CASE STUDY

Bioremediation of a BTEX and Solvent Plume at a Municipal Redevelopment Site

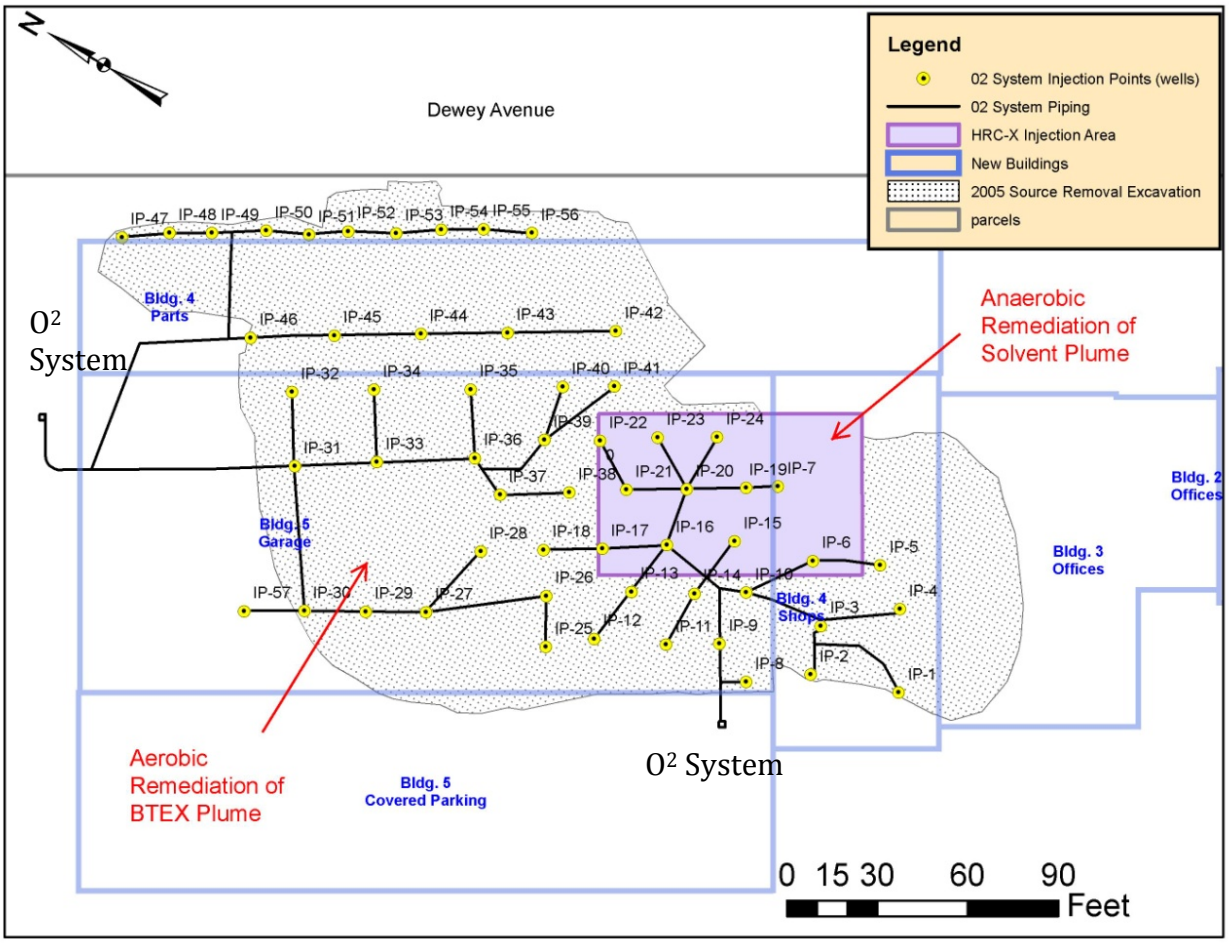
The City of Rochester, NY completed a major redevelopment project that included building demolition, site remediation and building of a new Operations Center for the Bureau of Water, Lighting and Parking Meters. The new facility includes buildings for storage and maintenance of vehicles and equipment and offices for staff.

The site was contaminated by petroleum products and chlorinated solvents (CVOCs) from the former operations, with a groundwater plume of approximately 30,000 square feet. Remediation alternatives were evaluated for effectiveness and the ability to be implemented safely during all phases of site redevelopment. The site presented a number of challenges to remediation including shallow bedrock (14 feet below grade), a plume of chlorinated ethenes within a BTEX plume, and the need to complete site remediation beneath the new Operations Center without vapor intrusion into offices or work spaces. Groundwater was measured at an average depth of 7 feet below grade in the overburden and within 1 foot of the top of bedrock in bedrock wells. Soil consisted of sand with lesser amounts of gravel and silt. Typical of this geologic setting, soil contaminant levels were highest at the overburden/bedrock interface.

After building demolition, approximately 18,000 cubic yards of petroleum impacted soil was removed and disposed off-site. A significant portion of the excavation was advanced to the top of bedrock resulting in the near complete removal of the primary source of groundwater contamination. Groundwater contaminant levels were measured up to 8.16 mg/L for BTEX and 1.45 mg/L for CVOCs.

Remedial design included geochemistry and microbial analyses. Dissolved sulfate was measured throughout the site but other electron acceptors (oxygen, nitrate and ferrous iron) were depleted. Field monitoring was done during demolition to identify and characterize hotspots within the plume associated with floor drains, oil-water separators and other subsurface features of concern.

As a result, there were high variations in contaminant levels and oxygen demand with soluble chemical oxygen demand (COD) ranged from 26 to 795 mg/L. The anaerobic CVOC degrading *Dehalococcoides* was detected in the overburden and bedrock in the CVOC plume area. Based on reducing conditions in the CVOC plume and the high ratio of DCE and vinyl chloride to TCE, injection of electron donor (HRCx) to the top of bedrock was completed to stimulate reductive dechlorination. HRCx consists of a glycerol polylactate compound that is specifically designed to release lactic acid when hydrated. The lactic acid is metabolized by anaerobic microorganisms resulting in the production of hydrogen which is used as an electron donor. Aerobic bioremediation with oxygen injection was selected for the larger BTEX plume with injection points also installed in the CVOC plume for polishing following anaerobic dechlorination. 57 oxygen injection points, including 10 as a biobarrier to prevent off site plume migration, and 2 oxygen injection systems were installed. The oxygen injection points were installed 1 to 2 feet into bedrock with sand pack extending into the overburden. This design provided targeted treatment of the overburden/bedrock interface. A sub-slab depressurization system with a chemical resistant vapor barrier was also installed underneath the new buildings to mitigate potential vapor intrusion from the CVOCs.



CVOCs were reduced to non-detect in the anaerobic treatment zone with no post treatment rebound. Oxygen was pulse injected 6 times per day to each injection point at mass injection rates of 2.25 lbs/day. Dissolved oxygen increased from an average baseline of less than 3 mg/L to 37 mg/L and ORP increased by 200 to 300 mV in the plume. On average BTEX was reduced by 95% after 1 year of operation, and from 7.14 mg/L to 0.012 mg/L in the most impacted well. Active remediation is complete and the site is currently in closure phase. Removal of soil to the bedrock surface and evaluating site geochemistry and microbial conditions before implementing the groundwater remedy were important to a successful remediation project.