DCHWS 2019 Abstract Submission #29

CATEGORY: Technology

Application of Multiple Remedial Techniques and Approaches at a Former Pharmaceutical Manufacturing Facility

Background/Objectives. Multiple technologies were used to address environmental risk receptors at a former pharmaceutical manufacturing facility in New Jersey that resulted in redevelopment of the property for mixed use as a Brownfields site. The pharmaceutical plant was a Resource Conservation and Recovery Act (RCRA) 2020 corrective action site being remediated under an Administrative Consent Order (ACO) with the New Jersey Department of Environmental Protection (NJDEP). A site-wide remedial strategy was developed to effectively address risk receptors and move the ongoing remediation toward closure and eventual sale for redevelopment. The site has complex geology including shallow and deep bedrock impacts that are influenced by production well pumping operations throughout the region. A comprehensive site conditions report (CSCR) summarizing 16 years of remedial investigation and remedial action activities was developed for this facility. The constituents of concern included aromatic hydrocarbons, alcohols and 1,4-dioxane that was historically used in the pharmaceutical manufacturing operations. The CSCR was presented as a baseline document to both the Environmental Protection Agency (EPA) and NJDEP to facilitate a site-wide approach to overall future required activities at the facility

Approach/Activities. Based upon the findings of the CSCR, an overall site-wide remediation strategy was presented to bring the site toward closure. The site-wide strategy included evaluating the existing groundwater extraction and treatment system that was preventing migration of impacts to the adjacent river, recommending additional source remediation at Residual Contamination Areas (RCAs) and conducting a cost benefit analysis of potential remedial alternatives applied to the RCAs. The cost benefit analysis indicated that the RCA remedial actions would result in significant savings relative to overall remedial action costs and reduce the remedial time period. A RCA remediation program was implemented consisting of construction and implementation of two in-situ remedial mobile trailers that apply high vacuum multi-phase extraction and in-situ bioremediation technologies to the various RCAs at the facility. The multi-phase extraction system was applied to a RCA with light non-aqueous phase liquid (LNAPL) and effectively addressed the LNAPL and remediated the RCA effectively. The biosparge system was applied to a RCA with methanol, aromatic hydrocarbons and 1,4-dioxane resulting in lines of evidence that cometabolic bioremediation of 1,4-dioxane was occurring. The mobile remedial systems effectively addressed the RCAs in concert with the effective operation of the groundwater extraction system to address overall environmental risk receptors. Upon effective closure under RCRA and demonstration of effective remediation to NJDEP, the property was sold to a Brownfields developer with transfer of liability and is currently being developed for mixed commercial and residential use.

Results/Lessons Learned. The development of an innovative site-wide remedial approach resulted in effective remediation of RCAs while providing hydraulic control over potential migration impacts. The use of multiple remedial techniques to address the various constituents of concern, including 1,4-dioxane, expedited the overall remedial process. This project illustrates how the cooperation of the Responsible Party, State Regulator, Environmental Protection Agency and Brownfields Developer resulted in effective remediation and reuse of a Brownfields property.

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Mr. Russell has over 38 years of experience in wastewater engineering, hazardous waste site characterization, wastewater and hazardous waste sampling and monitoring, innovative and alternative treatment technologies, design/build soil and groundwater remediation, and environmental compliance and permitting. He is a Professional Engineer in three states and Licensed Site Remediation Professional in the State of New Jersey. He acts as a remedial Practice Leader for AECOM"s Northeast Region and is a ChemPharma account manager.

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DCHWS 2019 Abstract Submission #31

CATEGORY: Technology

A Dual Biorecirculation System to Facilitate VOC Mass Reduction and Hydraulic Control in Fractured Bedrock

CDM Smith designed a dual biorecirculation system to both provide hydraulic control and to speed site remediation in source areas with higher concentrations via reductive dechlorination.

Case Study Background. Groundwater underlying and downgradient of a former industrial complex contains volatile organic compounds (VOCs), especially chlorinated solvents, in dissolved and non-aqueous phase liquid (NAPL). The VOCs are present predominantly in fractured bedrock in the source area and overlying alluvial deposits downgradient. The fractured bedrock geology has complicated historical source area remediation efforts, while the downgradient alluvial deposits have facilitated contaminant mass transport. Past remedial activities included several emulsified oil injections to develop an offsite biobarrier and control downgradient flux, as well as manual removal of NAPL in source area wells.

