Sustainable Remediation Utilizing a Combined Waste Stream with a Green Technology to Obtain Cost Effective Closure at a Brownfields Site

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Background/Objectives. A midwestern brownfields site, a former drycleaning equipment repair and warehousing facility, was impacted with tetrachloroethylene and breakdown daughter products in soil and groundwater. EnviroForensics first performed an excavation to treat the source soils followed by injection of a colloidal liquid activated carbon grid. Three monitoring wells near the grid treatment area responded well and maintained near 100% reduction in concentration of all contaminants. Two wells located on the fringe of the treatment first exhibited nice reduction in concentrations with subsequent rebound. It was determined that closure would not be possible with upward concentration trends at the two wells. The combination of finite funding for the brownfield project and EnviroForensics' push toward sustainable and green technologies led to the objective of utilizing an inexpensive waste stream combined with a green technology to cost effectively polish the areas where the remaining impacted wells are located. EnviroForensics successfully combined cheese whey, a byproduct of cheese production, and zero valent iron (ZVI). The ZVI was formed with an electrolytic chemical process that utilizes a byproduct of iron manufacturing.

Approach/Activities. A cheese factory in close proximity to the site was disposing of 100% of its cheese whey as a waste product. In the past, cheese whey has been utilized as an electron donor with mixed success for bioremediation activities. In order to increase chances of success, EnviroForensics decided on a more aggressive synergistic treatment approach, a 3-5-micron ZVI was added to the whey prior to direct push injection. The target interval is a 1- to 4-foot-thick sand unit that has clay units above and below. Three points were utilized in each of two injection areas. Each batch of substrate consisted of 300 gallons of cheese whey mixed with 44 pounds of ZVI. A mechanical mixer was used to stir up the combined substrate and the high fat content of the whey aided in keeping the non-colloidal ZVI in suspension until injected. 100 gallons of the substrate was injected into each point. Weekly sampling of field parameters such as pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), and specific conductivity were initiated pre-injection and will be continued for several months after the injection along with 30-day volatile organic compound (VOC) sampling and subsequent quarterly VOC monitoring.

Results/Lessons Learned. The injection was conducted in late August 2018, and after two sampling events, only trace concentrations of daughter/breakdown products of PCE were detected in groundwater at these locations. The geochemistry parameters demonstrated very favorable results for dechlorination. The whey/ZVI substrate was injected without difficulty and at a very inviting price point of less than $12,000. The lessons learned from the initial injection event are that in this case a waste product combined with a green technology can be utilized successfully in the cleanup of chlorinated solvents. In this case, low level impact was stalling the closure of a project with finite funds.