FIELD DEMONSTRATION OF ACTIVATED CARBON AMENDMENT TO SEDIMENT IN A RIVER

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In our recent work, we demonstrated how sediment geochemistry can be altered by the amendment of sorbents, such as activated carbon, to reduce contaminant availability, exposure, and accumulation in sediment-dwelling organisms. Results of a field demonstration study of in situ sediment amendment with activated carbon (AC) being carried out in a river will be presented. The pilot-scale demonstration study was conducted in 2006 in Grasse River, NY to study the effectiveness of activated carbon addition to sediment in a field setting. Field sediments in a 0.5-acre plot in the Grasse River were mechanically amended with AC in mixed and unmixed treatment areas. Monitoring before and 1 and 2 years after AC amendment included bioaccumulation tests conducted in situ and ex situ, and the measurements of aqueous equilibrium, PCB desorption kinetics, and the spatial distribution of AC dose achieved in surficial sediments.

Efficiency of the treatment after 1 year depended on dose and method of application and mixing. Treatment sites where the AC was applied, but not mixed into the sediments and received the target dose demonstrated percent reduction in PCB tissue concentrations between 69 and 84% in ex situ measurements. Treatment sites where the activated carbon was mixed into the surficial sediments and achieved the target dose showed 82-92% and 92-95% reductions in average tissue concentrations (as µg/g wet weight) in in situ and ex situ tests, respectively. Bioaccumulation tests 2 years after application showed further reductions from Year 1 levels at nearly all monitoring sites. Based on the 2-year post treatment monitoring data, it appears that PCB bioaccumulation and aqueous concentration decreases with increasing dose of AC up to a dose approximately equal to the native total organic carbon (TOC) content of the sediment. At an AC dose equal to native TOC, reductions in aqueous equilibrium concentration approach 100%, but reduction in PCB concentration in worm tissue and lipid are in the range of 70-95%. A 3-year monitoring was performed in the Fall of 2009 and the samples are being analyzed in the laboratory. Based on the results obtained thus far, it appears feasible to apply AC under 15-feet of water on a large scale in a river. Also, the carbon is preserved in the surficial sediments 2 years after application and it remains effective in reducing contaminant bioavailability.