Development of Safeguards Approach of Intermediate-Sized Pyroprocessing Facility

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1. Introduction

Safeguards approach is a set of safeguards measures to allow the IAEA to meet the applicable safeguards objectives [1]. Safeguards approaches of the existing nuclear material handling facilities were already developed, and a safeguards approach of a pyroprocessing facility is required for the effective and efficient safeguards implementation in the pyroprocessing facility.

Korea Atomic Energy Research Institute (KAERI) developed the safeguards approach of a reference facility named Reference Engineering-scale Pyroprocessing Facility (REPF) in collaboration with Korea Institute of Nuclear Nonproliferation and Control (KINAC) from 2008 to 2011 as an IAEA Member State Support Program (MSSP). The annual throughput of the REPF was 10 MtHM. At present, KAEI is developing a safeguards approach of an intermediate-sized facility named Reference Engineering-scale Pyroprocessing Facility plus (REPF+) also as a task of a MSSP. This presentation provides the overview of the REPF+ safeguards approach, which is under development.

2. Methods and Results

The REPF+ is a conceptually designed pyroprocessing facility. SFR fuel fabrication process as well as pyroprocessing process is included to the REPF+. The input material of the REPF+ is PWR spent fuel, and the output materials are SFR fuel assembly, and U ingot. The annual throughput is 30 MTH and the total operation days are roughly 200 days.

The facility is divided into four Material Balance Areas (MBAs). Inventory Key Measurement Points (IKMPs) are identified mainly based on the material type. Flow Key Measurement Points (FKMPs) are also identified to verify the nuclear material streams across the MBA boundaries. Other Strategic Points (OSPs) are defined for the verification of nuclear material flow within MBA.

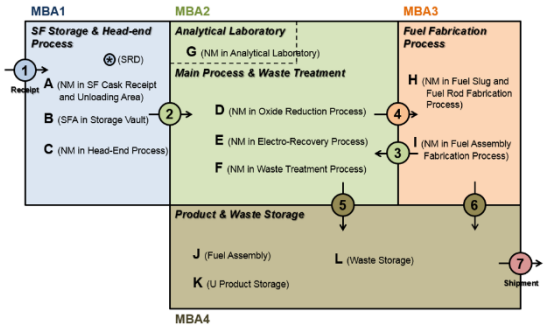

Fig. 1. Draft MBA and KMP structure of the REPF+.

MBA1 consists of a spent fuel receipt and storage area and an air-filled hot cell named Head End Process (HE) cell. The spent fuel assembly is converted into feed material of an oxide reduction process such as fragment and porous pellet. The Shipper Receiver Difference (SRD) is evaluated in the MBA1. The containment/surveillance plays

important role before determining the receiver value in the MBA1. Near Real Time Accountancy (NRTA) is not applied to the MBA1.

MBA2 consists of an Oxide Reduction process (OR) cell, an Electro Recovery (ER) cell, a Waste Treatment (WT) cell, and Analytical Laboratory (AL). Most of the material form in the MBA2 is bulk. The NRTA is applied to the OR cell, the ER cell, and WT cell, but the NRTA is not applied to the AL.

The MBA3 consists of a Fuel Slug Fabrication/Fuel rod Welding Process (FF) cell and Fuel Assembly Fabrication (FA) cell. The input material of the MBA3 are the U/TRU product, and the U product, and the output material of the MBBA3 are the fuel assembly. Process materials in the FF cell are contained in a container, on which an ID is attached. The NRTA is only applied to the FF cell, and the NRTA is not applied to the FA cell.

MBA4 consists of a fuel assembly storage, and a U product & waste storage. The input material of the MBA4 is fuel assembly, U product and waste form. They can be shipped to outside facility. The material form in the MBA4 is item, and the MUF is not evaluated in the MBA4. The NRTA is not applied to the MBA4.

Physical Inventory Verification (PIV) is carried out once per year. Facility operators should arrange the process plan to complete the last campaign prior to the PIT. The Interim Inventory Verification (IIV) is carried out once a month or every three months, and Short Notice Random Inspection (SNRI) and unannounced inspection can be included. Inventory change verification methods at each FKMP are specified.

Joint use of the operator's DA/NDA system and automatic sampling system are included to the verification methods in the REPF+ safeguards approach.

3. Summary

A safeguards approach of the intermediate-sized pyroprocessing facility is being developed. The safeguards measures in the safeguards approach are based on the current IAEA equipment and the safeguards technology under development. The NRTA is applied to the specified area of the REPF+. The operator's DA/NDA system is jointly used for the verification. The process monitoring and the C/S on the material and equipment transfer door are included to increase the effectiveness.

Our effort will help the effective and efficient safeguards implementation in future pyroprocessing facility.

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REFERENCES

[1] IAEA Safeguards Glossary 2001 Edition.