Preliminary Study for Risk Schedule Management of NPP Project: An illustrative Example

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1. Introduction

A nuclear power project has specific characteristics such as complicate interface, diversity of procedures and process, rigid security, and safety requirements, which impact on schedule delay and cost overrun. These could jeopardize the license to operate the nuclear power plant licenses[1]. To develop a baseline of reliable planning and performance measurements to accurately estimate timelines and costs, project participants must identify and analyze factors causing delays and consider them as project planning risks.

Thus, we analyzed and compared the international construction project, international NPP project and the NPP project in progress in the UAE, and aim to develop a framework for schedule risk analysis.

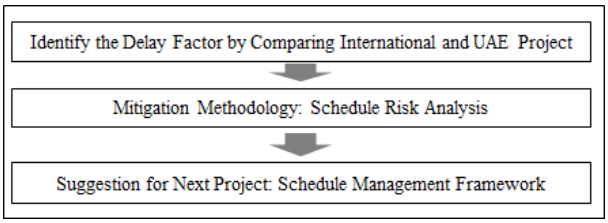

Figure 1. Framework for Research

2. Delay Factor Analysis

In this section quantitative analysis was adopted. There are many researches that already analysis on regard delay causes of international construction project. For case study, NPP construction project in UAE was analyzed. Two groups were compared to identify the character of UAE project.

2.1 Delay Causes in International Construction Project and NPP Project

In the research of 24 reviews, delay cause in international construction projects were identified as; see right column of below table 1 [2]. Construction of a nuclear power plant project has its own characteristics that affect the exact project schedule and cost estimation. Inaccurate estimates can result in delays and over-costs, which could jeopardize the license to operate the nuclear power plant licenses.

Samer Alsharif and Aslihan Karatas in another study conducted a study and found the main causes of the delay in the nuclear power plant construction project [3].

Construction Projects	NPP Construction Projects
Missing Schedule Updates	Inadequate planning
Design Error/ECR	Finance and payment
Scope Change	Slow in Approving
Contractor	Variation
Materials/Vendor	Ground condition
Funding	Labour supply, and subcontractors
Schedule Productivity	Design changes
Resources Productivity	Material shortage
Plant Support Engineering	Manufactured and imported items
Rework	Site Management
Owner decision	Weather
Weather	Fluctuation
Other/Delays	Construction mistake
	Contractors experience
	Contingency or unforeseen

Table 1. Causes for Delay

2.2 Delay Causes in NPP Construction Project in UAE (Identification of Problems)

Authors analyzed total 89 monthly progress reports (MPRs) from Jan 2010 to May 2017. MPR is an official document, and the author can analyze it based on that report. Delayed activities are described and reasoned.

Causes for Delay	Count
Delay in precedence work	3,971
interference occurs	811
Undefined	470
Const. Method Change	383
Delay in material delivery	315
Design Change	311
Lack of manpower	293
Design Delay	196
Delay in Selection of Subcontractor	186
Delay in Owner Decision	125
Quality	103
Lack of equipment	75
Procurement Delay	71
Work Stop	58
Review	51
Working Condition	39
Low productivity	23

Table 2. Causes for Delay in UAE NPP Construction Project

Total delayed activities were 7,513. MPR contains most issues regarding schedule. The MPR

However, the NPP construction project in UAE uses MPR to simply manage activity number, impact, original schedule, causes of delay and measures. The omission of the managing field and data is insufficient for effective schedule management. Also, construction risk management was not effective. Currently, risk management in the UAE NPP is managed by hand without scientific or computerized tools.

3. Schedule Risk Analysis

Schedule Risk analysis involves examining how project outcomes and objectives might change due to the impact of the risk event. Once the risks are identified, they are analysed to identify the qualitative and quantitative impact of the risk on the project so that appropriate steps can be taken to mitigate them. This study used Primavera Risk Analysis to analyse the risk of the project and to find the anticipated schedule, cost and finish date. Analysis used 17 factors of delay identified previous work above to mitigate and compare the project's auxiliary building schedule, cost, and finish date.

