Regulatory improvement plan for Safety-Security Interface (SSI) in terms of Nuclear Security

Song Lee*, Poe il Park, Kookheui Kwon
[a]*Korea Institute of Nuclear Nonproliferation and Control (KINAC), 1418 Yuseong-daero, Yuseong-gu, Deajon 34101*
**Corresponding author: sssong@kinac.re.kr*

Keywords: Nuclear Safety, Nuclear Security, Security, Regulation

1. Introduction

Nuclear power, a zero-carbon energy source, is emerging as an essential solution for achieving carbon neutrality by 2050. Consequently, there is a global push to advance the development of Small Modular Reactors (SMRs). As a result, nuclear power generation is expected to become more widespread. However, nuclear power plants have the potential to cause catastrophic damage to humanity in the event of unforeseen incidents, such as terrorist attacks or accidents like the Fukushima nuclear disaster.

If the safety and security issues of major nuclear facilities are dealt with in interface with nuclear disasters, it is expected that a more efficient nuclear regulatory system can be established.

This study proposes improvements to the legal-institutional and inspection systems related to nuclear security in order to better interface the nuclear safety and security regulations.

.

2. Current Regulations

This section describes the current issues related to nuclear safety regulation and nuclear security regulations in the Republic of Korea and the United States.

2.1 Nuclear Safety and Security Regulations in the Republic of Korea

Table1. Comparative Analysis of the Characteristics of Nuclear Safety and Security [1]

Category	Nuclear Safety	Nuclear Security
Concept	Maintaining proper operating conditions of nuclear facilities to prevent accidents of mitigate their consequences, thereby protecting workers and preventing unintended radiation exposure to the public and environment	Maintaining proper operating conditions of nuclear facilities to prevent accidents of mitigate their consequences, thereby protecting workers and preventing unintended radiation exposure to the public and environment
Measure	• Engineering safety system design and management (by licensee) • Safety regulation (by government)	• Physical protection (by licensee) • Safety regulation (by government)
Actors	National government	• National government • International organizations (IAEA)
Characteristic	• Transparency of information • Accessibility	• Confidentiality of information • Restricted access
Objective	Preventing and mitigating harm to the public and environment from the risks of nuclear power plants.	

Korea's Nuclear Safety Act and the Act on Physical Protection and Radiological Emergency (APPRE) are independent legal systems, respectively.

Korea Institute of Nuclear Safety (KINS) is responsible for matters related to the Nuclear Safety Act, while Korea Institute of Nuclear Nonproliferation and Control (KINAC) handles matters related to the APPRE. The purpose of the two legal systems is different. According to Article 1 of the Nuclear Safety Act, the purpose of nuclear safety regulations is “to protect humans and the environment from nuclear facilities and radiation hazards.", and, the purpose of nuclear security regulations under the APPRE is to "prevent the unauthorized removal and sabotage of nuclear materials and facilities".

However, for the effective regulation of safety and security in nuclear facilities, KINS and KINAC should depict a unified objective to integrate the legal purposes addressed above. A unified objective could be expressed as: "To protect the unauthorized removal and sabotage of nuclear materials as in consequences radiation-related disasters that affect humans and the environment are prevented."

2.2 Safety and Security Interface Regulation Activities in United States (U.S NRC)

As part of Security-Safety Interface (SSI) activities, the Nuclear Regulatory Commission (NRC) has established a regulatory guide (RG) 5.74 which is applicable guidance to title 10 of the Code of Federal Regulations part 73.58 (10 CFR 73.58) to clarify SSI. If potential conflicts between security and safety are identified, the NRC mandates the implementation of appropriate compensatory or mitigation measures to maintain both safety and security [2].

Also, in 10CFR 73.55(m), prescribes requirements for the review of each element of a licensee’s physical protection program at least every 24 months. And the review must include an audit of the effectiveness of the safety-security interface activities [3]. In this manner, the NRC is consistently working to achieve the regulatory for SSI.

3. Regulatory Improvement plan for Safety-Security Interface (SSI)

This section describes improvement strategies for nuclear SSI. Two methods were described. First is Legal institutional improvement measures. The second is inspection improvement measures.

