

# Assessment of sources and pathways of spring water contamination by the combined use of hydrochemical, isotopic, microbial and geophysical data

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This presentation introduces a research case that identified the contamination pathway from the source to the receptor through the combined use of hydrochemical, isotopic, geophysical, and microbial techniques. In the study area, foul-smelling sewage water used to leak in a spring after rainfall, and was presumed to be livestock excreta given land use nearby. To identify the pollution sources and pathways, a total of 21 water samples (11 spring water and 10 groundwater) were collected with potential pollutant sources (e.g., livestock excreta) for the analysis of hydrochemical and isotopic compositions and microbial communities. Ground penetrating radar (GPR) and electric resistivity surveys were performed for the understanding of subsurface structures. Based on the results of factor analysis using the hydrochemical data, the water samples were divided into three groups: (1) non-polluted, (2) contaminated with wastewater, and (3) contaminated and nitrified. Consistently, the microbial communities were different between the three groups. In particular, the number of microbial communities originating from pig manure such as *Clostridium sensu stricto* was high in the contaminated and nitrified group including the spring water. The nitrogen-oxygen isotope analysis of nitrate in spring water also supported the contamination derived from manure. Meanwhile, the GPR and electrical resistivity survey results along with the tracer test indicated the permeable pathways in the subsurface environment from the source (livestock farming facilities) to the receptor (spring water). This study emphasizes the importance of combining multidisciplinary techniques to identify sources and pathways of pollution in the geologic environment. [Acknowledgement] The completion of this work was supported by the Korea Environment Industry & Technology Institute (KEITI) through the Subsurface Environment Management Research Project (No. 2021002440003).