Evaluation of the Potential for Monitored Natural Recovery of Chlorinated Benzene Compounds in Groundwater-Impacted Sediments in a Freshwater Canal

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Background/Objectives. The selection of monitored natural recovery (MNR) as a remedial alternative for contaminated sediment sites can provide significant environmental and cost benefits when compared to more intrusive remedies (e.g., dredging and capping). However, the selection of MNR as a sediment remedy requires a substantive demonstration that site conditions are conducive to natural recovery processes that will reduce exposure to acceptable levels within a reasonable timeframe. The evaluation of MNR suitability requires a robust conceptual site model (CSM) and supporting monitoring data to demonstrate elements critical to successful remedial outcomes, including source control, institutional controls for human exposure, reduced exposure within the biologically active zone (BAZ), sediment stability, and relevant natural recovery processes. These elements may be demonstrated using existing remedial investigation data and data acquired from focused studies designed based on MNR objectives. The development of a formal MNR investigation framework is an essential tool in evaluating and documenting: 1) the suitability of site conditions for MNR; 2) lines-of-evidence for natural recovery processes; and 3) data gaps in the evaluation of MNR criteria. This work describes the development of an MNR investigation framework and presents preliminary investigation findings to evaluate the suitability of MNR in a freshwater canal in New Jersey (USA) impacted by chlorinated benzene compounds historically transported via groundwater.

Approach/Activities. An MNR Investigation Framework Document (MNR Framework) was developed to provide a comprehensive weight-of-evidence evaluation of natural recovery processes in sediments within the canal. The MNR Framework synthesized existing data to support the current CSM and evaluate MNR criteria. The framework also provided the basis for sampling and analysis plans (SAPs) designed to address data gaps identified in the MNR evaluation and establish long-term monitoring of natural recovery processes. SAPs were developed for long-term monitoring of bulk sediment and pore water concentrations within the canal. A groundwater monitoring SAP was also developed to evaluate the effectiveness of an interim measure to eliminate the migration of impacted groundwater. In addition, focused MNR investigations were conducted to evaluate identified natural recovery processes, including sedimentation and biodegradation using compound specific isotope analysis (CSIA). Multi-media investigations supporting the MNR Framework were conducted from 2015 to 2016.

Results/Lessons Learned. Multi-media investigations conducted to support the MNR Framework indicate that conditions within the canal are conducive for an MNR remedy. Groundwater monitoring conducted through 2016 indicates that the interim groundwater remedial measure is effectively controlling the primary source of contamination. Multiple lines of evidence from bulk sediment and pore water investigations indicate that natural recovery processes, including chemical transformation, biodegradation, and physical isolation are occurring within canal sediments. The evaluation of current exposure based on bulk sediment and pore water data indicate reduced exposure point concentrations within the BAZ. Collectively, these findings indicate that MNR is a viable remedial alternative for canal

sediments. Continued monitoring of multiple media is recommended to support the weight-of-evidence evaluation of natural recovery processes identified in the MNR Framework.