Lessons Learned: The Importance of Proper Project Planning When Integrating In Situ Mechanical and Biological Hydrocarbon Remediation Technologies

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Background/Objectives. One of the common challenges at large-scale, long-term remediation sites is the proper integration of mechanical and biological in situ remediation technologies. Project planning often focuses on the high-dollar, and highly visible, mechanical systems that remove the bulk of free product at a location. However, biological processes that function in locations not easily accessed by these mechanical systems or as critical polishing steps, are often incorrectly assumed to be capable of performing their duties regardless of what changes are imparted on the subsurface by mechanical remediation actions. A former U.S. Air Force (USAF) base was decommissioned in the early 1990's, after over 50 years of military service. A legacy of subsurface impacts by JP-4 jet fuel had been addressed by mechanical remediation, which rendered site conditions unfavorable for the originally-planned enhanced bioremediation (EBR) strategy that was to follow. This resulted in costly project delays and threatened a failure to meet remedial objectives.

Approach/Activities. From 2014 through 2016, full-scale steam-enhanced extraction (SEE) was conducted by the USAF in order to more rapidly remove contaminants from groundwater. During this time, approximately 216,000 gal of free-phase hydrocarbons were reported to have been removed from the subsurface. EBR was then planned to commence. However, it was quickly determined that the availability of an appropriate, hydrocarbon-degrading, microbial population was in question due to residual, inflated subsurface temperatures and altered site geochemistry. Plans were also not in place to properly demonstrate and monitor indigenous microbial contaminant bioattenuation during the planned EBR phase. Substantial project delays, increased lifecycle costs, and heightened regulator scrutiny were the result. Significant but necessary corrective actions were performed to outline, and then subsequently conduct, proper biogeochemical analyses prior to EBR inception. In addition, a workplan was established to ensure proper EBR monitoring and documentation during the EBR project phase.

Results/Lessons Learned. This project dramatically underscores the need to correctly plan for the transition between mechanical and biological remediation strategies at a long-term contamination site. Technical microbial knowledge is required in order for essential contaminant-degrading bacteria to have the greatest chance of success in their critical role. At this location, strong intervention ensured that appropriate biogeochemical assessments were designed, performed, and correctly interpreted. This has resulted in a body of molecular, stable isotope, and other site biogeochemical data that strongly suggests that the correct microbial population has now been targeted to achieve the biodegradation of residual site hydrocarbons. In addition to showing signs of success, where EBR failure was once almost-ensured, this corrected EBR workplan also allows for proper monitoring and documentation of biodegradation throughout the EBR project phase. This presentation will outline how to increase the chance of project success when both biological and abiotic remediation techniques are required to work in tandem to achieve remedial objectives and project goals.