Consideration of NPP Site Condition in Planned Decommissioning of Kori Unit 1

Hyung-Woo Seo and Chang-Lak Kim*
KEPCO International Nuclear Graduate School, 658-91, Haemaji-ro, Seosaeng-myeon, Ulju-gun, Ulsan, Republic of Korea
**Corresponding author: clkim@kings.ac.kr*

1. Introduction

The oldest Nuclear Power Plant (NPP) in South Korea, Kori-1, was permanently shut down in June, 2017 and is now in a transition phase for cooling Spent Nuclear Fuel (SNF). There are 6 NPP units (Kori-1, Kori-2, Kori-3, Kori-4, Shinkori-1, and Shinkori-2) in Kori site. Because Kori-1 is not a single unit, other neighboring units should be taken into account when planning a decommissioning plan. Especially, Korea's NPPs are managed in two units and share some facilities and systems, so Kori-1 and Kori-2 are located close to each other. Therefore, the purpose of this paper is to review the decommissioning stage of Kori-1 and propose a decommissioning milestone of Kori-1 considering the cessation of Kori-2.

2. Methods and Results

2.1 Milestone for Kori-1 Decommissioning

Kori-1 decommissioning plan established by Korea Hydro Nuclear Power (KHNP) majorly consists of 4 stages as shown in Fig. 1. The total duration is expected to be about 15 years as follows [1]:

- Pre-planning: approximately 2 years.
- Transition period: minimum 5 years.
- Decommissioning and dismantling: minimum 6 years.
- Site restoration and release: minimum 2 years.

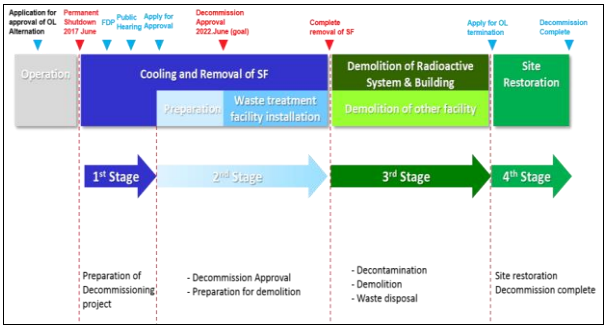

Fig. 1. Kori-1 Decommissioning Stages [2]

For summary, the 1st stage is the preparation phase for the decommissioning project, during this stage, a comprehensive design for dismantling, licensing and evaluation of pre-dismantlement characteristics should be implemented. The 2nd stage is the preparation phase for the decommissioning plan approval and dismantling activities, during this stage, application and approval of the decommissioning plan should be conducted. In addition, waste treatment facilities are installed in preparation for the radioactive waste generated in the dismantling stage. The 3rd stage is decontamination, dismantling and waste treatment stage, during this stage, reactors and large equipment are cut and dismantled. The 4th stage is site restoration and decommissioning completion phase. During that period, site restoration work will be carried out including demolition of underground facilities, site maintenance and environmental cleanup.

2.2 Challenges for Kori-1 Decommissioning

There are various considerations to be taken into account in the dismantling phase for establishing the decommissioning plan of Kori-1. Above all, it seems that a decommissioning plan should be prepared considering that Kori-1 is located in multi-unit site including Kori-2 in operation. Due to the proximity of Kori-2 (see Fig. 2), some challenges can be raised as follows:

- Few common/shared systems and turbine buildings.
- Blasting and vibration impact to Kori-2 during dismantling activities of Kori-1.
- Site restoration and release will be affected each other.

Fig. 2. Aerial View of Kori Site

2.3 Dismantling Strategy

The three major decommissioning strategy are DECON, SAFSTOR, and ENTOMB, which can be described as follows [3].

- DECON: The equipment, structures, and portions of the facility and site that contain radioactive contaminants are removed or decontaminated to a level that permits termination of the license after cessation of operations.
- SAFSTOR: The facility is placed in a safe stable condition and maintained in that state until it is

subsequently decontaminated and dismantled to levels that permit license termination.

- ENTOMB: ENTOMB involves encasing radioactive structures, systems, and components in a structurally long-lived substance, such as concrete.

