The Nuclear Power Plant Life-cycle Analysis Considering the Decommissioning Projects

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1. Introduction

Life-cycle management is meant to manage the information and processes throughout the entire cycle of the plant. The life cycle of a nuclear power plant is divided into planning, engineering, procurement, construction, operation & maintenance, and decommissioning phases. Korea has experience in constructing various type of nuclear power plants and operating multiple units, and is now pursuing a decommissioning project. The project in the field of nuclear facility decommissioning is an area that has not yet been experienced and should be well prepared.

There are many studies related to the establishment of a management system and integrated information management focusing on data-driven processes in consideration of the nuclear power plant life cycle. However, it can be assessed that the management focused on the construction and operation phase of the nuclear power plant life cycle [1].

It should be used as an opportunity to complete the nuclear power plant industry system for the entire cycle of 'construction – operation - decommissioning (waste management)' of nuclear power plants through the decommission of Kori Unit 1 [2].

This study proposes the nuclear power plant life cycle that includes the decommissioning phase from the perspective of project management through literature review.

2. Methods and Results

According to the decommissioning project promotion strategy, the project management is essential to complete the decommissioning project within the provisions, optimization of the decommissioning schedule and minimizing radiation waste [2]. The nuclear power plant life cycle, taking into account the decommissioning phase of the project management point of view as follows:

2.1 The Nuclear Power Plant Life Cycle Review

The nuclear power plant life cycle process is defined as shown in Fig. 1 in consideration of the characteristics of each project stage, and the EPCS stage of construction divides the project management process and the execution of construction [1].

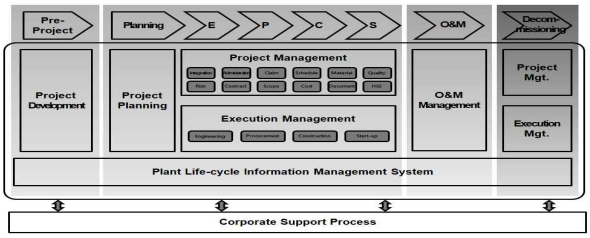

Fig. 1. Nuclear power plant life cycle from the construction management (modified from [1])

In construction EPCS phase, management is divided into 14 representatively. Project management process is divided into 12 and execution management process is divided into 4.

The decommissioning phase is also necessary for the project management process and execution management process in the same way as in EPCS phase, and it must be developed in a balanced way [1].

2.2 Analysis of decommissioning phase through literature

From various perspectives, the execution process mentioned in the papers related to the decommissioning project are shown in the table I.

Table I: Literature summary

Reference	Decommissioning phase
Park [3]	(Project management) ①Pre-decommissioning ②Main decommissioning ③Post decommissioning
Jeong [4]	(Technology classification) ①Decommissioning Engineering ②Characteristic evaluation and safety evaluation ③Decontamination, Cutting and demolition ④Radiation waste management ⑤Site restoration
KINGS [5]	(Decommissioning waste) ①Radiation waste ②Non-radiation waste
Shin [6]	(Decommissioning cost) ①License Termination ②Spent Fuel Management Site Restoration

Jeon [7]	-German Case (1.Order: From outside to inside) ①Removal of the turbine building and related systems ②Removal of the reactor building and related systems, and ③Removal of the nuclear power plant (2.Phase Approaches) ①Operational phase, ②Post operational phase ③Residual operations and dismantling phase - pollution system and parts removal - large structure removal - reactor system removal - residual system and parts removal
Choe [2]	-Kori Unit 1 Case (1. Stage Approaches) ①Safety management stage ②Demolition stage of non-radioactive equipment ③Demolition stage of radioactive equipment ④Site restoration stage (2.Unit process) ① Decommissioning engineering ②Decontamination of system ③Construction and operation of waste treatment facilities/ Decontamination/Demolition ④Cutting and demolition of nuclear reactor facilities ⑤Radiation measurement evaluation and verification ⑥Site restoration

2.3 Proposal of the nuclear power plants life cycle including the decommissioning management

The decommissioning technology is a comprehensive engineering-convergence technology that combines knowledge and technologies in various fields such as radiation safety management, machinery, chemistry, and control. It is necessary to develop an optimized convergence technology in a radiation environment by incorporating commercially available general industrial technologies [2].

It is suggested that the procedures and systems used in the construction and operation stages be customized to suit the decommissioning project as much as possible. This is because the establishment of completely new process ignoring the existing operational processes can cause problems in adopting and using the new system. In addition, management of radioactive waste will have to be developed with its role and scope extended from the operational process.

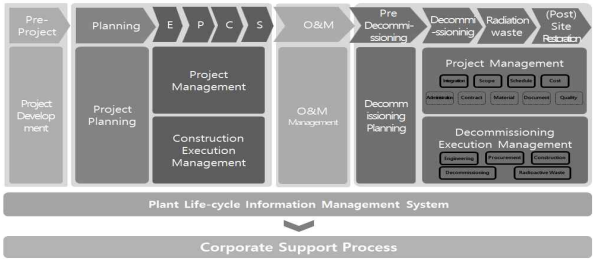

Fig. 2. Proposal for the nuclear power plants lift cycle considering decommissioning

3. Conclusions

In this study, we reviewed nuclear power plant life cycle management processes proposed in the construction advancement plan. Additionally by surveying literature related to the decommissioning project, the entire nuclear power plant life cycle included the decommissioning project was proposed. In the future, additional research is needed on the standards and guidelines for decommissioning regulations, work methods and workload according to the decommissioning technology and equipment development. Based on this, project management from decommissioning technology & method - schedule management - cost management - waste management should be organically linked.

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