Selection of In Situ Stabilization Target Areas for NAPL-Impacted Sediment Remediation

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Background/Objectives. The Gowanus Canal in Brooklyn, New York, is a historic industrial canal built in the mid-1800s that served several heavy industries, including three former manufactured gas plants. The canal sediments are extensively and highly impacted by non-aqueous phase liquids (NAPLs). The canal was listed in the United States Environmental Protection Agency's (EPA's) Superfund list in 2010. In 2013, EPA issued a Record of Decision (ROD) for cleanup of the canal, which specifies a multicomponent sediment remedy that includes: 1) dredging of the soft sediment, 2) in situ stabilization (ISS) of native sediments in areas of the canal with the potential for upward NAPL migration, and 3) capping the entire canal with a multilayer cap system. Selection of the areas targeted for ISS is a critical step in the remedial design (RD) and the implementation of the ROD requirements.

As part of the RD, the potentially responsible parties (PRPs) collected extensive NAPL data in the upper canal in 2015 and 2016, which was used to establish NAPL saturation thresholds and hydraulic gradient thresholds for upward NAPL migration. Frozen core Tar-specific Green Optical Screening Tool (TarGOST) analysis was used to establish a TarGOST reference emitter (RE) response measurement which was indicative of the NAPL pore saturation threshold for upward NAPL migration. Because some of the threshold exceedances for migration were present in thin NAPL layers or were not immediately below the dredge line (at the interface of soft and native sediment where the cap would be placed), a one-dimensional mass balance was utilized by the PRP group to determine which locations with NAPL threshold exceedances had the potential to reach the cap by upward migration.

Approach/Activities. The in situ characterization included analysis of several TarGOST borings located throughout the canal. Laboratory analyses specific to NAPL migration and mobility included evaluation of pore fluid saturation, NAPL mobility testing by water drive, NAPL mobility testing by centrifuge, and controlled gradient mobility tests. Finally, sediment cores were analyzed using laser induced fluorescence frozen core analysis which was matched to the TarGOST RE response for each sediment.

This large data set was analyzed and the results were presented to the EPA. Of the 67 TarGOST sample locations in the upper canal, 40 had a threshold exceedance for saturation based in the TarGOST correlation. However, when the one-dimensional mass balance was applied to the results by the PRP group, their analysis indicated only 10 locations with potential NAPL mobility requiring ISS.

Results/Lessons Learned. EPA's review identified that no sensitivity analysis was performed in running the one-dimensional mass balance. The approach did not account for potential migration layers present outside of the one-dimensional data set. As a result, EPA proceeded to perform a sensitivity analysis on the data set that resulted in identifying 26 locations containing NAPL with the potential of migrating upwards into the cap layer and therefore requiring ISS. Subsequently, EPA issued a directive to the PRPs to include the 26 locations for ISS in the RD.

This presentation will discuss the one-dimensional mass balance utilized by the PRP group and how the sensitivity analysis was performed on the data to further refine the determination of areas in the upper part of the Gowanus Canal requiring ISS.