

Barrier Design and Angled Injections used to Treat BTEX and MTBE to Non-Detect

Project Highlights

- A former service station was contaminated with BTEX and MTBE.
- Enhanced aerobic biodegradation using ORC Advanced was used for treatment.
- The remediation design utilized a staggered, barrier configuration to optimize oxygen distribution.
- Angled injections were used to deliver ORC Advanced beneath the restaurant.



Angled injections were required to apply ORC Advanced beneath the active restaurant.

Project Summary

A former gasoline service station in Colorado had three petroleum underground storage tanks (USTs) and associated product dispensers/lines removed in 2009. Subsequent site investigation activities delineated the majority of soil and groundwater contamination, identified LNAPL and groundwater impacts as high as 7.45 mg/L for benzene and 21.9 mg/L for MTBE. A soil vapor extraction well and numerous enhanced fluid recovery (EFR) events were performed between January 2001 and November 2011 to remove LNAPL.

LNAPL levels were removed and injection technologies were evaluated to polish the remaining groundwater plume. Because the site had been converted to a busy restaurant it was imperative the selected technology allow for relatively quick injections and mitigate potential surfacing which would cause unwanted aesthetic and health and safety concerns. After evaluating several other enhanced bioremediation options ORC[®] Advanced was selected for direct-push injection at the site.

Remediation Approach

A series of enhanced biodegradation treatment barriers were placed along the length of the plume source and staggered to optimize oxygen distribution through the aquifer. Angled injections were required to place 24 points of ORC Advanced in multiple treatment rows beneath the restaurant and drive-through lanes. Since depth to groundwater was roughly 28-feet below ground surface this aided in the ability to angle inject product to all required locations beneath the restaurant property. Approximately 1,200 pounds of ORC Advanced was injected on-site.

Post ORC Advanced application, the monitoring well beneath the restaurant and directly below the former tank excavation has measured below detection limits for four quarters. Another well located just below the former east end of the tank excavation was below detection limits for the previous three quarters starting with the first quarter after injection. Although groundwater treatment in the main plume has proven to be effective, additional LNAPL was since identified at wells farther east of the restaurant and of the former tank excavation. This unexpected discovery of LNAPL post-treatment may undergo additional EFR and potential ORC Advanced application.

Technology Description

Advanced Formula Oxygen Release Compound (ORC Advanced[®]) is a proprietary formulation of food-grade, calcium oxy-hydroxide that produces a controlled-release of molecular oxygen for periods of up to 12 months upon hydration.

Site Type: Service Station, Restaurant

Contaminant of Concern: BTEX, MTBE

Concentration: 14.1 mg/L

Remediation Approach: Enhanced Anaerobic Biodegradation

Soil Type: Sandy Clay

Treatment Area: 2,000 Square Feet

Technology Used: ORC Advanced