Uncertainty and Sensitivity Analysis of Non-Aqueous Phase Liquid Dissolution Models in Subsurface

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Groundwater contamination by organic chemicals in the form of nonaqueous phase liquids (NAPLs) is a widespread problem which poses a serious threat to groundwater resources. NAPLs in the subsurface can become a long-term source of groundwater contamination given their persistence as a result of small aqueous solubilities. An important step to predict the fate and behavior of NAPLs in the subsurface is to quantify NAPL dissolution characteristics. Residual NAPL dissolution in porous media is a very complex process which is controlled by many factors. A suite of experimental correlation models exist in the literature to describe NAPL dissolution process in porous formations. Most of these correlations apply a set of the most relevant and important parameters. However, it is difficult to determine the exact values of these parameters in the subsurface environment for the applications of the developed models. In this study, a statistical and sensitivity analysis based on these correlations is carried out aiming at providing guidance as to the significance and sensitivity of uncertainties in parameter determinations for these models. The dissolution rate coefficient statistics are derived and the influence of various controlling parameters and their uncertainties are examined and discussed.