A Case Study of a Sustainable, Dynamic, and Cost-Effective Approach to the Remediation of a Petroleum-Impacted Site

Speaker:

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Background/Objectives: Site Stripper Pit No. 43 (SP43) at Joint Base Pearl Harbor-Hickam (JBPHH), Hawaii is a 1.3-acre area planned for the construction of a joint fire/crash rescue station. A reported 2,000 gallons of jet fuel were released in 1997. Site investigations resulted in subsurface soil and soil gas contaminated by petroleum hydrocarbons with up to 1 foot of light non aqueous phase liquid (LNAPL) measured in monitoring wells. A Response Action Memorandum signed in 2011 required the implementation of land use controls (LUCs), monitored natural attenuation (MNA), source soil excavation/disposal, and in situ chemical oxidation (ISCO) using calcium peroxide. Overall project objectives were to prevent human exposure and implement source removal to reduce soil and soil gas concentrations below the site-specific industrial remedial action cleanup goals (RACGs).

Approach/Activities: Project scope was optimized through routine and constructive interactions with project stakeholders to implement a more sustainable remedy that would minimize landfill disposal. The final remediation plan consisted of pre-design activities including an ISCO bench test and injectability pilot test, ex-situ chemical oxidation (ESCO) of the identified source zone to reduce the LNAPL mass, baseline sampling using an incremental sampling (IS) approach, ISCO to reduce hydrocarbon concentrations outside of source zone, long-term monitoring for MNA, and LUCs to prevent human exposure where site-specific RACGs are not met. Ex-situ mixing was preferred versus mixing in place because of uncertainties on contamination depth and to achieve better contact between soil and oxidant. Data are presented to demonstrate that ESCO can be a sustainable and cost-effective alternative for the remediation of petroleum-contaminated soil (PCS) by comparing post-ESCO soil sampling results to industrial remedial action clean up goals (RACGs).

Results/Lessons Learned: Activated sodium persulfate (Klozur®) was selected as the most effective oxidant for the site to achieve maximum total petroleum hydrocarbons (TPH) destruction, while also minimizing volatile organic compounds off gas. ESCO included the excavation of approximately 3,150 cubic yards of PCS from the identified source area, mixing with lime-activated sodium persulfate (concentration of approximately 9 grams of per kilogram [g/kg]), and stockpiling soil on site for a 14-day reaction time. Stockpiled soil IS results indicated TPH concentrations below industrial (and in most cases also below residential) RACGs and up to approximately 85 percent destruction of TPH. All excavated soil was reused on site as backfill to close the excavation. This approach resulted in subcontractors cost savings of $265K during implementation of source removal. Critical to the project success were a very constructive interaction among stakeholders and a flexible remediation plan allowing the implementation of

a more sustainable solution, which avoided disposal of soil at the local landfill on a small island where the land is highly valuable. It is concluded that ESCO may be a cost-effective and sustainable alternative for remediation of PCS compared to dig & haul or ISCO.