Multi-Phase Hydrocarbon Remediation

Santa Fe, New Mexico

Client

New Mexico Environment Department

Highlights

- Contaminants of concern: NAPL, BTEX, PAHs
- First application of several technologies for NMED
- Unique combination of technologies in the state of New Mexico
- Highly constrained site
- Completed on schedule

The Santa Fe County Judicial Complex (SFCJC) site is a New Mexico Environment Department (NMED) State Lead site in historic downtown Santa Fe, New Mexico. It is a consolidation of several underground storage tank (UST) sites and other potential sources in the vicinity of Montezuma Avenue and Cerrillos Road. The NMED selected DBS&A through a competitive bid process to complete a grout barrier around the SFCJC property and a thermally enhanced soil vapor extraction (SVE) system for removal of non-aqueous phase liquid (NAPL) hydrocarbons and reduction of concentrations of volatile constituents adsorbed to soils in the unsaturated (vadose) zone. This was followed by application of ozone sparge and peroxide injection, in combination with low-volume pumping, to further reduce groundwater impacts. The remedial goal was to reduce contaminant impacts to a level that would pose a low risk to occupants of the new SFCJC building, the underground parking garage, and the surrounding properties.

Horizontal wells were installed underneath existing buildings to access the NAPL.

The purpose of the grout barrier was to deter the migration of NAPL onto the site during construction of the underground parking garage and partially mitigate impacts from construction dewatering activities. Due to an existing shoring system at the site, the majority of the barrier installed required high-pressure jet-grouted columns to form the barrier.

The grout barrier layout consisted of 600 linear feet of jet-grouted elements that overlapped with the ends of a 185-foot-long slurry wall. The barrier was 22 feet high, with 4 feet above and 18 feet below the static water table. Overlapping elements were installed in an alternating pattern with additional grouting near existing shoring piles.

Due to site limitations, the only feasible method to access the majority of the NAPL was to install horizontal wells underneath existing structures. DBS&A designed and oversaw the completion of three horizontal wells, two for soil vapor extraction and one for hot air injection. The wells consisted of approximately 180 feet of screen

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and a total length of between 280 and 320 feet. Drilling initiated through the side of a 20-foot-deep excavation on the SFCJC property, proceeded horizontally underneath existing buildings, and daylighted in a parking area. DBS&A made connections to tie in the horizontal wells to both the north and south sides of the project area, which allowed extraction from SVE systems that were installed on both ends of the site. This project was the first application of horizontal SVE wells by the NMED.

DBS&A accomplished treatment of extracted vapors using multiple treatment systems in four phases. The first was a temporary system installed on the Judicial Complex site to take advantage of falling water levels during initiation of construction dewatering. The second was a high-capacity enclosed thermal flare (ETF) and a traditional oxidizer on the north and south sides of the site. The third (thermally enhanced) phase used a traditional oxidizer on both the north and south sides of the site together with hot-air injection. Fresh air was heated and injected into horizontal and vertical wells to enhance volatilization of contaminants, reduce residual hydrocarbons in the smear zone, and accelerate the overall timeline for remediation. The final phase was use of just one oxidizer on the south side of the site with various wells from both the north and south sides accessed in rotation. Approximately 95 percent of the vapor phase contamination removal occurred in the first 18 months of operation. The various phases were completed as individual wells' contaminant levels fell below regulatory action levels. During the final phase of remediation activities, both ozone sparging and periodic hydrogen peroxide injections were used to reduce dissolved phase constituents. Ozone sparging was initiated, after a short pilot test, on a rotating basis to four different wells. Injection volumes and pressures were relatively low due to minimal groundwater movement at the site. In addition to sparging, DBS&A undertook periodic application of hydrogen peroxide to the site wells with the highest remaining dissolved contaminant levels. Limited pumping performed during peroxide injection was used to induce an artificial gradient at the site and provide better distribution of the peroxide.

This multi-phase remedial approach resulted in the removal of all apparent NAPL from the site. Additionally, all vapor samples from SVE wells show contaminant levels below regulatory action levels, including samples collected after system shutdown to monitor possible rebound. Mass removal calculations indicate more than 120,000 pounds of contaminant removed by SVE alone. Dissolved phase contaminant levels have decreased two to four orders of magnitude in most wells, with many site wells now below typical actionable levels. This project has significantly reduced the risk of impacts to surrounding properties and the environment.