Review of Reactor Oversight Process for Security in the US and Japan

So Eun Shin[a*], Youngsuk Bang[a], Keon Yeop Kim[a], Heung Gyu Park[a], Yong Suk Lee[a], Ha Neul Na[a]
[a] FNC Technology Co., Ltd.,
*Corresponding author: shin0811@fnctech.com

INTRODUCTION

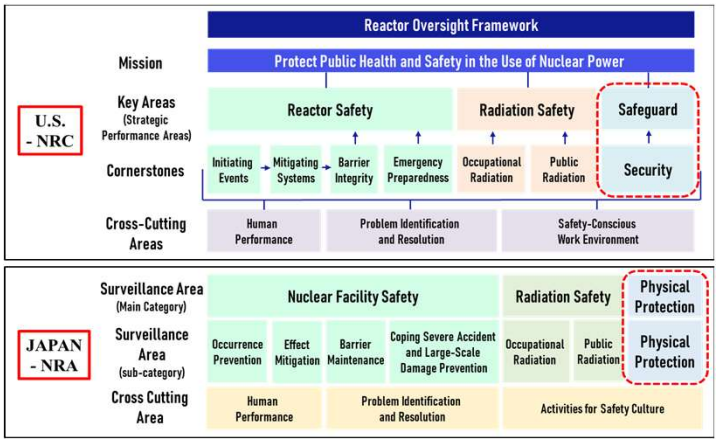
The Reactor Oversight Process (ROP)

- The ROP was first introduced by U.S. Nuclear Regulatory Commission (NRC) in April 2000 to inspect, measure and assess the safety and security performance of operating commercial nuclear power plants and respond to any decline in their performance.[1]
- Japan actively reformed the regulatory framework after Fukushima accident and adopted the ROP framework in April 2020.[2]
- In Korea, ROP for safety has been studied extensively; however, ROP for security has not received much attention.
- In this study, the ROP for security of the US and Japan have been reviewed and compared.

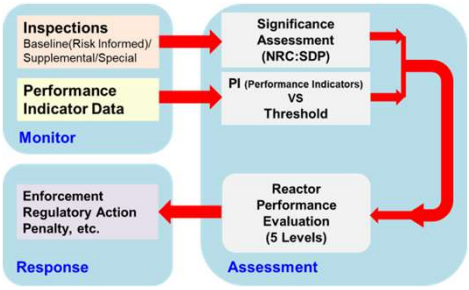
METHODS

ROP Frameworks

- The ROP monitors the plant performance in seven cornerstones.
- The focus is given on graded regulation based on objective risk and performance measurement.
- The Cross-Cutting Areas (CCA) are additionally reviewed to identify key issues that have a common influence on the seven cornerstones.
- In Japan, the security is assessed as a cornerstone of "Physical Protection".



Flowsheet to Perform the ROP



- The regulatory agency (NRC or NRA) collects the inspection results and the licensee collects performance indicator data.
- The significance assessment like SDP (Significance Determination Process) of NRC is used to assess the impact of inspection results on safety/security and the performance indicator is compared with the established thresholds.
- The reactor performance is evaluated by considering both results of the significance assessment and the performance indicator evaluation, and then countermeasures are taken by dividing it into 5 columns.

Performance indicators related the security

- Only Green and White thresholds are established for the security PI.
- The PI measures the aspects of security program that are not specifically inspected by the NRC's baseline inspection program.

	Cornerstone	Performance Indicators
US-NRC	Security	Security system equipment availability
JAPAN-NRA	Physical Protection	Percentage of unusable time of intrusion detectors and surveillance cameras (limited to those installed in restricted areas and surrounding protected areas)

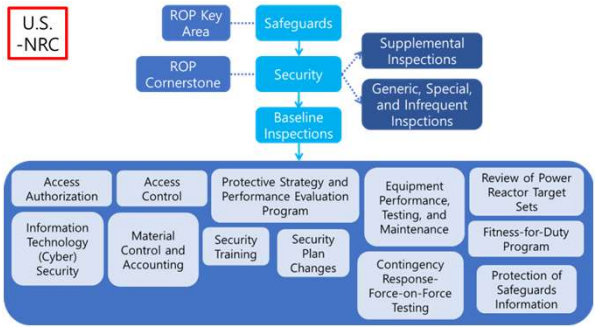
Significance Assessment

- The US-NRC introduced the Significance Determination Procedure (SDP) that grades and marks the importance of inspection results according to impacts on safety or security.
- The four-grade classification is shown as follow table, according to the significance assessment of the US/Japan.

