

Innovative Application of Pneumatic Fracturing and Atomized Injection Application in High Traffic Urban Environment

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The scope of the project required conducting Pneumatic Fracturing and Liquid Atomized Injection of micro-scale zero-valent iron (ZVI) in 56 injection boreholes as part of a downtown redevelopment plan to transform the area into a high-end retail/residential spa. A critical component of the in-situ remediation is ensuring that the amendment is distributed within the subsurface in a manner to maximize its performance. While the reductive chemistry of ZVI has been well documented and proven, the challenge to successfully implement any active in-situ treatment is the physical emplacement and dispersion of the reactive material. The injection boreholes were advanced by using a Geoprobe 8040DT rig down to a depth of 65 feet bgs. PF and ZVI injection were performed between the depths of 60 feet and 30 feet bgs. Approximately 12,000 pounds of ZVI were injected into each boring. A total of 672,000 pounds of ZVI powder were injected during the 2.5-month field duration. The fracturing initiation pressure ranged between 100 and 300 psig while the ZVI injection pressures were typically less than 200 psig after the fracturing.

Because of the location of the work and the amount of equipment required to implement the project, ARS worked closely with its client in planning and executing the field logistics to minimize the disruption to the local residential and commercial communities that host a weekly farmer's market and music festival adjacent to the work area in addition to the bustling shopping and restaurant scene.

The project was completed on schedule and budget. Groundwater monitoring results in the "hottest" well showed a 94% reduction in PCE three months after the completion of the injection activities from a baseline of 1,800 µg/liter to 170 µg/liter post-injection. Additional groundwater monitoring is taking place as the PCE mass reduction is expected to continue.