Taproot™ Technology: Non-Invasive Plume Delineation

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Abstract: TapRoot Technology is innovative sampling of vegetation to delineate soil and groundwater contaminants. Methods have been evaluated for many sites and different contaminants in recent research and are now ready for use in the public sector. On-site sampling of native, pre-existing trees can lead to considerable cost and time savings for site investigation with little or no negative impact on a site. Such research has also provided evidence that natural attenuation is ongoing by showing both presence of degradation products and that plants are removing contaminants. Sampling results at a contaminated rail yard resulted in a better understanding of contaminants on site with one day of sampling. From the analytical data, maps can be generated from this data in under a week. Given the cost, many samples can be taken from a site and much greater spatial resolution on plume delineation can result, given the presence of trees.

Plume Delineation: Sedalia Missouri Site

Site Information: A former switching yard, Figure 1, was known to be contaminated with tetrachloroethylene (PCE) and had undergone site investigation efforts, resulting in 40 - 50 monitoring wells being installed and sampled for over a decade. Based upon the resulting plume model, an interceptor trench was installed to prohibit contaminant migration offsite. While the trench met expectations, its operation is anticipated to span more than 20 years. To better evaluate the potential benefit for a source removal action, Taproot Technology™ was implemented at the site.

Methodology: Over 100 tree cores were taken in one day by a team of 4 using an incremental tree corer, Figure 2. Cores were obtained from each tree and capped for laboratory analysis, following established procedures (1-3). Analysis was completed and data was produced in under a week. High resolution GPS was utilized to precisely map each tree sampled.

Plume Delineation: The resulting contaminant delineation, Figure 3, using Taproot Technology™ revealed two distinct source areas, rather than one continuous plume. The source areas existed at a smaller spatial scale than the installed sampling wells could detect. To further investigate the source areas geoprobe sampling was undertaken and revealed a paint waste disposal cell in the newly detected source area, Figure 3. Sampling of the surrounding soil revealed concentrations over 500 ppb for PCE. A removal action has taken place to remove the source material. Sampling in the other source area also revealed more extensive PCE contamination.

Discussions and Taproot Technology™ Potential

- Taproot Technology™ can delineate contaminant plumes with great speed and at much lower costs, and can be a more powerful tool in initial investigations, directing locations of groundwater wells to avoid unnecessary monitoring wells and the reoccurring analytical costs associated with each. This was proven in initial research at a contaminated site in New Haven, Missouri, Figure 4 (3). Tree core analysis provided accurate plume delineation before wells were placed and wells were then placed to transect the plume, with no extra, unnecessary wells. Remediation actions and monitoring at Sedalia would have been more cost efficient if source areas were known prior to remediation and fewer wells and less monitoring would have been needed.
- Increased spatial accuracy can result from Taproot Technology™ due to the large number of samples that are possible with few limitations to sampling regarding site access, shutting down site operations or private property access concerns.
- Natural attenuation can be evaluated and detected using tree coring, offering proof that attenuation is occurring and a potential for low-cost, long-term monitoring component in a monitored natural attenuation sampling plan.
- Sampling at remote sites can be extremely rapid and cover large areas with minimal mobilization costs.

References & Acknowledgements


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