

COAL TAR RECOVERY SUCCESS AT A FORMER MANUFACTURED GAS PLANT SITE (CONT'D)



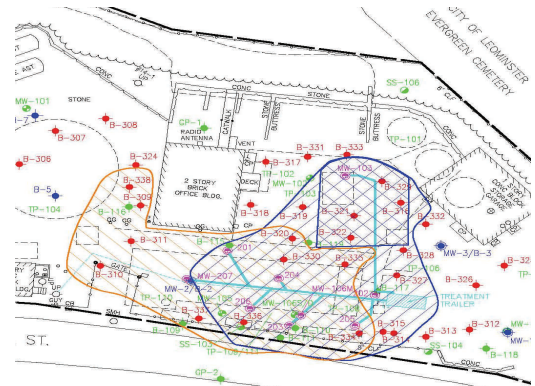
INNOVATIVE ENGINEERING SOLUTIONS, INC. is currently providing consulting services at a former manufactured gas plant (MGP) located in the North East US. We have been responsible for completing response actions at this site starting with the Comprehensive Site Assessment (including a human health risk assessment) through design, implementation and operation of the selected remedial action alternative. Conditions at the site required implementation of 2 Immediate Response Actions (IRAs), one to address light non-aqueous phase liquid (LNAPL) and the discovery of two underground storage tanks; and the second to address the presence of dense non-aqueous phase liquid (DNAPL).

During subsurface explorations, a silty clay layer was encountered at a depth of about 25 feet below the ground surface and appears to have created a localized perched aquifer (that is present at a depth of about 14 feet below the ground surface) wherever it was encountered. A deeper aquifer is present at the site at approximately 40 to 45 feet below the ground surface. The majority of contamination in soil and groundwater appears to be coincident with the silty clay layer. DNAPL (that was similar to coal tar) was observed at thicknesses greater than 8 feet above the silty clay layer; downward movement of the DNAPL appears to be limited by the low permeability and configuration of the perching layer.

Initial DNAPL recovery efforts were conducted using a basic timed-pump removal system from the bottom of the 9 recovery wells using 6 peristaltic pumps (operating on timers). During the approximate year of operation, more than 8,000 gallons of fluid (primarily DNAPL) were recovered and disposed off-site.

Based on the successful operation of limited DNAPL recovery effort and the results of pump tests, an expanded DNAPL recovery system was designed and constructed. The pump test results suggest that about 600,000 gallons of fluid are present on the perching layer, and the recharge of precipitation will contribute and additional 1,000,000 gallons of water to the layer annually. Therefore, the expanded system was designed to remove any recoverable DNAPL and water from the perching layer, and to collect the annual recharge volume.

The expanded system includes the continued use of 9 existing recovery wells and 11 new wells for fluid collection using both pneumatic pumps and peristaltic pumps; separating NAPL and water from the collected fluids using an aboveground oil-water separator;



Extent of LNAPL and DNAPL was mapped



Initial system consisted of timed peristaltic pumps to extract NAPL from bottom of wells



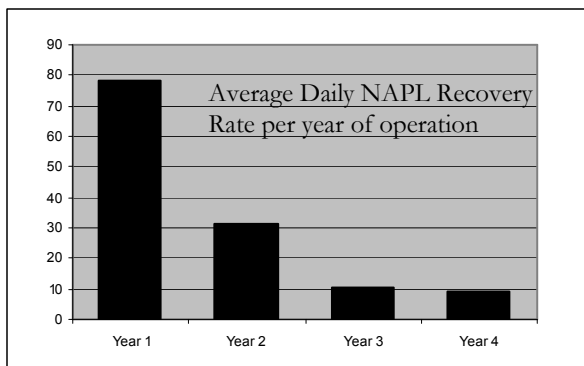
Coal tar in separator. Coal tar consistency can vary as it is recovered. The system was designed to accommodate changes in coal tar.

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transferring the NAPL to a storage tank for removal from the site; and treating the water using a bag filter to remove particulates and liquid phase granular activated carbon (GAC) to remove organics prior to discharge to the sanitary sewer system. A new building was constructed to house the expanded system. Construction of the new building and expanded DNAPL recovery system was completed in 4 months to meet DEP deadlines. Since startup of the system in December 2003, over 60,000 gallons of DNAPL have been recovered and disposed offsite and over 1,800,000 gallons of water have been treated and discharged to the local sewer system.

The rate of DNAPL recovery has reduced from a high of 78 gallons per day during the first year of operation to 10 gallons per day of DNAPL (which is still an impressive amount of recovery). This reduction in daily DNAPL recovery was anticipated and in response, IESI has been pilot testing enhanced recovery methods (e.g., pH adjustments, surfactants, solvents, etc.). The pilot test is ongoing and is showing encouraging results for continued use of the recovery system.

During operation of the system, cyanide concentrations slowly increased over time, resulting in excessive GAC replacement (5,000 pounds of GAC were consumed after treating about 200,000 gallons of water). We conducted several column tests using various media (activated carbons, organoclays, and resins) to determine the effectiveness of these media in removing cyanide and oil and grease (a primary component in the influent; the use of one media would be preferable over two media). After completing the tests, we determined that using the existing GAC filters (for oil and grease removal) followed by an anionic exchange resin (for cyanide removal) was the most effective configuration. The system was subsequently modified, and has treated more than 500,000 gallons of water (using 4,000 pounds of GAC and 160 pounds of resin) without requiring media replacement.



Coal tar recovery rates have declined as expected. System versatility will allow continued use. Average total system cost per gallon of recovered coal tar is \$25 and dropping...



Upgraded system was installed inside newly constructed garage to match site décor.



Upgraded system is automated with dial-out and remote connection capabilities



As with many historic industrial sites, subsurface obstructions are numerous. IESI has worked on dozens of MGP sites and is familiar with the nuances they bring.