Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.25513

DNAPL tracing and related health risk assessment using radon and microbial community compositions under seasonal effects

JAEYEON KIM, YE JI KIM, DUGIN KAOWN AND KANG-KUN LEE

Seoul National University

Contaminants in groundwater are considered one of the most critical issues for sustainable groundwater resource management. In particular, dense non-aqueous phase liquids (DNAPLs) are among the most hazardous contaminants in the groundwater environment and pose health risks to humans due to their low solubility in water and higher density compared to water. Therefore, investigating the fate and transport of DNAPLs, along with health risk assessments, is essential. Radon has often been used in previous studies to quantify NAPL saturation; however, its use is limited by seasonal effects. The study site, South Korea, experiences distinct wet and dry seasons. To overcome these limitations, microbial community data were incorporated. The results showed that while radon tracing can identify the DNAPL source zone regardless of season, it is insufficient for tracing the plume boundary zone during the wet season. Bioremediation through microbial reductive dechlorination was observed during the wet season, indicating the mixing effects of local precipitation, which aligns with the O and H isotopic data. Human health risk indices also showed lower values in the wet season, suggesting that less intensive management is needed during this period compared to the dry season. This study demonstrates that the combination of radon and microbial evidence can effectively characterize DNAPLs both qualitatively and quantitatively, considering seasonal effects. This novel coupled method helps avoid over- or under-estimation of contaminant distributions.

[This abstract is based on the published paper: Kim, J., Kaown, D., & Lee, K. K. (2024). Coupling of radon and microbial analysis for dense non-aqueous-phase liquid tracing and health risk assessment in groundwater under seasonal variations. Journal of Hazardous Materials, 134939.]

[Acknowledgments: This study was supported by the Institute for Korea Spent Nuclear Fuel (iKSNF) and National Research Foundation of Korea (NRF) grant funded by the Korea Government (Ministry of Science and ICT, MSIT) (NRF-2021M2E1A1099413). This work was also supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2022R1A5A1085103).]