A Review of the Final Decommissioning Plan for Wolsong Unit 1

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1. Introduction

Wolsong Unit 1 is about 679MWe Pressurized Heavy Water Reactor (PHWR). AECL was responsible for Nuclear Steam Supply System (NSSS) design and supply. Wolsong Unit 1 was operated from 1983 to 2019. Currently, Wolsong Unit 1 is under safety management after permanent shutdown. As the first commercial PHWR nuclear power plant undergoing in South Korea and worldwide, KHNP has been preparing for the decommissioning project of Wolsong unit 1. The Final Decommissioning plan (FDP) for Wolsong unit 1 has been developed. So, we need to review the current status of the Wolsong Unit 1 Decommissioning Project from the perspective of the FDP.

2. Methods and Results

Wolsong Unit 1, a PHWR, has different characteristics compared to Pressurized Light Water Reactor (PLWR).

2.1 Design Characteristic of Pressurized Heavy Water Reactor

Wolsong Unit 1 is under safety management after permanent shutdown. Wolsong unit 1, a heavy water reactor, has the following characteristics.

·Unlike Light Water Reactors, which have vertical reactors, Heavy Water Reactor is installed horizontally.

·The internal structure of the reactor is more complex than that of a light water reactor (380 pressure tubes in reactor as called Calandria)

·The Calandria Vault, a large concrete structure filled with light water, is located outside of Calandria

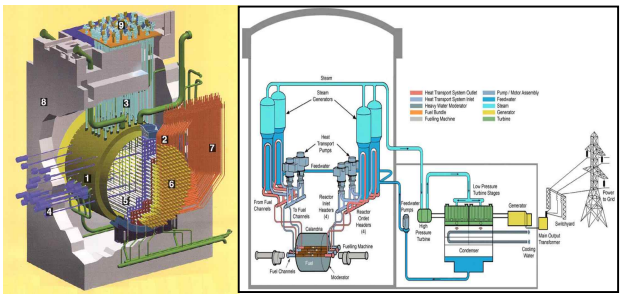

Fig. 1. Reactor and System of PHWR

2.2 Wolsong Unit 1 Decommissioning Project

The target of Wolsong Unit 1 decommissioning Project include Unit 1 SSCs and the Site measuring about 74, 490 m^2. The project outline is as follows.

·Type: PHWR(CANDU6) / 678MWe
·NSSS Supplier: AECL (Canada)
·Decommissioning Objects: Unit 1 SSCs & Site (about 74, 490 m^2)
·Project Period: 2029.12(Permanent Shutdown) ~ 2034.12(Site restoration)

2.3 Contents of Wolsong Unit 1 FDP

The Nuclear Safety Act stipulates that if a commercial NPP is permanently suspended, the utility must submit the FDP within 5 years.
Therefore, KHNP has been developed the FDP for Wolsong Unit 1 and submitted it to the government within the deadline. In South Korea, the FDP is to be prepared in accordance with the relevant notices and consists of 11 major chapters as follows.

Table I: Contents of FDP

Chapter	Title	Input Data
1	Introduction	Main SSC features and drawing
2	Project Management	Decommissioning Cost Estimation and Procedure
3	Status of Site and Environment	Environmental Evaluation data and results of Characteristic Evaluation Radioactive Structure
4	Decommissioning Strategy	Immediate Dismantling Strategy and Schedule
5	Design Characteristic	Design Features of main equipment
6	Safety Evaluation	Establishment of exposure scenarios and dose evaluation criteria
7	Radiation Protection	Radiation Area Classification and Work procedure
8	Decontamination and Dismantling	Reactor (Calandria) dismantling process
9	Radioactive Waste Management	System for Radioactive Waste(Solid, Liquid, Gas)
10	Environment Impact Evaluation	Establishment Environmental Monitoring Plan Criteria
11	Fire Protection	PHWR Fire protection code and standard

2.4 Wolsong Unit 1 Decommissioning Stages

Nuclear power plant decommissioning generally consists of four phases from stage 1 to stage 4 as shown Figure 2.

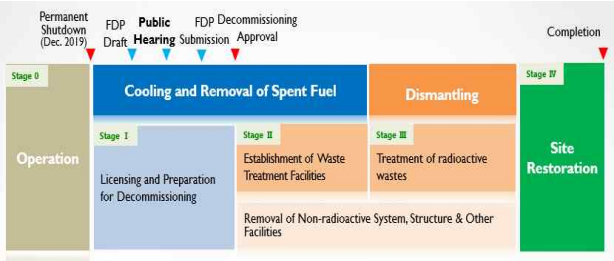

Fig. 2. Wolsong Unit 1 Decommissioning Stages

KHNP completed the development of the FDP for Wolsong Unit 1 and completed the collection of residents' opinions and public hearings in May 2024. The licensing process is currently underway, as follows.

