Enhanced Phytotechnology as a Nature-Based Solution for Supporting Climate Resiliency

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Background/Objectives. Soil and groundwater at a former fuel distribution facility had been impacted with petroleum compounds including TPH, VOCs, and PAHs. LNAPL was periodically detected in groundwater at localized areas. The site is a former terminal located in a primarily commercial area within a city along the Gulf Coast of Texas which has been subjected to hurricanes. Site geology consists primarily of fine-grained material with groundwater at a depth of approximately 15 feet below surface. As part of the feasibility study to evaluation potential remediation options, the original preferred alternative was to cap the area to prevent contact with impacted media and implement land use controls. Further evaluation of other alternatives, including a sustainability assessment, identified phytoremediation a potential effective remedy.

Approach/Activities. Phytoremediation was implemented as the remedial technology to address surface soil, subsurface soil, and groundwater petroleum contamination. The phytotechnology at this site used 164 OP-367 hybrid poplar trees to treat subsurface soil and groundwater; and buffalo grass (*Bouteloua dactyloides*) to treat surface soil. Phytoremediation was originally eliminated as a potential option due to the presence of LNAPL. Therefore, the trees and grasses were inoculated with the PD1 (*Pseudomonas putida*) bacterial endophyte strain. This inoculation is done to both improve tolerance for the trees to survive in toxic conditions and enhance effectiveness of degradation of the petroleum compounds within the plant tissue. Hybrid poplars and Buffalo grass were selected because drought conditions exist in the areas and these species are known to be drought tolerant. A drip irrigation system was installed to support growth.

Results/Lessons Learned. The phytoremediation system intercepted groundwater within two years of planting and subsequently petroleum concentrations decreased significantly. The phytotechnology has survived two hurricanes suggesting it is a remedy that is resilient to extreme weather events. An environmental footprint assessment of the remedy using SiteWise™ compared this phytotechnology and the original option of cap and MNA. The phytotechnology is estimated to have five times less GHG emissions and energy usage than capping. This type of phytotechnology has shown to be an effective sustainable and resilient remediation technology. A consideration for remote phytoremediation sites that are subject to extreme weather events is to include a telemetry monitoring system to maintain continuous monitoring of the site.