Aerobic Bioremediation Case Study:

Bioaugmentation Following ISCO to Remediate TCE in Groundwater

Location
Manufacturing facility
Eastern, Massachusetts

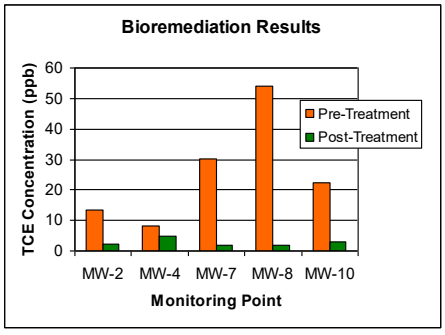
Site Conditions
Ground water plume in an alluvial aquifer beneath an active facility. Aerobic aquifer conditions.

Target Chemicals
The target chemical was TCE. The risk driver and most significant exposure was via vapor intrusion.

Special Considerations
The bioaugmentation followed in-situ chemical oxidation that appeared to have reached a treatment limit.

Application
160 gallons of hydrated CL-Out microbes were injected into 14 injection points covering 1,200 square feet.

Results
After 30 days the TCE concentrations decreased by 97% without the production of DCE or vinyl chloride.



Background

The chlorinated solvent trichloroethylene (TCE) was discovered in ground water at a manufacturing facility in eastern Massachusetts. ISCO was selected for remediation of the ground water. Although ISCO reduced TCE concentrations, the residual post-ISCO TCE concentrations were above the applicable remediation standards. The environmental consultant chose CL-Out® bioaugmentation to treat the residual ground water contamination. The CL-Out® treatment successfully achieved the remediation goal quickly and at a low cost.

Geology and Hydrogeology

The contaminated ground water was in a shallow, sandy, water-table aquifer. The residual contamination was located under a manufacturing building and adjacent to a river. The main receptor concerns were vapor migration into the building and contaminated ground water migration into the river.

TCE was the only contaminant in ground water. Post-ISCO TCE concentrations were as high as 54 µg/L. Daughter products were not detected. CL-Out® was selected for the treatment because it is capable of cometabolizing the TCE without producing daughter products such as vinyl chloride. Furthermore, the CL-Out® organisms are aerobic, so they were compatible with the natural oxygenated conditions of the aquifer.

Remediation Design

CL-Out® was introduced into the contaminated ground water by injection through temporary well points. Three drums of the CL-Out® were injected into the ground water through 14 injection points over an area of 1,200 square feet.

The ground water treatment results were monitored by analysis of ground water samples from five locations. The 30-day monitoring results show an immediate decrease in the TCE concentrations without the production of DCE or vinyl chloride. After 30 days as much as 97% of the TCE was destroyed and the ground water met applicable standards.
Dissolved oxygen (DO) concentrations and oxidation-reduction potentials (ORP) were also monitored to assess the growth environment for CL-Out® organisms. Before the bioaugmentation the DO concentration was 0.47 mg/L. After the bioaugmentation, the DO concentration dropped to 0.04 mg/L, which confirms active aerobic microbial metabolism. The ORP was 208 before and 272 after bioaugmentation, which shows positive redox potential was maintained even though oxygen was being utilized.

Ground water samples were tested for CL-Out® organisms by plate count analysis 30 days after the injection. The CL-Out® population was greater than 300,000 cfu/ml in 4 of 5 monitoring points 30 days after the inoculation, confirming a good distribution of the organisms and that the population was sustained at the planned level.

Conclusions

This project demonstrates several of the benefits of aerobic bioaugmentation. Bioaugmentation provides active control of the site as effective organisms compatible with the site conditions were injected where they were needed. Furthermore, the CL-Out® aerobic cometabolism was compatible with the residual conditions following ISCO treatment. The TCE was destroyed without production of daughter products, which accelerated site closure at minimal cost.

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