Innovative Bioremediation Approach implemented in Complex Karst Geology to Treat LNAPL Releasing from Seeps to a Creek and Residential Properties in Gallatin, Tennessee

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Background/Objectives. The Tennessee Department of Environment and Conservation's (TDEC) Division of Underground Storage Tanks partnered with the City of Gallatin on a long-term cleanup effort to remediate petroleum contamination that had been identified seeping from along the eastern bank of Town Creek Greenway. Additional seeps were identified within the residential neighborhood adjacent to Town Creek releasing petroleum impacted groundwater to the surface resulting in significant petroleum odors.

The objective of TDEC, its state contractor, and supporting subcontractors was to develop and implement an aggressive fast tracked comprehensive clean-up plan to eliminate impacted groundwater from entering the creek while identifying sources contributing to the contamination.

Approach/Activities. The first step was to complete a data gap analysis that included: historical research, site reconnaissance, surveying, testing USTs and piping used to store and dispense gasoline at five former or active gas facilities upgradient of the seeps. The results of the data gap analysis combined with a remedial design characterization (RDC) was used to develop a detailed conceptual site model of the contaminant distribution in the complex karst geologic setting. The RDC included the following components: dye-trace study to determine flow groundwater flow paths, surface geophysics to map the structure and possible pathways, two rock cores, twenty bedrock wells, downhole geophysics, discrete groundwater sampling of bedrock features, high resolution soil and groundwater sampling within areas of possible primary and secondary source mass. No source could be identified from the investigation that would be considered a primary contributor to the groundwater impacts. Groundwater impacts are moving mostly through weathered bedrock epikarst features, and shallow features in the competent bedrock. Shallow overburden groundwater and soil impacts were identified in a large field adjacent to the creek. Interim remedial measures included the injection of the carbon based amendment BOS 200® in the formation to reduce the migration of petroleum mass and establish a platform for long term biological treatment. The BOS 200® was injected as a slurry into the shallow competent bedrock and epikarst features in transects to intercept groundwater migration. The slurries were applied to the bedrock using a specialized straddle packer assembly and high energy injection pumps and mixing system. The slurries were applied to the epikarst using GeoTap drilling and injection techniques. In addition, the BOS 200® was applied as an aerial treatment in the large field adjacent to the creek to address secondary source mass and establish a treatment curtain for groundwater migrating to the creek.

Results/Lessons Learned. The seeps along the creek have reached drinking water groundwater cleanup criteria and the odors have diminished in the neighborhood. Surface treatment of a seep within the backyard of a residence was attempted by building a passive treatment cell to capture contaminant as it was released to the surface. The treatment cell was unsuccessful due to disturbance of the natural groundwater flow path with the construction diverting groundwater away from the cell.