Automated LNAPL Baildown Testing Equipment: Better, Cheaper, Safer Data

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High-quality execution of light non-aqueous phase liquid (LNAPL) baildown tests has become more critical as LNAPL transmissivity is increasingly accepted as a recoverability metric and regulatory endpoint for LNAPL remediation. Baildown testing requires field personnel to repeatedly measure LNAPL thicknesses in monitoring wells using an oil/water interface probe. Ideally, a series of measurements are collected that document LNAPL recovery to 100 percent of the initial thickness observed in a monitoring well or clearly show that LNAPL will not recover to 100 percent. Furthermore, LNAPL baildown tests provide diagnostic indications of how the LNAPL interacts with the geologic formation. Subtle shifts in LNAPL recharge behavior can indicate confined or perched LNAPL, and the fluid elevation where the recharge behavior changes is used can identify the elevation of the confined or perched unit.

The current practice of using an oil/water interface probe to measure LNAPL thicknesses during baildown testing presents several problems. When LNAPL transmissivity is very high, it is not feasible to collect repeated measurements quickly enough to characterize LNAPL recharge. When LNAPL transmissivity is low, which is the case at many legacy LNAPL sites, collection of an ideal data set to resolve LNAPL transmissivity may require overnight measurement or measurements extending several days or weeks, incurring significant labor costs. It is common practice at low transmissivity sites to greatly reduce the data collection frequency during the latter parts of the test in order to reduce labor costs, which results in a loss of data resolution and ability to identify shifts in LNAPL recharge behavior. In addition to data quality concerns, wells with moderate to low transmissivity require repeated access for field personnel to collect measurements, which may include the need for track protection and associated safety considerations.

ARCADIS developed an automated system to measure and record LNAPL thickness in monitoring wells. Use of this system during baildown testing provides a high-density data set, lowers labor costs for data collection, and reduces safety concerns and track-time needs associated with repeated access to monitoring wells. This innovative system uses two pressure-sensitive sensors deployed within the monitoring well and a data logging device and power supply in a portable, weatherproof case. The system is set up at a test well, a baildown test initiated, and the data is retrieved at the completion of the test. Field baildown test trials have demonstrated that the automated system produces results that correlate with traditional LNAPL thickness measurement methods, with higher resolution and better characterization of LNAPL recharge. The value of the equipment extends beyond baildown testing, including automated LNAPL thickness measurements to support other forms of transmissivity testing or long-term automated LNAPL thickness measurements for high-resolution monitoring of LNAPL thickness changes in response to seasonal or tidal groundwater fluctuation.

The principles of operation for this system will be presented, followed by a description of the equipment used and presentation of data from field trials. The potential advantages relative to traditional methods will be illustrated with a side-by-side comparison of costs and data quality associated with each approach. Potential future applications and improvements to the equipment will also be discussed.