PROJECT HIGHLIGHT

HRSC AND ACTIVATED SODIUM PERSULFATE INJECTIONS AT FORMER GAS STATION

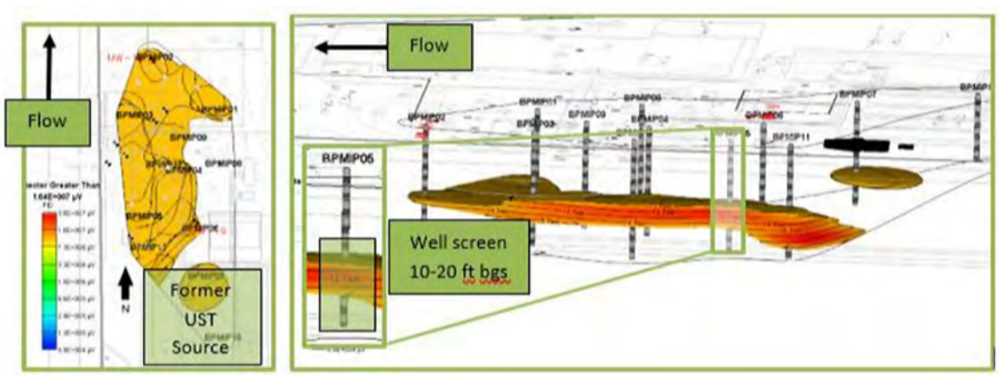
High Resolution Site Characterization (HRSC) was used to optimize In Situ Chemical Oxidation (ISCO) of petroleum hydrocarbons to better define contaminant mass distribution at a site in Winston Salem, NC. The Membrane Interface Probe (MIP) was utilized to define the target treatment volume, resulting in reduced project costs by almost 25%. Additionally, caustic persulfate distribution was verified using Electrical Conductivity (EC) logging to confirm distribution within identified source mass.

CLIENT: Inactive Gas Station
LOCATION: Winston Salem, Nc
TECHNOLOGY: MIP, EC Logging Followed by ISCO Injections
REAGENT: Activated Sodium Persulfate
CONTAMINANTS: Benzene

The site was an inactive gas station within a busy retail intersection. Previous traditional remediation approaches using mechanical systems had not achieved the remedial goals. Due to site heterogeneity, an MIP investigation was performed to identify any data gaps in the conceptual site model. Additionally, since targeted distribution of oxidant is critical to chemistry efficacy, distribution was verified using direct sensing logging approaches to lock in injection flow rates, pressures and point spacing prior to full scale remediation. Since a large portion of benzene mass was sorbed to soil, two injection events were planned to achieve benzene reductions. The client's main goal was to reduce source area benzene concentrations below the risk-based cleanup level of 5 mg/L benzene.

APPROACH

MIP logging of the site was used to better define the contaminated horizontal and vertical extent in the heterogeneous source area to support the design of a targeted ISCO remedy. The MIP was used at 13 locations to an average depth of 20 feet below ground surface (bgs) over 2 days. The vertical injection interval was decreased, and the activated sodium persulfate injections were slightly increased based on the findings of the survey.



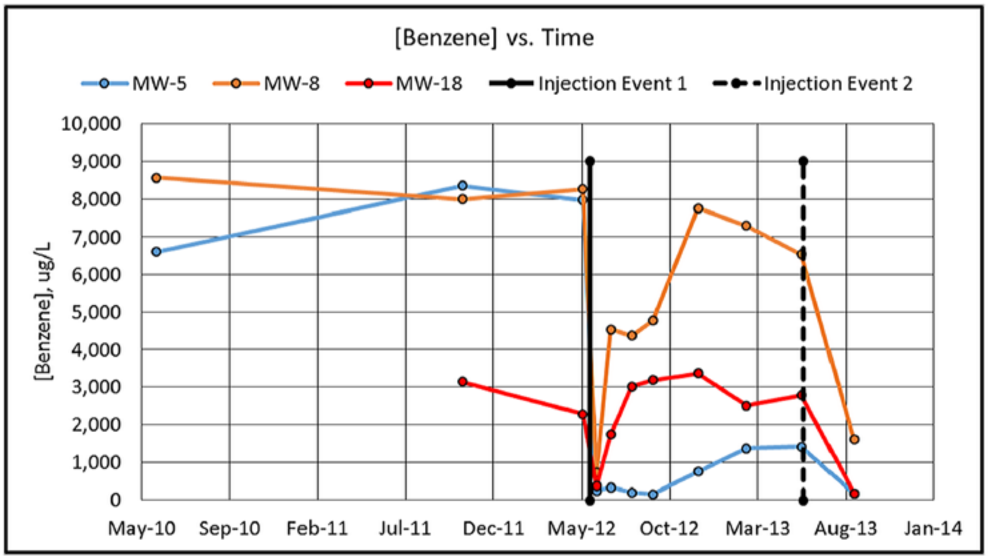
HRSC AND ACTIVATED SODIUM PERSULFATE INJECTIONS AT FORMER GAS STATION

	Preliminary Design	Optimized Design	% Change
Treatment Area	2,500 ft^2	3,000 ft^2	+20%
Injection Interval	10-20 ft bgs (based on well screen)	12-17 or 12-20 ft bgs (based on MIP data)	
Treatment Volume	925 yd^3	630 yd^3	-32%
Oxidant Quantity	19,500 lbs	10,400 lbs*	-47%
Field Days	10 (estimated)	6 (actual)	
Approximate Project Cost (with chemicals)	$90,000	$55,000	
MIP Cost	N/A	$10,000	
Pilot Test Cost	N/A	$5,000	
Total	$90,000	**$70,000**	-23%

** Note: the treatment volume and oxidant quantity did not scale together since the preliminary design assumed a higher soil oxidant demand value versus what was determined in the laboratory after the MIP phase of work, when soil samples were collected.*

RESULTS

The remediation program resulted in site closure and results from the source area monitoring wells are presented below. Rebound after the first event was expected due to matrix back diffusion. This rebound was seen in all wells, with the largest concentration increase in well MW-8 (well closest to the source area.) The site was targeted with a second round of injection in June 2013.



CONCLUSION

This project demonstrated how HRSC tools like the MIP and EC, when integrated into a remedial design, can optimize overall remediation performance and reduce project costs. At the same time, they provide a more targeted remedial strategy and design. HRSC is sometimes associated with only adding cost to a project but as this project shows, HRSC can reduce overall project costs by reducing the overall cubic yards of saturated soil to be treated, along with achieving contact between contaminants and oxidant.