Combining ERH and TCH for More Effective Remediation: Don't Restrict Your ROD or RFP to A Single Heating Technology

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Background/Objectives. Several recent Records of Decision (RODs) and Requests for Proposal (RFPs) have limited remedial options to only one of the three in situ thermal remediation (ISTR) technologies available in the marketplace. During the bidding process, this prevents the thermal vendors from considering the full range of possible heating options when developing designs to best meet site conditions and cleanup goals.

The three major in situ thermal heating technologies, thermal conductive heating (TCH), electrical resistance heating (ERH), and steam enhanced extraction (SEE) each have their own sweet spots and weaknesses. Sometimes, the pros and cons of the technologies equal out. In other instances, one technology is a clear choice for the site. Finally, there are some sites where combining technologies represents the best remedial approach.

For instance, SEE represents the most economical way to put energy into the subsurface, but is limited to high permeability saturated soil lenses. Treatment of dry permeable vadose zones and low-porosity bedrock can be challenging for ERH. At other sites, the proximity of buildings and infrastructure or buried metal can complicate the deployment of ERH.

Developing quality in situ thermal plan requires combining a thorough review of site conditions and remedial goals with the experience and engineering knowledge held by the technology providers. The thermal vendors perform these tasks in preparing their unique response to a RFP and can produce the most appropriate plans when all heating options are available to them.

This presentation examines the site characteristics that challenge the application and cost-effectiveness of the major in situ heating technologies and presents some technical solutions. We then propose a simple adjustment for up-coming RODs and RFPs that can provide site owners with the best recommendations for technology design, application, and costs.

Approach/Activities. Our database of over 90 in situ thermal remediation (ISTR) projects provides an unparalleled pool of knowledge about the performance of all three thermal technologies. We have data-mined these projects to find sites were the chosen technology was very challenged by site conditions to determine what solutions were available and why. We focused on site issues that were severe enough to justify using alternate heating technologies, or combinations of technologies. Then we applied these learnings to a current project in Indiana, where ERH is heating the majority of the treatment volume, while TCH is treating a portion of the site where drilling access was challenging and ERH heating efficiency was uncertain.

Results/Lessons Learned. While the RFP specified ERH, the site slopes to a flowing creek requiring angled heating elements and near surface heating to achieve the remedial goals. The large diameter of electrodes (10 to 12 inches) made installation on the slope difficult. Additionally, the Ohmic resistance and modest water content of the near surface soil on the slope had the potential to hinder heating and increase the risk of stray currents.
The client accepted an innovative combination of technologies where ERH was used to heat most of the site, while the sloped bank was heated with TCH. TCH heaters were installed at

multiple angles, allowing for heating and treatment of PCE present in the bank sediments near both the flowing creek and the ground surface. This elegant combination was used to (1) meet the technology selection requirement set forth in the RFP and (2) to address real site constraints not accounted for previously.