

## **Assessing the natural background level (NBL) of uranium in South Korean groundwater, in relation to geological and hydrochemical properties of aquifers**

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Uranium in groundwater is harmful to human health and is mostly originated geogenically (i.e., dissolution of U-bearing minerals). In order to effectively manage groundwater quality, it is important to distinguish the areas requiring special care by evaluating the natural background concentrations. This study aimed to estimate the natural background level (NBL) of groundwater uranium in catchments in South Korea (n=117) and to understand geological and hydrochemical factors controlling uranium concentrations. For this study, a total of 5075 groundwater samples were collected across the nation from 2006 to 2015 except for 2007. The average concentration of groundwater uranium was  $7.47 \mu\text{g L}^{-1}$  and 3.8% of the total samples exceeded the EPA's Recommended Water Quality Standard of uranium ( $30 \mu\text{g L}^{-1}$ ). The NBL of uranium in each catchment was defined as the 90 percentile, based on the confirmation that uranium concentrations follow a log-normal distribution. The NBLs higher than 30 ppb (= EPA standard) occurred in the catchments of Precambrian metamorphic rocks and Jurassic granite, while the values less than 3 ppb (= 1/10 of the EPA standard) was observed in the catchments of Mesozoic sedimentary rocks. In addition, hydrochemical properties of groundwater control the uranium concentration in groundwater, as well as the source minerals (e.g., uraninite, micas) in aquifers. The pH-Eh diagrams of U-C-O-H and Fe-O-H systems also showed that uranium concentrations in groundwater are regulated by two geochemical processes: 1) precipitation under reducing conditions and 2) adsorption onto iron-oxide minerals under oxidizing conditions.

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