Study on Segmentation Plan for Kori Unit 1 Reactor Vessel Internal

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1. Introduction

After the permanent shut down of Kori unit 1, the first commercial nuclear power plant (NPP) in Korea, various decommissioning activities are awaiting. The segmentation of large components are one of the primary activity. Since the reactor vessel (RV) and reactor vessel internal (RVI) are relatively highly activated, they should be carefully treated to achieve the safe and economical decommissioning. The RV and RVI had been activated by neutron from the fuel during operation. They are classified as ILW, LLW, and VLLW [1]. Since the lower part of RVI are directly irradiated by neutron from the fuel, some part of them are classified as ILW. Rest of RV and RVI are classified as LLW and VLLW. In this study, the segmentation plan for Kori unit 1 RVI and estimation of radioactive waste generation are studied.

2. RVI Segmentation Plan Development

Since the core part of RVI are directly irradiated by neutron from the fuel, the lower part of RVI is the most highly activated region in whole NPP component. The segmentation of RVI is implemented under the water to achieve ALARA principle.

2.1 Segmentation Process

The RVI is disassembled, segmented, and packaged under the water with remotely controllable equipment. The dimension of cavity and arrangement are shown in Fig. 1 [2].

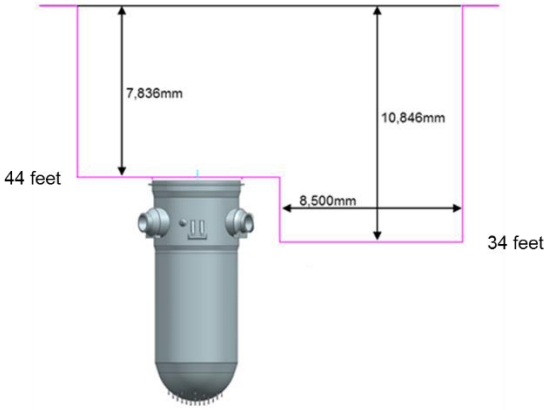

Fig. 1. Dimension and Arrangement of RV/RVI and cavity [2].

First, the cavity is filled with water and upper/lower part of RVI are moved to the stands in lower cavity, 34 feet, as shown in Fig. 2.

After the removal of RVI to the stands, the RV flange region, located near 44 feet, is sealed. The workstation, where primary segmentation process is implemented, are prepared at the upper cavity, 44 feet, with band saw, circular saw, etc. In the lower cavity region, water filtration system, fastening tool guide system, various cutting tool, etc. are equipped.

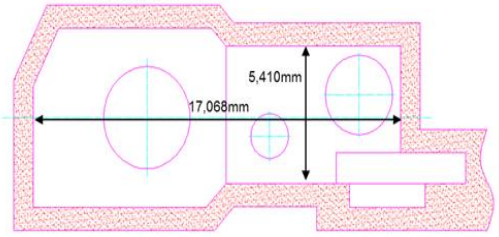

Fig. 2. Top View of Cavity.

2.2 Segmentation Plan

The RVI consists of various physical shapes: tube, thick and plates, rigid cylinder, asymmetry complex structures, etc. Various segmentation methods are required to achieve the minimization of secondary waste and process period [2]. Fine plasma cutting, contact arc metal cutting (CAMC), and mechanical cutting tools are essential for the segmentation. In addition, some part the RVI are assembled with lots of bolts, nuts, and pins. The fastening process are important to reduce the cutting time and utilize the equipment efficiently.

The preparation of equipment, including inspection, assembling, and measurement, is implemented at the operation floor, 70 feet. The additional bridge, which withstands massive segments and tools, is also equipped at the operation floor.

According to the previous experiences, the floating particle, micro bubble, and foreign substance hinder the micro observation during under water process and delay the segmentation process. The preparation of effective filtration system is prerequisite for the efficient segmentation process. The expected segmentation plan and radioactive waste generation are summarized in table1.

Table 1. Segmentation plan

Item	Results
Total cutting length	~354 m
Package generation (200L drum)	~232 drums
# of Segments	764 ea.

3. Conclusion

The segmentation of Kori unit 1 RVI is studied to achieve safe and economical decommissioning. It is suggested that the RVI is segmented under water with remotely controllable tools. The estimated cutting length, package, and number of segments are ~354 m, ~232 drums, and 764 ea., respectively. The optimized segmentation plan with new packages will be suggested in future works.

ACKNOWLEDGEMENTS

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