

## Successful Bioremediation at a Former Air Force Base Fire Training Area

### Carbon Tetrachloride Concentrations Reduced Below Treatment Goal within 8 Months

### Project Highlights

- Air Force Base contaminated with high levels of carbon tetrachloride due to on-site firefighting training.
- 97% reduction in contaminant within three months.
- Carbon tetrachloride reduced to below detection limits.

### Project Summary

Training exercises at Texas Air Force Base resulted in an impact to soil and groundwater by trichloroethylene (TCE) and carbon tetrachloride. A monitored natural attenuation study conducted indicated that chlorinated solvents at the plume would naturally decline to acceptable levels after 30 years of monitoring.

After over 14 years of monitoring, contaminant reductions were not proceeding as quickly as predicted and additional remediation was advised. It was determined that limited anaerobic activity was present and biostimulation was a viable option. A pilot test was conducted on-site. The objective of the project was to determine the feasibility of injection into the shallow, discontinuous groundwater unit. The pilot test was also designed to determine if the residual TCE and carbon tetrachloride could be biodegraded through enhanced bioremediation and reduced to below 5 ppb (the Texas Risk Reduction Program limit).

### Remediation Approach

3-D Microemulsion® was injected into 30 points at the site; approximately 380 gallons of the product was applied per boring at the site. Initial results indicated a significant reduction in concentrations of parent chemicals - carbon tetrachloride was reduced by 95% within 1 month post-injection and 97% within 3 months of injection within the source area. A monitoring well 50-feet downgradient of the source area experienced a 69% reduction by the third month as 3-D Microemulsion began to reach the well location.

Follow-up injections were applied downgradient of the source area and also in a barrier configuration several hundred feet downgradient of the source were implemented about 6 months after the pilot test. The combination of the pilot test and full-scale application resulted in a 97.8% reduction in carbon tetrachloride 8 months post-injection with chloroform, methylene chloride, and chloromethane remediation daughter products on a downward trend. High TCE concentrations were effectively treated as well with TCE peaking after injections to 126 ppb and then being reduced within a 3-month period to 0.2 ppb.

### 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.



*3-D Microemulsion was applied on-site to treat high levels of carbon tetrachloride.*

**Site Type:** DoD - Air Force Base

**Contaminant of Concern:**  
Chlorinated Solvents, Carbon Tetrachloride

**Concentration:**  
Carbon Tetrachloride - 313 ug/L

**Remediation Approach:**  
Enhanced Anaerobic Bioremediation

**Soil Type:** Clay and Gravel

**Technology Used:** 3-D Microemulsion