Remedial Action/Construction. CDM Smith designed, constructed, and operated two stages (two loops: one around the source area, and one downgradient) of an automated system that includes pulsed groundwater extraction, addition of amendment with electron donor, and reinjection of amended water into injection wells. Both biorecirculation loops include injection and extraction wells that were installed following the enhancement of hydraulic permeability via hydraulic fracturing to maximize the efficacy of the wells. The hydraulic fracturing was performed following downhole geophysics and high-resolution NAPL vertical profiling with FLUTe liners. The wells installed in the upgradient source area loop were installed following emplacement of zero valent iron into the fractures, to accelerate remediation further. The reach of the hydraulic fractures was characterized via tilt-meter data collected during installation, and pressure transducers were installed into monitoring wells during startup activities to gain a better understanding of hydraulic connectivity within the upgradient source area recirculation loop.

Results/Challenges/Lessons Learned. Challenges encountered included the presence of DNAPL, site access constraints (light rail bridges, major arterial streets, and freeways), preferential flow pathways in fractured rock, and redevelopment efforts. Operational data, challenges, and best practices for installation and operation of a biorecirculation system in fractured bedrock will be presented, as well as the discussion of the multi-loop strategy to simultaneously eliminate offsite migration of VOCs while reducing contaminant concentrations in the source area. Finally, general concepts regarding biorecirculation feasibility for other sites will be presented.

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BRIEF PANELIST BIOGRAPHY:

Jeff is a principal environmental engineer with over 18 years of experience in the planning, design and implementation of innovative and conventional in situ and ex situ soil, groundwater and soil vapor treatment systems and remediation technologies. He has a BS in Engineering from Harvey Mudd College and a MS in Environmental Engineering from UC Berkeley.

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DCHWS 2019 Abstract Submission #51

CATEGORY: Technology

Lessons Learned from the Installation and Operation of a Combined Injection and Groundwater Recirculation Trench System for In Situ Remediation

In situ remediation, with injection of various reagents, has become a standard practice in the industry. However, injection-based remedies are not always implemented successfully due to heterogeneous subsurface condition causing uneven and poor distribution of reagents. One method to enhance the distribution of reagents is to combine injections with recirculation of groundwater through a reactive trench or a subgrade biogeochemical reactor. Recirculating groundwater can enhance the distribution of reagents and improve the biogeochemical environment, making the target treatment area more suitable for the desired reactions. This presentation will provide a case study on the installation and operation of a combined injection and groundwater recirculation trench system.

The case study was implemented at a former metal plating shop, where chromic acid was used. Over the 80-year life of the facility chromic acid was spilled multiple times, both documented and undocumented. As a result of the spills high concentrations of hexavalent chromium [Cr(VI)] are present in groundwater at the site in the overburden and shallow bedrock aquifers, as well as a mile-long downgradient plume.

The case study was a pilot test implemented at the Site to evaluate the efficacy of remediating the Cr(VI) groundwater source using a combined in situ approach. The pilot test included injections paired with groundwater recirculation though a reactive zero-valent iron (ZVI) trench within the source area of the Site.

The injections were carried out in 21 wells overburden injection wells and included a combination of treatment media included emulsified vegetable oil, lactate, a pH buffer and micro-scale zero valent iron (ZVI). Injections were completed in November 2018 and will be monitored for a total of 18 months.

The groundwater recirculation trench was constructed as a 44 ft long by 5.5 ft wide by 14.5 ft deep trench filled with granular ZVI and sand/gravel treatment media. The trench was installed to the top of the competent bedrock, approximately 5 feet below the water table. Three extraction wells were installed to extract Cr(VI)-impacted groundwater, which was then infiltrated into the ZVI trench. Construction was completed in July 2019, and the recirculation system will be operated and monitored for a total of 18 months.

The presentation will focus on challenges encountered, design changes implemented, and lessons learned during construction and operations of the combined injections and groundwater recirculation trench system. Groundwater monitoring well data as well as operational data from the recirculation system will be presented to illustrate the benefits and downfalls of both an injection only approach and an injection with recirculation approach. Recommendations for future applications of these technologies will also be discussed.

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Dr. Darpinian received degrees of BA in Chemistry from Point Loma Nazarene University, MS in Organic Chemistry from University of California Riverside, and PhD in Agricultural and Environmental Chemistry from University of California Davis. After starting as a scientist at a private consulting firm for seven years, Dr.Darpinian now serves as a Senior Project Manager with the Army Corps of Engineers-Kansas City District. At the Corps, she has responsibilities for investigation and remediation for the Hazardous, Toxic, and Radioactive Waste (HTRW) program. She served as a project chemist starting in 1999 until 2016 when she transitioned to project management. Recent key projects include the Garfield, Unimatic, and Wolff-Alport Remedial Designs which are contaminated Superfund sites in New Jersey and New York, however in the past 25+ years she has worked as the technical lead on more than 40 EPA R2 Superfund sites.

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