

Using ISCO Technologies to Hasten Remediation in DNAPL-contaminated Aquifers

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Allegany Ballistics Laboratory in Mineral County, West Virginia is a government-owned, contractor-operated research, development, testing, and production facility for solid propellants and motors used for ammunition, rockets, and armaments. Site 1 comprises an 11 acre area that includes an active RCRA-permitted burning ground, three former solvent disposal pits and several other disposal areas. The site is located adjacent to the North Branch Potomac River. Between 1972 and 1978 up to 1,000 pounds of TCE per month and a much lower amount of other chlorinated solvents were disposed of in the solvent pits. A remediation system that includes 27 alluvial and 6 bedrock extraction wells is containing and treating the resulting groundwater contamination.

A pilot study using *in situ* chemical oxidation was performed to determine the effectiveness of oxidants at reducing contaminant mass in vertically adjacent alluvial and bedrock aquifers where the presence of DNAPL was confirmed in the bedrock aquifer using FLUTE™Liner technology.

In May 2005, approximately 7,000 pounds of sodium persulfate mixed with 3,150 gallons of water were injected into seven injection points in the alluvial aquifer. Small amounts of chelated iron were injected and steam was used to act as a heat catalyst for the persulfate. Approximately 3,200 pounds of potassium permanganate mixed with 9,300 gallons of water were injected into one bedrock injection well.

Initial results following injection showed that TCE concentrations decreased in the majority of alluvial wells, with reductions ranging between 28% and 82%. Subsequent results demonstrated a general site-wide rebound in TCE. However, the most recent sampling indicated an average site-wide decrease of 27,000 ug/l, with a maximum decrease of 97,000 ug/l for TCE. Initial results for the bedrock aquifer showed that TCE concentrations decreased in each well with reductions ranging between 37% and 100%. Several other chlorinated solvents within the bedrock aquifer were reduced to below detectable levels. Subsequent results demonstrated a site-wide rebound in the bedrock aquifer. However, the most recent sampling indicated an average site-wide decrease of 21,000 ug/l, with a maximum decrease of approximately 100,000 ug/l for TCE.

Mass flux modeling was conducted to evaluate contaminant mass reduction and to evaluate the remedial effectiveness of the two oxidants. Based on a review of the analytical data and modeling it is apparent that both technologies were effective at reducing dissolved phase chlorinated solvents. However, DNAPL is likely still present in the subsurface as evidenced by contaminant rebound.