Preparation Activities to Consider during Operations of Nuclear Power Plants for Decommissioning

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1. Introduction

In order to prepare for decommissioning Nuclear Power Plant (NPP), the contents of decommissioning preparation activities must considered from the phase of transition. Currently, Kori Unit 1 was permanently shut down in June 2017, and Dismantling and Decontamination (D&D) activities will be initiated after five years of transition period, so the licensee should prepare for the decommissioning properly.

In order to establish appropriate guidelines for the decommissioning activities of Kori Unit 1, KHNP reviewed the overseas decommissioning experiences, existing guidelines on decommissioning plans, expert training, etc. Therefore, the purpose of this study is to review activities that are considered to prepare for decommissioning nuclear facilities. To this end, we hope that the results of this paper will be applicable to the Kori Unit 1 in which the Final Decommissioning Plan (FDP) will also be prepared in the near future.

2. Decommissioning Tactical Tasks

Activities to prepare for decommissioning can be categorized including decommissioning planning funds, characterization activities, remediation and decontamination activities, record keeping activities, environmental monitoring, waste disposal, and changes to plant systems, as summarized in Table 1.

2.1. Decommissioning Regulations

In the phase of normal operation of nuclear plant, there are several regulatory guidelines for the decommissioning. In general, the following rules applied to overseas NPPs. [1].

• NPPs are generally required to minimize the presence of residual radioactivity into the site.

• NPPs are generally required to periodically estimate the decommissioning costs and are also required to provide assurance that funds will be available for the plant decommissioning.

• NPPs are generally required to maintain records of all information important to decommissioning.

2.2. Waste and Contamination Management

Waste and contamination management activities that can be prepared during normal operation phase involves non-radioactive waste contamination which is a significant amount of waste and needs to be managed and to be improved.

Table 1: Categorization of activities for NPP Decommissioning

Categories	Activities Description
Decommissioning Regulations	Minimize of residual radioactivity
	Estimate future decommissioning costs
	Records of all information
Waste and Contamination Management	Minimization of waste/contamination generation
	Waste disposal/contamination remediation
	Elimination of hazardous materials
	Characterization
	Environmental monitoring
Record Keeping	Documentation of waste/contamination generation
	Radioactive and hazardous material inventory
	Documentation of plant equipment and systems
Spent Fuel Management	Independent spent fuel storage installation (ISFSI) construction
	Removal of spent fuel from the SFP
Chemistry Control	Full decontamination
Pre-Planning for Decommissioning	Planning during extended outages
	Planning for major decommissioning projects
	Regulatory submittals
	Technology and strategy watch
Miscellaneous Topics	Regulatory watch
	Communications
	Employee retention
	Dismantlement of abandon systems
	Plant construction

Basically, activities should be carried out to minimize the generation of waste/contamination during operation.

The effects of cost reduction should be considered for activities to reduce waste generation at the time of decommissioning and to prioritize waste generated during normal operation. Performing a characterization of the waste during normal operation is often more efficient than when performed during decommissioning.

A groundwater monitoring program is required to assess whether contaminated material from leaks or spills reaches the soil/groundwater. These regulations

have significant impacts on groundwater contamination, waste disposal, cost, and schedule.

2.3. Record Keeping

After a permanent shutdown, many decommissioning plants should strive to collect all the information necessary to establish a decommissioning plan.

Among them, important things for decommissioning includes information on contamination from incidents, events result in waste generation, details of changes in plant equipment or procedures, and information on the design of the constructed plant.

In addition, the plant must maintain a record of the leaks incident. Historical Site Assessment (HSA) is a document that summarizes and evaluates radiation and hazardous substance contamination and leaks, site survey and other radiation exposure during the life of the plant.

It is recommended that a database is created in some documents and organized based on all information from plant systems, structures, and implement of site characterization. This also means that changes made during the operation of the plant must be timely updated.

2.4. Spent Fuel Management

In other countries, after a permanent shutdown, many of them have chosen to transfer spent nuclear fuels to the Independent Spent Fuel Storage Installation (ISFSI), a dry storage facility on site, rather than storing spent fuels in the Spent Fuel Pool (SFP) for decommissioning.

Plants need to consider regularly transferring spent fuel from SFPs to ISFSI during normal operation to reduce schedule and cost for the decommissioning.

2.5. Chemistry Control

If alpha contamination occurs, it is essential to record all relevant information about the event since alpha contamination can significantly affect the increase of decommissioning planning. Full system chemical decontamination may be beneficial for a plant with significant alpha contamination.

2.6. Pre-Planning for Decommissioning

A detailed decommissioning plan should be established prior to the permanent shutdown in order to establish the proper scenarios to minimize costs and duration of decommissioning.

In case of unexpected permanent shutdowns, it is desirable to consider performing detailed level of activities regardless of the design life of plants because unexpected permanent shutdowns may cause a long interruption.

Most draft licensing documents for the decommissioning are expected to be prepared during the transition period. In order to prepare for the decommissioning, it is possible to draft a decommissioning plan during normal operation. During the period of developing the initial decommissioning plan, the licensee should review relevant materials such as decommissioning guidelines, decommissioning experiences in the past, and cooperation with experts who have decommissioning experience.

2.7. Miscellaneous Topics

The plant management personnel at the current operating plant are encouraged to review the current decommissioning plan and participate in the process of developing/modifying the shutdown of the plant.

It is also important to maintain smooth communication with the government and surrounding communities during the decommissioning process.

After plants are permanent shutdown, it is natural that staffs in the plant will decrease. However, key personnel must remain on site to establish a plan for decommissioning and provide input to several key decommissioning tasks (e.g., site characterization plan) [2].

Plant buildings and systems not in use during normal operation may be contaminated during the process of plant decommissioning. Therefore, if possible, it is advisable to dismantle unused equipment/systems during normal operation.

3. Conclusion

There are a number of operational practices and events occurring during normal operation that may affect upcoming decommissioning activities and costs.

After a permanent shutdown, many overseas decommissioning plants have reviewed the plant history to identify important information related to the waste generation/contamination events.

Instead of compiling the useful information at the time of permanent shutdown, it is much more efficient and accurate to document and organize the information in real time during normal plant operation. These actions will significantly reduce the costs and efforts for preparation of the site characterization, and also reduce the risk for wastes/contamination, which can result in substantial impacts on decommissioning cost and schedule.

Furthermore, to better prepare for an unplanned permanent shutdown, it is recommended that all operating plants, regardless of plant design life time, develop well-organized decommissioning plans.

REFERENCES

[1] Activities during Plant Operation to Facilitate Future Decommissioning. EPRI, Palo Alto, CA: 2017. 3002010605.
[2] Guidance for Transitioning from Operation to Decommissioning for Nuclear Power Plants, EPRI, Palo Alto, CA: 2016. 3002007551.