

NAPL Mobility beneath the Newtown Creek Study Area: Multi-Stage Testing Process and Results for Creek Mile 0–2

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Background/Objectives. A multi-stage testing process was developed to characterize nonaqueous phase liquid (NAPL) mobility at the Newtown Creek Superfund Site in Brooklyn/Queens, New York. NAPL mobility is a key consideration in the Feasibility Study (FS). Within the 3.8-mile long waterway, approximately 10 to 25 feet of soft, organic silty sediment overlies firmer native materials including alluvium and glacial deposits. NAPL has been identified in soft sediment and native deposits, and its mobility is being assessed in both units. Previous investigations delineated the areas and general depth intervals containing the most notable NAPL presence in sediment and native materials. The primary objective of the FS NAPL mobility program is to characterize NAPL mobility in areas most likely to contain potentially mobile NAPL, but the program also includes sampling and testing in areas where sediment screening observations and tests suggest NAPL is present, but mobility is unlikely.

Approach/Activities. This study comprehensively evaluates NAPL mobility along the entire waterway in areas where NAPL has been identified in sediment and native deposits. At 33 sampling stations, three cores are collected through the entire soft sediment thickness and to various depths in the native materials. A tiered, three-stage approach was used to determine NAPL mobility. During Stage 1 testing, cores are slabbed and photographed under white light and ultraviolet light to select test intervals with the highest visible NAPL presence, which are centrifuged at 25G (hydraulic gradient of 25) for 10 hours; this driving force is hundreds to thousands of times stronger than those experienced in situ. If no NAPL is produced, it is determined that the NAPL is immobile and no further testing is required. For samples that produce NAPL during centrifuging, Stage 2 mobility testing is conducted using flexible-wall permeameter water-drive testing at hydraulic gradients between approximately 0.5 and 4 (dimensionless) for periods of days to weeks. If no NAPL is produced, the NAPL is immobile and no further testing is required. For samples that produce NAPL under Stage 2 laboratory test conditions, additional evaluations are conducted during Stage 3 to evaluate the potential for NAPL to migrate upward into the overlying materials under field conditions.

Results/Lessons Learned. Results for creek mile 0 – 2 indicated Dean-Stark NAPL saturation values of 1.0% to 13.6% in the soft sediment samples, and 1.5% to 15.7% in native material samples. None of the 28 Stage 1 centrifuge tests produced any NAPL. Core photographs show that NAPL in sediment consists primarily of disconnected droplets a few millimeters or less in diameter. These droplets are interpreted as oil-particle aggregates, oil droplets coated with fine particulate matter, which were emplaced along with the sediment during decades of deposition in the urban waterway. The absence of NAPL mobility in the sediment and native materials is attributed to relatively low saturation and discontinuity of NAPL and is consistent with the previously collected NAPL delineation information for this part of the Study Area. The absence of NAPL mobility in the native deposits is consistent with the U.S. Environmental Protection Agency's NAPL mobility test results at the nearby Gowanus Canal site, which indicated that NAPL in the native materials is immobile at or below a NAPL saturation of approximately 20%.