

Discussion on Bioshield Dismantling Process of Kori Unit 1

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1. Introduction

Kori unit 1 has been permanently suspended in June 2017, and preparations for decommissioning are in progress.

Activated wastes in radioactive waste include reactor vessel, reactor vessel internals, and bioshield.

Among them, bioshield has a large, and there is a difference in degree of pollution in each district, so a strategic dismantling plan should be established.

This paper describes the overseas case and discusses the process of disassembling the bioshield of Kori unit 1 in consideration of Korea's policies and environment.

2. Bioshield

The bioshield is surrounded by nuclear reactor vessel and has the function of reactor vessel protection and shielding from the heat as shown in Fig. 1.

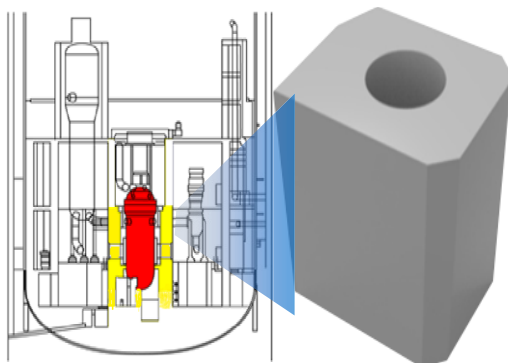


Fig. 1. Bioshield structure in Kori unit 1.

Kori unit 1 bioshield structural features are as follows.

Kori unit 1 bioshield mainly consists of concrete containing reinforcing bars, epoxy, liner plate, etc.

In the lower part, there is a penetration part of the in-core measurement instrument.

In the middle, there is a structure in which the ex-core measuring instrument is inserted.

It is closest to the nuclear fuel, so it is also called the belt line, and the activity is expected to be the highest.

In the upper part, structures such as in-leg and out-leg piping are formed.

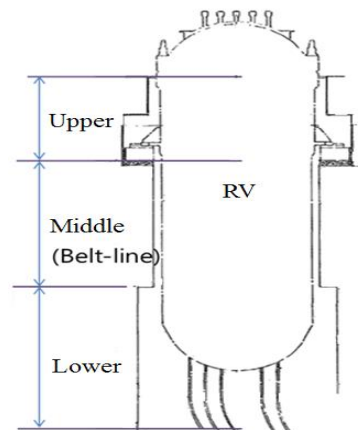


Fig. 2. Bioshield structure.

3. Dismantling Process

3.1 Activation evaluation

In order to dismantle, the bioshield characteristics must be evaluated before dismantling process is decided. The bioshield structure and material properties are assessed to perform the activation evaluation.

According to the result of proper activation evaluation, it is possible to manage the dose and to

classify the radioactive waste systematically in the dismantling process. This is more important because it directly relates to the cost of treating radioactive waste.

In the case of overseas cases, evaluation of bioshield activation includes the method of radioactivity evaluation using MCNP code and the method of directly sampling or collecting by coring or drilling as shown in Table 1.

Table 1. Overseas status of the activation evaluation

| NPP | Activation Analysis | Sampling | Activation Depth |
|--------------|---------------------|----------|--|
| Jose Cabrera | MCNP/ ORIGEN-S | Drilling | 120cm |
| SONGS-1 | - | Drilling | First 30cm highly activated in RV beltline region |
| Maine Yankee | - | Coring | Activation to 60cm, First 40cm above site release limits |
| Yankee Rowe | MCNP/ ORIGEN-S | Coring | First 27cm above site release limits |

3.2 Establish cutting process

Once the ex-core device structure is removed, a small perforation is created in the middle and upper part of the bioshield. The cutting operation can be performed by using the penetrating portion.

This is similar to Jose Cabrera's method of cutting a bioshield into a saw recently.

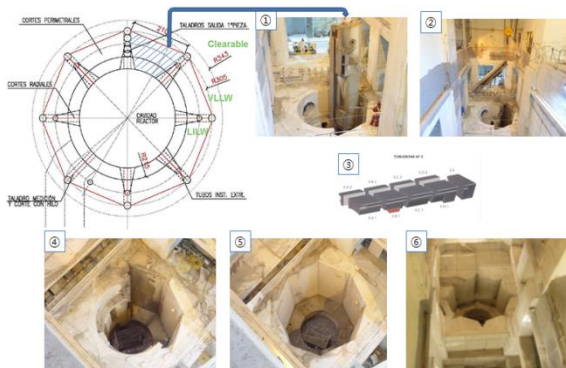


Fig. 3. Cutting process of Jose Cabrera.

According to the results of the activation evaluation, the radiation level & cutting line have

been determined.

In addition, there should be a way to more effectively capture the dust generated during the cutting of concrete and a method to prevent the spread of radioactive contamination to concrete with a relatively low contamination level.

There are ways to install tents and dust collectors, which have the advantages of low contamination spread, effective dose management and dust collection, but also have the disadvantage of installation costs and secondary radioactive waste generation.

It should be decided taking into consideration various measures.

4. Conclusion

Bioshield concrete contains radioactive concrete, and its capacity is large, requiring a strategic dismantling process. It is necessary to accurately evaluate the bioshield structure and physical properties of Kori unit 1 to perform activation evaluation.

Further, by analyzing the radioactivity through the sampling, comparative analysis with the results of the activation evaluation can be performed to obtain a more accurate characteristic evaluation result.

It is necessary to design and cut the cutting line by making good use of the characteristics of the structure, and to establish the cutting process considering contamination spread, worker dose management, and secondary radioactive waste.

REFERENCES

- [1] EPRI 1015502 "Concrete Characterization and Dose Modeling During Plant Decommissioning".
- [2] 15th EPRI International Nuclear Power Plant Decommissioning Workshop "Jose Cabrera NPP Characterization and Decontamination of Biological Shielding".