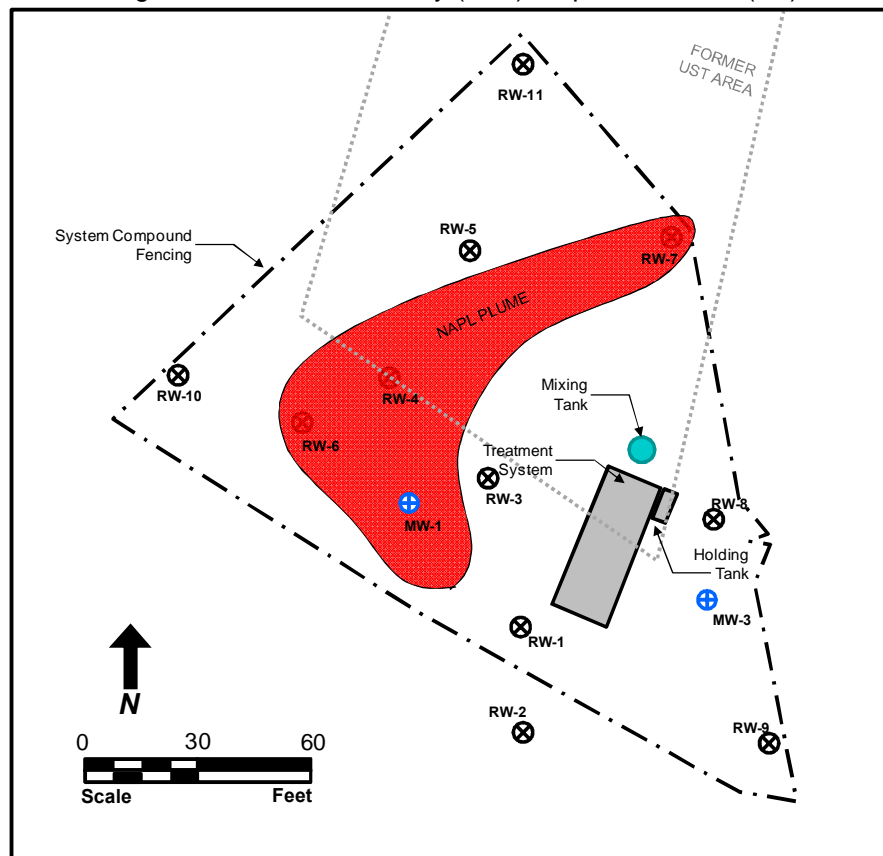


SURFACTANT-ENHANCED LNAPL RECOVERY PETROSOLV™ SURFACTANT

- Type of Project:** Full-scale
- Contaminants Treated:** Light non-aqueous phase liquid (LNAPL) . gasoline & diesel fuel
- Concentration:** NAPL layer ranging from 0.1 to 1.5 feet in thickness
- Technology Applied:** Dual-phase Extraction and GW Recirculation supplemented with Surfactant Flushing
- Geology:** Sandy SILT and Saprolite
- Treatment Interval:** GW and smear zone at 22-28 feet bgs
- Average % Reduction:** 99% - reduced NAPL to less than 0.01 feet across the site
- Timeframe:** 13-month remediation period
- Project Reference:** Available on request.

SITE SUMMARY: During UST removal in the early 1990s, fuel releases were discovered at a former truck transportation facility in Georgia. Historically, the free product (NAPL) plume covered an area measuring 90 feet x 45 feet. For over 15 years, various passive and temporary/intermittent recovery methods (bailers, sorbent socks, 8-hr. vacuum events) were applied, with only marginal results. A dual-phase remediation system consisting of Total Fluids Recovery (TFR), Vapor Extraction (VE), GW injection, and Surfactant Injection (INJ) began operation in July 2008. The system included 11 recovery wells that were used for vapor extraction, GW extraction, and/or GW injection. Injection and extraction was alternated during the operation period to adjust the fluid capture zone and ensure effective treatment of smear-zone soils.

Within the first 6 months of system operation, NAPL thicknesses in all site wells were reduced to below 1/8th of an inch. The remediation system operated for only 13 months, resulting in recovery of over 240 equivalent gallons of NAPL fuel.



CASE STUDY

TYPE: Surfactant-Enhanced NAPL Recovery
COMPONENTS: Biosurfactant & Nutrients

VAPOR EXTRACTION (VE) SYSTEM OPERATION: Based on influent/effluent vapor analytical results, 111 equivalent gallons of NAPL was removed via vapor-phase concentrations by the VE system.

TOTAL FLUIDS RECOVERY (TFR) SYSTEM OPERATION: The TFR system extracted and treated over 950,000 gallons of groundwater; of this, 315,000 gallons were discharged, and 640,000 gallons were re-injected to enhance mobilization of trapped NAPL. Based on influent/effluent analytical results, the TFR system removed 88 gallons of NAPL via dissolved-phase concentrations.

SURFACTANT INJECTION (INJ) SYSTEM OPERATION: The INJ system performed pulsed injection of surfactant into the subsurface to enhance mobilization of weathered, trapped, adsorbed NAPL. As a result of intermittent surfactant application, dissolved TPH concentrations increased dramatically in the subsurface, and were subsequently captured and treated by the TFR system. As a result, the surfactant solution was responsible for a significant portion of the NAPL that was recovered by the TFR system.

BIOREMEDIATION SYSTEM OPERATION: In addition to surfactant injection, over 2,000 pounds of nutrients and secondary electron acceptors (nitrate, sulfate) were injected into the subsurface. These electron acceptors supported degradation of over 35 equivalent gallons of NAPL.

RESULTS: Six months after system shutdown, no NAPL has been detected in any site wells. In addition, no BTEX constituents exist above site cleanup goals. As a result, No Further Action status has been proposed for this site, and is under regulatory review.

COST: Approx. 220 gallons of PetroSolvi[®] and 2,000 lbs. of CBN nutrients were used for the entire project, at a total cost of \$14,000, including shipping. Consultant labor/equipment/O&M costs were not available.