

## Analysis of Advanced Project Management Techniques and Structures for the Decommissioning of NPPs

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### 1. Introduction

All Nuclear Power Plants (NPPs), whether or not they contain radioactive materials, will eventually need to be decommissioning. Almost countries have experience in removing from service and in dismantling and demolishing NPPs that are permanently shutdown. Therefore, there are particular concerns with the safe, timely and cost effective removal and disposal of radioactive materials, and the reuse/release of the plants and their sites for new purposes. For this requirement, it must respond to regulatory requirements and meet normal engineering, economic and occupational safety goals. Achieving this scope of goals requires a systematic approach to NPP decommissioning that specifically encompasses policies and strategies. This study provides guidance in the area of structured and methodical framework for the management of NPP projects from their initiation to their closeout, so as to enable a best practice approach. Therefore, by analyzing the project management techniques and structures that are applied worldwide, it is intended to be helpful as basic data for decommissioning operator organizations to establish a NPP decommissioning project management system.

### 2. Project Management System

#### 2.1 Project Phases and Life Cycle

Projects are different from other ongoing operations within an organization because unlike operations, projects have a definite beginning and an end. To describe a high-quality project management process for a NPP Project, an international tool can be applied, as shown in Figure 1. Its foundation is a series of Plan, Do, Check and Act (PDCA) cycles, sometimes referred to as 'Plan, Do, Study, and Do (PDS) cycles

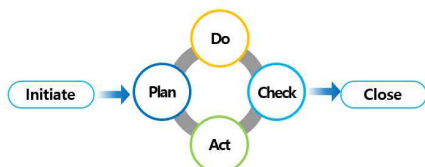


Fig. 1 Typical Project life cycle [1]

This also applies to sub-processes that are meant to control various aspects of projects, although not all parts of initiate, PDCA and close might be necessary for each sub-process. For example, how to plan for its preparation ('plan'); how to write it and initially get it approved ('do'); how to confirm that it meets requirements based on experience during initial stages of the projects ('check'); how to implement necessary changes by requesting a revision to be initiated ('act'); and finally back to 'plan' and 'do' for the revision process.

#### 2.2 Project Management Activities for New NPP in Each Phase

This sections provide more detail surrounding the specific activities and considerations for project management within each project phase of an NPP development project using the phases defined in the IAEA's Milestones Approach [2]. Table 1 provides an overview of these sections.

Table 1: Defining phase for NPP Project [2]

Index	Activity
Phase 1	<b>Pre-Project Activities</b>
	• The pre-feasibility and feasibility studies
Phase 2	<b>Project Development Activities</b>
	• Project planning
	• Approval to proceed to development stage
	• Siting and evaluation
	• Infrastructure and industrial involvement planning
	• Grid integration planning
	• Licensing
• Procurement	
Phase 3	• Radiation dose and radioactive waste management
	• Emergency Planning and Response(EPR)
	• Security and safeguards
	<b>Construction &amp; Decommissioning</b>
	• Project management activities
	• Contracting
	• Construction (contract management)

During Phase 1, it is necessary to analyze all of the issues that would be involved in introducing nuclear power, so that at the end of Phase 1, it is in a position to make a knowledgeable decision on whether or not to introduce NPPs [2].

Phase 2 consists of all preparatory work to prepare for the contracting and construction of a specific NPP after a national policy decision has been taken by the government.

Phase 3 consists of inviting bids/negotiating a contract for the NPP and then constructing or decommissioning the actual facility. During this phase of the project, the owner/operator will need to engage with all necessary stakeholders, regulators and key contractors to negotiate and draft all of the agreements required to move the project into execution, to obtain necessary licenses and permits, to obtain final investment approval and to manage the actual construction.

The list of areas to be managed as part of a nuclear project is large, and owner/operators need to work on developing a robust framework for nuclear project management at the earliest stages of the project life cycle.

### 2.3 Global Project Management Techniques

As described above, a project is a temporary effort designed to create a unique product or result with a set start and end time, and project management is a process in which the performing organization achieve a goal within a given time period. Therefore, this section describes several international project management frameworks that an organization can adapt and incorporate into its own project management system.

#### ✓ PMBOK Guide [3]

The PMBOK Guide contains 5 process groups (PGs) including initiating, planning, executing, monitoring and controlling, and closing; and 10 knowledge areas (KAs) including integration, scope, time, cost, quality, human resources, communication, risk, procurement and stakeholder management.

