High-Resolution Subsurface Characterization of Non-Aqueous Phase Liquid and Groundwater Impacts at a Former Manufactured Gas Plant Site

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Background/Objectives. Manufactured gas plants were common in the late nineteenth and early twentieth centuries. At a former manufactured gas plant site located in the upper Midwest, dense non-aqueous phase liquid (DNAPL) and groundwater impacted by dissolved organic compounds were discovered beneath the site to depths of over 100 feet. DNAPL from manufactured gas plants in groundwater has proven to be recalcitrant to conventional removal techniques and emulsification further challenges removal and treatment.
The site is underlain by recent alluvial deposits and a complex assemblage of glacial deposits that includes till and glacio-fluvial sediments that are nearly 200 feet thick. The purpose of the subsurface investigation is to determine the distribution of DNAPL beneath the site relative to the lithological units in which it resides. An objective is to develop a working understanding of the distribution of mobile DNAPL and to design a recovery system to remove it.

Approach/Activities. Subsurface investigations were conducted which incorporated available technology to identify the distribution of DNAPL. Data were collected with a vertical sampling resolution of 1 inch. Soil samples were collected and analyzed to measure pore saturation and DNAPL mobility. An extensive lithological boring program was conducted to develop an understanding of the distribution of lithological units that may allow for the horizontal or vertical transport of DNAPL. A three-dimensional (3-D) lithological model was created and evaluated against the observed distribution of the DNAPL to develop a conceptual site model which was then used to design a recovery system for the DNAPL and associated dissolved-phase plume of impacted groundwater.

Results/Lessons Learned. This paper discusses the success and limitations encountered while employing direct-push techniques used to determine the distribution of the DNAPL. This paper also discusses the resulting interpretations of the mobility of DNAPL which concludes that there are two separate areas, one in which the DNAPL is expected to be mobile and one in which it is not expected to be mobile. The limitations in the data regarding the distribution and relative mobility of the DNAPL poses challenges during the implementation of the DNAPL recovery system. The detailed lithological interpretations are presented along with the limitations imposed by the paucity of certain data. Alternative interpretations of the interconnectivity of certain lithological units are discussed. A summary of the major design elements for the recovery system are shared along the initial results of its implementation.