

PCE REMEDIATION USING HRC® IN FRACTURED BEDROCK AT A NEW JERSEY PRINTED CIRCUITS SITE



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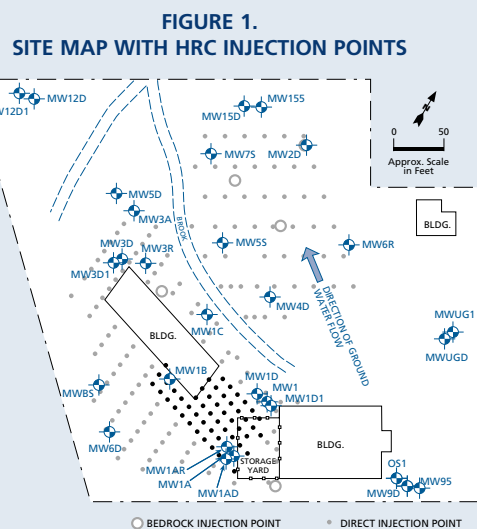


ABSTRACT

Spilled perchloroethene (PCE), at a manufacturing facility migrated through the saturated overburden and into fractured bedrock. Ground water monitoring measured PCE concentrations up to 80,000 ug/l, where PCE represented more than 80 percent of the total VOC mass. Hydrogen Release Compound (HRC®) was injected during September/October 2001. Monitoring in the first year after injection demonstrated dramatic improvements in the core of the treatment area. Post-injection PCE concentrations declined to less than 10 percent of the total VOC mass and 1,2-DCE increased to approximately 85 percent of the VOC mass with significant increases in vinyl chloride concentrations. PCE concentrations at the fringe of the treatment area exhibit PCE reductions of more than 50 percent. Targeted re-injection of HRC and attenuation monitoring are planned. HRC has significantly influenced geochemical conditions to promote in-situ dechlorination. The outcome has been dramatically improved groundwater quality and a high probability that the site will be suitable for no further remedial action within a 3 to 5 year timeframe.

BACKGROUND

The property is situated in an urbanized portion of northeastern New Jersey where it operated as a printed circuits manufacturing facility from the 1960s until the mid 1980s. The site initiated the Industrial Site Recovery Act (ISRA) Program, where required investigations discovered a Storage Yard where drums of spent solvents had previously been staged. The spent solvents consisted of chlorinated VOCs, principally PCE, which were placed into drums and accumulated in the Storage Yard. Site characterization investigations were subsequently performed to assess the occurrence of VOCs in the subsurface of the site. In 1991, soils from the former Storage Yard were excavated and removed for off-site disposal. Approximately 16,000 pounds of HRC was then injected into the aquifer to treat contaminants below the water table.



HRC APPLICATION

A "Pilot Level Study" Remedial Action Workplan (RAW) for the injection of HRC was prepared and submitted to the NJDEP in May 2001 and approved in August 2001. The RAW presented the conceptual model for site hydrogeologic conditions and offered that model as a technical basis for input data that were applied to Regenesys' HRC Application Design Software to determine the volume and placement of HRC injection. Based on the Regenesys software output, HRC was injected over two grids covering the plume area. The injection points shown on Figure 1 represent a high-density grid proximal to the source area, surrounded by a lower density grid over areas downgradient of the source.

HRC was injected into the saturated overburden through direct-push (GeoProbe™) borings, and it was injected into the bedrock interval by use of existing or newly installed temporary wells for the pressure injection of HRC below an inflatable packer. Due to the construction of two of the existing monitoring wells, HRC could not be pressure injected, however they were treated by passive diffusion of HRC from the well casing and bore hole. Approximately 16,000 pounds of HRC was injected at a total of 200 locations during September and October 2001.



Site HRC Injection Images

TREATMENT SELECTION

To be effective, a groundwater remediation system should address the residual VOC source and groundwater advection pathways within the aquifer. At this site, a confined fractured bedrock aquifer restricted vertical movement of VOCs, which were limited to shallow bedrock fractures and overlying unconsolidated materials. The use of HRC as an injectable substrate to accelerate the bioremediation of chlorinated compounds could exploit these restrictive hydrogeologic conditions and effectively deliver lactic acid and hydrogen throughout the source area and associated fracture pathways.



Bedrock Injection with Inflatable Packer System

RESULTS:

Significant degradation of PCE in groundwater within the aquifer was facilitated through the use of HRC. The high-density injection grid at the source area (MW-1B) (Figure 2) produced the most significant reduction in PCE (99%), while wells more distal to the source, with reduced injection density, exhibited less dramatic results. Bedrock injection points injected under pressure have achieved better results at neighboring wells than wells where HRC was passively released to the aquifer. Figures 3 and 4 represent changes in concentrations of PCE (ug/L) over a period slightly greater than one year.

ESTIMATED COSTS

Costs to conduct enhanced bioremediation at this site were approximately \$250,000 and is estimated to cost less than \$500,000 through project completion.

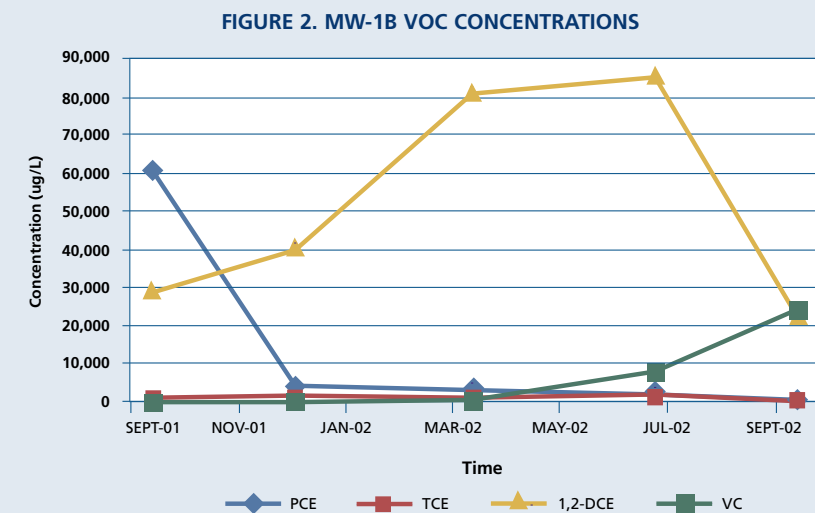


FIGURE 3. PRE-HRC INJECTION



FIGURE 4. POST-HRC INJECTION

