High-Resolution Mobile NAPL Interval Identification and Transmissivity Calculations for DNAPL

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Background/Objectives. Dense non-aqueous phase liquid (DNAPL) transmissivity is a metric to quantify the hydraulic recoverability of DNAPL. Existing methods developed to measure LNAPL transmissivity within granular porous media have often failed to reliably quantify DNAPL transmissivity in any type of porous media. These failures in DNAPL transmissivity calculations neglected key identification of the DNAPL mobile NAPL interval (MNI) and hydrogeologic condition as well as the geometry and discharge rate for individual MNIs. In addition, methodologies to identify individual MNIs have often required intrusive, time-consuming and expensive techniques. Finally, DNAPL transmissivity measurement methodologies must be applicable to granular, fractured and/or karst porous media.

Approach/Activities. Well conceptual models (WLCMs) are constructed from existing well construction, lithology, gauging, LIF data and other borehole parameters from multiple wells to provide a contextual understanding of DNAPL presence. Following removal of the DNAPL (either as a baildown test, or following manual skimming, or any other extraction of DNAPL from a well), high resolution DNAPL recharge into the well is gauged until it returns to equilibrium. This data is then used to create a Discharge versus Drawdown (DvD) plot. DNAPL transmissivity for each individual fracture as well as the well in the aggregate is then calculated from the DvD data. In addition, the vertical location and thickness of each MNI is identified.

Results/Lessons Learned. This new methodology substantially improves the accuracy and reliability of DNAPL transmissivity calculations in any porous media. Armed with the vertical location, thickness and DNAPL transmissivity value for each MNI as well as the aggregate value for each well, practitioners can target individual MNIs with recoverable DNAPL for more efficient remediation design and optimization, and can also more accurately determine whether or not DNAPL is hydraulically recoverable at any scale. Improved accuracy should lead to better designs, more efficient operations, and increased trust and reliability on DNAPL transmissivity in any porous media by all stakeholders. Where DNAPL presence is the only driver, sites may be able to achieve closure or no further action status by accurately quantifying and demonstrating DNAPL transmissivity is below hydraulically recoverable threshold metrics.