Project Summary

Chemical oxidation was utilized at a former gas station located near Syracuse, New York in October 2009 to remediate petroleum contaminants. The compounds of concern included benzene, toluene, xylenes, and various functionalized benzene compounds. The in-situ program covered a total area of 9,225 square feet and treated soil and groundwater from 9-15 ft. below ground surface. The remedial liquids were injected into 39 points via direct push technologies (fig.1). Two intervals between 10 and 18 feet below ground surface (bgs) were used to inject the liquids into the targeted media affecting a radius of 7-10 feet for each point.

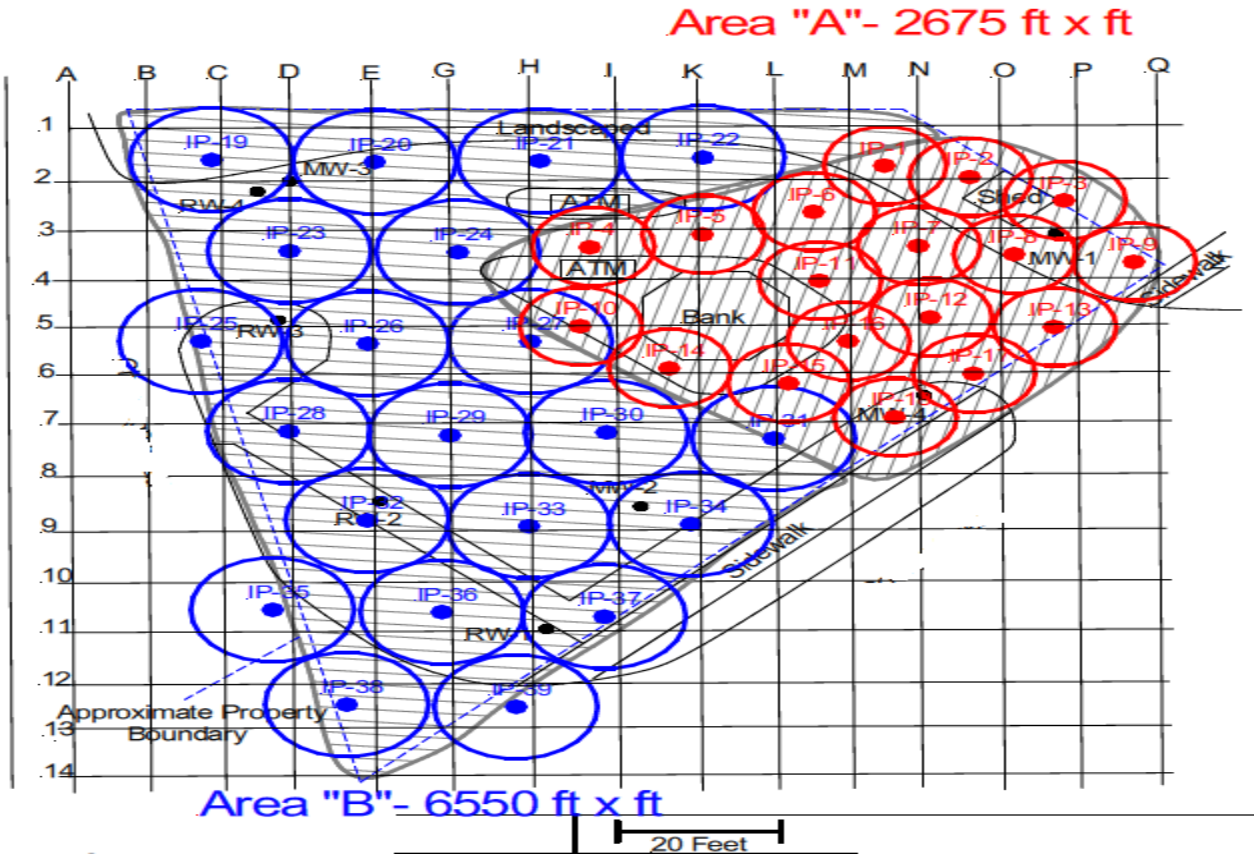

Figure 1: Site map showing the location of 39 in-situ injection points that occurred in Oct. 2009.

Remediation Plan

The injection program utilized direct-push technology to apply a combination of sodium persulfate, hydrogen peroxide and zero-valent iron (ZVI). The objectives of the program were to utilize advanced oxidation processes with a unique blend of hydroxyl, peroxyl and sulfate free radicals. This mixture allows for Fenton-like reactions with long-lived sulfate free radical oxidation to occur, utilizing ZVI as the activator for both reactions. The first phase of the remedial design targeted BTEX compounds via hydroxyl and sulfate free radicals, while the second phase utilized the decomposition products of the

phase one reactions to stimulate facultative biological activity. This combination was utilized to effectively treat BTEX compounds in the groundwater and saturated soils.