	Quantitative Assessment		Qualitative Assessment
	ΔCDF (/yr)	US: ΔLERF (/yr) / JAPAN: ΔCFF (/yr)	
Red	> 1E-4	> 1E-5	• A level that has a large impact on the function or performance of securing safety and makes it impossible to use the reactor
Yellow	1E-5 ~ 1E-4	1E-6 ~ 1E-5	• The level of having an effect on the function or performance of securing safety and a significant decrease in the safety margin
White	1E-6 ~ 1E-5	1E-7 ~ 1E-6	• It has an effect on the function or performance of securing safety and the decrease in safety margin is insignificant, but the level that needs improvement due to regulatory intervention
Green	< 1E-6	< 1E-7	• Although there is an effect on the function or performance of securing safety, it is limited and extremely small, and the level to be improved according to the operator's correction program (CAP)
Minor	Little to no impact on safety		

* CDF: Core Damage Frequency, LERF: Large Early Release Frequency, CFF: Containment Failure Frequency

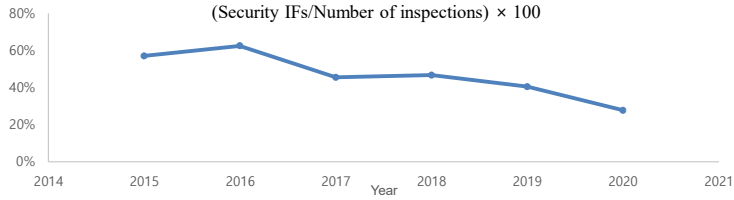
Inspection Area of the Security Cornerstone



- The NRC inspection guide for security is described in IP (Inspection Procedure) 71130, and it is subdivided into twelves and provides each inspection guide.
- Inspection procedures for the physical protection cornerstone in Japan are mainly composed of eight parts. It is somewhat different from the composition of the NRC inspection procedures.
- As a result of the terrorist attacks on September 11, 2001, the US did not disclose details about the result of security inspection to prevent providing security-related information to a possible adversary.

Historical Performance for Security [3]

- There are no IF(Inspection Findings) for security above "White" grade in the US from 2012 to 2022.6.
- In the case of Japan, there was a security IF with the "Red" grade in 2020. Therefore, it was evaluated as the 4th grade for response in the NRA annual comprehensive evaluation. Illegal use of ID card at Kashiwazaki-Kariwa nuclear power plant is the reason of the "Red" grade.
- The ratio of the number of IFs to the number of inspections is gradually decreasing in the US.



Security IFs(Total)	2015	2016	2017	2018	2019	2020
Total number of inspections conducted	242	224	230	192	180	162
Total Number of IFs	138	151	110	113	98	67
Total number of green findings	127	137	98	104	93	57
Total number of greater-than-green findings	1	2	3	0	1	1
Total number of SL IV violations	9	6	9	9	4	4
Total number of greater-than-SL IV violations	1	6	0	0	0	5

RESULTS

- The ROPs of the US and Japan are similar in view of the overall concept, the regulatory framework and the flowsheet to perform ROP, because Japan introduced the ROP in 2020 by benchmarking the one of the US.
- Unlike in the US which has not had an inspection finding above "White" grade for the past decade, Japan has the "Red" grade of inspection finding in 2020.
- Based on the case of Japan, which drastically changed the inspection system by benchmarking the ROP of the US-NRC after the Fukushima accident, a system for introducing the security field of ROP in Korea can be established.

REFERENCES

[1] NUREG-1649, Reactor Oversight Process, Rev. 6, U.S.NRC, 2016.
[2] KINS/ER-1149, Review of Japan's Nuclear Regulatory Inspection System, KINS, 2020.
[3] NUREG-1885, Rev. 14, Report to Congress on the Security Inspection Program for Operating Commercial Power Reactors and Category I Fuel Cycle Facilities: Results and Status Update, Annual Report for Calendar Year 2020, U.S.NRC, 2021.