Finding the Information of the Unknown DNAPL Residual Source using various tracer data, Wonju, Korea

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In this study, analytical solution method which can evaluate and quantify the impacts of partial mass reduction by remedial action performed in study site is applied to estimate the unknown DNAPL source mass and dissolved concentration using long-term monitoring data collected from 2009 to 2019. Also, noble gas tracer method was applied to identify the partitioning processes which can be happened in TCE contaminated site. By using the source zone monitoring data during about 10 years and analytical solution, initial dissolved concentration and residual mass of TCE in spilled period at the main source zone were roughly estimated 150 mg/L and 1000 kg, respectively. These values decreased to 0.45 mg/L and 33.07 kg direct after an intensive remedial action performed in 2013 and then it expected to be continuously decreased to 0.29 mg/L and 25.41 kg from the end of remedial actions to 2020. From results of quantitative evaluation using analytical solution, it can be evaluated that the intensive remedial action had effectively performed with removal efficiency of 70% for the residual source mass during the remediation period. From the results of noble gas analysis, the distance from TCE source zone was divided into three groups from Zone 1 to 3. Zone 1 includes samples that are the closest from the TCE main source, and are highly partitioned to TCE compared to other zones. Zone 3 samples show least accordance with either of the fractionation lines, showing that sampling points are influenced highly by other mechanism rather than partitioning to TCE. Also, it is identified that seasonal variation of groundwater level can be affected to the distribution of noble gas at around TCE source zone. Samples from only “High TCE” zone are plotted along with ideal batch equilibrium and Rayleigh fractionation line again and divided into two groups according to their sampling date. From August 2018 to October, 2018, samples shift from right to left in the figure, getting closer to Rayleigh fractionation line. In August, noble gas was relatively in equilibrium between groundwater and TCE. However, as water table rises, noble gas became touch with residual TCE locating above the previous water-level, which is a receiving fluid in water-TCE system. Results of this study was support that it was able to estimate the unknown quantitative information for TCE contamination and noble gas as the indicator of DNAPL contamination could be applied in allocating the DNAPL source which is relatively hard to estimate.