Adaptive Management and Remedy Implementation: Differences between Anticipated and Operational Dredging on the Hudson River PCB Superfund Site

Mike Traynor (mtraynor@louisberger.com) (Louis Berger US, Albany, NY, USA)
Edward A. Garvey and Bruce Fidler (Louis Berger U.S., Morristown, NJ)
Marc S. Greenberg (U.S. EPA, Edison, NJ)
Michael Cheplowitz and Gary Klawinski (U.S. EPA, Albany, NY)

Background/Objectives. In the 2002 Record of Decision (ROD), USEPA (EPA) selected a dredging remedy from potential alternatives to address 2.65 million cubic yards of PCB-contaminated sediment in the Upper Hudson River that included removing contaminated sediments from certain areas and natural attenuation of PCBs remaining in undredged areas. The selected remedy also included certain institutional controls, a monitoring program to determine when Remedial Goals are reached, and separate upstream source control. Remedy selection involved the use of model forecasts based on assumptions regarding dredging implementation involving the time needed to complete dredging, an upstream-to-downstream dredging sequence, and the use of two sediment processing facilities.

Approach/Activities. It is not unusual for a large complex project such as the Hudson River remediation to encounter challenges to operational assumptions made during planning; and to observe, short-term localized, and transient impacts to water column and fish-tissue PCB levels during dredging. EPA anticipated these results and had scheduled a peer review of operations and the agency's engineering performance standards between the first and second year of operations. Beginning in 2011, peer review panel recommendations were implemented that improved overall dredging productivity while maintaining protectiveness. In addition, during remedy implementation, modifications were made to certain aspects of the dredging operations compared to modeling inputs. Each individual modification by itself may not have constituted a major deviation from key model assumptions. However the sum of these modifications resulted in conditions during dredging that were not fully accounted for in the alternatives as modeled.

Results/Lessons Learned. This presentation describes key differences between dredging design/modelling assumptions and dredging operations and how those differences changed conditions in the river during implementation. We will discuss how EPA responded, through adaptive management, to challenges those differences presented. For example in the design, depth of contamination was expected to be a readily achievable horizon. In reality, observed depths of contamination were often deeper than design cuts. This led to data-driven re-dredging, higher than anticipated resuspension releases, and schedule adjustments. PCB resuspension releases were anticipated to be particle-borne from bucket disturbances of the river bottom. However, PCB releases were often observed as oil representing NAPL remaining within target sediments. In response, EPA directed the contractor to modify operations compared to original design cut depths. In concert with EPA's development of an index-based evaluation system to facilitate re-dredging and closure decisions, this response reduced the time between dredging initiation and completion within dredging operational units. Other modifications included using one processing facility and dredging sequence revisions in consideration of safety. We will discuss these and other adaptive management responses and describe potential implications for long-term recovery of the river and associated monitoring. We will also compare actual observations to dredging model forecasts and post-dredging conditions while recognizing the uncertainty and variability in both.