

## **Application of Alkaline-Activated Persulfate to Treat Petroleum Hydrocarbon Contamination beneath the Active Construction of a 32 Story High-Rise**

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**Background/Objectives.** A 32 story high-rise was being constructed in the Chelsea neighborhood in Manhattan, New York. Historical site uses included a lumber yard, metal works facility, coal yard, piano manufacturer, livery car service, and a gasoline station. Historical site uses had impacted groundwater and soils with benzene, toluene, ethylbenzene, and xylene (BTEX), naphthalene, diesel range organics (DRO), and gasoline range organics (GRO). Average concentrations for BTEX and naphthalene were 3,000 milligrams per liter (mg/L) and 140 mg/L, respectively. DRO and GRO soil concentrations had a combined average concentration of 1,400 mg/kg. The objective was to remediate petroleum impacts to regulatory standards and required a field application during active construction of the building.

**Approach/Activities.** Alkaline activated persulfate (AAP) was applied as a result of nine months of planning that included evaluation of the chemical compatibility with the building substructure, bench testing of multiple in situ chemical oxidation technologies, and coordination with the contractors responsible for the tower construction. The highly coordinated field event included obtaining permits to gain street access for the onsite storage and batching of chemicals, daily modification of the injection system to accommodate construction activities, and coordination with the building contractors and union workers. The AAP application injected 72,732 pounds (lbs) of sodium persulfate and 31,242 lbs of sodium hydroxide in 35,432 gallons in 6 injection days to accommodate the construction schedule. The injection utilized the RemMetrik® process and Wavefront™ technology to target treatment and optimize reagent distribution.

**Results/Lessons Learned.** The application, the largest in Manhattan at the time, successfully reduced the combined concentration of BTEX compounds in groundwater by 92 to 95 percent and DRO, GRO and BTEX in soil by greater than 99 percent. The groundwater reductions were sustained in quarterly monitoring events a year after the application, leading to the NYSDEC issuing a site closure letter.