Results

The concentrations of VOCs across the site have averaged a significant decrease in concentration, with total VOC concentrations decreasing by 77% across the site since the baseline sampling event (fig. 2). Biological attenuation appears to be occurring at a fast rate in many of the monitoring wells, with the exception of MW-3 that saw a slight increase in total VOC concentrations, from 10.35 to 13.7 µg/L. Total VOC concentrations continued to decrease site wide by 50.8% from October 2010 to March 2011 and compounds that are more readily biodegraded, such as xylene, are readily disappearing. Additionally, compounds that are more recalcitrant such as benzene are beginning to be degraded at high rates.

A second injection event was expected to be required following another quarter of sampling. Due to the success of the first injection event the site has been closed and has been awarded a "No Further Action" letter.

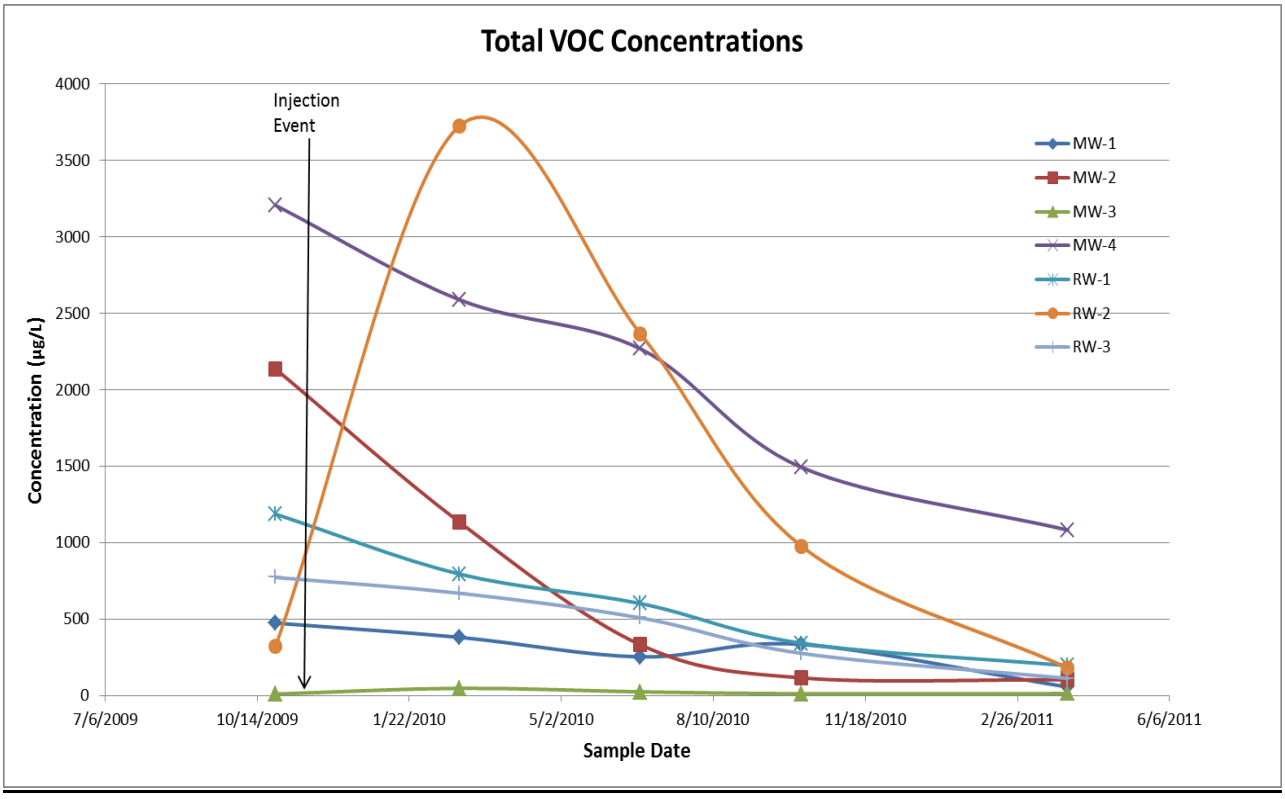

Figure 2: Total VOC Concentrations (µg/L) in seven wells sampled across the site.