Activated Carbon-Amended Enhanced Natural Recovery (ENR): Results from the Lower Duwamish Waterway Pilot Study, Year 1

Victor S. Magar (vmagar@ramboll.com)(Ramboll, Chicago, IL, USA)
Jason Conder (Geosyntec, Huntington Beach, CA, USA)
Gretchen Heavner (Floyd Snyder, Seattle, WA, USA)
Cliff Whitmus (Wood, Seattle, WA, USA)
Lis Nelis (Ramboll, Seattle, WA)
Rob Webb (Dalton, Olmsted & Fuglevand, Seattle, WA, USA)
Debra Williston and Jeff Stern (King County, Seattle, WA, USA)
Brian Anderson and Joe Flaherty (The Boeing Company, Seattle, WA, USA)
David Schuchardt, Peter D. Rude, and Allison Crowley (City of Seattle, Seattle, WA, USA)
Joanna Florer (Port of Seattle, Seattle, WA, USA)

Background/Objectives. Application of activated carbon (AC), as a stand-alone in situ treatment or to augment enhanced natural recovery (ENR), is gaining recognition as a remedial technology for reduction of the bioavailability of hydrophobic, bioaccumulative compounds in contaminated sediments. Application of AC can reduce the bioavailability of organic chemicals to benthic organisms and higher trophic receptors by an order of magnitude or more. A pilot program is underway on the Lower Duwamish Waterway (Seattle, WA, USA) to test the use of AC to augment an ENR layer of sand or gravelly sand materials and reduce the bioavailability of PCBs in sediment.

Approach/Activities. This pilot project compares the effectiveness of ENR with ENR amended with AC (ENR+AC) in the Lower Duwamish Superfund Site, an active, urban, deep draft waterway subject to a range of flow conditions and sediment characteristics. Parallel ENR and ENR+AC subplots were successfully placed in three, separate, one-acre plots: one in the deeper navigation channel, one in a berthing area subject to prop scour and one in an intertidal location subject to waves and wakes. Construction took place November 2016 to February 2017. Monitoring is scheduled for three years to evaluate and compare ENR and ENR+AC performance in reducing the bioavailability of PCBs in the uppermost 10-cm surface layer. Monitoring events already completed include baseline sampling before construction, post-construction monitoring in February-March 2017, and the Year 1 monitoring event completed May-June 2018. Monitoring metrics include evaluation of ENR and ENR+AC stability, including the stability of carbon in the ENR+AC layers, and chemical bioavailability using whole sediment and porewater (freely-dissolved) analyses.

Results/Lessons Learned. This talk will present the monitoring design and results after one year of placement. We will discuss monitoring methods and results, evaluating the stability of the AC amendment under different site conditions, the deposition of natural sediment on the ENR and ENR+AC subplots, PCB bioavailability in both the ENR and the ENR+AC layers, and initial implications on effectiveness.