An Intercomparison exercise of thoron concentrations between NYU and NIRS

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Recently, a concern for thoron has risen internationally though Japan has been researching thoron aggressively so far. Although a lot of studies for indoor radon have been carried out, some influence of thoron contamination has been pointed out in several cases. In fact, a radon concentration value was affected by thoron and was evaluated higher than an actual value. Radon-thoron discriminative measurement techniques, thus, have been developed. For radon, several calibration facilities are internationally authorized and the reliability of radon concentrations has been ensured through calibration and intercomparison exercises. Because of difficulty of thoron measurement caused by its short half-life and its difference of decay series with radon, however, a standard measuring method for thoron has not yet been established. A thoron exposure chamber system at NIRS has been recently completed and a brand-new radon-thoron discriminative detector has been calibrated with this system. Simultaneously, a thoron calibration system and a radon-thoron detector have also been developed emphatically at New York University (NYU). Therefore, an intercomparison exercise for thoron was conducted between NYU and NIRS. The present study mainly describes comparisons of two calibration procedures and experimental results with their detectors developed by themselves.

The first experiment was carried out with the NYU chamber system at New York. The thoron chamber system has a stainless steel cylindrical vessel (19 L), an internal-installation-type thorium source that is placed at the bottom of chamber and a small stirrer fan. The standard detector used at NYU is a passive type radon monitor (Ultratrack monitor) with CR-39, which has been repeatedly calibrated over a long time with the EML radon chamber. The Ultratrack monitor and another passive type radon-thoron discriminative detector, “4-Leaf monitor” was also used in this exercise. On the one hand, the radon-thoron discriminative detectors with CR-39 used in NIRS are “Raduet” and its prototype detector “Radopot”. These detectors had been exposed together separately for three groups. The difference of thoron concentration between NYU and NIRS detectors ranged from -3\% to +14\%.

The second experiment was conducted with NIRS chamber system at Chiba, Japan. The chamber system is composed of the stainless steel cylindrical chamber (100 L), the external-supply-type thoron gas generator with layered lantern mantles, a continuous radon-thoron monitoring device (RAD7, Durridge) and a environmental monitor for temperature and relative humidity. Those thoron concentrations were corrected by a scintillation cell (300A and AB-5, Pylon). The NYU values ranged from -30\% to -17\% when comparing with the AB-5 value as the NIRS standard.