

## **A Comparative Study on Safeguards Implementation under Bilateral Nuclear Cooperation Agreements and the IAEA Comprehensive Safeguards Agreement**

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### **1. Introduction**

A Nuclear Cooperation Agreement (NCA) requires several conditions, so-called obligations, on the items under the agreement such as: 1) peaceful use, 2) retransfer consent, 3) consent prior to reprocessing or enrichment and 4) safeguards and security. These obligations of the NCAs are imposed by the supplier country. Especially several NCAs including the NCAs with Canada, Australia, Japan and the United States have provisions for maintaining the inventory of the obligated items and providing annual reports based on the inventory. The Comprehensive Safeguards Agreement (CSA) between the International Atomic Energy Agency (IAEA) and its member states require similar activities. However, there is a significant gap in nuclear material accountancy between safeguards implementation under the NCA and CSA. The difference of those two frameworks is compared herein, focusing on the unique features of the NCA safeguards and its implications are presented. In this study, the NCAs between the ROK and Canada, Australia and US were analyzed since each of them is one of the ROK's major nuclear trading partners.

### **2. Distinctive Concepts in the NCA Safeguards**

The most difference between the NCA and CSA safeguards are derived from the characteristics of nuclear materials: nuclear materials have 'fungibility.' It implies that uranium from any source is identical to uranium from any other. It is impossible to physically identify the origin of the uranium. The fungibility of uranium as well as other nuclear materials led to establish several concepts for applying safeguards.

#### *2.1 International Obligation Exchange*

An international obligation exchange is defined as an exchange of obligations between equivalent quantities of material located in different countries or jurisdictions. The ownership and physical location of the materials remain unchanged. It requires prior consent by the safeguards authorities for both locations [1].

#### *2.2 Principle of Fungibility, Equivalence and Proportionality*

The principle of fungibility implies that nuclear material under the NCA could be interchangeable with nuclear material from other sources if they have equivalent quantities with the same isotropic composition.

The principle of equivalence is based on the principle of fungibility. It provides that when material under the NCA loses its separate physical identity, an equivalent quantity of material can be made subject to the Agreement to replace the original material. It does not permit substitution by a lower quality material.

The principle of proportionality is based on the relative quantities of the element or isotope of significance when nuclear material under the NCA is (chemically or physically) processed or irradiated. In other words, a portion of the resulting material will be regarded as the material under the NCA corresponding to the same proportion as was the material under the Agreement initially [2].

### **3. Accounted Items in the NCA Safeguards**

Accounted items under the NCA and CSA differ in several aspects: First, the NCA items entail derived materials. Second, some NCAs call for maintaining inventory of items which are excluded in the CSA.

#### *3.1 Derived Materials*

Derived materials are nuclear material or material of any origin which has acquired obligations under the NCA as a result of being produced or processed with the use of obligated items subject to the NCA. The derived materials create undertakings identical to items sent directly under the Agreement.

The concept of derived materials was introduced due to the Indian nuclear weapon test in 1974. The plutonium used in the test was derived from a Canadian supplied reactor. At that time, the peaceful use provisions in the NCA between Canada and India did not apply to nuclear material or material produced through the use of Canadian-obligated items.

#### *3.2 Expanded Scope*

The CSA require accounting for and control of all nuclear materials within the jurisdiction of the country.

However, some NCAs require maintaining inventories of items under the NCA and reporting them in the annual report. Items under the NCA generally refer to nuclear and non-nuclear material, equipment, components and technology, pursuant to the NCA.

#### **4. Reconciliations**

Since the NCA safeguards could be extra burden to nuclear industry besides the IAEA safeguards, the reconciliations between these two safeguards system could be referred in the past experience.

The NCA between the ROK and US, entered into force in 1973 and superseded by its revision later in 2015, states that “[...] the safeguards rights accorded to the Government of the United States of America [...] will be suspended during the time and to the extent that the Government of the United States of America agreed that the need to exercise such rights is satisfied by a safeguard agreement as contemplated in this paragraph [the IAEA safeguards].” It implies that the safeguards rights of the US were entrusted to the IAEA. After the trilateral agreement between the ROK, US and IAEA in 1968 was suspended by the conclusion of the CSA between the ROK and IAEA in 1975, there was attempt to conclude additional suspension protocol between two countries. This is due to provision on nuclear material to be used in non-peaceful activities in the Article 14 of the CSA, which opposes the condition specified in the ROK-US NCA. Instead of signing the suspension protocol, the revised ROK-US NCA requires annual report on the obligated items.

#### **5. Conclusions**

The safeguards implementation under the NCA is usually specified in an Administrative Arrangement (AA) under the Agreement. The ROK has two AAs in force with Canada and Australia among 29 countries with NCA. Recently, the AA with Canada was revised in December 2015, with those concepts mentioned above. The AA with the US is currently under discussion.

Cooperation in nuclear energy between two countries could be further enhanced through reliable implementation of the NCA undertakings. Taking into account the unique features of the NCA, we need to establish effective strategy for fulfilling the obligation under the Agreement. The cooperation between competent authority and nuclear industry is prerequisite to accomplish this.

Furthermore, as the ROK became one of nuclear suppliers, we should contemplate our position on our recipient countries: whether to request to maintain the inventories of obligated items and report the changes in the inventories on a regular basis.

#### **REFERENCES**

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- [6] SUPPLEMENTARY ARRANGEMENTS BETWEEN THE NUCLEAR SAFETY AND SECURITY COMMISSION OF THE REPUBLIC OF KOREA AND THE CANADIAN NUCLEAR SAFETY COMMISSION PURSUANT TO THE AGREEMENT BETWEEN THE GOVERNMENT OF CANADA AND THE GOVERNMENT OF THE REPUBLIC OF KOREA FOR CO-OPERATION IN THE DEVELOPMENT AND APPLICATION OF ATOMIC ENERGY FOR PEACEFUL PURPOSES, AND TO THE EXCHANGES OF NOTES BETWEEN THE GOVERNMENT OF THE REPUBLIC OF KOREA AND THE GOVERNMENT OF CANADA CONSTITUTING AN AGREEMENT AND AN UNDERSTANDING RELATING TO THE TRANSFER OF TRITIUM ITEMS FOR THE WOLSONG TRITIUM REMOVAL FACILITY, entered into force December 22, 2015.