

## **The performance assessment of surfactant enhanced remediation in a two dimensional heterogeneous aquifers**

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**Abstract.** The Partitioning Interval tracer test (PITT) has been used to estimate the NAPL source zone mass and to assess the performance of remediation. The underestimation of DNAPL mass when PITT is used in heterogeneous media has been pointed out by many researchers; however, the effectiveness of PITT as a method to assess the performance of remediation of source zones with high DNAPL saturation has not been adequately evaluated. This study evaluates the effectiveness of PITT for assessing the performance of a surfactant enhanced remediation (SEAR) which was conducted in a two dimensional large tank with a dimension of 80cm x 5.0cm x 120cm. The tank was packed to create a heterogeneous field with known geostatistical parameters (mean  $\text{Ln}K = 4.18$  m/day,  $\sigma = 0.25$ ). The source zone creation, pre-surfactant PITT to characterize source zone, SEAR, source zone saturation and mass measurement using an automated gamma system both before and after spill, and post-surfactant PITT was conducted to determine the performance of SEAR. The performance of SEAR was evaluated by comparing the actual source zone mass measured from gamma with the estimated mass obtained from both pre and post surfactant PITT using moment analysis. The method of moments showed a PCE mass removal of 34 to 22% but the actual reduction of PCE mass by SEAR was only 5 %. This result suggests that under conditions of high DNAPL entrapment saturations, the combination of pre and post-remediation PITT fails the performance evaluation of SEAR. With the goal of improving the estimation accuracy, inverse modeling was used as an alternative to moment analysis. The issue of equilibrium and non-equilibrium partitioning effect of tracers was also studied. This analysis showed that accounting for non-equilibrium behavior in the tracer data analysis does not have a significant effect on the estimation accuracy for the conditions that were tested.

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