Optimization of Large-Scale LNAPL Recovery Operations Using a Graphical Analysis Tool

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Background/Objectives. Light nonaqueous phase liquid (LNAPL) recovery operations using total fluid pumping methods have been occurring at an active petroleum refinery since the 1980s. Current LNAPL recovery operations include up to 28 vertical extraction wells that operate via total fluid recovery. The geology and hydrogeology of the site are complex. Interbedded sand and silt layers are present. Seawater intrusion management activities since 1971 have resulted in an approximately 40-foot increase in potentiometric surface elevation. The LNAPL distribution is therefore highly variable and is present above and below static water level. Many existing recovery wells also have screens that have become submerged. The variability of LNAPL distribution and submerged screen recovery wells create difficulty when attempting to optimize LNAPL recovery operations. The objective of this study was to develop an efficient method to utilize a large amount of existing and current investigation and operational data to optimize LNAPL recovery operations under the site-specific condition.

Approach/Activities. The skimming method may not be the most effective at removing submerged LNAPL as well as from wells with submerged screens. Recovery under this condition should consider not only the screen interval but also the subsurface LNAPL distribution. Therefore, recovery pump inlets were adjusted to maximize LNAPL recovery based on nearby laser-induced fluorescence (LIF) data and actual LNAPL recovery. By lowering the recovery zone, this study also seeks to lower the water level locally to potentially mobilize previously “trapped” LNAPL to enhance LNAPL recovery. To study the effects of the enhanced LNAPL recovery, individual graphics were created for each well by combining a variety of historical data including LIF and cone penetrometer testing (CPT) logs, well construction details, fluid gauging data, fluid recovery rates and LNAPL transmissivity. All data were referenced to a common vertical scale (when applicable) to allow for ease of interpretation.

Results/Lessons Learned. The creation of individual graphics allowed for rapid analysis and decisions regarding system operation throughout the project team. Specifically, graphics were utilized to adjust extraction well pump placement for LNAPL recovery optimization and determine the optimal operating conditions for each well.