Unique Challenges on an ERH Project: AMCO Superfund Site, California

Alex Bowerman, PE (abowerman@otie.com) and Mike Lawson, PE
(Oneida Total Integrated Enterprises, Walnut Creek, CA, USA)
Kelly Manheimer (US Environmental Protection Agency Region 9, San Francisco, CA, USA)
Paul R. Hegele (McMillan-McGee Corp., Calgary, AB, Canada)

Background/Objectives. The AMCO Chemical Superfund Site is a former bulk chemical repackaging facility located in Oakland, California. The 0.9-acre site is located within a mixed residential and commercial/light industrial neighborhood. The nearest residences are located adjacent to the site. Chemicals handled at the site included trichloroethene (TCE), tetrachloroethene (PCE), and Stoddard solvent, among many others. Contaminants are distributed site-wide in soil and groundwater at depths as great as 45 feet below ground surface. Non-aqueous phase liquid (NAPL) has been observed on the water table over a large portion of the site. EPA elected to perform a non-time critical removal action (NTCRA) to reduce the potential for vapor intrusion into residences and on-site structures. The objective of the NTCRA was to remove as much contaminant mass from the site as practicable in anticipation of final remedy selection and issuance of a Record of Decision (ROD).

Approach/Activities. EPA selected electrical resistive heating (ERH) as the preferred alternative for implementing the NTCRA. One hundred seventy five electrodes were installed at several depths in 69 borings to pass electric current through groundwater and raise temperatures to the boiling point of water, thereby increasing the volatility of organic contaminants. Seventy-nine groundwater and vapor extraction wells were installed to concurrently extract soil vapor, groundwater, and NAPL. Extracted vapor was treated using regenerative granular activated carbon (GAC), sacrificial GAC, and media impregnated with potassium permanganate. After separation of NAPL, extracted and condensed water was treated using air stripping and GAC.

Site conditions and project constraints posed unique technical challenges that required creative solutions. An air monitoring system was deployed to the site to monitor compliance with EPA's stringent site-specific health risk screening levels in near real-time. The system included a gas chromatograph utilizing separate detectors for TCE/PCE and VC to analyze air sampled continuously from 13 indoor and outdoor locations as well as the treatment system vapor effluent. Creative soil vapor and groundwater extraction were required to mitigate contaminant migration after record winter rainfall raised the already shallow water table to virtually eliminate the unsaturated zone. Targeted VI mitigation measures were applied to protect tenants occupying an on-site building located within the ERH treatment area. A chilled water injection system was installed to protect a temperature-sensitive 50-year-old, 10-foot diameter, concrete sewage interceptor located adjacent to the treatment area. Treatment equipment upgrades were applied on the fly to improve solids handling issues necessitated by greater than expected loading of silt, mineral precipitates, and biomass. A novel wellfield vapor sample collection and conditioning technique was employed to prioritize locations within the treatment area.

Results/Lessons Learned. Solutions to technical challenges facilitated recovery of more than 20,000 pounds of contaminants within the first six months of ERH operation. Lessons learned regarding the importance of identifying operational constraints during the project planning phase, and the need to anticipate changes in those constraints as well as extreme deviations in site conditions will be presented. Performance monitoring methods used at the site to assess compliance with operating constraints, evaluate ERH system performance, and to identify and diagnose problem areas will also be discussed.