A Study on Improving Domestic Security Regulation System considering Experience and Current Status of U.S.NRC

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1. Introduction

Nuclear Safety and Nuclear Security has a common aim of protecting human life and health and the environment. However, they have different focuses and measures; nuclear safety is to achieve of proper operating conditions on risks from unintended events while nuclear security is to prevent, detect and response against malicious acts (intended actions) [1]. Since the first days of nuclear industry, nuclear safety has been the first priority while the attention on nuclear security has been continuously increased [2~4].

To prevent the spread of nuclear weapons and weapon technologies, the safeguard has been considered importantly. The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) has been prepared and signed in 1969. With the increased concerns and to strengthen the nuclear security, the physical protection as the most positive mean among nuclear controls and with cyber security has been emphasized to protect against theft, lose or unauthorized diversion of nuclear materials and against sabotage of nuclear facilities by individuals or groups. IAEA prepared the INFCIRC/225, Recommendations for the Physical Protection of Nuclear Material in 1972 and INFCIRC/274, the Convention on the Physical Protection of Nuclear Material has been established in 1979. Each country has implemented the regulatory frameworks to strengthen the nuclear security. Currently, the physical protection is considered a synonym for nuclear security and is distinguished with nuclear safeguards.

Historically, the nuclear stakeholders and the regulation agency/government have been struggling between essential regulations and excessive regulations. The licensing burden has increased the construction and operation cost of nuclear power plants, which hinders the competitiveness of nuclear energy. With limited and finite financial and human resources, the increased procedures and regulations to follow would delay the licensing process and may result in insufficient inspections or reviews. To resolve the issues, the risk-informed performance-based regulation has been studied extensively and established as a basis of the reactor oversight in U.S.

In this study, the Strategic Goals and Implementation Framework of U.S. Nuclear Regulatory Commission (NRC) has been reviewed in view of changes in security considerations. Then, the current Korean nuclear regulatory system has been reviewed. With the comparison of the regulatory system and framework, the insights and the considerations to improve the efficiency of nuclear security regulations have been discussed.

2. Security in Developing Nuclear Regulation Framework of U.S. NRC

U.S. Nuclear Regulatory Commission (NRC) has established in 1975 and has a mission to license and regulate the Nation's civilian use of radioactive materials to provide reasonable assurance of adequate protection of public health and safety and to promote the common defense and security and to protect the environment [5]. Their strategic goals, long-term strategies and performance expectations have been provided in Strategic Plan, which is prepared every 4 years since 2010. Strategic Goals form the basis for a set of performance goals and indicators established to help the agency monitor and understand progress. All organizations within the NRC play a significant role in achieving the strategic goals. As can be seen in Table I, the security was included in Nuclear Material Safety in FY2000-2005 Strategic Plan. After the events of September 11, 2001, the importance of physical security had received significant attentions. Since then, *the nuclear security has been considered explicitly and stated in Strategic Goals not as a sub-component of Safety*, which represent that NRC increases and expands its efforts on security-related activities. Note that in strategic goals for 2022~2026, the safety and the security has addressed in a strategic goal, which represents the emphasis on the integrated and comprehensive regulation on safety and security matters.

Table I. Comparison of Strategic Goals of U.S.NRC

Fiscal Years	Strategic Goals
2000-2005	Nuclear Reactor Safety / Nuclear Material Safety / Nuclear Waste Safety / International Nuclear Safety Support
2004-2009	Safety / **Security** / Openness / Effectiveness / Management
2008-2013	Safety / **Security** (Organizational Excellence)
2014-2018	Safety / **Security**
2018-2022	Safety / **Security**
2022-2016	Safety and **Security** / Organizational Health / Stakeholder Confidence

The Reactor Oversight Process (ROP) is the U.S. NRC's program to inspect, measure, and assess the safety and security performance of operating commercial nuclear power plants, and to respond to any decline in their performance and has been implemented since April 4, 2000 [6]. As can be seen in Fig. 1, there are three key strategic performance areas: Reactor Safety, Radiation Safety, and Safeguards. Each strategic performance area has cornerstones, which are affected by cross-cutting areas. NRC develops an oversight process based on inspections and performance indicator data collected by licensees. NRC evaluates inspection findings for safety significance using a significance determination process and compares performance indicators against prescribed risk-informed thresholds. Then, the agency assesses the resulting information and determines an appropriate response using the guidelines in an action matrix. This oversight program provides a more predictable and objective approach to enforcement that is commensurate with the plant performance declination and violations.

