Source Area Remediation of PCE in Soil
Fair Lawn, New Jersey

Project Summary
TRS Group, Inc. (TRS) was retained by Anderson Mulholland and Associates, Inc. (AMAI) to perform an Electrical Resistance Heating (ERH) remediation of DNAPL in soil at the former Topps Dry Cleaners property in Fair Lawn, NJ. The remedial goal of this project was a reduction of tetrachloroethene (PCE) in soil to less than 1 milligram per kilogram (mg/kg) in every soil sample. Final confirmatory soil sampling indicated that all soil samples were below 1 mg/kg PCE and average soil concentrations were reduced to less than 0.1 mg/kg PCE throughout the treatment area. The PCE concentrations were reduced by 99.9% from an average pre-treatment concentration of 31 mg/kg to an average post-treatment concentration of 0.035 mg/kg. A project first for TRS in New Jersey, ERH was shown to be highly effective at remediating the bedrock/Passaic formation. Although, the principle focus of this remediation was the reduction of PCE in soil, the average concentration of PCE in groundwater was reduced by 98%.

TRS Project Manager: Chris Blundy
Site Geology and Hydrology: glacial till - surface to approx. 16 to 20-ft bgs; fractured bedrock beneath; groundwater averaging 9-ft bgs
Treatment Area Size, Volume, and Depth: 6,164 square feet, 5,000 cubic yards, 0.5 to 26-ft bgs
Beginning Contaminant Concentrations: 288 mg/kg maximum PCE; 31 mg/kg average PCE in soil
Final Contaminant Concentrations: Less than 0.1 mg/kg PCE in soil
Remedial Goal: Less than 1 mg/kg PCE in soil
Actual Cleanup Achieved: 99.9% in soil; 98% in groundwater in treatment area & >99% in deeper wells
Period of Performance: 203 days
Contract Terms: Standard fixed price remediation (SFPR)

Background
This project was a remedial action initiated by the New Jersey Department of Environmental Protection (DEP) involving a PCE source area in soil located beneath a former dry cleaners facility that had been demolished prior to the remediation. The maximum pre-ERH PCE concentration in soil was 288 mg/kg.

Site Characteristics & Design Parameters
The ERH treatment area measured 6,164 square feet in surface area. There were four targeted heating zones that varied in depth as shown in Figure 1 below. Area A, with a volume of 3,500 cubic yards (yd³); Areas B and D, each with volumes of 200 yd³ and 100 yd³ respectively; and the former basement area, Area C, with a treatment volume of 1,200 yd³, for a total of approximately 5,000 yd³ for all areas.

The lithology of the treatment volume was composed of a glacial till from the surface to approximately 16 to 20 feet below ground surface (ft bgs). The fractured sandstone bedrock (the Passaic formation) underlies the till and the contaminant source. Twenty three of the electrodes were installed into bedrock with one electrode only treating to 12-ft bgs in Area D.

Figure 1. Site Plot Plan

TRS Contact Information: Mr. David Fleming, (425) 396-4266 dfleming@thermalrs.com
www.thermalrs.com
System Construction and Operations

Construction of the ERH system began with the installation of the TMPs for monitoring subsurface temperatures. Eight thermocouples were installed within each of the 10 TMP’s at the intervals of 1, 3, 5, 10, 15, 20, 25, and 28-ft bgs. In addition, a 4-inch layer of insulating foam was installed over Area A to minimize heat loss to the atmosphere, and improve energy efficiency. The foam also acted as a thermal protection barrier to prevent personnel from coming in contact with the concrete surface cap, which reached temperatures as high as 100ºC during operations.

A total of 24 electrodes, with co-located vapor recovery (VR) wells were installed as follows: Area A utilized 16 electrodes and extended from 0.5 to 26 ft bgs; Areas B and D each required one electrode that extended from 5 to 26 ft bgs and 2 to 12-ft bgs respectively; Area C utilized 6 electrodes to treat from the former floor at 9 ft bgs to 26 ft bgs.

A security system was installed to restrict unauthorized access to the equipment compound and electrode field. ERH operations began on August 14, 2007 and continued for 203 days, during which a total of 1,248,619-kilowatt hours (kW-hr) of energy was applied to the subsurface.

Project Results

Four soil confirmation sampling events occurred at 66%, 84%, 95% and 99% remediation completion stages to optimize heating and narrow remediation to areas that had not achieved the PCE target cleanup goals. The average concentration of PCE in groundwater before heating was 2,625 µg/l. Upon completion of the ERH application, the average concentration was reduced to 59 µg/l. The percent reduction in average PCE groundwater concentrations within the treatment area was 98%.

Confirmatory soil samples were collected on December 4, 2007 at 66% completion and upon review of the laboratory analyses it was determined that 20 of the 23 sample intervals were below the cleanup goal and 13 were below the method detection limit of PCE. The second soil sampling event was conducted on January 9, 2008 at 84% completion and included all areas that were above the cleanup goal during the first round of testing. All samples were below the cleanup goal and only one sample reported above the detection limit. At 95% completion, February 5, 2008, the third round of soil samples were collected and results narrowed to one remaining location above the cleanup goal. The final sampling on March 3, 2008 results confirmed all areas achieved the cleanup goal of less than 1 mg/kg PCE in soil. Results clearly indicate that ERH is a viable treatment technology for remediation of bedrock lithologies. Figure 2 illustrates average PCE concentrations in soil before and after ERH.

Figure 2. Average PCE in Soil Before and After ERH