Management of Small Quantity of Nuclear Material at Locations Outside Facilities in Korea.

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1. Introduction

Nuclear materials in medical, industrial, and research applications requires that the state effectively protect, regulate and control it under the comprehensive safeguards agreement and the additional protocol. Small quantity of nuclear material (SQNM) is prescribed to be less than specified minimum quantities of nuclear material in a facility. SQNM is used at the locations called locations outside facilities (LOFs). LOFs are used to control the locations and installations that store nuclear materials under one effective Kg, respectively.

Holders of SQNM don't need to require a license for use or possession of Uranium or Thorium exclusively for non-nuclear activities, or neither report them to the System of Accounting for and Control of nuclear material (SSAC) under specified quantities according to the Atomic Safety Law. The national LOFs need to be managed meticulously in order to keep track of nuclear materials with regard to both nuclear safety and safeguards in parallel with well-defined national safeguards laws.

2. Status of SQNM at LOFs

2.1 inspection

LOFs are defined in the additional protocol as "any installation or location which is not a facility, where nuclear material is customarily used in amounts of one effective kilogram or less." Facility means "any location where nuclear material in amounts greater than one effective kilogram is customarily used." [1].

National LOFs are composed of the virtual groups to control small amount of nuclear materials. They are covered by one facility attachment with a single MBA with different KMPs for such a location in Korea.

Managing LOF started after the ROK-IAEA joint review meeting held in 1998 substantially. National LOF management system is regularized to a full-scale since the additional protocol ratified in 2004. Currently national LOFs are composed of 3 KMPs ; total of 110 LOFs -- 75 NDA industrial uses (KMP A), 33 research and academia (KMP B) and 2 others (KMP C). Holders of SQNM declare their inventory changes and exempted NM information to the KINAC via Web- based national LOF management system shown in Figure 1.

National LOF Management System

Fig 1. National LOF Management System

KINAC collects data from each location in order to report the accountancy to the IAEA. Figure 2a shows the regulatory framework of SSAC to implement safeguards. KINAC visits about 30% of the total locations each year so as to verify the information reported by the companies. Besides, KINAC carries out a PIT for the LOFs based on the information every year.

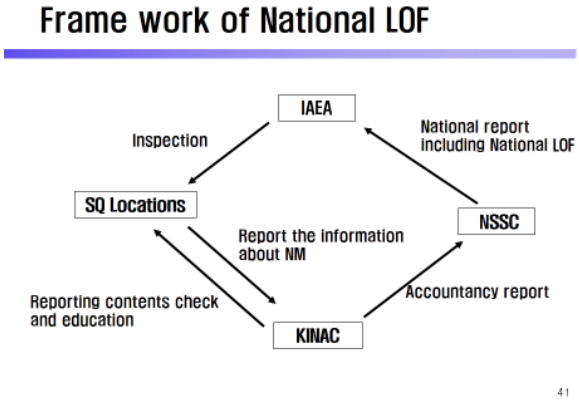

Fig 2a. Diagram of Declaration and Inspecton System

2.2 Radiation Shielding Material under Safeguards

The majorities of LOFs are involved in non-destructive testing and second majorities are in medical area, where Depleted Uranium is used as shielding material. Typical radiographic device is shown in Figure 2b. Figure 2c shows DU disks which are assumed to be used as radiation shields in the medical sector. They had been found accidentally in a scrapyard in 2014. Users and its applications of them are not identified so far.

Fig 2b. Radioisotope Camera.

Fig 2c. DU Disks

2.3 Regulatory System of Small quantities

Users in industries, medicals, research institutions or academies holding SQNM have reporting obligations. They are required to submit reports regarding imports and export as well as nuclear material inventories. Atomic safety law and subordinate legislation currently have some exceptive clauses to license, however.

Users of SQNM don't need to require a license for use or possession of Uranium or Thorium exclusively for non-nuclear activities, or neither report them to the national authority below specified quantities under the current the Atomic Safety Law.

