment Technologies in a PCB-Contaminated Wetland

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Introduction: Remediation of contaminated sediments from palustrine and tidal wetland systems traditionally has involved excavation of wetland sediments (hydric soils) and off-site transport of excavated materials for treatment and disposal. This type of remediation is both ecologically destructive and expensive, and restoration of ecological systems can be challenging. This ongoing program investigates an alternative remedial approach that allows targeted in situ remediation of wetlands through the application of activated carbon-based sequestration agents, a technology that has the potential to reduce costs tremendously with the added benefit of minimizing impacts on ecosystem components.

Methods: A field demonstration project was recently completed at a PCB-contaminated coastal Mid-Atlantic USA site to evaluate the efficacy of delivering activated carbon (AC) to wetlands using different application technologies. The field demonstration commenced in the fall of 2010, when AC was administered to multiple plots in the wetland system via pelletized dry-broadcasting and slurry delivery systems. Three treatment technologies, as well as inert sand caps and "no treatment" controls, were included in the study. Two different pelletized AC amendments were delivered via a small scale granular application spreader and a mulch blower, whereas an AC slurry system resulted in the delivery of powdered AC to test plots using a portable high solids sprayer. Performance in the field application is being gauged through several measures of reduction of contaminant bioavailability (e.g., pore water evaluation and bioaccumulation studies) following addition of the sequestration agents. Monitoring samples were collected at twenty treatment test plots prior to the field demonstration, and at six and twelve months following amendment application.

Results: Six and 12 months following carbon treatment, reductions in sediment porewater concentrations were observed for both dry broadcast and slurry delivered amendments. A porewater increase in PCB concentrations was observed in the sand control plots. A similar trend was observed in laboratory bioaccumulation studies. Pore water decreases post-application were related to oligochaete tissue residues, and partition coefficients increased for both pore water and tissue up to 12 months post application. Studies to evaluate the health of hydrophytic vegetation following amendment application and potential impacts of amendment addition on nutrient uptake indicated that the hydrophytic plant community was generally un-impaired by any of the amendment applications, and that in fact nutrient uptake might increase following AC application.

Discussion: The PCB bioavailability analysis determined that the pore water partitioning was enhanced and bioavailability was reduced by addition of carbon amendments to this tidal wetland system. The results of the ecological monitoring suggest that there was no effect of treatment on plant species composition, diversity, or abundance within the field demonstration wetland. Furthermore, none of the demonstration treatments are likely to impair the uptake of nutrients and metals into plants in the treated wetland. However, longer term monitoring is recommended to provide a more rigorous assessment.

Acknowledgements: The U.S. Department of Defense (DoD) Environmental Security Technology Certification Program (ESTCP) kindly funded this program.

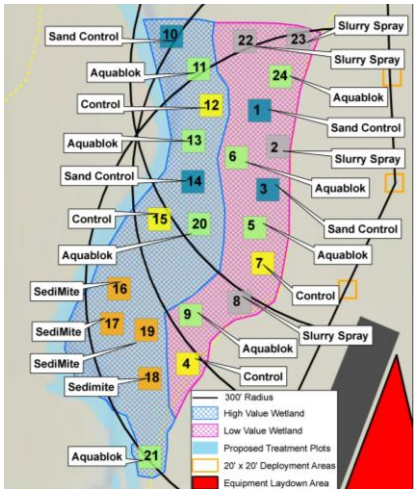

Figure 1. 24 plots were monitored in this AC demonstration program