As a consequence of the terrorist attacks on September 11, 2001, ROP was modified so that individuals could not obtain and use sensitive, security-related information about a nuclear facility's design, operation and protective capabilities for malevolent purposes [7,8]. In order to protect security-related information from public disclosure, NRC developed and implemented a security assessment process separate from the safety cornerstones within the ROP framework on May, 2005. However, the staff recognized that the application of separate assessment processes had the potential to programmatically constrain its regulatory response and not holistically evaluate licensee performance. Therefore, *the security cornerstone was reintegrated into one ROP action matrix* that would include inputs from all seven ROP cornerstones on July 1, 2012 to more accurately reflect a holistic representation of licensee performance. Currently, the security performances of the plants are available on the web, but the detailed information about the inspection findings are not publicly available.

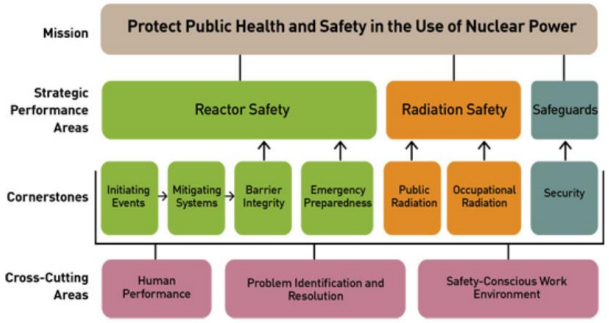

Fig. 1. U.S.NRC's Reactor Oversight Framework [6]

3. Security Regulation Program in Korean Nuclear Regulation System

Regulatory authority of Korean government is Nuclear Safety and Security Commission (NSSC). It established in 2011 having missions of protecting people and the environment and to contribute to the peace of mankind [9]. NSSC leads roles of rulemaking/enforcement on nuclear facilities and activities to ensure safety and developing/implementing nuclear regulatory policies. NSSC is delegating technical review and inspections on nuclear safety and nuclear security to KINS and KINAC, respectively. As a safety regulatory expert organization, Korea Institute of Nuclear Safety (KINS) established in 1990 and has been carrying out functions regarding nuclear safety review and inspection and developing technical standards and guidelines [10]. On the other hand, Korea Institute of Nuclear Nonproliferation and Control (KINAC) established in 2006 and, as a regulatory expert organization, has been executing safeguards, physical/cyber protection and export/import control regarding nuclear facilities and materials [11].

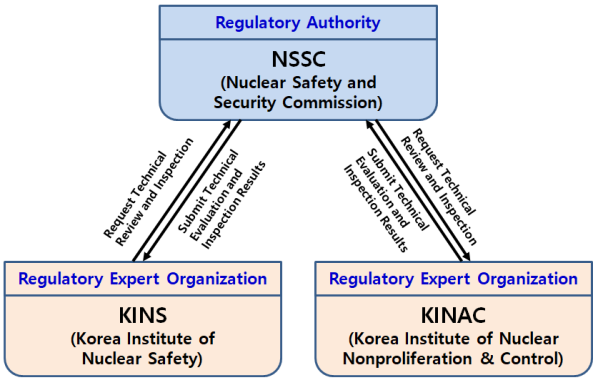

Fig. 2. Korean Nuclear Regulatory Framework [12]

In Table I, the inspection procedures for security of U.S. NRC's ROP and KINAC have been compared [13]. The inspection aspects for both countries are covering overall similar areas with minor differences. For example, 1) the security against the high-power electro-magnetic pulses are explicitly covered only in Korean regulations, 2) in Korea, the Force-on-Force Testing is not required. Regarding Performance Indicators(PIs), the data for availability of security systems and failures of the personnel screening and fitness for duty process have been selected as performance indicators. On the other hand, there is no performance indicator program related to security in Korea. It is important to note that it would be inappropriate to judge strictness or rigorousness only by inspection program because the fundamental regulatory concepts for both countries are different in view of the risk-informed and performance-based regulation and holistic performance assessment in decision-making).

