Analysis of the Effect of Radiation/Radioactivity Information on Decommissioning System for Nuclear Facilities

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1. Introduction

In July 2017, Kori Unit 1 was permanently shut down. Interest in spent nuclear fuel and radioactive waste generated during decommissioning is increasing. In particular, it is required to develop an integrated management system to manage the overall history from generation of radioactive waste to the disposal. And the research is actively proceeding [1]. Radioactive waste classification system of Korea has been amended Article 2 (1) of the Enforcement Decree of the Nuclear Safety Act reflecting the new IAEA classification criteria in 2009. The detailed standards are specified by noticing such as standards on radiation protection [2~3]. The radioactive waste classification standard is determined by concentration of the nuclide. To determine the concentration of the nuclide, radiation/radioactivity measurement is essential.

In this paper, we investigated the decommissioning case study to analyze the effect of radiation/radioactivity information on decommissioning system for nuclear facilities. Based on the results, we explain the effect of radiation/radioactivity measurement and analysis on decommissioning.

2. Methods and Results

2.1 The Reactor Core and Rotary Specimen Rack of KRR-2

For decommissioning of KRR-2, appropriate radiological survey was conducted as shown in Table 1 for each step of the decommissioning project as the purpose for knowing the radiological status of the working area and proper management. The initial radiation/radioactivity survey is to know the basic condition of the working area. During the period of decommissioning, any small changes in the radiation/radioactivity state are measured. For example, radiation/radioactivity survey should be performed prior to decontamination and decommissioning to take action, such as installing a temporary shielding wall or installing a protective mask. This radiation/radioactivity survey should be continued until the completion of the construction and the final radiation/radioactivity survey. The final radiation/radioactivity survey is carried out immediately after completion of the decommissioning for each facility. The reactor core and the rotary specimen rack in the shielding vessel of KRR-2 can lose their ability to be shielded by the water tank before they are lifted out of the reactor water tank. In order to confirm the ability of the shielding container, there is an example of conducting radiation/radioactivity survey [4].

Table 1. Condition at the Stage of Radiological Survey

	Initial radiological survey	Radiological survey during construction	Final radioactivity survey
Time	Initial stage of decommissioning design work	During the decommissioning period	After completion of decommissioning work
Purpose	- Exposure dose and risk assessment of workers and public	- Radiological contamination range setting - Determination of the timing of survey for radiation/radioactivity	- Satisfaction of related laws
Measurement object	- Measurement of surface contamination and dose rate - Sample collection	- Radiation/radioactivity monitoring including surface contamination and dose rate measurement - Analysis of radiological samples for characterization of all materials	- Survey of surface contamination and radiation - Analysis of radiological samples on structures

2.2 Bio-shielding Concrete

Assessment of radioactivity and surface radioactivity inventory of the research reactor and decommissioning of nuclear facilities is one of the first priorities to be taken when decommissioning these facilities. The radionuclide concentration, radioactivity and gamma-ray dose of the decommissioning facilities irradiated to the neutron can be estimated from neutron activation calculations for the target constituent. The calculation of the radioactivity inventory is based on the transport theory code. This code can be used to calculate the concentration of many types of radionuclides, including the generation and disappearance of radionuclides during reactor operation [5].

3. Conclusions

Based on the results of the measurement and analysis of radioactivity of shielding concrete in KRR-2, the effect of radiation/radioactivity information on the overall decommissioning process was analyzed. The radiation/radioactivity analysis is required to estimate the physical/chemical and radiological conditions of radioactive materials and the amount and characteristics of radioactive waste. In addition, it should be ensured that the classification criteria of the working area according to the radioactivity level. The purpose of decommissioning is to make the facility ultimately at an unlimited usable level. Therefore, after completion of the decommissioning, the final radiation/radioactivity survey should be conducted to confirm whether the facilities and sites meet the radiological approval standards. The concept of ALARA (As Low As Reasonably Achievable) should be introduced to minimize the spread of radiation exposure and contamination during decontamination and decommissioning. These contents will be used as important information in decommissioning information integration system.

REFERENCES

[1] K.H.Lee, J.H.Jeong, W.J.Park, Data Collection and Information system of Waste Comprehensive Information Database (WACID), Abstract of Proceedings of the Korean Radioactive Waste Society AUTUMN 2004, p. 27, 2004.
[2] Nuclear Safety and Security Commission, Radiation Protection Standards, Notification No 2016-16 of Nuclear Safety and Security Commission, 2016.
[3] Nuclear Safety and Security Commission, Regulation on Classification of Radioactive Waste and Self Disposal Standards, Notification No 2014-003 of Nuclear Safety and Security Commission, 2014.
[4] Korea Atomic Energy Research Institute, Decommissioning Plan of KRR-1&2 Facility Decommissioning Project (2nd revised edition), 2008.
[5] H.S.Park, S.B.Hong, K.W.Lee, C.H.Jung, S.I.Jin, A Study of Radiation Distribution for Dismantling a Nuclear Facility, Abstract of Proceedings of the Korea Information Processing Society AUTUMN 2006, Vol.13, p. 299, 2006.