Review on Characteristics of Decommissioning Waste Generation in Foreign Nuclear Power Plants and Potential Waste Characterization Issues

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1. Introduction

Kori unit 1 was shut down in June 2017 and is scheduled to begin decommissioning in 2022. There is no decommissioning experience with commercial nuclear power plants (NPP) in Korea. And considering the characteristics of decommissioning waste (DW) current regulatory guidelines are not sufficiently prepared.

In the United States and Europe, which have operated NPPs for a long time before Korea, decommissioning of NPPs whose lifetime is over or commerciality is low has been in progress and some NPPs already had been decommissioned [1-3]. Therefore, if the characteristics of the DW are arranged in advance through analysis of the decommissioning experiences of abroad, it can be used as a basis for developing the regulatory guidelines on DW.

This study investigated the decommissioning experience of abroad and related cases including Kori Unit 1 estimated case [4]. And through the analysis of the characteristics of DW confirmed whether there may be have potential issue in the currently regulation of radioactive waste (RW).

2. Investigation and analysis of decommissioning waste characteristics

This study investigated the cases of generation of DW were reported due to the decommissioning of NPPs. A total of 23 cases were collected through the survey. However, the report criteria for DW generation varied according to the case. Among them, 6 cases reported DW generation based on the type of material. DW was classified as concrete, metal, soil, mixed waste, resin and dry waste, and ETC. And the range and average values of the types of DW are shown in Fig 1. Only the generation classified as RW in DW was used for the Fig 1.

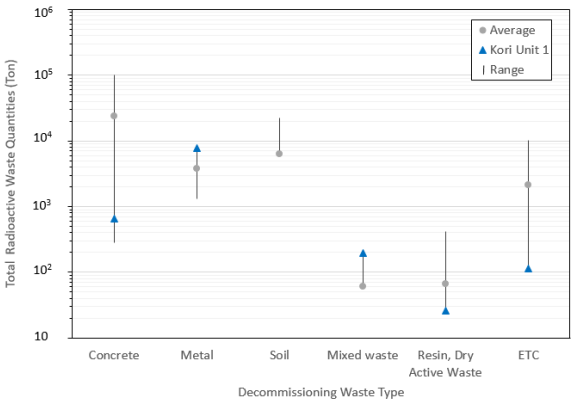

Fig. 1. Quantities of decommissioning waste.

The average generation of concrete was the highest, and there is a large difference in generation depending on the case. Average generation of metal is the third high of them. Soil was generated in only 2 of 6 cases. The range and average values in Figure 1 were used only data of 2 cases. Although it was generated only in 2 cases, average generation of soil is the second high when if it is generated. Mixed waste, resin and dry active waste had a lower average generation than other types of DW. ETC is a combination of hard-to-distinguish waste. Therefore, the generation was varied depending on the case.

Next, this study summarized the generation characteristics of each type of DW.

Concrete is used as building materials and Bioshield for NPPs. Considering the total amount of combined radioactive and non-radioactive concrete, it accounts for most of the total amount of DW. Most of the concrete is low radioactivity, it is classified as low level RW or exempt waste.

Metal is used as building materials and components for NPPs. Some components around the reactor are activated due to the activation reaction. Some of these activated components are highly activated and become intermediate level RW. And some components are large size, so they are generated large size waste. And some metal pipes are internal contaminated.

Mixed waste is a waste with both radiological and non-radiological hazards. The asbestos used as the structural material of the building can be inhale into the respirator of the worker at building dismantling process. Chelating agents used as decontamination and they can affect the mobility of radionuclides.

Contaminated soil can be generated from decommissioning. It may not be confirmed before decommissioning [1-2].

The currently RW regulation may have potential issue regarding these DW. Table 1 shows the potential issue regarding DW.

Table 1. The potential issue of the currently RW regulation regarding DW

Waste type	Potential issue
Concrete	Generated in large quantities in a short period of time when the building dismantles. And type of contamination or contamination level is not uniform.
High activated metal	Difficult to in-situ measure due to high radioactivity and volumetric contaminated. Therefore, Indirect measurement and theoretical measurement are required.
Large components	Currently standard RW package is 200-L drums. It is necessary to consider the characteristics that generate in large size.
Contaminated pipes	A proven technique to measure internal contamination is needed.
Asbestos	Fatal impact on inhalation, but there is no regulation for radioactive asbestos.
Chelating agent	There is no detail list of chelating agents at RW regulation.
Contaminated soil	The Kori unit 1 case does not consider the occurrence of contaminated soil. It can generate unexpectedly, so need to be prepared for the generation.

3. Conclusion

In this study investigated the decommissioning experiences and related cases and classified the DW by types. Also summarized the generation characteristics of each types of DW and analyzed the potential issue regarding DW. Considering these, it is necessary to develop the DW management plan and regulation.

ACKNOWLEDGEMENT

This work was supported by the Nuclear Safety Research Program through the Korea Foundation Of Nuclear Safety (KOFONS), granted financial resource from the Nuclear Safety and Security Commission (NSSC), Republic of Korea (No. 1605008).

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