

Unannounced Safeguards Inspection and its Efficiency Assessment

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1. Introduction

As the global nuclear landscape continues to change and verification challenges are growing and becoming more complex, the IAEA needed to improve safeguards efficiency under limited resources while effectively achieving safeguards objectives. Consequently, in accordance with the 2012 IAEA's General Conference Resolution (GC(56)/RES/13), the Director General of the IAEA conceptualized and structured the State-level concept (SLC) through the "The Conceptualization and Development of Safeguards Implementation at the State Level" (GOV/2013/38) submitted to the Board in August 2013. The SLC is a concept in which safeguards are effectively and efficiently implemented by considering a State's nuclear and nuclear-related activities and capabilities as a whole, within the scope of the safeguards agreement. The State-level approaches (SLA) is an IAEA's internal document describing the safeguards objectives for a certain State, the means of applicable safeguards measures, and the safeguards activities that the IAEA can perform on site and at its headquarters, according to the SLC.

The IAEA discussed with Republic of Korea (ROK) to lead the implementation of improved safeguards approach (i.e., SLC developed in 2013) and in particular, the IAEA expected that it could bring greater efficiency if ROK adopt the improved safeguards approach since ROK was the 5th highest cost member States as of year 2014.

The core of the SLA update in ROK is the Unannounced Inspection (UI) on the light-water reactor plants. The UI is one of the IAEA's safeguards activities which the IAEA inspectors need to get access to the strategic points within two hours of notification. Through the UI, the IAEA expected that safeguards efficiency can greatly be improved. ROK also expected that the ROK's nuclear non-proliferation will be further strengthened through the adoption of UI.

The IAEA's updated SLA was officially applied in September 2015 and the UI on the light-water reactor began to take effect in May 2016 after 12 months of pilot operation. In this paper, main contents of the updated SLA were reviewed. In addition, more than four years after the application of the updated SLA, it is examined whether the efficiency of safeguards has been

achieved as originally aimed. In particular, it is considered whether three organizations directly affected by the updated SLA, the IAEA, ROK's regulatory body and nuclear licensees, were able to achieve safeguards efficiency in their respective aspects.

2. Methods and Results

2.1 Major changes in the updated SLA

The major change in the updated SLA was the UI for light-water reactor plants. The existing remote monitoring equipments were uninstalled right after the application of the UI. However, those equipments are temporarily installed only during the open-core period. In addition, physical inventory verification (PIV) and design information verification (DIV) were not carried out simultaneously in the open core of the light-water reactor plants. In other words, only the PIV was carried out during the open-core condition. There were no changes to the nuclear fuel fabrication company and heavy water reactor plants. In case of HANARO research reactor which is classified as Category I facility, the IAEA surveillance cameras, which usually a stand-alone mode, has newly reconfigured to remotely send real-time monitoring data to the IAEA through the internet.

Regarding the IAEA's inspection frequency, the probability of inspection frequency was previously specified in the nuclear facility's safeguards inspection procedure. However, after the update of the SLA, the probability of inspection frequency became difficult for Member States to know because the frequency is specified in the IAEA's annual inspection plan which is not disclosed to the Member States. The inspection frequency for the random interim inspection (RII) on the light and heavy water reactor plants was previously written in the procedures that an inspection target is selected at an annual probability of 20%, but the updated SLA excluded it from the procedures and reflected it in the annual inspection plan.

Advance reporting requirements were also changed. Only the category I facilities in KAERI are subject to the advance monthly and quarterly report, but after the updated SLA, category III facilities were also included for the report.

In order to respond to IAEA's UIs following the application of updated SLA, KINAC, technical support organization for Nuclear Safety and Security Commission (NSSC) in ROK, needed to change the domestic independent safeguards inspection system. Existing domestic inspections were carried out simultaneously during the IAEA inspections and used the same procedures as IAEA inspections. To better respond to the IAEA's updated SLA, the domestic inspection system was reformed so that domestic inspectors conduct inspections at a different time from IAEA inspections and verify whether licensees abide by the safeguards relevant regulations approved by the NSSC. In the case of light-water reactor licensees, the facility entry control related regulations needed to be amended to let UI inspectors quickly get access to strategic points within two hours after the UI notification. Also a new system had to be established for immediate availability of inspection equipment, documents, and technical support personnel.

2.2 Efficiency assessment of the updated SLA

It is assessed whether the efficiency of safeguards has been achieved as originally aimed more than four years after the application of the updated SLA. The IAEA's inspection frequency, which can be represented as Person Day Inspection (PDI), was used to assess the efficiency. Contrary to initial expectations, the following Fig. 1 shows that no significant decrease on the PDIs of the light-water reactor plants have been made before and after the 2016's update of the SLA. Rather, the average yearly PDIs slightly increased after the updated SLA from 49 to 53 while Material Balance Areas (MBAs) are quite stable.



Fig. 1. IAEA's PDIs on ROK's LWR

This is due to the small increase in the UI which is the replacement of the RII for light-water reactor plants after the updated SLA. Although the frequency of the UI is not known, Fig. 2 clearly indicates that the UIs are carried out more often than the RIIs which were usually happened 20% annual frequency.

Table. 1. RII and UI of ROK's LWR

Year	RII				UI			
	'12	'13	'14	'15	'16	'17	'18	'19
PDIs	4	3	3	3	5	5	7	6

In conclusion, from the IAEA's point of view, it is difficult to state that safeguards efficiency has been achieved after updating the ROK's SLA in 2016.

At the ROK's regulatory perspective, the transparency of nuclear nonproliferation has been further enhanced through reform of the domestic independent inspection system and by dispatching inspectors to each LWR site's regional office to respond to the updated SLA. However, it should be further assessed whether the degree of resources and efforts taken by the ROK's regulatory body was appropriate. With respect to the licensee's perspective, it is clear that the workload has been increased after the SLA's update. Furthermore, it is also necessary to assess whether the site's security has been weakened due to the easing of the access control requirements.

3. Conclusions

In this paper, it describes how the IAEA's inspection activities changed under the updated SLA and what efforts ROK regulator and nuclear licensees made. In addition, it reviews whether the SLA enabled the IAEA and ROK to achieve the desired efficiency. In conclusion, it is difficult to say that the original goal of reducing the frequency of inspections has been achieved due to the increased frequency of inspections in the IAEA aspect. And it is clear that transparency in nuclear nonproliferation has increased due to the application of updated SLAs from the perspective of ROK's regulator and nuclear power operators. However, a sufficient assessment of whether the effort and resources have been appropriately invested will have to be studied. This study only focused on the safeguards efficiency using the PDIs, so more various aspects need to be further studied to assess the updated SLA as a broader perspective.

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