Well Rehabilitation and Sitewide Adaptive Management for In Situ Treatment of Hexavalent Chromium in Groundwater in Hinkley, California

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Background/Objectives. Pacific Gas and Electric (PG&E) is conducting assessment and cleanup of a hexavalent chromium (Cr[VI]) plume in groundwater related to industrial activities from the 1950s and 1960s at the PG&E Hinkley Compressor Station near Barstow, California (the Site). The groundwater remedy consists of in situ remediation through operation of three in situ reactive zones (IRZs) and hydraulic containment through operation of a network of extraction wells, nine agricultural treatment units (ATUs) and freshwater injection. Remediation wells associated with these systems foul due to biological growth, changes in groundwater geochemistry and chemical precipitates. This presentation will examine the methods used to rehabilitate and maintain performance of site remediation wells and how adaptive management was used to expand the remedial system over time.

Approach/Activities. The core of the plume containing the highest Cr(VI) concentrations is approximately 3 miles in length and 1-mile wide. The source area of the plume is being treated with three IRZ systems which continually recirculate water dosed with periodic organic carbon substrate amendments, i.e. ethanol. Currently up to 92 injection wells arranged in transects oriented perpendicular to groundwater flow are used to distribute dosed groundwater. Water is supplied from a combination of eight IRZ specific extraction wells and extraction wells associated with the nine ATUs. The nine ATUs include six center pivots and three linear machines, cover approximately 296 acres and use Low Energy Precision Application (LEPA) emitters fitted with flexible socks to prevent spraying. Fifty-three extraction wells supply water to the ATUs and IRZ systems. Six freshwater injection wells located along the western distal side of the plume to inhibit westward movement of chromium-affected groundwater and are supplied by four freshwater extraction wells.

Results/Lessons Learned. As the project progressed from 2004 to present from interim remedial actions to a comprehensive groundwater remedy, the 13 different remedial systems were sequentially constructed and brought on-line. Concurrently, success of these systems resulted in contraction of the plume and the need to refocus extraction to areas in the plume core. To better manage plume remediation and pumping efficiencies, IRZ and ATU system piping have been interconnected through diversion vaults fitted with modulating valves allowing optimization of extraction and to provide additional water to the expanded IRZ systems. Several types of well fouling impacts performance of the extraction and injection wells. IRZ wells experience biological fouling due to fostering of bacterial populations that are part of biologically mediated Cr(VI) reduction. Tracking well performance enabled determination of optimal timing for proactive well rehabilitation, leading to limited downtime, increased well performance, and extension of IRZ well life from months to years. Biological and chemical precipitate fouling at the freshwater injection wells has been addressed through biweekly backwashing in conjunction with recirculated chemical cleaning. This approach maintains required injection rates at older wells and above 80% of the initial specific injectivity at newer wells.