Optimization of Hydraulic Capture of CVOCs and Management of Injection Well Fouling for a Groundwater Treatment and Injection System

John Williams, PG (john.e.williams6@boeing.com)
(The Boeing Company, Huntington Beach, CA, USA)
Colleen Canfield, PG (ccanfield@haleyaldrich.com)
(Haley & Aldrich, Inc., Costa Mesa, CA, USA)
Ian Jones, PhD, CHg (dba Accord Environmental, Long Beach, CA, USA)

Background/Objectives. A review of the groundwater remediation system (system) for the source area of a chlorinated volatile organic compounds (CVOCs) site in Los Angeles County, California (Site) revealed several opportunities for improvement that could avoid proposed treated water disposal to sanitary sewer, which included a $1M connection cost and associated long-term discharge fees. The Site is in the Central Groundwater Basin in the Los Angeles Coastal Plain and is underlain by the Lakewood Formation. Within the Lakewood Formation, the Exposition Aquifer (A-Sand) occurs from approximately 120 to 240 feet below ground surface. The A-Sand is a leaky-confined aquifer consisting mostly of laterally extensive fine to coarse grained unconsolidated sands and is the focus of this presentation. The system comprises one dual-screened A-Sand extraction well and five A-Sand upgradient injection wells. Fluctuating CVOC concentrations in downgradient monitor wells led the project team to consider increasing the extraction rate for optimum CVOC plume capture. Sewer disposal of treated water was thus considered in lieu of injection to facilitate the disposal of the increased volume of treated water resulting from the increased extraction rate as well as to avoid the ongoing and significant management of injection well fouling, which already resulted in system downtime. Following the system review, a plan was made to optimize the system operation and avoid sewer disposal.

Approach/Activities. The characteristics of the A-Sand were re-examined to improve the conceptual model of plume migration and capture using a sequence stratigraphic model as well as video logs, flow surveys, and depth discrete sampling of the extraction well. Based on the results, a packer was installed in the well to restrict groundwater extraction to the upper A-Sand, and pumping tests were conducted at 40 and 60 gallons per minute (gpm) to evaluate the capture zone and to refine the measurement of hydraulic conductivity for the upper A-Sand.

Injection well fouling was examined through analysis of water collected at various points in the treatment stream and of solid material collected from within the injection wells. Manganese oxide generation in the treatment system and the injection wells was identified as the primary reason for well fouling; this was managed through implementation of an aeration/filtration system and well rehabilitation using chemical, sonar, and back-flushing methods.

Results/Lessons Learned. Vertical variations in A-Sand horizontal hydraulic conductivity, well yield, and chlorinated solvent distribution observed during extraction well flow survey and testing was unanticipated and proved to be critical to system optimization. These findings led to improvements that reduced the A-Sand extraction rate from 60 to 40 gpm; focused plume capture on the upper A-Sand where there is greater contaminant mass; and reduced the vertical downward gradient to the lower A-Sand. While long-term injection performance continues to be evaluated, the frequency of well rehabilitation efforts has decreased dramatically because higher specific injection capacities are achieved and maintained for longer periods of time. These improvements allow for the continued sustainable injection of treated water to the subsurface and avoid expensive sewer disposal. Next steps include evaluation of transport pathways of injected water in the A-Sand for further remedial optimization.