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Enhanced Reductive Dechlorination at General Services Administration Reclamation Yard, Kennedy Space Center, Florida

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Background/Objectives. The General Services Administration Reclamation Yard was constructed in the late 1960s to facilitate the recycling of variety of equipment and chemicals. The 2001 Resource Conservation and Recovery Act Facility Investigation identified a shallow tetrachlorethene (PCE) source area in the southwest portion of the site. In 2006, approximately 378 tons of solvent-impacted soil was excavated and sodium permanganate was applied during back filling as in-situ treatment. Long-term groundwater monitoring began in 2007 and, by 2009, additional source material was identified below the floor of the earlier excavation. From 2008 to 2010, 386 samples were collected from 79 locations using direct push technology (DPT) to delineate the remaining source zone area and groundwater plume. During baseline groundwater sampling in 2012, high resolution DPT sampling identified PCE dense non-aqueous phase liquid (DNAPL) in the 21-22 feet below land surface (bls) interval on the upgradient side of the source zone. Additional assessment was conducted in 2013 to refine the treatment area.

Approach/Activities. Enhanced reductive dechlorination was the selected technology to remediate the PCE source zone (area with DNAPL) and high concentration area (PCE concentrations greater than 300 µg/L). The total treatment area was 5,200 square feet, from 11 to 27 feet bls. Emulsified zero-valent iron (EZVI) was injected at two concentrations into the subsurface within the PCE source zone. The area with PCE concentrations greater than 30,000 µg/L received EZVI equivalent to 15% pore volume, while areas with PCE less than 30,000 µg/L and greater than 10,000 µg/L received 10% EZVI. A total of 9,060 gallons of EZVI was injected through 28 injection points with an estimated six foot radius of influence (ROI). Emulsified vegetable oil and lactate (VO/L) were injected at 6% saturation into the subsurface within the PCE high concentration plume (concentrations of PCE between 300 and 10,000 µg/L). A total of 26,000 gallons of VO/L was injected through 13 injection points with an estimated 12 foot ROI.

Results/Lessons Learned. Performance monitoring began in July 2014, approximately eight months after the injections, to track the progress of reductive dechlorination and evaluate effectiveness of the IM. Additional sampling events were conducted in March 2015 and November 2015 (15 and 24 months post-treatment, respectively). Samples were analyzed for target compounds: PCE, trichloroethene, cis-1,2-dichloroethene and vinyl chloride. Based on results from the baseline sampling event and the third performance monitoring event, the volume of the plume exceeding a concentration of 10,000 µg/L or higher PCE has reduced by 93%. The volume of the plume exceeding 300 µg/L for PCE has reduced by 88%. In addition, performance monitoring results at perimeter locations do not indicate contaminant movement based on pre- and post-IM results. The molar concentration of target compounds was reduced by 86% in the EZVI-treated area and 78% in the VO/L-treated area. A fourth performance monitoring event is being conducted in August-September 2016. In that event, microbial and geochemical data are being collected from a background location and points representing the three treatment protocols (15% EZVI, 10% EZVI and VO/L). The results will be used to compare conditions between each and gain insight into the relative efficiency of each protocol and the biological effects of EZVI.