



\$150,000 Cost Savings Achieved using Enhanced Anaerobic Bioremediation and Bioaugmentation

Site Closure Pending for Treatment of TCE at Former Manufacturing Facility

Project Highlights

- Pilot test moved to full-scale application after rapid decrease in TCE and daughter product contamination
- Cost for ERD injection was approximately \$70,000, compared to more than \$250,000 for the proposed-permanganate ISCO injection
- A no further action request has been submitted to the regulatory agency and is being reviewed for closure

Project Summary

During due diligence for a property transfer at a former manufacturing facility in Indiana, TCE impacts in groundwater were discovered downgradient from a former above-ground storage tank (AST). Little to no TCE remained in the sandy soils within the source area but migrated into groundwater resulting in a plume extending off-site. An initial plan was proposed to address the TCE in groundwater via an in situ chemical oxidation (ISCO) approach using potassium permanganate. The consultant, KERAMIDA, believed this approach was overly aggressive, given the relatively low groundwater concentrations and lack of significant soil impacts. Also, the permanganate ISCO treatment was much more expensive and difficult to implement compared to a biological enhanced reductive dechlorination (ERD) approach. At the request of the regulatory agency, a pilot injection using 3-D Microemulsion® and BDI® Plus was performed in the source area and rapid reduction of TCE was observed within the first three months, accompanied by daughter product (cDCE and VC) production. Based on the results, the regulatory agency approved a full-scale injection one year later. Post-injection monitoring performed for two years following the full-scale injection indicated rapid decreases in TCE concentrations in all of the impacted wells with concurrent increases in daughter product concentrations. Daughter product concentrations also decreased significantly 9 months after 3-D Microemulsion and BDI Plus injection. At the conclusion of two years of post-injection monitoring, all of the wells in the treatment area were below the regulatory action levels for all compounds. A request for closure is currently being reviewed by the regulatory agency.

Remediation Approach

KERAMIDA developed a remedial plan that involved ERD and bioaugmentation, using 3-D Microemulsion and BDI Plus. The total cost for the injection was approximately \$70,000, compared to more than \$250,000 for the proposed permanganate ISCO injection. A total of 6,400 pounds of 3-D Microemulsion and 48 liters of BDI Plus were injected into 48 points spaced 15 feet apart in a grid pattern throughout the primary impacted area. The injection interval was approximately 9 to 18 feet below grade. The ERD/bioaugmentation approach saved more than \$150,000 compared to the permanganate ISCO approach, likely more since the nature of ISCO as a contact-based remedial technology would likely have required multiple injections to achieve remedial goals.

Technology Description

3-D Microemulsion is an engineered electron donor material that offers a novel 3-stage electron donor release profile, pH neutral chemistry and is delivered on-site as a factory-emulsified product.

Bio-Dechlor INOCULUM Plus is an enriched natural microbial consortium containing species of Dehalococcoides sp. (DHC). This microbial consortium has since been enriched to increase its ability to rapidly dechlorinate contaminants during in situ bioremediation processes.



3-D Microemulsion®

Site Type: Manufacturing

Contaminant of Concern: TCE

Concentration: 50-1,200 ppb TCE

Remediation Approach:
Enhanced Aerobic Biodegradation,
Bioaugmentation

Soil Type: Sand

Technology Used: 3-D Microemulsion,
BDI Plus