2.3.1 Review on Nuclear Safety Laws

National nuclear laws are reviewed from the point of license for use in **Nuclear Safety Act, Article 45,** in **Enforcement Regulation, Article 71** and in **NSSC Notice 2014-40, Article 1**. Uranium is exempt from license for use if it is used for shielding of radioisotope cameras. More precise reviews on SQNM as follows.

Nuclear Safety Act, Article 45 (License of Use, etc. of Nuclear Fuel Material) [2].
(1) A person, who wishes to use or possess nuclear fuel material, excluding those falling under any of the following Subparagraphs, shall obtain the license of the Commission under the conditions as prescribed by the Presidential Decree.
3. Where nuclear fuel material of such kinds and quantity as prescribed by the Presidential Decree is used.

Enforcement Regulation of the Nuclear Safety Act, Article 71 [3]. (Nuclear Fuel Material not Subject to License for Use) For the purpose of Subparagraph 3 of Article 45 (1) of the Act, the term "nuclear fuel material of such kind and quantity as prescribed by the Presidential Decree" means the nuclear fuel material falling under any of the following Subparagraphs:
1. With respect to uranium for which the ratio of uranium 235 to uranium 238 is the same as the natural mixture and its compounds, the quantity of uranium is not more than 300 grams;
2. With respect to uranium for which the ratio of uranium 235 to uranium 238 is less than the ratio in the natural mixture and its compounds, the quantity of uranium is not more than 300 grams;

NSSC Notice, 2014-40 (Types and Quantities of Nuclear Fuel Material not Subject to License for Use), Article 1 [4]. **(**Types and Quantities**):**
2. Natural or depleted Uranium if it is overlaid by durable coatings or claddings not to touch and tags on it.
(1). Uranium as a counter weight for airplane;
(2). Uranium shielding for radioisotope camera
3. Natural Thorium for chemical analysis under 100 gram per package;
4. Materials containing Thorium satisfying following requirements;
(1). Vacuum tubes or indoor lights under 50 mm grams of Thorium per item;
(2). Sterilizing or outdoor lights under 2 grams of Thorium per item;
(3). Welding rods or gas lamp wicks under 700 Bq per item in Thorium radioactivity;
(4). Nickel, Tungsten or Magnesium alloy products under 4 as Thorium weight ratio;
(5). Optical lenses with electroplated Thorium under 30 as a weight ratio.

NSSC Notice 2014-75, Article 5 [5] states reporting of material account for the special nuclear material under 0.1 effective Kg not subject to reporting to state authority.

2.3.2 Complementing Current Nuclear Safety Laws for Small Quantities

Uranium or Thorium is used in radiation shielding or as catalysts for use in the chemical industry. Some of the companies that are under LOFs are small business with low profits or on the verge of going bankrupt. Some cases show that keeping track of those nuclear materials is challenging in case of bankruptcy. KINAC is keeping abandoned shielding NM of DU in storage. It is necessary to protect against material loss or accident gain such as DU disks found by chance in a scrapyard in 2014. Atomic safety law and its lower legislation need to supplement in respect to SQNM which is not to subject to license or not to report them.

3. Conclusions

Well defined safeguards law is fundamental to the effective control of nuclear material, facilities and nuclear related activities. In the current nuclear safety legislation, there are some exceptive clauses. Users of SQNM don't need to require a license for use or possession of Uranium or Thorium exclusively for non-nuclear activities, or not report them to the national authority below specified amount. It is necessary to complement the laws in order to facilitate tracking of nuclear materials for both nuclear safety and safeguards aspect.

REFERENCES

[1] "Definitions, Article 18", Model Protocol Additional to the Agreement (INFCIRC/540), p.16, 1997.
[2] Nuclear Safety Act, Article 45 (License of Use, etc. of Nuclear Fuel Material), 2014
[3] Enforcement Regulation of the Nuclear Safety Act, Article 71, 2014
[4] NSSC Notice, 2014-40 (Types and Quantities of Nuclear Fuel Material not Subject to License for Use), Article 1, 2014.
[5] NSSC Notice, 2014-70 "Reporting of Special Nuclear Material Accounting", Article 5, 2014.