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Considerations for Improving ERD Design and Implementation Practices

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Background/Objectives. Enhanced reductive dechlorination (ERD) applications rely on injection of organic carbon substrates over time to establish reducing conditions, foster microbial growth, and drive biodegradation of chlorinated volatile organic compounds (CVOCs). Common organic carbon substrates include soluble compounds such as ethanol, lactate, molasses, and cheese whey, while slow-release compounds include emulsified vegetable oils (EVO) and other propriety amendments. Typical remedial strategies involve the use of fate and transport modeling to develop preliminary remedial goals (PRGs) with active injections proceeding until PRGs are met, followed by a transition to monitored natural attenuation (MNA) as a polishing step. Remedial timeframes are typically based on general assumptions about persistence and influence of active treatment on contaminant degradation rates.

Approach/Activities. This presentation presents the results of an assessment of data from multiple ERD sites that have transitioned to MNA to better understand how ambient geochemical conditions (e.g., methane and/or sulfate concentrations and groundwater pH), physical processes (e.g., dilution via groundwater washout at various velocities) and sustained treatment effects (e.g., TOC longevity and redox recovery timeframes) influence remedial timeframes. Overall, this assessment is intended to help remediation practitioners improve remedial timeframe predictions at various stages of a remedial program, including the feasibility study and remedial design phases for substrate selection and injection-based strategy development, the operational phase for remedial optimization and transition to MNA, and the long-term monitoring phase for achieving remediation completion.

Results/Lessons Learned. Findings demonstrate that more frequent injections are typically required at sites with higher groundwater velocities to maintain treatment conditions, while at sites with slower groundwater velocities biomass recycling can extend treatment effects after the carbon substrate has been consumed for several years. CVOC degradation rates were observed to be slower under low pH (less than 5.5. s.u.) and high sulfate conditions (greater than 500 mg/L).