Focused Testing to Resolve Causes of Sediment Toxicity for Ecological Risk Assessment at a Complex Urban Waterway

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Background/Objectives. Newtown Creek is a tidal tributary to the East River located between the boroughs of Brooklyn and Queens, New York, with a long history of impacts from municipal and private/industrial contamination. It is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)—or Superfund—site due to the presence of pollutants in its sediments. As part of the Baseline Ecological Risk Assessment for the Newtown Creek Remedial Investigation, 28-day sediment toxicity tests were completed for 36 creek stations and 24 reference area stations, using the amphipod *Leptocheirus plumulosus*. Reference area data were used to develop a reference envelope for comparison with the site that reflected the range of industrial and municipal point source/combined sewer overflow (CSO) influences on toxicity at the site. Based on synoptic measurements of porewater contaminants and bulk sediment SEM-AVS, observed toxicity at some stations could be explained by polycyclic aromatic hydrocarbon (34) (PAH [34]) with some minimal contribution from metals. However, there was a subset of stations for which toxicity could not be fully resolved based on porewater contaminant concentrations. Given the proximity of these stations to CSOs and municipal stormwater outfalls, a follow-up testing program focused on the role of non-typical CERCLA stressors such as pharmaceuticals and personal care products (PPCPs), an unresolved complex mixture (UCM) of non-PAH weathered oil, and sulfides, which are known to be a standard confounding factor in sediment toxicity tests.

Approach/Activities. The toxicity testing program was designed to address three key questions: 1) are PPCPs bioavailable and associated with toxicity; 2) are amphipods physically impacted (i.e., fouled) by non-PAH hydrocarbons; and 3) are the carbon-enriched sediments contributing to toxic sulfide levels that are not mitigated using standard pre-test procedures? A 10-day toxicity testing program was conducted using two species of amphipod, *Leptocheirus plumulosus* and *Ampelisca abdita*, to evaluate differences in organism sensitivity. In addition, two test series were conducted: one pre-treated by allowing for equilibration 12 days prior to test initiation, and one without pre-treatment. To evaluate fouling as a mechanism of toxicity, sacrificial replicates were evaluated on days 1, 2, 4, and 10 using microscopy and digital photography to document amphipod condition. Porewater chemical concentrations were measured using multiple methods including solid-phase microextraction fibers and high-speed centrifugation.

Results/Lessons Learned. The testing program results and data analysis indicate that stressors other than typical CERCLA hazardous substances are also likely contributing to benthic macroinvertebrate toxicity in sediments subject to ongoing municipal point source discharges in this urban waterway. These other stressors include high organic matter leading to sediment porewater sulfide concentrations above threshold values, measured sediment porewater concentrations of PPCP chemicals above threshold values (i.e., nonylphenol, bisphenol-A, and 4-tert-octylphenol), and elevated concentrations of bulk sediment UCM that result in a physical fouling of the organisms.

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