INTRODUCTION
Sediments in the urban harbors often exhibit elevated levels of polychlorinated biphenyls (PCBs) bioaccumulation, limiting their suitability for beneficial use or placement in aquatic sites. Hydrophobic organic contaminants of concern are typically strongly bound to the organic fraction of fine-grained sediment. Amendment of dredged material in the bioactive zone with activated carbon has the potential to provide bioaccumulation control, permitting expanded use of aquatic placement where confined disposal facility (CDF) capacity is being exhausted.

Activated carbon has been applied directly to sediment only about a dozen times, mostly in small pilot demonstrations (Patmon et al. 2015). Only a few of these applications were larger than our current demonstration and half of the applications were much smaller. None of these applications used techniques representative of common dredging operations. The purpose of this demonstration is to determine the efficacy of mixing activated carbon (both powdered and granular) within the bioactive zone of the demonstration site to compare their physical, chemical and bioaccumulative characteristics. Then, the dredged material was amended with powdered activated carbon (PAC) and granular activated carbon (GAC) (Figure 3). The activated carbon and dredged material were blended using a 7.8-cubic meter (10-cubic yard) clamshell bucket to mix the material in the barge (Figure 4). The amended material was discharged over the dredged material mound to create a treated bioactive zone.

Approach
In August 2015, fine-grained sediment from the Ashtabula, Ohio Harbor on Lake Erie was mechanically dredged and placed in an 1150-cubic meter (1500-cubic yard) eight-compartmented bottom dump scow (Figure 2). The dump scow sampled to characterize its physical, chemical and bioaccumulative characteristics. Then, the dredged material was amended with powdered activated carbon (PAC) and granular activated carbon (GAC) (Figure 3). The activated carbon and dredged material were blended using a 7.8-cubic meter (10-cubic yard) clamshell bucket to mix the material in the barge (Figure 4). The amended material was discharged over the dredged material mound to create a treated bioactive zone.

In July 2016, an additional twenty-five surface grab samples were collected at the placement site using a 10-liter Petersen grab dredge that collected approximately a 7.6-cubic meter (10-cubic yard) deep sample over an area of 930 square centimeters (a square foot). Roughly the top half of the samples contained activated carbon and were analyzed for grain size distribution, solids content, organic content, labile organic matter, refractory organic matter, PAC content and GAC content. Organic and activated carbon contents were analyzed gravimetrically by incremental combustion and sieving.

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SUMMARY AND CONCLUSIONS
• Activated carbon can be applied for bioaccumulation control using conventional dredging equipment. Good coverage of the dredged mound was achieved.
• GAC appears to be less effective in the short term due to the diffusion kinetics in a low mixing environment.
• Losses of PAC during descent and collapse of the amended discharge were much greater than expected. However, the losses would still provide benefits to the project.

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