Introduction of an Integrated safeguards Approaches for Depleted, Natural and Low Enriched Uranium Conversion and Fabrication Plants

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1. Introduction

Since the Additional Protocol entered into force in ROK, the IAEA is developing the facility-specific Integrated Safeguards (IS) approaches with ROK cooperation before the Sate Level IS Approach. This paper mentions what the key elements of IS approach at Korea Nuclear Fuel Company (KNFC) is, and compares of traditional and integrated safeguards approaches. The IAEA defined the Integrated Safeguards as follows.

"The optimum combination of all safeguards measures available to the IAEA under comprehensive safeguards agreements and additional protocols achieve maximum effectiveness and efficiency in meeting the IAEA's safeguards obligations within available resources"

2. Current Approach

Under the traditional safeguards, both sides of the ROK and the IAEA agreed to apply the LEU and NU zone approaches in ROK. Since then, the IAEA has been performing a physical inventory verification and two interim inspections at KNFC and also implementing the simultaneous inspection at the NPPs storing fresh fuels in order to cover 'borrowing' at the time of PIV of KNFC. The LEU zone includes the LWR fuel fabrication plant and all LWRs, and the NU zone includes the CANDU fuel fabrication, the nuclear material storage facility including CANDU bundles and all CANDU reactors. And also both sides are operating the fresh LWR fuels tracking system because both sides don't need to verify fresh fuels again at LWRs, which were verified at KNFC before shipping. So far it is evaluated that zone approach helps the IAEA reduce three interims at KNFC as the current Safeguards Criteria requires five interim inspections at LWR fuel fabrication plant.

3. Integrated Safeguards Approach for DNLEU Conversion and Fabrication plants

Taking into consideration a conclusion of the absence of undeclared nuclear material and activities in a State, the IAEA will decide to apply the State Level IS Approach based on the facility-specific IS approachese. If the conclusions are drawn, the detection probabilities for defect test may be reduced from medium (50%) to low (20%). Verification of material balance should include full verification coverage of inventory changes (flow). For this purpose, short-notice random inspection (SNRI) will be used where conditions for their implementation can be met under arrangement agreed by both sides. Otherwise, random interim inspections with 7-days notice should be used.

Once a year, a PIT will be performed by the operator for each DNLEU conversion and fabrication plant. If there is more than one such facility in a state, the IAEA will verify the inventory (PIV) at 50% of them randomly selected. Table 1 is a comparison of traditional and integrated safeguards approaches. Therefore, for achieving maximum effectiveness and efficiency in meeting the IAEA's safeguards obligations, the IAEA has been considering to apply the facility specific IS approach at the KNFC.

Table 1 Comparison of Traditional and Integrated Safeguards Approaches

Activity		TS		IS	
Options				Base option	Alternative
PIT		annual PIT		annual PIT	
PIV		annual PIV		annual PIV	
Number of Interim Inspections for flow verification per year	announced (at least 7-day notice)	3 – 5		~1(N)/~3(LEU) SNRIs	~1(N)/~3(LEU) SNRIs(7-days notice random interim)
	SNRIs		3 – 5		
	UI		3 – 5		
Flow verification coverage		minimum 20%	100% (SNR/UI)	100%	
Borrowing coverage		at the PIV simultaneous inspections		covered by SNRI	at the PIV simultaneous inspections
Efforts (PDIs) PIV		~ 20 (+s)**		~ 10	~ 10 (+s)**
Interim		12 ~ 20 (4 X 3-5)		4-10	4 – 10

3.1 Physical Inventory Verification

All of nuclear material strata should be verified at the Physical Inventory Verification (PIV). Then, an inspector will verify the bulk material with low detection probability for gross, partial and bias defect, and the item form with low detection probability for gross and partial defects. And, in case implementing random interim inspection with 7-days notice, the simultaneous inspection at

randomly selected facility with borrowable material should be performed at the time of PIV of KNFC.

3.2 Random Interim inspections

To facilitate the implementation of interim inspection, the IAEA should be provided with up-dated inventories of the feed and product stores. The IAEA asks the operators declare the updated inventories of them kept within the residence time agreed by both sides by using mailbox system. It is annually required to perform average 3 inspections at facilities handling LEU and average 1 inspection at facilities handling NU.

In cases where SNRIs are implemented, "borrowing' is covered and inventory changes are verified with 100% verification coverage of domestic transfers. A short notice random inspection (SNRI) is an announced inspection using the shortest notification agreed by both sides. In any case, it should be shorter than the residence time of receipts and final products in the plant.

The use of random interim inspections with 7-day notice is acceptable only if the time during which the nuclear material remains available for verification is longer than 7 days. But it must be supported by additional safeguards measures and activities (e.g. simultaneous inspections, to cover the possibility of 'borrowing'). Both sides agreed to apply the short notice random inspection at the KNFC, and have been developing the facility specific IS approach.

3.3. Elements of Short Notice Random Inspection

In order to fulfill 100% verification coverage of domestic transfers in ROK, the IAEA asks the operator to declare the updated inventories of the new receipts and products stored within residence time by using mailbox system. The facility operators have to do the declarations at the time agreed by both side everyday, even though there are no inventory changes. So now, the facility operators are confirming how many days is the best residence time for both items because it will affect the frequency of SNRI and the number of verification samples then. Because of that, the residence time is the most important element of SNRI.

As a short notice random inspection (SNRI) is an announced inspection using the shortest notification agreed by both sides, the notice time is another important element to both sides. In case of IAEA, they want to get the shortest notification to increase the safeguards effectiveness. But, facility operator want to get a little longer notification because they have to prepare the books needed for SNRI. And also, a national inspection team of NNCA has to wait for its notice within notification time at all working days. Therefore a SNRI will play a burden to the facility operators and a national inspection team. But, the ROK agreed to apply SNRIs at KNFC because all inspection efforts in ROK decreases and it causes the IAEA develop the State Level Approach well.

4. Conclusion

The IAEA defined the Integrated Safeguards as the optimum combination of all safeguards measures available to the IAEA. In a State with a CSA and AP where the broader safeguards conclusion will be drawn. The IAEA develops the facility-specific IS approaches with the ROK cooperation and they will be incorporated into State Level IS Approach. For these works, both sides agreed to hold the IS working group meeting and have been discussing all facility-specific IS approaches needed in ROK. This paper will help us fully understand what the key elements of SNRI of KNFC is and make the final facility specific approach agreed by both sides.

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