

**TECHNICAL BRIEFING – FINAL 2011 ANNUAL MONITORING REPORT GROUP 3, SITE 2 (PICA 008)
GROUNDWATER AND SURFACE WATER – MAY 2012**

The document reviewed was an annual report for post-remedy groundwater and surface water monitoring completed in 2011. The response action for the site involved in-situ enhanced bioremediation for chlorinated volatile organic compounds (VOCs). In August and September 2010 six injection wells were installed along with three monitoring wells. A total of 8,260 gallons of dilute emulsified vegetable oil (EVO) were injected. The monitoring for the remedy was designed for both compliance – to ensure that contaminant concentrations are decreasing – and for performance – to determine that groundwater conditions are suitable for biodegradation. The frequency for compliance monitoring for the first year after remedy implementation was quarterly starting in the fourth quarter of 2010. Performance monitoring was on a semiannual frequency. Nine monitoring wells were utilized for compliance monitoring (2MW-4D, 2MW-10, 2MW-14, 2MW-17, 2MW-25, 2MW-26, 2MW-27, 2MW47-101, and 2MW47-102) along with five surface-water sampling locations. Eight monitoring wells were utilized for performance monitoring (all of those included for compliance monitoring except 2MW-4D).

Primary degradation pathways identified are as follows:

Carbon tetrachloride (CT) → chloroform → dichloromethane → chloromethane → methane

Tetrachloroethene (PCE) → trichloroethene (TCE) → dichloroethene (DCE) → vinyl chloride (VC) → ethene → ethane → carbon dioxide

Of these compounds, PCE, TCE, 1,1-DCE, and CT were identified as contaminants of concern (COC) in the record of decision (ROD).

Other possible degradation reactions noted are hydrolysis and dihaloelmination. The characteristics and extent of the in-situ reactive zone (IRZ) are determined by how effectively the carbon source (in this case, emulsified vegetable oil - EVO) can be brought to the subsurface microbes.

The EVO was injected into eight injection wells: six wells in the Southern Area and two wells in the Northern Area.

Performance Monitoring

Performance monitoring parameters were as follows: ethene, ethane, methane, dissolved organic carbon (DOC), temperature, pH, and specific conductivity. DOC was highest closest to the injection sites and declined over time which was attributed to consumption by microbes. Methane was detected in monitoring locations near injection wells which was attributed to establishment of methanogenic conditions considered favorable to reductive dechlorination of PCE and TCE. Methane found in downgradient wells in the absence of DOC was deduced to be evidence of the establishment of methanogenic conditions upgradient.

Compliance Monitoring

There were no detections of VOCs in the five surface-water sampling locations. Thus the groundwater contamination is apparently not affecting surface water.

The report includes tabulated monitoring results for groundwater samples as well as “trend plots” contained in Appendix B (graphs of contaminant concentration versus time). Results are tabulated and graphed for two groups of constituents as follows: (1) PCE, TCE, cis-1,2-DCE, 1,1-DCE, and VC; and (2) CT, chloroform, and methylene chloride, and chloromethane. The report states the following: *“The long-term trend in all monitoring wells has been a sustained decrease in concentrations of parent compounds PCE, TCE, and CT, as illustrated in Appendix B.”* It is the opinion of the reviewer that the data and the plots demonstrate decreases in concentration in some wells but in most cases the decreases are so negligible as to be insignificant. The decreases are more pronounced in a few wells closest to injection sites. None of the post-injection decreases result in order of magnitude differences in concentrations before treatment compared to those after treatment. The slight decreases are reason to be optimistic about the treatment outcome but not to definitively conclude that there is a widespread and significant decreasing contaminant trend that will definitely persist. A program of quarterly sampling is going to be pursued for the next year of monitoring rather than semiannual as originally proposed. It is the opinion of the reviewer that another year of quarterly sampling could be

useful in determining contaminant concentration trends and that a longer observation period is required to define trends.

Conclusions

Surface water is not being affected by groundwater contaminants based on current monitoring results. Monitoring frequency will be reduced from semiannual to annual. Groundwater compliance monitoring shows some slight decreases in contaminant concentrations which are most pronounced in wells closer to the injection sites. Sampling frequency for compliance monitoring of groundwater, originally proposed to be reduced to semiannual, will remain at quarterly for the next year. Performance monitoring shows that indicator parameters have concentrations favorable to the establishment of a reducing zone and as such are beneficial to biodegradation.