

## Enhancing Safety in Nuclear Power Plant by Identifying Successful Performance

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### 1. Introduction

Learning from experience is essential and effective to achieve safety at nuclear power plants. So licensees in the nuclear industry are required to collect and analyze lessons from their operation events in order to prevent the recurrence of similar events. IAEA reports that the reasoning why learning is such an essential aspect to safety-critical organizations is because it is assumed to enable the organization to respond effectively to environmental challenges and turbulence, and to avoid the occurrence of adverse events.[1] And many national and international regulatory bodies make guidelines and requirements that enforce the implementation of lesson from operating experience.

To prevent the recurrence of some events, it is natural that many learning process focuses on failure. These traditional approach emphasizes avoiding things that go wrong. It is tend to focus on identifying the causal links that have led to failure and then attempts to eliminate them. However, these approaches begin to show symptoms of their limitations in ultra-complex systems such as nuclear power plants.[2] As the systems are unstable and unpredictable, everything cannot go as planned and right way just eliminating a single component failure or risk factor.[3]

Modern safety theories suggest that using success as source for learning may be good. These approaches focus on understanding the reasons behind successful activities which are largely ignored by traditional approaches.[3] The key concept here is performance variability in complex system cannot be completely removed. So it needs to be maintained in such a manner that it leads to positive outcomes by identifying the contributing factors that affect successful activities.

This paper summarizes a preliminary version of framework for capturing successes. Then, we introduce the progress of empirical study process at nuclear power plants in Korea.

### 2. Steps and principles for capturing successes

#### 2.1 Four steps for capturing successes

In order to investigating the concept of success how it is perceived, recognized and capturing successful performance, the four steps below are required.[4]

- (1) **Case selection:** In this step the main topics that should guide the data collection should be defined to establish an empirical basis for development of principles for capturing successful performance.

- (2) **Data collection:** data collections methods should be determined such as interviews, observations and event reports, etc. for the various situations in this step. Identification of the methods for gathering data might formulate the guidelines. The guides should ensure that the data collected will reflect the data needed to answer the research questions. After that, we gather data in the field.

- (3) **Episode Analysis:** The analysis can start from the raw data collected in step 2. First, it is important to establish of the complete event sequence which means the chronicle of what happened. Generally, combining observations and interview date and linking additional related information from event report and other documents is main process in this step. What were not considered as a success performance by an interviewee, may be seen as successful – and vice versa. To identify success occurrences, criteria for assessing the event have to be prepared.

- (4) **Assessment:** In this step, it is possible to extract critical aspects associated with positive outcomes from episodes. “Operation experience” process can be formulated to share.

#### 2.2 Principles

##### Acknowledge that success may take many forms

: Success is a complicated and multidimensional phenomenon that can be captured in various ways. This means that situations where a task that has previously considered a success might be found out to be a failure, later. Because of this characteristic, changes in the extent to which a task was successful from some perspective may not be reflected to everyone that was involved with the task. We can understand of success over time based on changing in criteria, stakeholders, outcome, expectations, environment, subjective, etc. So a basic approach to success is acknowledging the complexity of success and attempting to approach it from multiple perspectives may provide better opportunities for learning.

##### Look closely at the task progress

: After choosing success episode that has taken place during task execution, looking closely at how the task progressed may provide good evidence regarding how the success was achieved and what could be learned from it. It is possible to understand how these processes

were begun and carried out with useful information regarding what was actually done to achieve the success. This process can be done asking questions such as “What decisions were made?” “What actions were taken?” “What initiated the decisions or actions?”

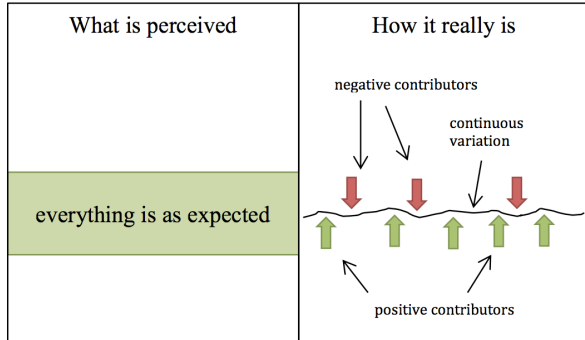


Figure 1. Illustration of the hidden processes behind performance (NKS, p.87)

Analyze the reasons behind the successes

: It is necessary to understand what the reasons behind the successes were. One approach is to begin a analysis of what constituted success or what contributed to success. Formal procedure(e.g. instructions, checklists, regulations, rules), informal practices(local good practices, tacitly embedded knowledge), adaptive performance(e.g. anticipating future developments, responding to unexpected events) are some of the most important constituents of success. There are also a variety of contributing factors such as organizational factors, group processes, performer characteristics, technological factors. It is easy to find these factors in established analysis methods such as event investigation and safety culture evaluation models.

Evaluate the successes critically

: This principle means that success analysis should be to establish, whether the organization wishes to embrace the activity that led to the success or not. For all activities that lead to a successful performance are not necessarily generalizable, it requires critical evaluation of what the successes were and how the successes were achieved.

**3. Empirical study at Nuclear Plant in Korea**  
(in progress)

This study aimed at demonstrating the validity of the framework above and enhancing safety of NPP. In order to identifying successful activities in Korea NPP, we collected the date that considered good performance from KHNP since 2015. And then we select the most appropriate cases for each site based on safety culture principle which is developed by KINS. The lists are below. Currently, it is planned to interview relevant staff and manager and to analyze event report. Next, episode analysis and assessment will be performed.

Kori-2	Case description
	-Preemptive promotion of FHA(Fire Hazard Analysis -MSO(Multiple Spurious Operation) scenario analysis
	Subjective success criteria
Hanul-2	Case description
	- Detects Debris Filter bellows swelling abnormality and performs emergency maintenance work during daily check
	Subjective success criteria
Wolsong-2	Case description
	- Application of Tritium Monitor by Technical Specification
	Subjective success criteria
	- Conformance with the regulations

**4. Discussion**

In this paper we introduce a framework to how successful performance can be captured. We found that success is a complex and multidimensional concept that can take many forms. It is observed that success can have properties such as time and situation-dependence and that it relates to the expectations of multiple stakeholders.

Based on this framework, we are carrying out a case studies in nuclear power plants in Korea. It can elaborate the concept of success in nuclear industry and how it can be utilized for learning purposes. We hope that commonly shared “success story” which identified and captured, improve team-spirit and work motivation in future NPP tasks. Similarly, developing these activities is important in order to avoid unwanted side-products of learning from success and to maintain good overall culture in the organization.

**REFERENCES**

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