EOS® PERMEABLE REACTIVE BARRIERS SUCCESSFULLY TREAT A LARGE TRICHLOROETHENE PLUME

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Problem
A large manufacturer in Indiana needed to remediate a long plume of TCE-contaminated groundwater, threatening a river almost 2 miles downgradient of the source.

Project Goal
Cut-off TCE migration and reduce plume size in an economical, efficient and sustainable manner.

Methodology
Installation of six PRBs along the plume transect using EOS® emulsified oil substrates:

- EOS 598B42 (410,000 lbs)
- EOS 450 (412,000 lbs)
- EOS LS (120,000 lbs)

Results
To date, the PRBs have effectively cut off the downgradient migration of TCE and continue to reduce overall plume size.

EOS® substrate injection resulted in:

- Rapid establishment of reducing conditions within each PRB
- Rapid transformation of TCE
- Formation of TCE daughter products and ethene downgradient of PRBs
- A growing community of dechlorinating bacteria

Regulatory Approval
Indiana regulators have approved the cleanup technology and environmental goals for the site.

Historical use of trichloroethene (TCE) and other chlorinated solvents at a former automotive parts manufacturing plant in Indiana resulted in a large groundwater plume, stretching approximately 2 miles from the site. TetraTech GEO evaluated several remedial alternatives and selected enhanced in situ bioremediation to reduce contaminant concentrations and eliminate continued plume migration at the site.

The Challenge

Historical releases of TCE from multiple sources within the 36-acre manufacturing plant has resulted in a plume roughly 9,000 ft long and 1,100 ft across, traversing an unconfined aquifer to a depth of 50 to 75 ft below ground surface (bgs) **(Figure 1)**. Over time, the west-to-east trending plume has migrated to a river downgradient of the site. Groundwater velocity ranges from 1.4 to 2 ft/day. A large area of the plume contained TCE concentrations greater than 1,000 µg/L.