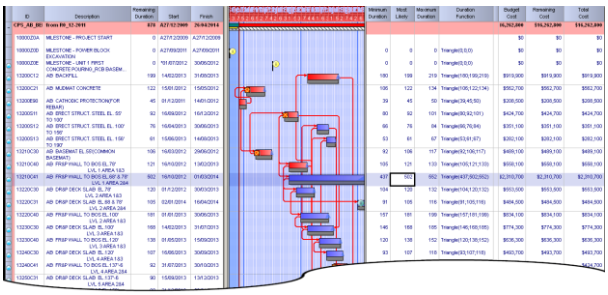

Figure 2. Input Risk Analysis

After running pre and post-mitigation of risk register authors can get the data. Figure 2 allows risk management to compare project impacts with and without mitigation of risk and no risk at all. If the project does not consider the risk, the auxiliary building would be finished on 30 Apr 2014. In case of pre-mitigate, highest probability to finish in 10 May 2014, beside post-mitigate is on 7 May 2014, the result provides a difference between risk management and non-risk management.

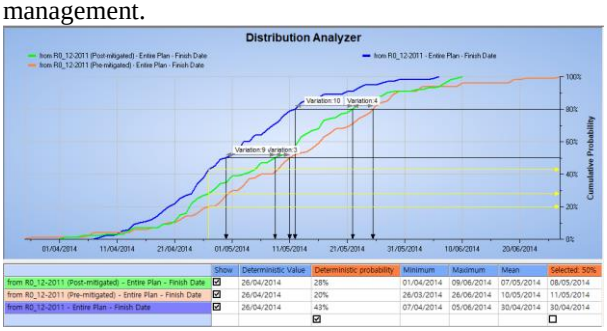

Figure 3. Distribution Analysis

4. Preliminary Schedule Management Framework

During the analysis of delay causes of UAE project, the authors confirmed the limitations of the project's schedule management. In particular, the project was focused on monitoring for the construction schedule. This monitoring was useful to check the construction status of the past and present, but it can be a fatal disadvantage that cannot build a mitigation measure for schedule impact or lesson learned for next project. MPR's schedule delay table, which is the center of the project's schedule management, was changed and operated several times after the project started.

Field	Use in UAE	Recommend to add	Description
Activity Number	O	O	Unit, PBS, Work type
Activity Name	O	O	Activity Name
Planned Start/Finish Date	O	O	To see the Original Schedule
Duration(Current)	X	O	To see the Original Schedule
Critical	X	O	If it is critical, the management can manage intensively
Actual Start/Finish Date	X	O	To see the Original Schedule
Duration(Actual)	X	O	To see the Original Duration of Work
Reason of Delay	△	O	To see the Reason of Delay
Impacted Precedence Activity	X	O	To check the root cause of delay
Impacted Successive Activity	X	O	To see the Impacted Successive Activity
Mitigation Measures	△	O	To manage catchup
Division of Responsibility	△	O	To give a responsibility

Table 3. Suggested field for Managing the Schedule Effectively

The Prime Contractor of the project aims to be the leading company of the International Nuclear Power Plant in the future. In order to do that, it is necessary to accumulate construction experience in UAE as meaningful data. It is necessary to establish and manage a consistent and meaningful schedule management framework from now on.

5. Conclusions

This study reviewed various studies and practice in UAE. The major delay factors of the UAE project are investigated in Section 2, and compared to other construction project. The necessity of schedule risk analysis to response these factors of delay was explained in Section 3. In addition, effective schedule management and additional criteria required for schedule management were suggested in Section 4. The results show the many necessities of adopting advanced schedule management skill in field. Of course, due to the lack of the data and information, authors assumed the data and practices, but this suggested framework for risk schedule management would be useful for considering risk causes and optimizing the schedule risk. In the near future, Korean team might have another chance to build the NPP in abroad. In that time, this kind of schedule management tool would be helpful to optimize schedule and to manage risk.

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