KHNP and the government selected DECON as a decommissioning strategy in order to accumulate decommissioning experience as soon as possible. Therefore, the decommissioning of Kori unit 1 followed by Kori unit 2 would have many advantages in terms of economy and safety. Table I represents the characteristics and advantages of continued decommissioning project Kori unit 1 and 2.

Table I: Advantages of continued decommissioning project for Kori units

• Experience of decommissioning project organization and workforce at Kori site maintained. • Continued use of decommissioning waste treatment facility.
• Combined site decontamination of Kori 1&2 for simultaneous site release. • Decommissioning planning for Kori unit 2 in consideration of Kori unit 1 project • Interference of Kori unit 2 can be minimized.

2.4 Proposed Kori-1 Decommissioning Milestones

Considering the proximity of Kori-2, it seems reasonable to set up a decommissioning strategy for Kori-1 along with the Kori-2. The design life of Kori-2 expires in 2023, and if it is permanently shut down, it will have a transition period of 5 years. Kori-2 will take the same period of 6 years as Kori-1's dismantlement period. The dismantling of Kori-2 will commence in 2028 and the dismantling of the common facilities of Kori-1 can be done at the same time. Site restoration and release also can be done at the same time, or after the completion of the limited opening of Kori-1, Kori-2 may be released simultaneously when Kori-2 is restored.

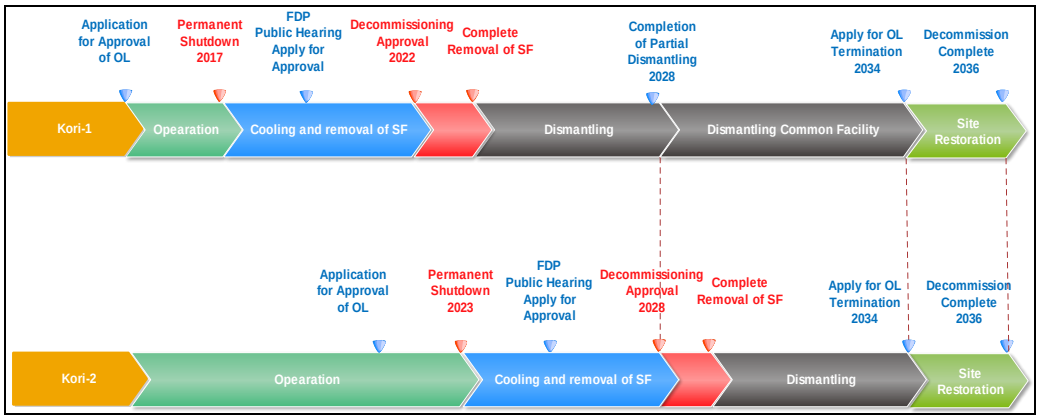

Fig. 3. Kori-1 Decommissioning Strategy Considering Kori-2

3. Conclusions

Kori Unit 1 was permanently shut down in June 2017 and became a commercial nuclear power plant to be dismantled for the first time in Korea. KHNP has selected the DECON strategy to acquire dismantling technology and know-how, and it is expected that the dismantling period will take about 15 years to open the site. However, the neighboring NPP, Kori-2, is in operation and the design life is scheduled to expire in April 2023. The Kori-1 decommissioning should include plans for the common facilities and the systems that affect the safe operation of Kori-2. This paper proposed a plan to dismantle common facilities after 2028, when Kori-2 starts dismantling. It is uncertain what will happen to the government's policy to extend of Kori-2's operation. However, in view of the design life of Kori-2 and recent government's nuclear policy decisions, Kori-1's decommissioning plan should be established considering Kori-2's decommissioning.

4. Acknowledgements

This work was supported by the Research Fund of the KEPCO International Nuclear Graduate School (KINGS), Republic of Korea.

REFERENCES

[1] KHNP, Preparation Program at the Pre-Decommissioning Phase for the D&D of the Kori-1 Nuclear Power Plant, 2016.
[2] KHNP, Status of Preparation for Decommissioning of Kori Unit 1, Nuclear Safety & Security Information Conference, 2017.
[3] U.S. NRC, Decommissioning of Nuclear Power Reactors, Office of Nuclear Regulatory Research, Regulatory Guide 1.184, 2000.