#### ✓ ISO 21500 [4]

ISO 21500:2012 is an international project management standard developed by the International Organization for Standardization. Largely modelled on the PMI's PMBOK Guide.

#### ✓ PRINCE 2 [5]

PRINCE 2 describes 7 themes that need to be addressed continually during a project and tailored for specific circumstances. Project processes are divided into 7 typical areas of starting a project, initiating a project, directing a project, controlling a project, managing stage boundaries, managing product delivery and closing a project.

#### ✓ IAEA NG-T-1.6 [1]

In the case of IAEA, the structure of the overall project management technique adopts the principle of PMBOK, but in each area to be managed, the principle is explained similarly to the method of PRINCE 2 and its application is proposed. Definition of 12 fields to be managed in general projects and 4 field to be included in nuclear projects. Table 2 shows the lifecycle and techniques for each global project management technique.

Table 2: Comparison of Global Project Management techniques

Global Standard	Life cycle	Techniques
PMBOK	<ul style="list-style-type: none"> <li>• Initiating</li> <li>• Planning</li> <li>• Executing</li> <li>• Monitoring and Controlling</li> <li>• Closing</li> </ul>	<ul style="list-style-type: none"> <li>• Integration</li> <li>• Scope</li> <li>• Human Resources</li> <li>• Schedule</li> <li>• Cost</li> <li>• Risk</li> <li>• Quality</li> <li>• Procurement</li> <li>• Communication</li> <li>• Stakeholder</li> </ul>
ISO21500	<ul style="list-style-type: none"> <li>• Initiating</li> <li>• Planning</li> <li>• Implementing</li> <li>• Controlling</li> <li>• Closing</li> </ul>	<ul style="list-style-type: none"> <li>• Business Case</li> <li>• Organization</li> <li>• Quality</li> <li>• Plans</li> <li>• Risk</li> <li>• Change</li> <li>• Progress</li> </ul>
PRINCE2	<ul style="list-style-type: none"> <li>• Initiating</li> <li>• Directing</li> <li>• Managing a Stage boundary</li> <li>• Controlling stage</li> <li>• Managing Product Delivery</li> <li>• Closing a project</li> <li>• Starting up</li> </ul>	<ul style="list-style-type: none"> <li>• Radiation dose and radioactive waste</li> <li>• Licensing</li> <li>• Emergency planning</li> <li>• Security and safeguards</li> </ul>
IAEA NG-T-1.6	<ul style="list-style-type: none"> <li>• Identification</li> <li>• Initiation</li> <li>• Development and definition</li> <li>• Execution</li> <li>• Closeout</li> </ul>	<ul style="list-style-type: none"> <li>• Radiation dose and radioactive waste</li> <li>• Licensing</li> <li>• Emergency planning</li> <li>• Security and safeguards</li> </ul>

### 3. Conclusions

The project management technique is to tailor the execution process to the characteristics of the project. To this end, it is necessary to identify the types and characteristics of the work to be performed in the NPP decommissioning project and appropriately apply them to the management system.

Through the above analysis, the concept of the process group and knowledge domain of PMBOK and ISO 21500 can be utilized as the core of the project management system in the basic design stage of the nuclear power plant decommissioning process, and some of the principles and themes of PRINCE 2 are

applied to help develop a standard functional organization. In addition, it will be helpful in defining the project management structure and activities by adding the radiation dose and radioactive waste as a nuclear specific project management area.

#### **REFERENCES**

- [1] IAEA, Managements of Nuclear Power Plant Projects, Technical Reports Series No. NG-T-1.6, International Atomic Energy Agency, VIENNA, 2020.
- [2] IAEA, Milestones in the Development of a National Infrastructure for Nuclear Power, IAEA Nuclear Energy Series No. NG-G-3.1 (Rev. 1), 2015.
- [3] PROJECT MANAGEMENT INSTITUTE, Guide to the Project Management Body of Knowledge (PMBOK Guide), 6th ed., Project Management Institute, Newtown Square, PA, 2021.
- [4] INTERNATIONAL ORGANIZATION FOR STANDARDIZATION, Guidance on Project Management, ISO 21500:2012, ISO, Geneva, 2012.
- [5] AXELOS, Managing Successful Projects with PRINCE2® 2017 Edition, 5th ed., TSO (The Stationery Office), Norwich, UK, 2017.