Combined In Situ Remediation to Address DNAPL in Shallow Overburden and Weathered Bedrock

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Background/Objectives. A former dry-cleaning business was operated on site from 1965 until 1990, when the operations were transferred to a new owner. A review of the dry cleaner's records by state regulators indicated the use and storage of hazardous chemicals. In March 1993, sampling results identified the presence of tetrachloroethylene (PCE) and related compounds in the soil and groundwater at concentrations indicative of dense non-aqueous phase liquid (DNAPL) being present. Groundwater ranges from *ca.* 5 to 7 feet below ground surface and soil consists of dense silt and clay with some sand and gravel, which is underlain by saprolite at approximately 25 ft bgs. The former and current owners initially entered a Voluntary Cleanup Program in 1994; however, shortly thereafter, it became a state-led site because of the inability of the former and current owners to fund any potential remediation efforts. Building removal was completed in September 2018 with the property covered with a concrete slab, asphalt-paved former parking area, and limited vegetated areas. The site is in a densely populated residential and commercial neighborhood. Due to the level of contamination and location of the property, aggressive remedial methods were required to remediate the DNAPL, prevent further off-site plume migration, and reduce vapor intrusion risk.

Approach/Activities. Based on a preliminary evaluation of potential remedies at the site, in situ chemical and biological remediation was identified as a potential remedy to treat the source area and limit further off-site migration. Due to the level of contamination and challenging geology, a pilot study was performed in May 2022. The primary pilot goals were to evaluate our ability to deliver the proposed mass/volume of amendments within the low permeability saprolite formation, confirm contaminant of interest mass reductions, and determine if appropriate geochemical conditions can be established. Specific technologies utilized during the pilot test included emulsified zero valent iron (EZVI) to address the DNAPL/source area and Provect-IR (e.g., zero valent iron, organic substrate, nutrients, etc.) to create a permeable reactive barrier along the property boundary. Specialized injection equipment and methodologies were deployed to overcome the geological conditions, ensure subsurface reagent distribution, and effectively apply viscous/slurry reagents.

Results/Lessons Learned. Based on the pilot test goals and remedial design, a total of 1,470 USG of EZVI and 5,800 lbs of Provect-IR were applied over a 5-day period. Information on the reagent modes of action, dosing / application requirements, injection equipment utilized, and lessons learned during the field implementation will be presented along with results from field performance monitoring and application costs.