LNAPL Recovery and Remedy Transitions: A Case Study at a Railyard Fueling Facility

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Background/Objectives. A light non-aqueous phase liquid (LNAPL) plume exists at an active railyard associated with a long history of locomotive fueling operations. The site is situated near and adjacent to the Mississippi River and groundwater flow and elevations are dictated by seasonal variations. The LNAPL plume is situated within unconsolidated sand, gravel, and silty clay deposits of fluvial origin at depths of about 4 to 12 feet. Site investigative work began in 2009 and characterized impacts, supporting development of a remedial strategy. Results indicated that the LNAPL posed few composition concerns (i.e., dissolved phase and vapor phase impacts were minimal) but that LNAPL saturation and recoverability concerns would require remedial action to meet objectives. As remediation progressed, the remedial strategy was modified and transitioned to lower-energy technologies as the data and site conditions warranted, with the overall endpoint of allowing natural source zone depletion (NSZD) to address remaining LNAPL impacts.

Approach/Activities. A LNAPL recovery system was installed in 2011 that included 12 recovery wells, and system operation was supplemented using vacuum truck extraction. Initial recovery rates were favorable, but LNAPL recovery rates quickly declined within two years of operation. A vapor extraction component was added to the skimming system in 2012 and 2013 to evaluate the effectiveness of applying vacuum to the recovery wells to enhance LNAPL recovery. Although the results of the pilot testing indicated vacuum enhancement had a small effect on LNAPL recovery via skimming, it provided a larger and greater benefit through bioventing/biodegradation. The skimming well network was converted to a bioventing well network and biodegradation was tracked using vapor flow rates and carbon dioxide effluent sampling. In 2015-2016, a significant amount of LNAPL-impacted soil was removed from the fueling area and this work provided additional benefit to the site in terms of mass removal. Following soil removal activities, and as the biodegradation rates induced by bioventing declined, a NSZD assessment was conducted using the dynamic closed chamber and sorbent trap methods to measure carbon dioxide soil gas flux. Results indicated favorable NSZD rates compared to removal rates achievable through further system operation. The remedial strategy is currently being transitioned away from bioventing and toward NSZD as the final remedy in the sequence of remedial technologies employed.

Results/Lessons Learned. A series of remedy transitions for the site and remedial approach allowed a steady, data-driven progression toward lower-energy remedial technologies. This process offers benefits in terms of sustainability and efficient use of resources, matching the level of effort for remedial measures to an appropriate level for site conditions and remedy objectives. The last remedy transition, establishing NSZD as the appropriate approach to address remaining LNAPL impacts, is currently underway. The basis for these transition points was developed from several factors, including operational costs, overall LNAPL recovery rates, regulatory requirements, and the availability of suitable alternative measures. The presentation will discuss each remedy transition, review lessons learned, and assess potential improvements to the transition points that, in hindsight or with benefit of current technical understanding, may have been used as alternatives.