An Adaptation of Standard Mobility Tests for DNAPL

Trevre Andrews (Trevre.Andrews@CH2M.com) and ***Lynne Tseng*** (Lynne.Tseng@CH2M.com)

Background/Objectives. The goals of DNAPL mobility testing are to quantify DNAPL mobility recovery, improve conceptual site model understanding, and support remedial system design. DNAPL mobility testing differs from LNAPL mobility testing in that DNAPL continues to accumulate driving head as it migrates downward below the water table, where as LNAPL loses driving head due to buoyancy at the water table. As such, procedures developed for LNAPL must be modified for use with DNAPL.
Mobility tests provide a metric of mobility with certain associated qualifications. Various metrics (e.g., thickness, recovery rate, transmissivity) and their uses are covered as part of this procedure. DNAPL mobility testing generally involves the measurement and calculation of four parameters including DNAPL formation thickness, fluid drawdown induced, fluid recovery rate, and radius of influence as modified from the recently published ASTM International Standard Guide for the Estimation of LNAPL Transmissivity E2856 (2013). One of the most critical components of testing DNAPL mobility is proper well construction and the determination of DNAPL density which is addressed in this procedure. The ability to measure or calculate the certainty and the sensitivity of each of these parameters depends on the configuration of the well being tested. Typically, mobility testing for water or LNAPL is conducted by inducing a measurable amount of drawdown, across a given radius of influence; however, the complexity and variety of DNAPL distribution scenarios in the subsurface requires special considerations for certain DNAPL mobility parameter assignment. These are addressed in detail in this presentation.

Approach/Activities. This DNAPL mobility testing procedure was applied at more than a dozen sites across the US which contained measurable thicknesses of DNAPL within wells including on three sites in New York, one in Minnesota, and one in New Jersey containing MGP creosote, a site Illinois containing chlorinated solvent, and a wood treatment plants in Georgia containing creosote. In all cases DNAPL mobility results were used to identify optimal recovery schedules and recovery endpoints for wells containing DNAPL The resulting DNAPL transmissivities ranged from 0.01 to 40 ft^2/day. Wells with DNAPL transmissivities less than 0.1 ft^2/day observed to have reached asymptotic recovery conditions and would no longer benefit from hydraulic recovery. Wells with DNAPL transmissivities above 0.8 ft^2/day generally indicated enough mobile DNAPL remained for DNAPL to be effectively recovered.

Results/Lessons Learned. Measured DNAPL well thickness is historically used as a metric for recoverability, but the data from these sites illustrates how DNAPL well thickness is unrelated to DNAPL recoverability. Using the mobility test results, passive recovery wells were designed to minimize recovery operational costs using subsurface sumps as well as select the appropriate remedy and timeframe for continued recovery. This DNAPL recoverability testing illustrates the practicability of DNAPL recovery in the context of the contamination present at the site. Future application of DNAPL mobility tests will continue to further develop the procedures and highlight the importance of its use.