

Abstract

This is a final report of *“Development of Size Distribution System for Dose Assessment Based on Nanosize Radon and Thoron Progeny Aerosols in Mineral Industry.”* The research objectives are to 1) develop the size distribution and radiation measurement system, 2) implement the developed system in field work for determining the size distribution of aerosol of radon and thoron progenies, and 3) assess the radiation dose from receiving radon and thoron gas. The target area in this study is the Tin smelting located in Phuket province, Thailand, namely Smelting and Refining Company Limited. Research duration is 1.5 years. This research received the technical assistant and some equipment from National Institute of Radiological Science (NIRS), Japan. The research results can be summaries as follows.

The following 4 sub- systems were developed: 1) Radon-Thoron measurement system, 2) Radon-Thoron progeny system, 3) aerosol particle collection system for size distribution and 4) particle size testing system which can distinguish of the 1-10 μm particle size. All developed system was implemented for short-term and long-term measurement in target area in March 3-5, 2009 and February 16-18, 2010. The measurement areas include HSE office, ore storage, ore sample, tantalum storage, and Slag Bay.

For short-term measurement, the highest radon concentration was found in HSE office ($34.6 \pm 11.3 \text{ Bq/m}^3$ for 1st measurement and $22.11 \pm 10.23 \text{ Bq/m}^3$ for 2nd measurement). However, these values are still lower than the action level of 148 Bq/m^3 for the dwelling concentration. The highest thoron concentration was found at ore sampling area ($58.4 \pm 47.4 \text{ Bq/m}^3$ for 1st measurement and $53.4 \pm 46.1 \text{ Bq/m}^3$ for 2nd measurement). There has no action level for thoron established yet. Thoron progenies were found about the same level in HSE office for both investigations,. The HSE office is a close room and daily activity about the same during the period of measurement. Others measurement areas are large, open to air, and daily activities depend on the movement of ore materials.

However, in the second measurement, it was found that the thoron progeny concentration in all measurement area increased. The highest unattached and smallest size distributions of radon progeny were found at HSE office ($2.71 \pm 0.94 \text{ Bq/m}^3$ and 340 nm, respectively) but the highest attached radon progeny was found at sampling area ($3.66 \pm 0.75 \text{ Bq/m}^3$).

For long-term measurement, SSNDT CR-39 type was used for determination of radon and thoron concentrations. The measurement was carried on for every 3 months over the period of 9 months. The results agreed with the result of short-term measurement in almost areas for the whole measurement period. However, there are some parameters that effect to the emanation of radon and thoron from their sources during the period of measurement such as the local activities, ore quantity, temperature, pressure and humidity.

The assessment of effective dose in the study areas found to be 4.22 mSv/y, 1.76 mSv/y, 0.78 mSv/y in HSE office, tantalum storage area and sampling area, respectively. The annual effective dose recommend for public should not higher than 2.4 mSv/y, which 50 % of this value come from the inhalation of radon and thoron progenies (1.26 mSv/y). The results shows that the effective doses at HSF office and tantalum storage are higher than the recommended annual effective dose for public. Therefore, workers who are working in these areas should wear mask to protect themselves.

In this study, WLx monitor was also used to validate our development system by measuring radon and thoron concentration in unit of working level. The results agree and consistent with our results. Therefore, it can be said that our designed and developed system of radon and thoron measurement is reliable system.