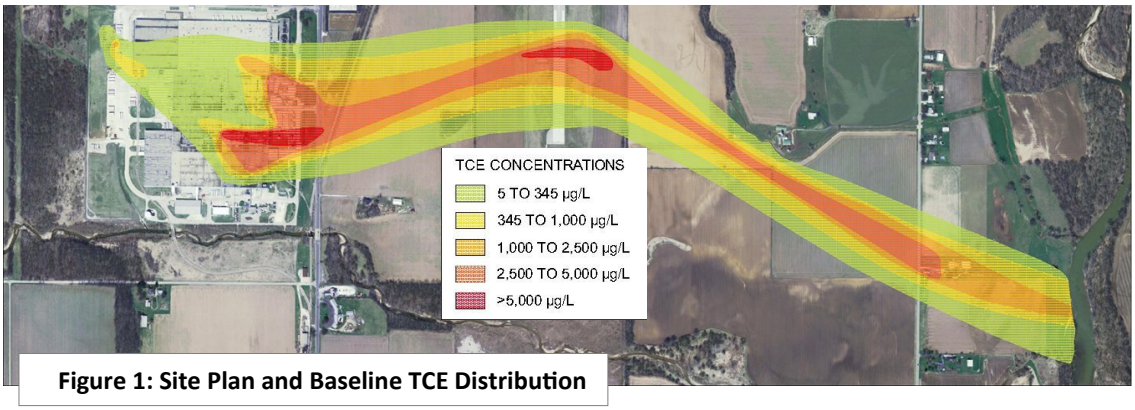

Figure 1: Site Plan and Baseline TCE Distribution

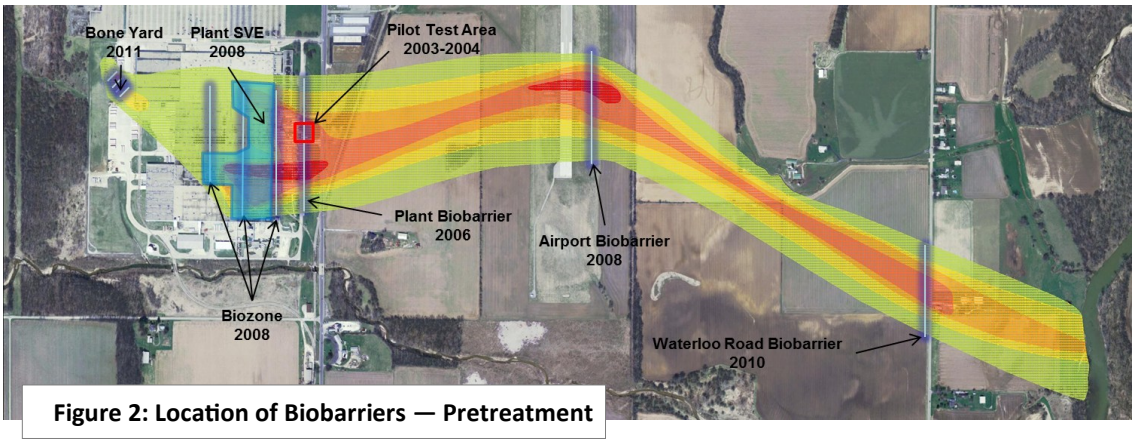

Figure 2: Location of Biobarriers — Pretreatment

The Strategy

Initial bench-scale testing by TetraTech GEO determined that enhanced *in situ* bioremediation would be an effective and economical technology to treat chlorinated solvents in site groundwater. As part of follow-up field testing, TetraTech GEO injected EOS 598B42 emulsified oil substrate, along with a commercially-available dechlorinating bacterial culture, to validate the technology at the site. A groundwater circulation system was operated for 5 months to enhance distribution of substrate and bacteria within the treatment zone. After 1 year, complete dechlorination of TCE was observed, leading to regulatory acceptance of the full-scale remedial design.

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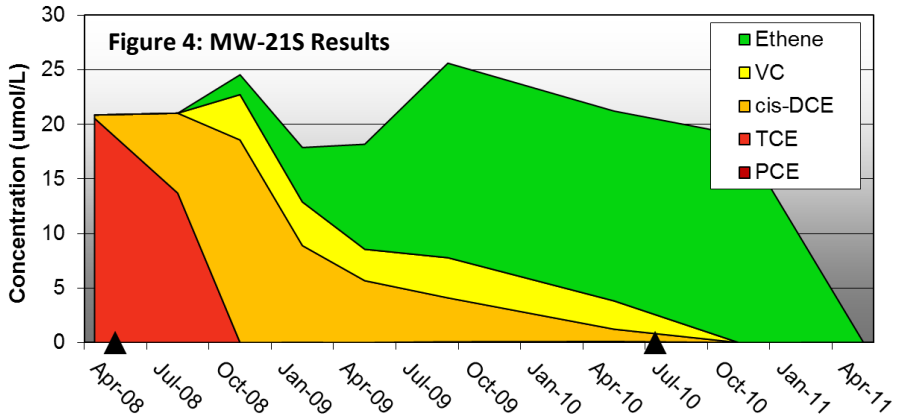
Full-Scale Design

Six 1,000-ft long permeable reactive barriers (PRBs) were constructed to intercept contaminant migration at various points along the plume transect **(Figure 2)**. Various EOS® products, including EOS 598B42, EOS 450 and EOS LS, were injected through a combination of permanent, temporary and direct push injection wells (typically spaced 15-25 ft on-center) to build the PRBs. A Dosatron® system provided in-line dilution of EOS® substrate prior to injection **(Figure 3)**. Maintenance injections were conducted approximately 1 to 2 years after the initial injections to replenish substrate both consumed by enhanced bioactivity and diluted by rapid groundwater flow. Approximately 824,000 lbs of EOS® substrates were injected to build and maintain the six PRBs.

Figure 3: Dosatron® injection from totes.

Results

The geochemistry of the aquifer downgradient of each PRB was transformed to conditions that support reductive dechlorination within 2 months of initial EOS® substrate injection. Oxidation-reduction potential (ORP) measurements were mostly below -100 mV and there were significant reductions in both nitrate and sulfate concentrations. **Figure 4** shows the rapid response to treatment measured in performance monitoring well MW-21S, located 50 ft downgradient of the Airport PRB. Daughter products including vinyl chloride (VC) and ethene formed soon after injection.



Regulatory Approval

The installation of six PRBs along the plume effectively cut off the downgradient migration of TCE from each PBR (e.g., Airport PRB; **Figure 5**) and several portions of the plume are compliant with site remediation goals. The documented improvement and continued success has allowed the Indiana regulators to endorse the cleanup technology and environmental goals for the site.

Figure 5: TCE plume 4 years after treatment

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