Challenges encountered on Heavily Contaminated Thermal NAPL Sites

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Thermal Conductive Heating (TCH), Electrical Resistance Heating (ERH) and Steam Enhanced Extraction (SEE) are thermal technologies widely used to remediate contaminated sites where Non-Aqueous Phase Liquids (NAPLs) are present. While the site geology and hydrogeology are typically the driving factors for technology selection, the mass distribution, chemical composition and thermal behavior of the site contaminants are often the key drivers in determining the extraction strategy, based on which phase the mass is mobilized.

The majority of the thermal cases completed to date have focused on sites where contaminants were removed in the vapor phase (VOCs, BTEX, etc). As thermal remediation is being considered for more complex mixtures of high-boiling point contaminants, that may not be the case.

In addition, thermal remedies are now being implemented to reduce the environmental risk in source zones, rather than focusing on full mass removal. This situation also supports a shift in focus from vapor removal to NAPL removal.

For creosote, coal tar, PCBs and general oil-based source zones, the reduction in liquid viscosity with temperature can be several orders of magnitudes and therefore plays a major role in contaminant behavior during the thermal remedy. Thus, it is crucial for a successful thermal design and remedy to include provisions for proper NAPL removal and management – to both capture the chemical mass in the subsurface and to properly handle the mobilized mass in the treatment system when brought to the surface.

This presentation will focus on how to overcome some of the common operational issues that arise during full-scale thermal NAPL projects. The presentation will cite numerous case studies, including thermal remedies implemented at Superfund sites where NAPL removal in the liquid phase was shown to be the dominant contaminant mobilization mechanism. The information provided will include several sites where more than 80-90% of the total mass was recovered as a NAPL. Governing removal mechanisms will be presented, as well as the common field issues encountered in subsurface, and process system components at high NAPL mass sites. Data and lessons learned from laboratory treatability studies, full scale remedies at former manufactured gas plant sites, oil sites and sites where mixed contaminants were present as NAPL will be presented. The presentation focuses on design considerations and lessons learned for these high mass NAPL source zones.