Achieving Monitored Natural Attenuation Remedy Using Electrical Hydrogeology

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Background/Objectives. Electrical imaging techniques are now commonly used to sample the subsurface to develop more robust conceptual site models. These data are useful for understanding microbial activity due to the significant changes in electrical conductance generated by their growth. Work in the field and laboratory settings have illustrated a range of electrical signatures created by microbial activity that can be utilized to characterize their activity. The objective of this work was to determine if electrical hydrogeology principles could be utilized to achieve site closure using monitored natural attenuation (MNA) at a site under regulatory oversite.

Approach/Activities. At a pipeline release site in Arkansas, GeoTrax Survey™ images were collected to provide a framework of three-dimensional electrical data to characterize the subsurface. The site was sampled with drilling and direct push to confirm the geologic structure and fuel distribution, and DNA samples were collected to evaluate the biochemical state of the fuel. Additional work demonstrated the non-aqueous phase liquid (NAPL) body was immobile and degrading. These data demonstrated the fuel trapped in the fine-grained aquifer was being remediated by oxic conditions generated by a gravel bar above the fine-grained soils. Due to the existence of the naturally occurring air sparge system supporting the microbial colony, the fuel posed little risk to the environment, and aerobic degradation provided comparable rates of mass removal equivalent to conventional, active in-situ treatment alternatives.

Results/Lessons Learned. The distribution of electrically conductive portions of the subsurface can provide significant support for sampling and confirming the presence and distribution of microbial activity on impacted sites. The integration of these data with more traditional data provide a framework to support MNA. The work suggests that electrical monitoring over time may provide an improved higher data density framework for MNA over previously utilized approaches.