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Optimization of a Large-Scale Biostimulation and Bioaugmentation Remedy

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Background/Objectives. The Grants Chlorinated Solvents Plume (GCSP) Superfund Site in Grants, New Mexico is in a mixed commercial and residential neighborhood, and originally included areas of contaminated groundwater containing chlorinated volatile organic compounds (CVOCs) at concentrations four orders-of-magnitude higher than the cleanup goals. The 2,500-foot long and 100-foot deep CVOC groundwater plume (dimensions prior to remedy implementation) is associated with historical dry cleaning operations. Since 2010, the implementation of in situ thermal treatment (ISTT) for the source area and enhanced reductive dechlorination (ERD) for the downgradient plume has reduced the total CVOC mass at the site by more than 90 percent. After two injection events of up to 300,000 pounds of emulsified vegetable oil (EVO), the dissolved-phase CVOC mass outside of the ISTT area decreased from approximately 200 to 66 kilograms (kg) with 70 percent of the residual CVOC mass as cis-1,2-dichlorothene (DCE) and vinyl chloride (VC).

Approach/Activities. Despite the Remedial Design implementation schedule stipulating 20 years of active ERD to meet remedial action objectives (RAOs), an effort to optimize ongoing operations is being implemented after two injection cycles to reduce life cycle costs. This remedy optimization effort includes the following:

- Collection of groundwater grab samples using direct-push technology (DPT) to complement the routinely collected data from the existing 100 monitoring wells at the site; use of 3D visualization to assess CVOCs concentrations and resulting plume geometry changes over time.
- Collection of water quality samples from the injection wells to assess the persistence of the EVO substrate and reassess re-injection frequency.
- Collection of soil samples and analysis of magnetic susceptibility and acid volatile sulfides (AVS) to assess the influence of abiotic dechlorination on long-term plume attenuation.
- Use of multiple commercial substrates during full-scale implementation to evaluate the most cost-effective product for long-term use.
- Injection and evaluation of the benefit of red yeast rice (RYR) on the suppression of methane generation and its influence on carbon substrate persistence.
- Redeveloping those injection wells with injection rates that decreased between the first and second injection events.

Results/Lessons Learned. As a result of remediation progress and the optimization effort, which is still ongoing, the number of injection wells and substrate delivered was reduced by 40 percent, LactOil was selected for the third and subsequent injection events, RYR will not be applied across the site, and multiple injection wells were redeveloped to improve delivery rates. In addition, LactOil will be injected in one area between injection transects with persistently elevated CVOC concentration to accelerate plume attenuation. Finally, the abiotic sampling results indicated that both biotic and abiotic processes are contributing to dechlorination indicating that natural attenuation may be a key component of the long-term remedial strategy at the site. The presentation will review the results of the optimization effort and present the resulting long-term costs savings for the site.