

Guidelines of Decommissioning Schedule Establishment

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1. Introduction

Decommissioning, the last stage of life cycle of Nuclear Power Plant (NPP), is defined as “the administrative and technical actions taken to allow the removal of some or all of the regulatory requirements from a facility” [1]. Decommissioning has recently become an issue highlighted in Korea due to the Permanent Shutdown (PS) of Kori-1 plant. Since Korea Hydro and Nuclear Power (KHNP) Company decided the PS of Kori-1 instead of further continued operation, Kori-1 will be the first decommissioning plant of the commercial reactors in Korea.

Korean regulatory authority demands Initial Decommissioning Plan (IDP) for all the plants in operation and under construction. In addition, decommissioning should be considered for the completion of the life cycle of NPPs.

To date, Korea has no experience regarding decommissioning of the commercial reactor and a lot of uncertainties will be expected due to its site-specific factors. However, optimized decommissioning process schedule must be indispensable in the safety and economic efficiency of the project. Therefore, procedures for the establishment of decommissioning schedule are described with a draft, and also, guidelines are suggested in this study.

2. Methodologies and Results

In order to establish a detailed decommissioning schedule, the current decommissioning strategies are used; project period, process technologies and disposal of decommissioning waste, final status of sites, and etc.

2.1 Decommissioning Period

KHNP announced the decommissioning period would take approximately fifteen years consisting of 4 phases whose outline is presented in Fig. 1.

The initial first two years are for planning of decommissioning preparation. In this phase, KHNP as the NPP licensee should acquire the approval of Operating License (OL) change and the IDP. Simultaneously, to prepare the decommissioning activities, management organization should be composed of KHNP executives and staff members.

With PS of the NPP, transition period should be conducted for at least 5 years. Transition period includes safe storage management with ALARA for workers of decommissioning. Spent fuel should be

moved from reactor to Spent Fuel Pool (SFP). From this moment, system decontamination and the radioactive waste treatment is supposed to be started.

At the end of transition period, Decontamination and Dismantling (D&D) phase follows for about six years. Spent fuel in SFP will be transferred out of the decommissioning NPP. Most of the activities for Structure, System and Components (SSCs) will go through all the process in this stage.

The final phase of decommissioning is site restoration. According to site release criteria, the final status of sites is determined and released as green field or brown field. The duration of this phase is around two years.

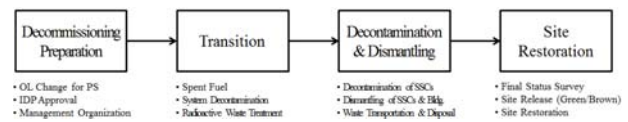


Fig. 1. Outline of decommissioning schedule.

2.2 Major Assumptions

To determine the major assumptions for decommissioning scenarios is the first important activity, as decommissioning assumptions have an effect on not only establishing the site specific schedules but also estimating waste quantities and costs. According to the strategies generally suggested, NPP decommissioning will be carried out by immediate dismantling known as DECON. To fortifying decommissioning technologies, KHNP have made up of the decommissioning project management organization, not to commit to Decommissioning Operating Contractors (DOC). Some of the detailed decommissioning scenarios are listed in Table I.

Table I: Assumptions for decommissioning scenarios

Scenarios	Assumptions
Alternatives	Immediate Dismantling
Management	By KHNP
Decom. Sequence	Cold to Hot
Waste Treatment	In Decommissioning Site
Site Final Status	Brown Field

2.3 Process Composition

Detailed activity schedules, especially critical paths, of decommissioning were composed of by considering the current decommissioning strategies in Korea and decommissioning experiences in USA [2,3]. Fig. 2 depicts a part of the detailed activity schedules of

decommissioning project; decommissioning preparation, transition, D&D and site restoration. Some of them do not put together with the start and end of each phase. It is essential for activities to progress a safe and economical decommissioning with preservation of the process integrity.

