Concurrent Implementation of Combined Remedies Incorporating Enhanced Reductive Dechlorination and Electrical Resistance Heating Reduces Shallow Solvent Plume by Three Orders of Magnitude

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Background/Objectives. A dry cleaning facility operated from 1947 to 2014. Fugro was retained by California Department of General Services to assess conditions, address risks posed, and to remediate the Site to allow redevelopment. The facility used a variety of dry cleaning solvents including tetrachloroethene (PCE) and the petroleum-based Stoddard solvent. Contaminant plumes of the various chemicals of concern (COCs) are commingled onsite.

The Site is located in a dense urban setting with low income and market rate housing, restaurants and a child care facility as direct neighbors. Subsurface conditions at the Site are complex with sandy silts, dense silts, silts and clays, silty sands, and cobble/boulders. Based on the soil matrix, three water bearing zones were identified. Fugro's focus was on the shallow groundwater because it is the source of vapor intrusion risk. The groundwater plume has been delineated to extend below several city blocks presenting unique challenges in development of the conceptual site model.

Approach/Activities. Site characterization data allowed the Site to be segregated into a multi-media impacted Source Area and a larger distal groundwater plume. A soil vapor extraction (SVE) system was the first remedy to be installed to mitigate vapor intrusion risk. A thermal desorption system using electrical resistance heating (ERH) was selected for the Source Area because it addressed all impacted media streams, involved removal of groundwater, and elevated groundwater temperatures within the Source Area. The elevated groundwater temperatures promoted expanded effectiveness for bacteria production from the enhanced reductive dechlorination (ERD) injections intended for the distal plume areas. ERD was proven effective through Site bench-scale testing and a limited pilot test that assisted in calibrating the final injection design and radius of influence (ROI). ERD is known to be effective with low-gradient, reducing conditions present in the comingled shallow ground water plume at the site. The selection of electron donor with an advantageous slow release chemistry enhanced the distribution of the amendment to achieve the required ROIs. To further maximize delivery, injection locations were designed to move material towards the Source Area due to concurrent extraction over 150,000 gallons of groundwater.

Results/Lessons Learned. These combined technologies have contributed to a reduction in the PCE plume in shallow groundwater to roughly one third its original size within twelve months injection and eleven months after ERH ceased, while reducing the highest PCE concentrations by three orders magnitude. While the project has shifted from an active remediation effort to a monitoring phase, the Site appears to be progressing toward reaching remediation goals within the next two years.