Section5 | Efficacy of radon |

05-4 Examination of radon concentration for evaluation of exposure dose from radioactive spring usage
–A case study in Mie prefecture–

Yasunori MORI1, 2, Akira DEGUCHI3, Chihiro MIWA4, Eri SUZUMURA3, Kazunori MAEDA3,
Keiko MORI3, Yasushi IWASAKI3, 5, Hiroya SHIMASAKI3,
Masayasu MIZUTANI3, Yoichi KAWAMURA3

1) Mie Prefecture Health and Environment Research Institute
2) Graduate School of Bioresources, Mie University
3) Oyamada Memorial Spa Hospital
4) Aichi Medical College for Physical and Occupational Therapy
5) Institute for Medical Science of Aging, Aichi Medical University

Objectives: Radon (\(^{222}\text{Rn}\)) is a noble gas found in the water of hot spring spas (“onsen”). In Japan, the Hot Springs Law and the Guideline of Analytical Methods of Mineral Springs (revised) classify springs containing 74 Bq/kg of radon as “hot springs” and those with levels exceeding 111 Bq/kg as “medical springs”, also called “radioactive springs”. According to the notification article (the Nature Conservation Bureau of the Ministry of the Environment in Japan), bathing in a radioactive springs may alleviate the effects of gout, arteriosclerosis, and hypertension as well as chronic conditions such as cholecystitis, gallstones, and skin and gynecological diseases. Drinking water from these springs may treat gout, chronic digestive disorders, chronic cholecystitis, gallstones, neuralgia, muscle pain, and arthralgia. To determine exposure doses from radioactive springs, it is important to establish an easy and accurate method of measuring radon concentration in water and humid air in bathing areas.

Methods: This study measured the concentration of airborne radon using an activated charcoal detector (PICO-RAD: AccuStar Labs), desiccant (Drierite; 8 mesh of anhydrous calcium sulfate: W.A. Hammond Drierite Company, Ltd.), a liquid scintillation counter (LSC LB-5: Hitachi Aloka Medical, Ltd.), and 2, 5-diphenyloxazole(DPO) + 1, 4-bis (5-phenyl-2-oxazolyl) benzene(POPOP) toluene solution (Wako Pure Chemical Industries, Ltd.) were used as the liquid scintillator.

Results and Conclusions: This study evaluated radon exposure doses due to radioactive spring at a spa in Komono town, Mie prefecture. After water was piped from hot spring storage tanks into bathtubs, only 5.3–18.0% of the radon remained in the water. Two days later, only 0.25% remained, likely due to radioactive decay and increased diffusion into the air from bathing and recirculating filters. Thus, we investigated radon levels in the humid bathroom air around the radioactive hot spring and determined the total radon exposure from spa water and air. The total exposure dose was calculated assuming a two-day stay, during which customers used the bath for some number of hours. Our findings confirm the safety and efficacy of the hot spring facility. This study was supported in part by a grant from the Daido Life Welfare Foundation.

Keywords: Radon, Radioactive spring, Activated charcoal detector, Exposure dose