3.1 Legal-Institutional Improvement Measures

3.1.1 Setting of Specific Standards for Vital Areas

According to 10CFR73 in the United States, the minimum vital area based on the High Radiological Consequence (HRC) was presented as follows from (a) to (d). By this, it is necessary to present specific vital areas based on HRC in the Protection and Prevention Act through additional research suitable for Korean nuclear reactors.

(a) Control room of the nuclear power plant
(b) Spent fuel storage pool
(c) Central alarm station
(d) Secondary alarm station

3.1.2 Setting of Vital Equipment

The Fukushima nuclear accident was triggered by a 9.0-magnitude earthquake that stopped A.C in Units 1 to 3. After the loss of all alternating current power, including the shutdown of the emergency generator due to the tsunami caused by the earthquake, the cooling system did not work, stopping the inflow of coolants to cool the reactor core and leading to a hydrogen explosion.

Therefore, it is necessary to select vital equipment not only by considering artificial threats such as unauthorized removal and sabotage but also by taking into account the impact of natural disasters such as flooding and tsunami. Specifically, in safety system of nuclear power plants, where power can be selectively supplied using Alternate AC Diesel Generator (AACDG) or Emergency Diesel Generator (EDG) on the accident situation, these backup power should be included in the vital areas.

3.2 Inspection Improvement Measures

3.2.1 Reorganize of Regular Inspection of Nuclear security (physical protection, Cybersecurity) systems

It is necessary to reorganize the inspection period for the nuclear security system of nuclear power plants to align with the revised inspection period for the nuclear power plant safety system.

In 2023, the Nuclear Safety and Security Commission (NSSC) of the Republic of Korea updated regulations. One of a change in the revised regulations is that the current nuclear safety system inspection will transit to a continuous inspection system. In the past, inspections were conducted during Over Haul (OH) periods. However, with the transition to a continuous inspection system, inspections are categorized into operational inspections, maintenance inspections, and in-depth inspections, and are conducted during the operating period.

On the other hand, regular inspections of nuclear security systems must be conducted every two years, as before, in consultation with the licensees, as stipulated by Article 12 of the APPRE.

It is essential to review the synchronize regular inspection periods for nuclear safety and nuclear security. By aligning these inspection periods, licensees can efficiently prepare for inspections of nuclear security systems and safety facilities. And simultaneously, ensuring that the review according to regulation of both nuclear safety facilities and nuclear security systems is addressed concurrently.

3.2.2 Promotion of the Introduction of Training Programs for Inspectors

Currently, the NRC is conducting initial training for employees through NRC inspector training program. The initiative aims of this program is to ensure that NRC staff possess the necessary knowledge and skills to effectively implement the reactors inspection.

The training program includes basic level training, proficiency level training, final qualification activities. Additionally, includes knowledge from recent inspector activities and updates to the inspection procedures. [4]

In relation to safety-security interface regulations, this study proposes the introduction of similar training programs for inspectors by KINS and KINAC.

By implementing these inspector education programs, inspection results can be shared, and targeted training for nuclear safety facilities and nuclear security systems can be provided. This approach aims to enhance the inspectors' capabilities and ensure effective implementation of safety-security interface regulations within the institution.

4. Conclusion

This study proposes measures to enhance the safety-security interface regulation for managing nuclear facilities. Specifically, it suggests reorganizing the legal framework for vital areas, revising the inspection periods for nuclear security systems, and implementing an inspector training program. These changes are expected to positively impact the development of more efficient nuclear regulation.

If related laws, regulations, and inspection systems are refined to better align with nuclear safety-security interface regulations, and if a flexible communication system between KINS and KINAC is established, it will lead to more transparent and safer nuclear operations.

REFERENCES

[1] SNU, Development of national interface technology between nuclear safety and security, 2012.
[2] NRC, 10CFR 73.58 “Safety/security interface requirement for nuclear power reactors, 2023.
[3] NRC, Regulation Guide 5.74 “Managing the safety/security interface”, 2015.
[4] NRC, Inspection manual Chapter 1245, 2023.
[5] KINAC, Development of the 3S interface in the regulatory point of view R&D Report, 2016.