STAR (In Situ) Pilot Test to Treat Coal Tar and Creosote

Former Creosote Manufacturing Facility in Washington

Overview

The subject site is a 22-acre former creosote manufacturing facility in Washington. Coal tar and creosote contamination is present in the shallow alluvium unit to a maximum observed depth of 34 feet below ground surface (ft bgs) and is distributed in discontinuous layers separated by low permeability materials. A STAR Pre-Design Evaluation (PDE) (IMAGE 1) was conducted to evaluate Radius of Influence (ROI), combustion front propagation rate, and treatment efficiency in a target treatment interval from approximately 13.5 to 17 ft bgs (water table at 8 ft bgs). The impacted zone consisted of medium to fine sand / silty sand layers separated by silty clay.

IMAGE 1: PDE test area showing the ignition / air injection well, associated thermocouple network, the STAR control trailer, and auxiliary equipment.

Conclusions

The STAR technology was successfully piloted and is included as part of the full-scale remediation strategy for the Site as outlined in the EPA's Proposed Plan.

The STAR PDE:

- Demonstrated self-sustaining smoldering combustion (i.e., no energy input into the system following ignition);
- Treated soils both above and below a silty clay layer bisecting the impacted zone;
- Showed an ROI of approximately 7 feet with a combustion front propagation rate of approximately 1.4 feet per day;
- Resulted in order of magnitude concentration reductions of principal threat waste (PTW) in the treatment zone; and,
- Provided site-specific parameters critical for full-scale design and integration of STAR into the EPA Proposed Plan for site remediation.

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Pre-Design Evaluation (PDE)

Self-sustaining smoldering combustion was achieved resulting in an ROI of approximately 7 feet with an average propagation rate of approximately 1.4 feet per day. A multiple lines of evidence approach based on laboratory analysis of soil samples, visual observations of pre- and post-treatment soil borings, thermocouple data, and combustion gas data was used to evaluate STAR performance and degree of treatment in this highly heterogeneous geologic environment. Total Petroleum Hydrocarbon (TPH) concentrations in soils were reduced from an average of 12,000 mg/kg to a few hundred milligrams per kilogram (IMAGE 2a). Near complete removal of key contaminants of concern (e.g., BTEX) were also observed within the target treatment zone (IMAGE 2b). Treatment was achieved both above and below a silty clay layer, demonstrating the effectiveness of STAR within the interbedded deltaic alluvial deposits found at the site. Photographs of 'Before' and 'After' soil cores confirm the degree of treatment within the target treatment interval (IMAGE 3a and 3b).

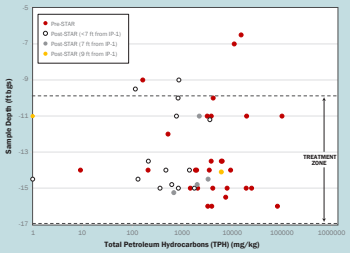


IMAGE 2A: Pre- and post-STAR Total Petroleum Hydrocarbon concentrations.

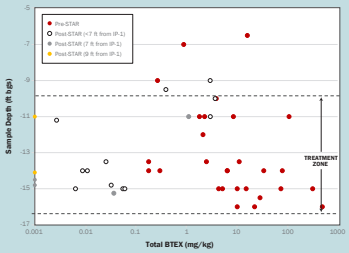


IMAGE 2B: Pre- and post-STAR BTEX concentrations.

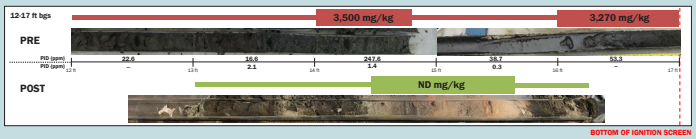
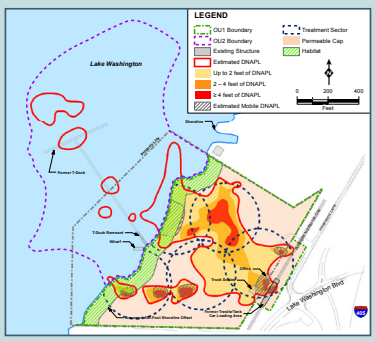


IMAGE 3A: Pre- and Post-PDE soil cores indicating TPH concentrations for the 12-17 ft bgs interval at a radial distance of 2 ft from the ignition well.

IMAGE 3B: Pre- and Post-PDE soil cores indicating TPH concentrations for the 12-17 ft bgs interval at a radial distance of 7 ft from the ignition well.



STAR is included as part of the EPA Preferred Alternative for full-scale remediation outlined in the Quendall Terminals Superfund Site Proposed Plan released in September 2019 (IMAGE 4). The Record of Decision for the site which is to include STAR is expected to be issued in Spring of 2020.

IMAGE 4: Proposed full-scale STAR treatment sectors to target TPH >3,000 ppm (EPA Proposed Plan, September 2019).