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Quantification of residual DNAPL within aquifer system using noble gas and radon

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Dense non-aqueous phase liquids (DNAPLs) have characteristics of low solubility and high density which cause extensive contamination to the groundwater in terms of time and space. Due to this aspect, the allocation and quantification of residual DNAPL is crucial for future applications of appropriate remediation actions. Hence, this study aimed to identify the possible spatial distribution of residual DNAPL between monitoring wells. The combined use of noble gases and radon was applied based on their common characteristic of preferential phase partitioning to DNAPL relative to water.

The study was conducted at Namdong Industrial Complex (NIC) where 15 wells are present. Among the noble gas concentrations, air saturated water (ASW) normalized Xe concentrations (F_{Xe}) were relatively depleted up to 20% nearby the wells of high dissolved PCE concentrations. Based on the depleted amount, the relative volume of residual DNAPL to water (V_{DNAPL}/V_{water}) was calculated to range up to 0.02. In order to determine the potential location of the calculated residual DNAPL, spatial distributions of F_{Xe} and F_{Kr} values were analyzed. Further specification of the location was determined by the radon concentration distribution, since radon concentration depletion was confined near the source zone and showed elevated concentrations elsewhere. Overall, this study showed that noble gases and radon act as complementary components in terms of DNAPL quantification and allocation, and is anticipated to provide fundamental information for future remediation procedures.

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