Estimation of Waste Quantities Using DeCAT-Pro

Taesik Yun, Hyejin Jung, Jaeyong Oh, Younggook Kim *
Decommissioning Technology Team, Central Research Institute, KHNP
70, Yuseong-daero 1312beon-gil, Yuseong-gu, Daejeon, 34101, Korea
Corresponding author: kim.090909@khnp.co.kr

1. INTRODUCTION

In accordance with the Basic Plan for Kori-1 Decommissioning made by Korean government [1], Kori-1 will be permanently shut down in June 2017. The D&D (Dismantling and Decontamination) is scheduled to get started in June 2022 elapsing five years of cooling spent fuels down. The final site status is postulated as Brown Field and tentative DCGL[1] of less than 0.1 *mSv* per year to evaluate waste quantities in a conservative manner. The decommissioning strategy was determined the immediate decommissioning whose whole period would be taken for approximately 15 years; pre-decommissioning for two years, spent fuel cool-down for five years, D&D for six years, site remediation for two years. The assumption to dismantle the underground facilities including SSCs is to one meter beneath the ground level and the other facilities remain intact. In addition, non-radioactive concrete wastes would be used to landfill gaps of the remaining facilities. Figure 1 illustrates and the Decommissioning process of Kori-1 nuclear plant.

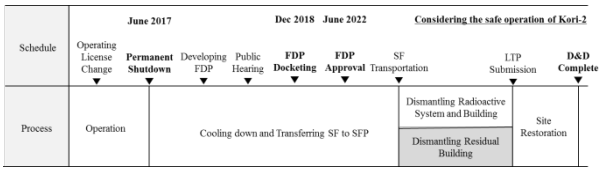

Figure 1. Decommissioning Process of Kori-1

The wastes generated from the common facilities and SSCs in the multi-unit site are assumed to be a part of quantities divided by the number of the units. In case of spent fuels, we did not include them the net waste quantities for this research. Instead, they are supposed to be transferred to a dry storage facility which is planned to be constructed.

2. AREA DESIGNATION

Decommissioning blocks were zoned to reasonably determine the status, source terms and quantity of residual radioactive materials in each room [2, 3]. Although the accurate analysis of those could be implemented after the shutdown of the relevant plant which is still in operation, we defined zones using engineering judgments, direct measurements with a couple of walk-downs and sampling and the like. For this purpose, we performed broadly three step approach; as the first step, we collected necessary data and reviewed design features and radiation controlled area (RCA) categorized with similar radiological conditions to identify buildings, structures and corresponding elevation, the second step was to supplement and revise zones defined from the previous step with scrutinized surveys and reviews using plant operating historical information, for the last step, we finalized the zones through direct measurements of the plant. The determined zone developed was used to estimate the plant inventory. However, a part of decommissioning zone was not included due to lack of data.

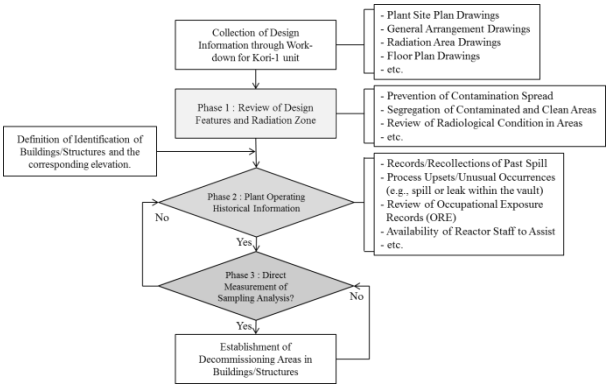

Figure 2. Development Flow of Area Designation

3. EMPIRICAL RESULTS

For the sake of a meaningful waste quantity evaluation, organic linking and batch processing of essential data, unit factors, area information, plant inventory, waste treatment and the like should be the priorities of concern. Accordingly, calculation in hand calculation or using Excel spread sheet would not be the appropriate choice to deal with these complicated data. Hence, we utilize the computer program, the Decommissioning Cost Assessment Tool Professional (DeCAT-Pro) which was developed in collaboration with KHNP, KEPCO E&C and RSCS. This tool provides an up-to-date and dynamic decommissioning cost estimate based upon site specific unit cost factors in respect of labor, equipment, waste disposal, insurance, and other variables that impact the entire decommissioning cost schedule. Figure 3 illustrates the evaluation process of waste quantity.

