**ITRC CASE STUDY**

**Site:** USG Corporation Facility, La Mirada, CA (Pilot Test)

**Contaminant:** TCE and 1,1-DCE
**Oxidant**: Potassium Permanganate

**Regulatory Agency Contact**: Mr. Steven Hariri (213) 576-6600
Los Angeles Regional Water Quality Control Board
**Consultant:** Mr. Gary Cronk

*Site Setting*

The aquifer sediments are comprised mostly of silty sands and sandy silts interbedded with clays and clayey silts. The aquifer has a relatively high hydraulic conductivity of 18 ft/day. Groundwater flows towards the northeast with a gradient of 0.033 feet per feet and a velocity estimated to be 0.17 feet per day. The Los Angeles Regional Water Quality Control Board (LARWQCB) considers the affected groundwater aquifer a potential drinking water source. The aquifer thickness is approximately 25 feet (depths of 80 to 105 feet bgs) and is considered part of the regional Artesia Aquifer. No sensitive receptors other than those associated with a drinking water source were identified in the immediate vicinity of the site.

*Description of Target Treatment Volume*

The plume, consisting of groundwater contaminated with trichloroethene (TCE) and 1,1-dichloroethene (1,1-DCE), was present at a depth of approximately 80 to 105 feet below ground surface. The areal extent of the entire plume measured approximately 55,000 square feet, although this pilot test was performed to determine the effects of in situ chemical oxidation treatment on a much smaller portion of the plume, approximated at 1375 square feet. The highest pre-treatment levels of TCE was 450 ug/l and 700 ug/l for 1,1-DCE.

*Remedial Design*

A field pilot test was performed using a single groundwater well to demonstrate the effectiveness of potassium permanganate ($KMnO_4$) to remediate a contaminated alluvial aquifer located beneath an industrial facility in La Mirada, CA. This project was the first in-situ chemical oxidation project performed in the Los Angeles basin, following the January 2002 approval by the LARWQCB of General Waste Discharge Requirements for in-situ technologies. The pilot test consisted of six injections each of 1,500 gallons of potassium permanganate ($KMnO_4$) solution (up to 5% by weight) into a single groundwater injection well (screened interval of 80 to 100 feet bgs) (total injection quantity of 9,000 gallons). The radius of influence was determined to be approximately 35 feet by field measurement of water quality changes (i.e., Redox, specific conductance, and turbidity), laboratory analysis of permanganate ion, and observation of "pink water" in the surrounding wells. The actual treatment radius was extended another 15 feet by inducing a hydraulic gradient via the pumping of groundwater from a down-gradient well (RW-3). Eleven existing wells were utilized as monitoring wells over a six-month monitoring period. Field measurements of specific conductance, oxidation-reduction potential, turbidity, and color (pink or purple for presence of permanganate) were used to assess oxidant dispersion and consumption of permanganate.

The primary goals of the pilot test were threefold: 1.) Evaluate the destruction of chlorinated ethenes (TCE and 1,1-DCE), 2.) Measure secondary water quality effects, 3.) Develop design data for scale-up to a site-wide permanganate treatment.

*Results*

Significant reductions of TCE and 1,1-DCE concentrations, from 86 to 100 percent, were detected shortly following the injections. The TCE concentrations in the three closest monitoring wells, within 35 feet of the injection well were all reduced to non-detectable (ND) levels (less than 1.0 micrograms per liter (ug/l)) during the first 70 days of the pilot test. This included a maximum reduction of TCE from 280 micrograms per liter (µg/l) to ND (<1 ug/l). Over the next 90 days, three additional wells (45 to 50 feet away) also began to show significant TCE reductions, with a maximum decrease in TCE from 450 µg/l to 65 µg/l. Effective treatment of 1,1-DCE was also observed in five wells, declining from 270 µg/l to ND (<1.0 ug/l) in one well and from 700 µg/l to 19 µg/l in another well. No significant rebound of TCE or 1,1-DCE levels has been monitored for 12 months following the pilot test.

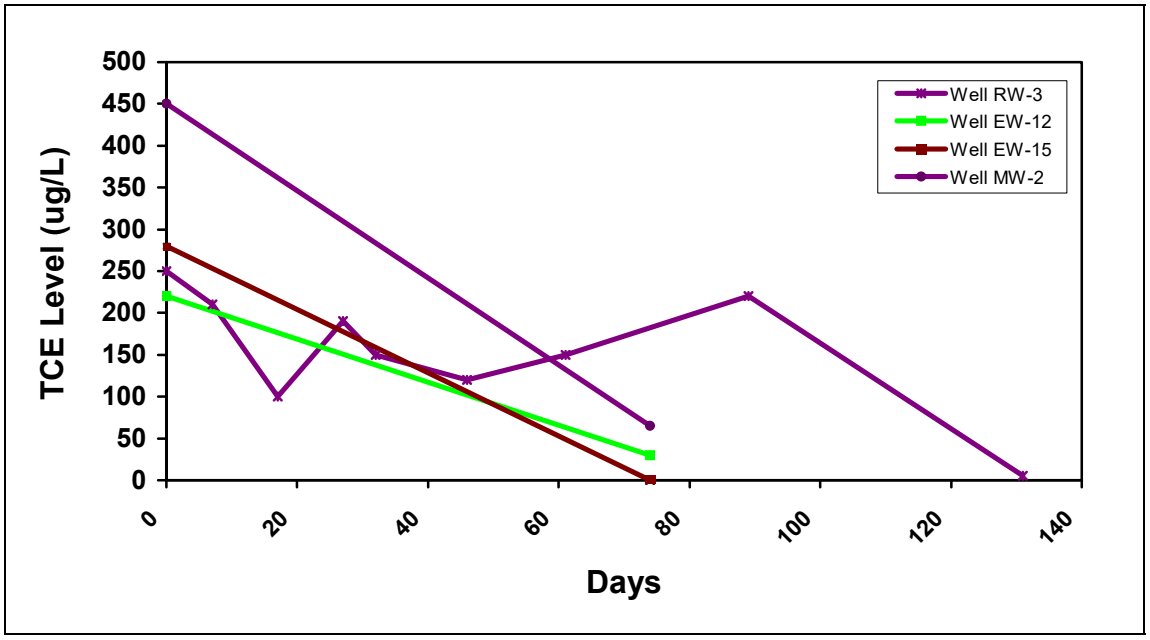


**Figure 1. Decline in TCE Levels Following KMnO4 Injections**

*Cost*

The pilot study also illustrated the cost-effective use of existing wells for monitoring purposes in lieu of direct push borings or new well installations. The total costs for this pilot test was approximately $160,000 or about $52 per cubic yard by volume. Based upon the successful pilot test, a full-scale application of $KMnO_4$ at the site will be implemented in cooperation with the RWQCB. The estimated costs of the full scale treatment will be about $200,000.