Characteristics of radon in groundwater of Korea and experimental assessment of its impact on radon in indoor air

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Groundwater is a main source of water supply including drinking water in much of the rural areas of Korea. Radon in groundwater was extensively investigated in Korea since elevated level of radon in groundwater was first observed in late 1990s. As of 2015, radon was measured for a total of 5153 groundwater samples taken from surficial and bedrock aquifers on a national scale, which showed an average of 97 Bq/L, a median of 50 Bq/L, 95th percentile of 325 Bq/L, and a maximum of 7219 Bq/L for radon concentrations in groundwater.

Compared to water radon standards of various countries, exceedances are 29.6%, 18.5%, 5.8%, and 0.3% for 100 Bq/L, 148 Bq/L, 300 Bq/L, and 1000 Bq/L, respectively. These exceedances are quite higher compared to other countries except for Northern Europe. Radon in groundwater is closely related to lithology of aquifers where highest radon levels were found in granitic rocks and lowest levels in volcanic and carbonate rocks. In terms of well depths, radon in groundwater is lowest in < 30 m, highest in 30 – 60 m, and decreases in deeper depths.

Radon in water is generally known to cause health risk mainly from inhalation rather than ingestion. In this regard, we carried out field experiments to evaluate how radon in water affects indoor air when water is used for shower and washing in a typical Korean house. The results showed that 20 % and 40 % of radon in water were transferred to indoor air for a tap in kitchen and a shower booth, respectively. Effective doses from indoor radon increased by 6 to 20 fold in the shower booth and in the kitchen, respectively without ventilation while it increased by only 4 fold in both places with ventilation with windows opened compared to background radon levels. These results indicate that ventilation is important to reduce health risk from indoor radon when using water with higher radon concentration.