

Decision Framework for Selecting Multi-Technology Remedy for Complex DNAPL Remediation

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Background/Objectives. Installation Restoration (IR) Site 03 at the Hunters Point Naval Shipyard in San Francisco, CA is developing a multi-technology treatment strategy to remediate a complex nonaqueous phase liquid (NAPL) comprised of a mixed petroleum hydrocarbon, chlorinated benzene, polycyclic aromatic hydrocarbon, polychlorinated biphenyl and aryl phosphates located next to San Francisco Bay that has resulted in chemical discharge to the Bay. Pilot testing was conducted to evaluate in situ thermal remediation (ISTR) and in situ solidification and stabilization (ISS) with hydraulic control to address the NAPL and facilitate redevelopment. For full-scale design, a Criterium Decision Plus (CDP) support tool was used to evaluate multiple combinations of NAPL remediation scenarios with ISTR and ISS to develop the remedial strategy and achieve remedial goals of treating mobile NAPL and preventing mass discharge of contaminated groundwater with concentrations above criteria for aquatic wildlife.

Approach/Activities. CDP is decision-making software that is based on multi-criteria decision making using the Analytic Hierarchy Process and the Simple Multi-Attribute Rating Technique. CDP input parameters were developed to evaluate the technology design scenarios qualitatively and quantitatively based on effectiveness, implementability, permanence, feasibility and risks, environmental footprint and sustainability, and cost.

Results/Lessons Learned. Over 14 ISS and ISTR design scenarios were evaluated. Table 1 presents the high-level results of the assessment, which selected ISS to treat the mobile NAPL because of its improved performance relative to ISTR. This paper will present the development of the quantitative metrics and overall evaluation and selection of the remedial technology.

Table 1. Summary of Technology Evaluation			
Criteria	Metric	ISTR	ISS
Feasibility and Risk	Qualitative score based on hazardous materials generation, handling, and disposal	Moderate	Low
Sustainability	Numeric score based on SiteWise™	High	Moderate
Implementability and Permanence	Qualitative score that measures the complexity of implementation	Difficult	Moderately Difficult
Capital Cost	Capitol Cost (\$M)	\$14.7	\$13.8