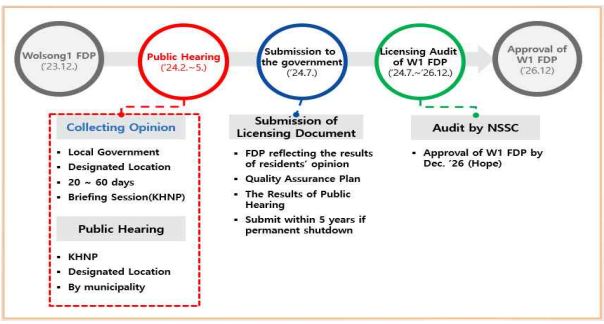

Fig. 3. Update of FDP for Wolsong Unit 1

2.5 Development of the FDP for Wolsong Unit 1

The Final Decommissioning Plan for Wolsong Unit 1 was developed by reflecting the engineering services results to it. Currently, engineering service progress status is as shown in figure 4.

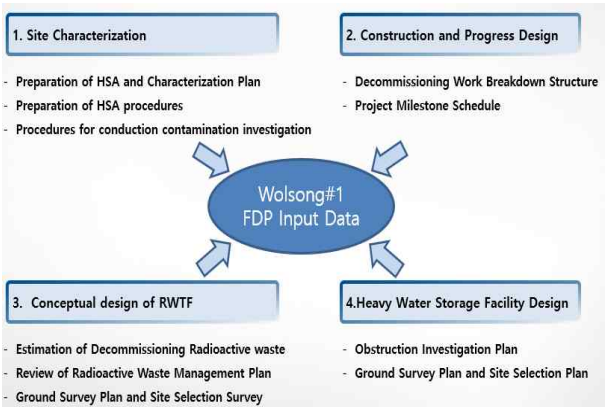

Fig 4. Engineering Service Progress Status

In addition, R&D projects such as cutting, packaging, measurement related to radiation structures and process management for decommissioning carried out. And the results have been used to develop the FDP and respond to licensing reviews. R&D development progress status are as follows.

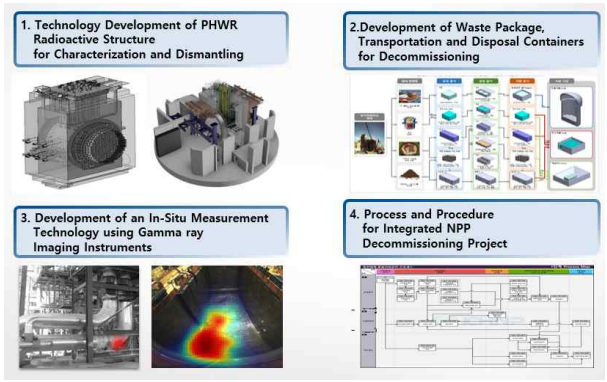

Fig 5. R&D Development Progress Status

2.6 Review of the FDP for Wolsong Unit 1

As shown in the figure 6, the FDP for Wolsong unit 1 of the development completed by the end of 2023, reflecting engineering service results, KHNP R&D results, COG technical cooperation results, and Kori unit 1 lessons learned.

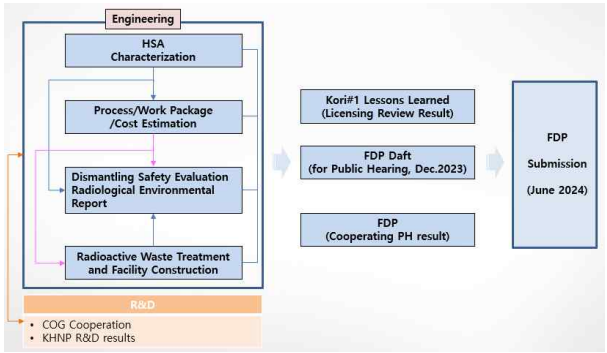

Fig. 6. Wolsong Unit 1 Decommissioning Stages

3. Conclusions

There are many difficulties in the development process as it is the world's first FDP development for commercial PHWR. Significant efforts are still required for successful decommissioning. It is necessary to secure global competitiveness through successful decommissioning of PHWR.

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