

The Status of IAEA Safeguards on Domestic Bulk-handling Facility

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1. Introduction

Since Korea signed a safeguards agreement with the IAEA in 1975, domestic nuclear facilities are obliged to maintain records for data of nuclear material accountancy and control and report on inventory change to the IAEA. The IAEA conducts inspections on facilities to confirm the consistency for the data submitted by the nuclear facilities and to detect undeclared nuclear activities and diversion of nuclear materials.

In Korea, a total of 24 nuclear power plants, including light and heavy water reactors, are in operation, and fuel assemblies used in domestic nuclear power plants are manufactured and supplied by KEPCO Nuclear Fuel located in Daejeon.

Since KEPCO NF is bulk-handling facility and the amount of nuclear material moved every day is very large, about 2 ton-U, it is very difficult to record and report inventory change and track the history of nuclear material during a certain material balance period, unlike item counting facilities. Therefore, KEPCO NF operates a mailbox system with the concept of a daily 'transactions' for inventory changes in major storage where nuclear materials are brought in/out. the daily report of mailbox system is submitted to the IAEA in electronic file format.

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2.1 Mailbox system

KEPCO NF operates a mailbox system with the concept of a daily inventory change report for SNRI(Short-Notice Random Inspection). In principle, the daily declaration of inventory change should be submitted by the next day.

Daily Declaration includes batch ID, a amount of nuclear material, MBA and weight of the nuclear material container, etc.. Transactions for nuclear material are indicated in the IAEA as Arrival, Birth, Death, Return, etc. Also, the nuclear material should be stored in that location for 3 days. This means that the nuclear material brought into the main storage can not be moved for 3 days(Residence time) to give the IAEA an opportunity to inspect, and the nuclear material can be into the process or transported to another MBA after 3 days[1].

Table I: Definition of abbreviation for daily declaration

Abbreviation		Definition
A	Arrival	
B	Birth	powder received or fuel assembly produced
D	Death	powder went into process or fuel assembly is packed for shipment
R	Return	powder returned from process or fuel assembly returned into process
S	Shipment	

This mailbox system is being submitted to the IAEA using encrypted email(outlook). Also, the daily declaration is secured so that mail can only be sent from a specific PC that have certificate and connect security token provided by the IAEA. The agency uses the database files accumulated with daily declarations of mailbox report on SNRI[2].

2.2 Short-Notice Random Inspection

In principle, SNRI is notified two hours in advance, and IAEA conducts nuclear material verification for the main storage of KEPCO NF(UF6 cylinder, UO2 powder, fresh fuel assembly, powder and bundle for heavy water reactor). SNRI is performed once every quarter and takes about 2 days.

During SNRI, KEPCO NF provides a PIL(Physical Inventory List), GL(General Ledger) for storage and weight of the assemblies, etc. IAEA uses CIOSEP, IAEA's on-site software package, to conduct book examination of accumulated data from the daily declaration of mailbox system and a list of nuclear materials provided at the site. Also, 100% of item counting of nuclear material in storage is performed. Through random sampling among the PIL, NDA-based nuclear materials are verified and DA samples for precision analysis are taken.

2.3 Physical Inventory Verification

The IAEA conducts physical inventory verification (PIV) for all nuclear materials once a year.

KEPCO NF autonomously conducts physical inventory tasking(PIT) once a year, every 12 months, on light and heavy water reactor fuel processing processes. At this time, since all nuclear materials are

targeted, all production processes are stopped, and nuclear materials for each process are cleaned-out and collected in a container. Then, classification list for PIV is prepared by nuclear material stratum such as the quantity, shape, and location of each nuclear material.

IAEA conduct PIV to verify the data such as List of inventory item, PIL, MBR submitted by operator of KEPCO NF using CIOSP and design information verification(DIV). Since the amount of nuclear material stored in nuclear fuel, such as the type and shape of nuclear material, is large, the verification method and utilization equipment are applied differently, resulting in a large difference in verification time, etc.

2.4 IAEA software for Inspection : CIOSP

IAEA uses a Common Inspection On-site Software Package called CIOSP during inspection for KEPCO NF that can reflect the characteristics of various nuclear facilities. CIOSP is a highly scalable software package with a structure in which individual plug-ins that can support various inspection activities. The main functions of CIOSP are as follows [3].

- ✓ facility configuration
: MBA, Verification parameter, Stratification rule, Calendar etc.
- ✓ Inventory verification
: verification listing and verification details
- ✓ Book examination
: examination of General Ledger
- ✓ Comparison of records and reports
- ✓ Editing the inspection data
- ✓ Sampling size calculation
- ✓ Sample Random Selection

2.5 The Status of Program for Safeguards Implement

The IAEA utilizes CIOSP when inspecting domestic bulk-handling facilities. The IAEA conducts a review of the consistency of the accumulated mailbox declaration, inventory change reports submitted by facility such as the list and total amount of nuclear materials and general ledger classified by MBA and type of nuclear material. One of the main functions of CIOSP is to calculate the number of nuclear materials and output a list of nuclear materials to be verified among the provided PILs. Based on this, the IAEA executes non-destructive verification and collects DA samples for nuclear materials.

In other cases, EURATOM independently uses ENMAS(EURATOM Nuclear Material Accountancy System) for accountancy data management and VARO(Validation of Accountancy Records of Operators) program to support inspection implementation. VARO is a mobile version that supports the synchronization of on-site necessary data through data transmission to the headquarters and performs consistency check of accounting records, book examination and item selection for nuclear material verification. VARO is co-

operation with the IAEA by exchanging inspection data, results through VPN channel[3].

In addition, in the case of the United States, PNNL has developed PIE-IS(Precision Information Environment for International Safeguards), a mobile information platform, to provide information, data analysis, technical and logistics support related safeguards to IAEA inspection[4].

As mentioned above, in addition to the programs used by IAEA, many countries have attempted and developed their own programs to support inspection activities. In Korea, KINAC has supported a IAEA's inspection activities and been autonomously conducting national inspection. However, due to the absence of independent field-type software in Korea, KINAC borrows CIOSP and performs sample size calculations together with the IAEA, and checks whether the IAEA is performing inspections properly.

If a field-type inspection program for domestic bulk-handling facilities is developed in Korea, it is believed that the independence of IAEA inspections and the ability to inspect national inspections can be improved.

3. Conclusions

KEPCO Nuclear Fuel, a domestic bulk-handling facility, is regularly inspected by IAEA. The IAEA is conducting an inspection using CIOSP, Common Inspection On-site Software Package, for examination of inventory change reports and general ledger, and calculation of the number of verified nuclear material and the list.

However, since Korea does not have independent on-site inspection support implementation program such as CIOSP, it will be considered development and research of program.

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