Using High-Resolution Site Characterization to Reduce Cost and Improve Outcomes on Thermal Remediation Projects

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Background/Objectives. In situ thermal remediation (ISTR) methods are typically only selected for the most difficult and technically challenging remediation projects, oftentimes when there is no other technically feasible alternative or after other methods have been tried and failed. When properly applied, ISTR can achieve very low post treatment concentrations and be both cost-effective and fast compared with most traditional remediation techniques. Despite the fact that modern high-resolution site characterization (HRSC) tools provide consultants and remediation practitioners with the ability to develop accurate and complete site characterization for less than 5 to 10% of the total ISTR remediation cost, many thermal remediation projects are implemented with incomplete site characterizations or significant data gaps. As the subsurface is heated the effects of this missing or inaccurate data can become apparent in the form of unanticipated contaminant influx, cooling or inability to adequately heat certain portions of the defined target treatment zone (TTZ) or extraction of previously unknown chemical constituents. This can result in unanticipated changes or expansion of the original ISTR scope and a corresponding increase in cost or schedule, or untreated contaminant outside the originally defined TTZ. Given the significant investment in infrastructure and cost to implement an ISTR solution, it is critical to have a complete, accurate and well-defined understanding of the subsurface contaminant distribution and hydrogeological conditions, prior to embarking on an ISTR project.

Approach/Activities. Modern HRSC tools, including the membrane interface probe (MIP), membrane interface hydraulic profiling tool (MiHPT), UVOST/TarGOST, Waterloo Profiler Core DFN, and, where appropriate, a modern, well-equipped field laboratory, can provide the tools necessary to rapidly, accurately and cost-effectively confirm hydrogeological properties and delineate a contaminant source zone targeted for ISTR. Several examples will be presented where HRSC methods were used define boundaries or close data gaps in a TTZ designated for ISTR as well as helping to accurately establish heating and extraction intervals for ISTR implementation. These successful cases will be contrasted against example cases where HRSC could have prevented unanticipated problems and costs on thermal remediation sites.

Results/Lessons Learned. Data from a well-designed HRSC program can provide owners, consultants and ISTR implementation contractors with a much better and more accurately defined TTZ upon which to develop the thermal remediation design basis. HRSC investigations performed prior to thermal remediation implementation can be used to refine the thermal treatment zone to limit the volume targeted for thermal remediation and therefore reduce the overall cost of the thermal remedy. Designing a thermal remedy to address a known subsurface condition at the start of a project is much easier and has less impact on overall project implementation than discovering an unknown condition in the field during ISTR remedy implementation. Example cases will demonstrate that the modest investment in HRSC efforts prior to ISTR implementation can provide a much higher degree of certainty in cost, schedule and achievement of remedial goals on ISTR projects for site owners, consultants and ISTR implementation contractors.