Korea NPP Decommissioning Project				
Preparation (2 yr)	Transition (5 yr)	D&D (6 yr)		Site Restoration (2 yr)
NPP Operation	Spent Fuel Storage/Transportation	Radioactive Waste Transportation/Disposal		
Decommissioning Engineering		Radwaste Processing		
Regulatory Activities	System Decon.	Non-Rad. Area Demolition	Rad. Area Demolition	Disposition/Release

Fig. 2. Detailed composition of decommissioning project.

2.4 Work Breakdown Structure

Work Breakdown Structure (WBS) is a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables [4]. To constitute decommissioning WBS, project schedule planner should understand the objectives, characteristics and correlations for each activities such as techniques, equipment and risks for the spread of contamination.

Similar to construction project, decommissioning project can be organized from the entire to the lowest grade of detailed activities by WBS. A part of decommissioning project WBS is shown in Fig. 3. It is not decided the actual configuration of WBS, but it can be an example for constitution of decommissioning WBS.

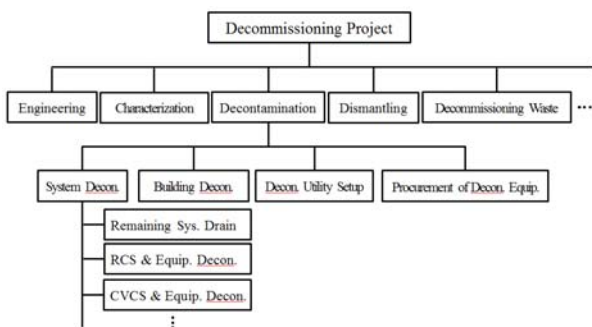


Fig. 3. A part of decommissioning WBS

2.5 Guidelines for Decommissioning Schedule

As mentioned above, decommissioning process schedule can be established by utilizing information such as assumptions, strategies, decommissioning period and WBS. In summary, the procedures of establishment of decommissioning schedule are simply described as below:

- Collect and investigate NPP data
- Confirm the regulation, policy and strategies
- Define decommissioning phases/critical path

- Set up the decommissioning WBS
- Establish the decommissioning process schedule

It is noted that decommissioning schedule should be modified by national policy and legislation, regulatory agency and strategies of NPP licensee or management organization. And also, the assumptions of main specific scenarios (site characterization, final status of site, demolition sequence, waste treatment facility operation and etc.) should be practical and definite. The most important thing for establishing the schedule is to reduce work complexity and congestions for the purpose of occupational dose minimization.

Fig. 4 describes a part of the detailed activities schedule conducted by this study referred to decommissioning experience reports and cost reports.

Activity Description	Y-2	Y-1	Y+1	Y+2	Y+3	...
Phase 1 – Decommissioning Preparation	[Red bar]					
NPP Operation	[Black bar]					
Engineering and Design Project	[Black bar]					
Decommissioning Design and Planning	[Blue bar]					
Establishment of Process Schedule		[Blue bar]				
Preparation of Work Procedures		[Blue bar]				
Regulatory Compliance	[Black bar]					
Preparation of License Document	[Blue bar]					
Preparation of Initial Decommissioning Plan	[Red bar]					
Operating License Change for Shutdown	[Red bar]					
Phase 2 – Transition			[Red bar]			
System Decontamination			[Black bar]			
Remaining System Drain			[Blue bar]			
Reactor Coolant System & Equipment Decon.			[Blue bar]			
Chemical & Volume Control System Decon.			[Blue bar]			

Fig. 4. Example of the detailed schedule

3. Conclusions

Differed from USA, Korea has no experience and know-hows of the operation and site management for decommissioning. Hence, in Korea, establishment of decommissioning schedule has to give more weight to safety than precedent cases. More economical and rational schedule will be composed by collecting and analyzing the experience data and site-specific data and information as the decommissioning progresses.

In a long-range outlook, KHNP having capability of NPP decommissioning will try to decommissioning business in Korea and foreign countries. At that time, the guidelines suggested in this study are expected to use for the future decommissioning schedule planning.

REFERENCES

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