Table II. Comparison of Security Inspection Procedures in US and Korea

US (NRC ROP)	Korea (KINAC)
71130.01 Access Authorization	KINAC/RS-104 Access Control, KINAC/RS-105 Security Search
71130.02 Access Control	
71130.03 Contingency response – Force-on-Force Testing	KINAC/RS-116 Physical Protection Drill
71130.04 Equipment Performance, Testing and Maintenance	KINAC/RS-102 Intrusion Firewall System, KINAC/RS-103 Intrusion Detection and Evaluation, KINAC/RS-106 Communication System, KINAC/RS-108 Central Alarm Station and Alarm System
71130.05 Protective Strategy Evaluation and Performance Evaluation Program 71130.06 Protection of Safeguards Information	KINAC/RS-107 Vital Area, KINAC/RS-109 Guard and Patrol, KINAC/RS-114 Physical Protection for Transportation, KINAC/RS-115 Insider Threat Prevention and Protection, KINAC/RS-101 Security Organization, KINAC/RS-113 Security Emergency Response Program
71130.07 Security Training	KINAC/RS-110 Qualification of Physical Protection Workers
71130.08 Fitness-for-Duty Program	KINAC/RS-110 Qualification of Physical Protection Workers
71130.09 Security Plan Changes	KINAC/GR-101~103 (Review Guidelines according to Change)
71130.10 Information Technology Security (Cyber Security)	KINAC/RS-011 Cyber Attack Response Drill, KINAC/RS-015 Security on Computer and Information System, KINAC/RS-018 Cyber Security on Wireless Connection, KINAC/RS-019 Critical Digital Asset Identification, KINAC/RS-020 Protection from High-Power Electro-Magnetic Pulse
71130.11 Material Control and Accounting	KINAC/RS-111 Record and Report, KINAC/RS-200 Account and Control of Special Nuclear Materials
71130.14 Review of Power Reactor Target Sets	Only for the vital area, Vital Area Review Guidelines (Identification Vital Areas)

It is important to note that licensee nuclear safety and security have been regulated by separate organizations. Though NSSC is the regulatory authority in charge of decision-making and enforcement, the inspection and review of licensee performance for safety measures and security measures have been independently conducted by two different organizations. One of the reasons of having two different organizations in Korea could be the geopolitical situation in Korea. The nuclear security as well as general security matters in all industrial and societal areas have been considered very importantly. It has been generally recognized that the nuclear security regulations in Korea have been applied and implemented in a stricter way than the ones of international recommendations and general standards. In addition, the nuclear facilities and nuclear materials in Korea have been also supervised strongly under the law of several other governmental entities, e.g., Ministry of Defense, National Intelligence Services.

Due to close relationships between nuclear safety and nuclear security [14], many countries have a single regulatory body with assistances of other governmental entities on security matters, e.g., police or military forces. For balanced and timely regulatory response with integrated assessments, it would be beneficial to share the inspection findings and communicate review results. On the other hands, there would be management issues, e.g., information sharing. In a safety respect, the transparency and openness would be promoted values while security culture requires confidentiality. Careful considerations should be given to safety-security interface for efficient utilization of regulatory resources to maximize the synergy and minimize the conflicts.

Considering that there is only one nuclear power company in Korea, i.e., Korea Hydro & Nuclear Power (KHNP), the communications with regulators would be shared smoothly and the safety and the security policies and decisions could be applied in a consistent manner. Though there are several nuclear power plant sites, the regulatory resources could be saved because the regulatory authority could communicate only with KHNP.

In terms of cross-cutting area, the current regulations in Korea require the formal regulation framework for continuous monitoring. For example, though the safety culture has been emphasized by regulatory authority and government for a long time, it relies on the licensee's voluntary programs. Without clear direction and targeted goals, the efforts would be diluted and the resources of licensees and regulators would be likely to be wasted.

4. Conclusions

The concepts and the main focuses of nuclear safety and nuclear security have been compared and the regulatory changes in U.S.NRC. Importantly, it has been changed after the events of September 11, 2001; 1) the security has been separated from the safety and considered explicitly in NRC's strategic goal, 2) the performance of the safety and the security has been separately assessed but reintegrated for assessing overall plant performance and determining the regulatory responses, 3) the detailed security-related

information has been classified and no longer publicly available.

In Korea, the U.S. ROP framework has been reviewed and studied extensively to enhance the nuclear safety and improve the efficiency of nuclear regulation. Though ROP would be the most advanced regulatory framework which many other countries have referred to, the unique situations in Korea should be considered and the management of safety and security interfaces should be carefully dealt. Especially, an efficient coordination mechanism between the two regulatory bodies should be prepared to ensure that regulatory requirements are compatible and serve optimally to advance both safety and security.

As a conclusion, nuclear safety and security have been regulated by different organizations, which is different with NRC. In addition, the risk-informed and performance-based approach has not been fully incorporated into the regulation philosophy and practices. In future, special efforts should be given in utilizing the experience of NRC while considering unique situations in Korea.

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