[1] DCGL: Derived Concentration Guideline Level

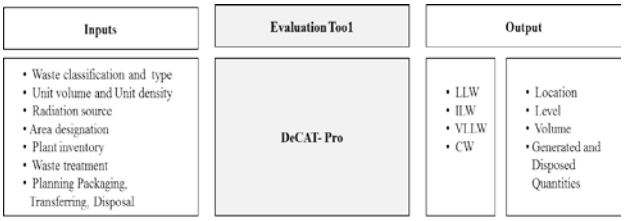

Figure 3. Evaluation Process of Waste Quantity

The quantity of valves, pipes and components directly related to the plant system is calculated on the basis of the list containing size, location, weight, system, while that of cable, HVAC, duct, concreate far from the plant system is estimated using both the quantity data from the construction phase and engineering judgments. Table 1 shows both the classification to estimate the Kori-1 decommissioning quantity and the estimated quantities generated.

Table 1. Waste Quantities under the DECON

Grade of Wastes	Waste Type	Volume (m^3)
Clean Wastes	Cable	139,527
	Pieces of concrete,	
	Hazard waste	
	Asbestos	
	Large component	
	Small components	
	SF Rack	
ILW	Small metals	23
	Resin and Filters[2]	
LLW	Cable	5,673
	Pieces of concrete	
	Scrabbling concrete	
	Dry Active Wastes	
	Hazard wastes	
	Asbestos	
	Large components	
	RV	
	Small metals	
	SF Rack	
	Resin and Filters	
VLLW	Cable	6,829
	Pieces of concrete	
	Scrabbling concrete	
	Hazard wastes	
	Asbestos	
	Small metals	
	SF Rack	
	Resin and Filters	
Total Radioactive Wastes		12,526

For reference, we estimated the quantity under the 50 year SAFSTOR to compare with that under the DECON strategy illustrated in Figure 4. Due to the decay effects, it is estimated that the radioactive quantity under the SAFSTOR is less than that under the DECON.

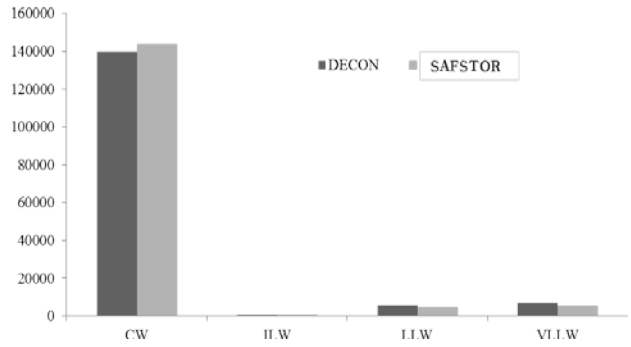

Figure 4. Waste of DECON vs. SAFSTOR

Figure 5 demonstrates the relation between the clean wastes and radioactive waste in case of DECON[3] and SAFSTOR. the quantity of the clean wastes is increased as time goes by under the SAFSTOR, while that of the radioactive wastes is reduced.

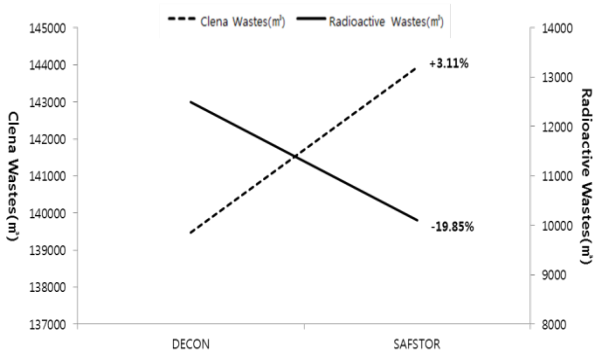

Figure 5. Change of Wastes, DECON vs. SAFSTOR

4. CONCLUSION

Although there are many assumptions we applied, the methodologies developed and the data produced by this research will play a meaningful role as a good starting point for the Kori-1 decommissioning after its shutdown to logically and reasonably estimate the waste quantity. However it is clear that tenacious efforts should be taken to successfully perform the decommissioning project. Furthermore, we should keep focus on the trends and changes of regulations and government policies and the status of a few decommissioning cases performed in other countries.

REFERENCES

[1] IAEA(2005), "Standard Format and Content for Safety Released Decommissioning Documents", SRS-45
[2] KHNP(2008), "Kori-1 FSAR"
[3] KHNP(1988), "Construction experience of Kori-1"

[2] Under the DECON Strategy, resin from the primary system is assumed ILW in the conservative manner, while other resins are assumed LLW

[3] DECON and SAFSTOR refer to the immediate dismantling and the deferred dismantling respectively.