Orlando Events Center

Modified Fenton's Reagent—Sodium Permanganate—Soil Excavation

Site Name: Orlando Events Center
Site Location: Orlando, Florida
Technology Used:

- In Situ Chemical Oxidation (Modified Fenton's Reagent)
- In Situ Chemical Oxidation (Sodium Permanganate)
- Soil Excavation

Regulatory Program: Florida Department of Environmental Protection Brownfield's Redevelopment Program
Remediation Scale: Full
Project Duration: November 2007 to February 2008.

Site Information: The site is a Brownfield located in a former commercial zone in Orlando (Figure 1). It was scheduled to be redeveloped into the Orlando Events Center.

Figure 1. Future home of Orlando Events Center

Courtesy AMEC

Contaminants: The contaminants of concern are tetrachloroethene (PCE) and its degradation products. The highest concentration of PCE detected at the site was 14,000 µg/L. Degradation product (trichloroethene [TCE] and dichloroethene [DCE]) concentrations are considerably lower (Bryant and Wilson 2008).

Hydrogeology: The site is underlain by about 40 ft of silty to fine sand that overlies a dark brown basal clay. Groundwater occurs at about 10 ft below ground surface.

Project Goals: To reduce groundwater contaminant concentrations to Florida Cleanup Target Levels (PCE—3 µg/L, TCE—3 µg/L, DCE—70 µg/L). The site was scheduled for redevelopment in August 2008 so site cleanup efforts had to be complete by then.

Cleanup Approach: Excavation and offsite disposal was chosen for shallow soil contamination. The deeper cleanup targeted the approximately 80 ft wide by 130 ft long and 40 ft deep source area. The highest groundwater contaminant concentrations were near the basal clay at 40 ft. Seventy-two injection wells were installed on 20-ft centers with three injection zones. The use of a direct push rig allowed the wells to be installed in two weeks. The presence of the highest PCE concentrations at the top of the clay indicated the potential for back diffusion rebound from the clay.

In anticipation of this, the injection was carried out in two phases. The first phase used approximately 85,000 gallons of 12.5% hydrogen peroxide and catalyst (modified Fenton's reagent) to greatly reduce the contaminant and soil oxidant demand. A week was allowed for the depletion of the modified Fenton's reagent before beginning the second phase injection of 21,000 gallons of a 4% sodium permanganate solution (Figure 2).

The purpose of the second phase was twofold. With a greatly reduced contaminant loading, the permanganate would lower the contaminant concentrations in the silty to fine sand even more to achieve the target cleanup levels. Permanganate is also relatively long-lived (months) which allows it to address back diffusion issues by both destroying contaminants as they emerge from low permeability materials and by diffus-

ing into the low permeability materials (Huling and Pivetz 2006).

Figure 2. Oxidant Tanker and Control Trailers

Courtesy AMEC

Project Results: Four groundwater sampling events, with the last being six months after the injections (August 8), have found non-detectable (<2 µg/L) levels of all contaminants of concern. Subsequent sampling of groundwater offsite has shown the presence of permanganate which likely continues to polish onsite groundwater as well as downgradient groundwater.

Field work was completed in 101 days. Costs totaled $596,000 for remediation (approximately $34/yd^3) and $85,395 for soil and groundwater confirmatory sampling during and after the injections.

Sources:

Bryant, D. and J. Wilson. 2008. Field Applications of Fenton's Chemistry Subsurface Remediation Symposium, April 29, 2008, 19 pp (PPT).

Huling, S. and B. Pivetz. 2006. Engineering Issue: In-Situ Chemical Oxidation EPA, 600/R-06/072, 60 pp. http://www.cluin.org/download/contaminantfocus/pcb/ISCO-600R06072.pdf

Oyler, Alan, Dan Bryant, and Ed Kellar. 2010. Dual-Reagent ISCO "Fast-Tracks" Cleanup of Orlando Brownfield in Technology News and Trends (October 2010). http://clu-in.org/products/newsltrs/tnandt/view.cfm?issue=1010.cfm#1

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