In Situ Thermal Remediation of a DNAPL Source Zone Program Challenges and Post-Treatment Findings

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Background/Objectives.
In situ thermal remediation (ISTR) was selected as the remedy for a chlorinated solvent/DNAPL source area at a Superfund site located in northeast Maryland. The 5-acre site is located at the base of a steep valley, adjacent to a creek. The overburden at the site (designated as Operable Unit 1) consists of fill materials overlying alluvial sediments, generally ranging from 10-20 feet in thickness, and is underlain by gneiss and schist bedrock (designated as Operable Unit 2). Fill materials included remnant building foundation sections and significant debris resulting from historic site use. Overburden and bedrock impacts identified through site investigations included a variety of chlorinated compounds, aromatic compounds, chlorobenzenes, CFC-113, and other compounds resulting from historical solvent recycling operations from the early 1960s through the late 1980s.

Approach/Activities.
The ISTR treatment zone designated for the OU1 remedy was located in the central portion of the site, where site investigations indicated the presence of significant soil and groundwater impacts, including groundwater concentrations indicative of the presence of DNAPL. The treatment zone encompassed over 40,000 square feet (approximately 25,000 cubic yards). ISTR heating operations commenced in February 2016 and were completed in November 2016. Results from groundwater and soil sampling conducted prior to, during, and following the heating operations period were used in conjunction with other lines of evidence to evaluate ISTR treatment progress/performance. A passive groundwater collection and treatment system (referred to as a stream isolation/groundwater treatment system) that was installed as a prior interim remedial measure (IRM) provided downgradient capture and treatment of groundwater flux from the ISTR treatment zone during the heating operations.

Results/Lessons Learned.
The presentation will focus on selected findings and challenges encountered during the ISTR remedial action implementation. For example, the presence of co-contaminants within the source zone (which were extracted from the treatment zone together with other targeted contaminants) presented significant operational issues with respect to the ISTR air handling and treatment system. Expedited investigations and system evaluation during the heating operations identified these compounds as siloxanes, and a modified operations approach was implemented to effectively manage the remedy implementation based on their presence. The presence of crystalline fractured bedrock (OU2) immediately underlying the ISTR treatment zone posed challenges with respect to interpretation of groundwater performance sampling results during the heating period and decision-making regarding heating operations shutdown. Iterative "hot" groundwater sampling results were therefore used in conjunction with "hot" soil sampling data and other lines of evidence to evaluate treatment status and manage sequenced operations shut-down. Although the total contaminant mass directly recovered by the ISTR implementation (approximately 15,000 pounds) was lower than program design estimates, analysis of data from groundwater sampling conducted following the ISTR heating operations support that the mass reduction goals were achieved through the remedy implementation.