Chemical Oxidation Remediation Project Wins Environmental Award, Saves Time and Cost

NSB KINGS BAY

In-Situ Chemical Oxidation was used to treat groundwater contaminated with high concentrations of PCE at a landfill located on the Naval Submarine Base, Kings Bay Georgia. This effort allowed the Navy to accelerate the estimated time for cleanup of the site and shut off the existing pump and treat system. Due to the effectiveness and innovation of the treatment approach, the project received the State of Georgia Chamber of Commerce Environmental Excellence Award. The State of Georgia Environmental Protection Division submitted the nomination.

Project Summary

- The site is a 25-acre municipal landfill that operated between 1974 and 1980.
- The Remedial Investigation identified Perchloroethylene (PCE) and its degradation products in groundwater emanating from the landfill towards a residential subdivision 500 feet away.
- Over 600 homes are located in the subdivision and many use groundwater for irrigation purposes.
- Groundwater extraction wells with an air-stripping treatment system were installed in 1992 to prevent migration of contaminants into the subdivision.
- The source of PCE contamination was identified on the perimeter of the landfill with concentrations of over 9000 µg/l.
- Natural Attenuation of the groundwater was found to be highly efficient but there was not enough distance prior to reaching the subdivision to complete the process due to the relatively high source area concentrations.
- In-situ Chemical Oxidation was selected to reduce the source of contamination such that the natural attenuation processes could efficiently treat the residual concentrations.
- The oxidation process utilized Fentons Chemistry. This process uses hydrogen peroxide and a ferrous sulfate catalyst to generate hydroxyl radicals. These radicals are strong non-specific oxidizers that transform the chlorinated hydrocarbons to carbon dioxide, water, and chlorides without any intermediate products.
- Injection of chemical reagents and catalyst was implemented by the placement of 23 injection wells.
- Two injection treatments were used for this site. One treatment began in November 1998 and lasted for a period of approximately 3 weeks. A follow-up treatment was conducted in February 1999 and lasted for 1 week.
- The initial source area treated consisted of a 175 x 50 ft^2 area and a 5 ft thick horizon. The horizon treated was approximately 37 feet below land surface.
- Treatment achieved over a 98% destruction of chlorinated hydrocarbons.
- Modeling predictions indicate that the remaining residual concentrations will degrade within 5 years.
- The natural attenuation of the plume will be monitored at the site until the residual concentrations meet the Federal groundwater Maximum Contaminant Levels (MCLs).
- Two additional nearby source areas in the landfill have been targeted for cleanup using this approach.

Site/Location:	Old Camden County Landfill, Site 11 NSB Kings Bay, GA
Site Description:	25-acre municipal landfill, which required investigation of Perchloroethylene (PCE) and its degradation products in groundwater emanating from the landfill towards a residential subdivision 500 feet away
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Technology:	In-Situ Chemical Oxidation Monitored Natural Attenuation
Contaminant:	Perchloroethylene (PCE), and its degradation products in groundwater
Action Levels:	Perchloroethylene (PCE) 5 µg/L Trichloroethene (TCE) 5 µg/L Dichloroethene (DCE) 70 µg/L Vinyl Chloride (VC) 2 µg/L
Legal Driver:	Resource Conservation and Recovery Act (RCRA) Permit No. HW-014
Decision Document:	RFI Report Recommendations Corrective Action Plan (CAP)

Regulatory Requirements/Community Involvement

The landfill is a Solid Waste Management Unit subject to corrective action as part of a RCRA Part B Permit. Cleanup requirements for groundwater specify action levels of federal MCLs. The remedy approach was communicated to the community through the Restoration Advisory Board and has been well received.

Construction Challenges

A remedy utilizing a combination of chemical oxidation and Monitored Natural Attenuation posed some early concerns regarding how quickly the microbial community would rebound from the treatment process. This was determined to be a relatively short period of time. Within 6 weeks of treatment, the source areas that had been saturated with dissolved oxygen returned to anoxic conditions indicative of anaerobic microbial activity.

Cost Avoidance Measures

The success of the chemical oxidation of the source area precluded the need to install new recovery wells and a new expensive off-gas treatment system (UV oxidation) to ensure containment of the plume. It is expected that long term monitoring cost will be substantially diminished at this site as the time for residual concentrations to meet MCLs through Monitored Natural Attenuation is predicted to be complete within less than 5 years. Net present value of life cycle cost savings exceeds $3.3 million.

Project Successes

- Treatment of the source area ensured that there would be protection of downgradient receptors.
- Reduction of the source area concentrations and utilization of MNA minimized the life cycle remediation costs.
- An existing RCRA consent order was rescinded upon treatment of the source area and the hydraulic containment wells and treatment system was shut off.
- The remedy for the contamination was changed from hydraulic containment to both an active and passive treatment
- On June 9, 1999 the State of Georgia Chamber of Commerce recognized the project for the State Award for Environmental Excellence. The Georgia Department of Environmental Protection submitted the nomination for this award.

Lesson Learned

The application of In-situ Chemical Oxidation at NSB Kings Bay was successful due to several factors. The source of the contamination was well defined both laterally and vertically. The geology at the site was sufficiently permeable that injection of the reagents into the aquifer was capable of contacting and destroying the contaminants.

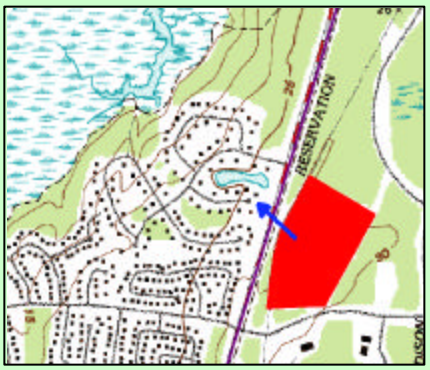

Figure 1: ***Location of landfill relative to subdivision and direction of groundwater flow.***

Figure 2: ***Process controls and catalyst in tractor-trailer and hydrogen peroxide in tanker truck.***

Figure 3*: In-situ chemical oxidation injection wells (background) monitoring well (foreground).*

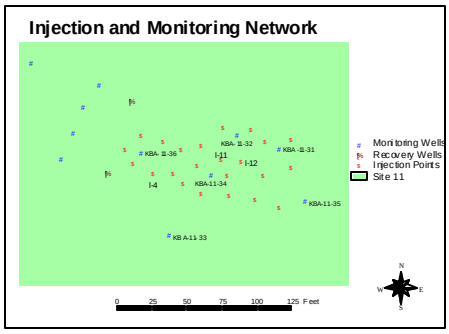

Figure 4*: Layout of monitoring and injection wells.*