

LNAPLs do not always Float: An Example Case of a Viscous LNAPL under Variable Water Table Conditions

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Abstract. An intermediate-scale experiment was conducted to investigate the behavior of a viscous LNAPL under variable water table conditions. Two LNAPL volumes were released from a small source zone on top of the flow cell into a partly saturated, homogeneously packed porous medium. Following a 30-day redistribution period, the water table was increased 0.5 m in 50 minutes. After the water table rise, LNAPL behavior was monitored for an additional 45 days. Fluid saturation scans were obtained periodically with a fully automated dual-energy gamma radiation system. Results show that both spills follow similar paths downwards. LNAPL drainage from the unsaturated zone was relatively slow and a considerable residual LNAPL saturation was observed after 30 days of drainage. Most of the mobile LNAPL moved into the capillary fringe during this period. After the water table rise, LNAPL moved up in a delayed fashion. After 45 days, the LNAPL has moved up only approximately 0.2 m. Since the LNAPL has only moved up a limited amount, nonwetting fluid entrapment was also limited. The experiment was simulated using the STOMP multifluid flow simulator. A comparison indicates that the simulator is able to predict the observed phenomena well, including residual saturation formation in the vadose zone, and limited upward LNAPL movement after the water table rise. The results of this experiment show that viscous mobile LNAPL, subject to variable water table conditions, does not necessarily float on the water table and may not appear in an observation well.

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