

Achieving Project Success through Remediation Failure

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Background/Objectives. Biologically-based in situ remediation systems can be effective in a wide range of geologic environments and contaminant concentrations and are therefore frequently recommended for sites that have MCL-level regulatory goals, complex geologies and/or NAPL-level concentrations. However, decades of implementation experience suggests that the achievable reductions in concentration during active operation of these biological systems is less than what we target during technology selection. That reality is highlighted by the results of ESTCP Project ER-201120, which showed the average reduction of parent concentrations at 117 biological remediation sites was only 1.4 orders of magnitude (OoM) and that site-wide MCLs were achieved at only 7% of the sites. As we continue to pursue smaller and smaller optimizations to the implementation of biological based remedial systems (e.g., amendment formulations, distribution improvements) in attempts to eke out incremental improvements in effectiveness, we should also consider that our largest potential for increasing our chance of client and regulatory success on a project is setting more realistic and achievable goals.

Approach/Activities. Available literature such as ESTCP Project ER-201120 and two well documented project examples will be used to demonstrate key concepts. The first project is a chlorinated solvent site where initial pilot test results indicated anaerobic reduction could be a successful strategy, but subsequent investigation encountered previously unidentified DNAPL and low-permeability geologic zones and the facility placed additional restrictions on access for system construction. Each of those changes significantly changed the timeframe and confidence for reaching the initial remedial objectives. The second project is a site where biological remediation resulted in significant reduction of dissolved phase concentrations, but continued to have lingering concentrations above the low regulatory targets for closure.

Results/Lessons Learned. In the first project example, the challenging conditions encountered following the successful pilot resulted in a change to the achievable endpoint of the full-scale system. Objectives of operation of that system changed from a pre-design goal of reaching a quantitative regulatory threshold to a post-construction goal of providing field documentation that the best available technology could not be effectively implemented and that additional remedial action should be deferred until a more appropriate technology could be implemented. In the second project example, challenges in reaching MCL-level goals across a site were communicated prior to implementation to both the client and the regulator. When those same conditions were encountered in the field the project team was able to combine discussions of storage zone diffusion, mass-flux calculations and long-term residual treatment from biomass cycling and in situ formation of reactive minerals to justify discontinuing injections before quantitative remedial goals were reached. In both examples, the projects were considered to be successful despite failing to meet quantitative remedial standards and that success was due to setting reasonable initial expectations for effectiveness of biological systems and proactively updating those expectations as additional information was obtained.