Process Development for Kori Unit 1 Reactor Vessel Segmentation

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1. Introduction

The segmentation of reactor vessel (RV) is classified as one of the primary process among various decommissioning activities. The RV is a massive component. The inner diameter, height, and weight of RV is ~3.3 m, ~9.7 m, and ~187 ton, respectively. The stainless steel cladding covers the inner surface area of RV. The role of reactor vessel are safe containment of fuel and reactor vessel internal (RVI) during operation and allows the energy, from fuel to water, and fluid transfer. Since the Kori unit 1 RV is irradiated to large number of neutrons during operation, the RV is classified as LLW according to the previous calculation [1]. In this study, the in-situ thermal segmentation of RV is studied to achieve low radiation exposure and reduce process duration.

2. RV Segmentation Plan Development

Since the core part of RV is exposed to large number of neutrons from the fuel, the middle of RV is one of the most highly activated region in whole NPP components. The segmentation of RV is implemented with remote controllable tools to achieve ALARA principle. In addition, rapid thermal cutting tools is favorable to reduce radiation exposure and process duration.

2.1 Preparation of Segmentation

The RV segmentation consists of preparation and segmentation steps. The Fig. 1. shows the dimension and arrangement of RV and cavity, where most of the process takes place. The flange region is located at 44 feet. There are four hot and cold legs, which support massive component and path for coolant water. Installation of tent, which cover top of RV to prevent secondary contamination during segmentation, adequate ventilation system, and rigging tool to raise RV are prerequisites.

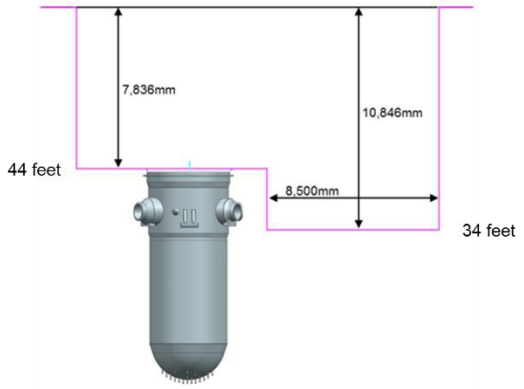

Fig. 1. Dimension and Arrangement of RV and Cavity [2].

The extension of bio-shield concrete around flange region is required to secure and install the oxy-propane torch. The insulation, which covers RV outer surface, is segmented and removed for further segmentation process.

2.2 Segmentation of RV

After preparation and installation, the RV is segmented with oxy-propane torch from top to

bottom. The example of RV cutting plan is shown in Fig. 2. Since thermal energy, which is generated from torch, melts carbon steel from outer surface and blows it into inner region, the generated slag is gathered in the RV bottom head and rigging tool.

Fig. 2. RV cutting Plan (Example) [2].

During segmentation using oxy-propane torch, it is generally accepted that the unfavorable aerosol is generated. Since the aerosol easily diffuses and increases the possibility of secondary waste generation, the additional ventilation system is strongly required for the adequate treatment of air contaminants, floating particle, and aerosol.

The shape of RV is relatively simple, cylindrical shape with rounded bottom head. Since the level of RV shell is similar in shell region, it is expected that the teaching and movement for remote segmentation of RV shell can be achieved in a short time. The detailed cutting plan is shown in Table 1.

Table 1. Segmentation plan [2]

Item	Results
Total cutting length	~530 m
Package generation (200L drum)	~484 drums
# of Segments	~510 ea.

3. Conclusion

The segmentation of Kori unit 1 RV is studied. The in-situ segmentation at the ambient surrounding with remotely controllable oxy-propane torch is suggested. The estimated cutting length, package, and number of segments are ~530 m, ~484 drums, and 510 ea., respectively. The optimized segmentation plan with new packages will be suggested in future works.

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