Derivation of site-specific preliminary derived concentration guideline levels at Korea Research Reactor-1&2 sites

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To open the KRR-1&2 sites indefinitely, they should satisfy domestic reuse dose standards. To this end, it is essential to derive the derived concentration guideline levels (DCGLs), which reflect the site characteristics. Accordingly, this study seeks to derive the DCGLs reflecting the characteristics of KRR-1&2. For this purpose, the target radionuclides for site clearance were selected through site history surveys of KRR-1&2. The selected nuclides were investigated to evaluate the exposure dose at the sites of the research reactors. Finally, the DCGLs were derived for each nuclide. In this study, the target nuclides were first selected to derive the DCGLs reflecting the characteristics of KRR-1&2, exposure doses were evaluated for KRR-1&2, and finally, the DCGLs of KRR-1&2 were derived for each nuclide and compared with the DCGLs presented in overseas decommissioning cases. A literature review was conducted related to the past operating history of KRR-1&2 and nuclide handling to select the nuclides for investigation, in addition to sampling analysis and investigations of field measurement data, investigations of reactor data of overseas research, and a dose contribution evaluation. To evaluate the exposure dose of the reactor sites, this study used RESRAD-ONSITE (ver.7.2), an exposure dose evaluation computer code, and the resident farmer scenario was applied. Finally, the DCGLs of KRR-1&2 were derived based on the 0.1 mSv/y standard of site clearance in South Korea, which were then compared with the DCGLs applied based on the RESRAD-based values. A total of seven nuclides were selected as the targets to derive the DCGLs of KRR-1&2; among these, the beta nuclides were H-3, C-14, and Sr-90 and the gamma nuclides were Co-60, Cs-137, Eu-152, and Eu-154. The maximum exposure dose of KRR-1&2 through the target nuclides was 5.92 mSv / y at 0.92y, and Co-60 showed the dominant dose in the first 10 years after opening, followed by Cs-137. The DCGLs of Co-60, which showed the highest dose contribution during the first three years after site opening, had a dose contribution of 0.058 Bq/g, and that of the DCGLs of Cs-137, which showed the highest dose contribution after 10 years, was 0.198 Bq/g. According to the sensitivity analysis, the thickness of the contaminated zone parameter showed high sensitivity for all nuclides; in particular, in the case of the beta-emitting nuclides, parameters affecting ingestion and inhalation showed high sensitivity. For the selection of nuclides to derive the DCGLs of KRR-1&2, this study selected rational target nuclides using actual information from KRR-1&2. Furthermore, the parameters sensitive to the applied values were confirmed by comparing the evaluation of the site-specific values and exposure dose with the default values. This study can be used as a reference for nuclide selection and DCGL derivation reflecting the site characteristics when decommissioning nuclear power plants in South Korea.