Study on Dismantling Scenario for Large Components of Kori Unit 1

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1. Introduction

After the permanent shut down, a nuclear power plan (NPP) enters new era, decommissioning phase. The removal of radioactive components and the demolition of the building take place in this phase. The removal of radioactive component, including reactor and large components (LC), is complex, expensive, and multidisciplinary. Among large components, including steam generator (SG), pressurizer, and reactor coolant pump, in containment building (CB), the treatment of SG is the most challenging task due to its size and level of contamination [1].

Dismantling scenario for large components is studied, in terms of processability and characteristics. Optimization of processes during decommissioning is one of the important task to reduce the cost and risk. The SG is selected as a representative item among LCs. In the previous experiences, the dismantling strategy for LC is related to the site condition, such as physical dimension, public acceptance, disposal, etc.

Fig. 1. Example of Steam Generator Withdrawal in ZORITA NPP.

2. Scenario Study of Dismantling

Three scenarios, listed below, are considered in this research. Since the large components in primary circuit are activated by neutron and/or contain surface contaminants, the direct disposal without segmentation is preferred in terms of radiation reduction of workers. However, the waste acceptance criteria should be considered for the implementation of disposal.

- Direct disposal (without segmentation)
- Segmentation in containment building
- Segmentation in waste treatment building

The total height, maximum outer diameter (OD), and weight of Kori unit 1 SG are 20.7 m, 4.5 m, and 327 ton, respectively. The steam generator has more than 4,900 U-tubes, made of Inconel 690TT. The coolant of primary circuit flows through U-tube and contaminates them. The dismantling of SG includes disassemble and separation of U-tubes from SG body. The height of U-tubes from the plate is 935 cm. The chemical and physical decontamination equipment is required to remove the contaminants inside the U-tubes. It is generally understood that the space, at least around 2.5~3 times of SG total height and outer diameter, is required for the decontamination and dismantling of SG. Based on the hypothesis, the required minimum length and width are 5.2~6.2 m and 1.2~1.4 m, respectively.

Fig. 2 shows the cross sectional view of the Kori unit 1 CB. Many components, including reactor, RCP, SG, etc., are closely packed in CB. It seem that the cavity region, blue dotted rectangle in Fig. 3, could be an only option for the decontamination and segmentation.

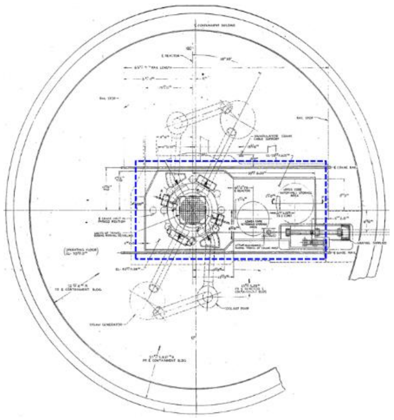

Fig. 2. Cross sectional view of Kori Unit 1 CB.

Since the SG is a massive component, weight of 327 ton, a solid plates and supporting structure should be prepared to cover the cavity region and provide sufficient force to support the SG. In addition, the safety plan from industrial hazardousness and management plan for transportation of cutting debris, particles, and aerosol should be prepared to decrease the secondary waste generation and reduce the risk.

On the other hand, decontamination and dismantling the LC at the outside of CB, for instance waste treatment facility, allows various advantages, such as conveniences in process, radiation protection of workers, packaging, etc. The sufficient space for the process allows worker prevent the unnecessary approach to the activated and/or contaminated LC. Also, higher degree of decontamination is achievable compared to implementation of the process in CB. This indicates that it is reasonable to conclude that the segmentation of LC in waste treatment building is favorable in the case of Kori unit 1.

Fig. 3 shows the suggested opening location of CB. Since the diameter of equipment hatch is smaller than OD of SG, some part of CB liner plate and concrete wall of CB. The suggested dimension of temporary opening is width and height of 6.9 m.

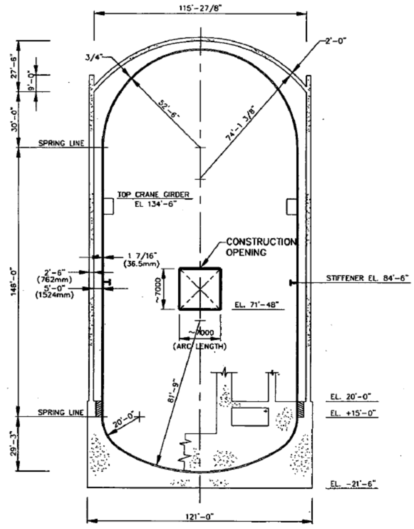

Fig. 3. Suggested Opening Location of CB.

3. Conclusion

Various scenarios for dismantling of large components are studied. Considering the status in containment building and ALARA principle, the segmentation in waste treatment building has advantages, such as radiation protection and processability.

ACKNOWLEDGEMENTS

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