DCHWS 2019 Abstract Submission #31

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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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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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