Carbon tetrachloride removal from a heterogeneous porous medium by two soil vapor extraction techniques

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Abstract. An intermediate-scale flow cell experiment was conducted to study the removal of a DNAPL mixture from a layered porous medium through soil vapor extraction (SVE) with moist and dry air. A dual-energy gamma radiation system was used at various times to non-intrusively determine fluid saturations. The mixture, which contained the volatile organic carbon tetrachloride, mimics the DNAPL disposed at the Hanford Site in Washington State. The flow cell was packed with two sloped coarse sand and two sloped silt layers in an otherwise uniform matrix of medium-grained sand. The water table was located 2 cm from the bottom, creating variably saturated conditions. A spill was introduced at the top of the flow cell from a small source area. It was observed that the DNAPL largely by-passed the silt layers but easily moved into the coarse sand layers. Residual DNAPL was formed in the medium-grained sand matrix. The DNAPL caused a distinct reduction of the capillary fringe. Most of the DNAPL ended up in a pool. Soil vapor extraction with moist air was not able to remove the carbon tetrachloride from the silt layers and the pool. Through a water table reduction and subsequent soil vapor extraction with dry air, the carbon tetrachloride in the silt layers and the pool was effectively removed. It was estimated that after the final remediation treatment, almost 90% of the total mass was removed.

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