

## Investigation for Public Awareness of Small Quantity Nuclear Material in ROK

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### 1. Introduction

Any country joining the Treaty on nonproliferation of nuclear weapons(NPT) should conclude Safeguards agreement with the International Atomic Energy Agency(IAEA) [1]. The IAEA generally applies Safeguards to nuclear materials held in facility or location outside facilities(LOF). The facility means a reactor, acritical facility, a conversion plant, a fabrication plant, a reprocessing plant, an isotope separation plant or a separate storage installation, or any location where nuclear material in amounts greater than one effective kilogram is customarily used [2]. On the other hand, the LOF means any installation or location, which is not the facility, where nuclear material is customarily used in amounts of one effective kilogram or less [3]. ROK currently has one national LOF as separated material balance area(MBA). The ROK's national LOF includes a lot of companies where small quantity nuclear material(SQNM) is customarily utilized for various purposes such as education, research, non-destructive analysis(NDA), etc. The SQNM is obviously subject of the IAEA's Safeguards and the regulation by the domestic law related to nuclear safety. However, it is difficult for the general public to know that the ROK's authority regulates SQNM. Therefore, the degree of public awareness for SQNM was investigated, and the results from that were summarized in this study.

### 2. Methods and Results

The investigation was performed for two categories. The people who is in charge of accounting for and control of SQNM in the companies included in the national LOF were considered for the first category. Among them, 64 people who carried out physical inventory taking(PIT) for SQNM last year were selected. And, the general public was considered for the second category. Total 1,500 people were randomly selected between the ages of 20 to 60. The important purposes and results of the investigation were summarized in this paper.

#### 2.1 Purposes for SQNM Users

The purposes for the first category(SQNM users) of the investigation are as follows.

- Check current inventory status of SQNM
- Feedback for the updated SQNM on-line system

- Check the degree of general understanding for accounting and control of SQNM

Each purpose had several questions summarized in Table I to investigate the SQNM user.

Table I: Summary of questionnaire for SQNM users

Check current inventory status of SQNM	
1.	Amount and number of SQNM held in company
2.	PIT procedure for SQNM
3.	Future plans for importing SQNM
Feedback for the updated SQNM on-line system	
1.	Experience with the SQNM on-line system
2.	Degree of satisfaction with the on-line system
3.	Necessary improvements for the on-line system
Check the degree of general understanding for accounting and control of SQNM	
1.	Framework of IAEA's Safeguards for SQNM
2.	Framework of domestic regulations for SQNM
3.	Access to SQNM by the IAEA or national inspectors
4.	Reporting of SQNM to the IAEA and authority

#### 2.2 Purposes for General Public

The purposes for the general public of the investigation are as follows.

- Check the degree of general understating for accounting and control of SQNM
- Check the degree of agreement on nonproliferation and IAEA's Safeguards
- Check the degree of awareness for safety of SQNM
- Check the degree of agreement on IAEA's Safeguards applied to SQNM

Each purpose had several questions summarized in Table II to investigate the general public.

Table II: Summary of questionnaire for general public

Check the degree of general understanding for accounting and control of SQNM	
1.	Framework of IAEA's Safeguards for SQNM
2.	Framework of domestic regulations for SQNM
3.	Access to SQNM by the IAEA or national inspectors
4.	Reporting of SQNM to the IAEA and authority
Check the degree of agreement on nonproliferation and IAEA's Safeguards	
1.	ROK's efforts to comply with the NPT
2.	ROK's supports for IAEA's various activities
3.	Establishment of ROK's own Safeguards regulation system for nuclear materials
Check the degree of awareness for safety of SQNM	
1.	Radioactive risk from SQNM

2. Necessity of management for SQNM
3. Appropriate method for SQNM disposal
<b>Check the degree of agreement on IAEA's Safeguards applied to SQNM</b>
1. Necessity of IAEA's Safeguards applied to SQNM
2. Relevance between SQNM and nuclear weapons
3. Necessity of the SQNM on-line system

### 2.3 Results from SQNM users

Most SQNM users of the first category were related to research and NDA(shielding material), and more than half of the SQNM users had fewer than 10 SQNMs. For the PIT procedures, most SQNM users used e-mail rather than the on-line system to report the status of SQNM. Also, they had no plans to import SQNM from other countries. Regarding to the on-line system for accounting and control of SQNM, half of the SQNM users had experience with the on-line system. In general, they satisfied with the updated on-line system compared to old one. However, about 40% of the SQNM users found several errors when they used the updated on-line system. Simple type of questions answered by yes or no was utilized to investigate the degree of general understanding for accounting and control of SQNM. Most SQNM users well knew the framework of the IAEA's Safeguards and the IAEA inspector's access to their SQNM. However, a number of SQNM users answered wrongly to the questions related to domestic regulation framework for Safeguards. These results are summarized in Table III.

Table III: Summary of results from SQNM users

<b>Check current inventory status of SQNM</b>
<b>[Utilization purpose of SQNM]</b> Research(40.6%), NDA-shielding(39.1%), etc(20.3%)
<b>[Reporting method for PIT results]</b> E-mail(76.6%), On-line SQNM system(23.4%)
<b>[The number of SQNM]</b> Less than 10(53.1%), 10~50(34.4%), More than 50(12.5%)
<b>[Plan to import SQNM in the near future]</b> Yes(17.2%), No(82.8%)
<b>Feedback for the updated SQNM on-line system</b>
<b>[Experiences with SQNM on-line system]</b> More than once(51.6%), None(48.4%)
<b>[Degree of satisfaction for SQNM on-line system]</b> Dissatisfaction(3%), Normal(54.5%), Satisfaction(42.4%)
<b>[Necessary improvements for SQNM on-line system]</b> 1. Error in accessing on-line system(6.3%) 2. Necessity for training for using on-line system(4.7%) 3. Error in saving information of SQNM (3.1%)
<b>Check the degree of general understanding for accounting and control of SQNM</b>
<b>[Question for definition of enrichment of SQNM]</b> Correct answer(84.4%), Wrong answer(15.6%)
<b>[Question for possibility of IAEA's inspection to SQNM]</b> Correct answer(79.7%), Wrong answer(20.3%)
<b>[Question for necessity of domestic licensing for SQNM]</b> Correct answer(59.4%), Wrong answer(40.6%)
<b>[Question for correction method of SQNM reports]</b> Correct answer(81.3%), Wrong answer(18.8%)

### 2.4 Results from general public

Most general public well knew the basic framework of the IAEA's Safeguards and the domestic regulation related to that. However, many people answered wrongly to the question related to the necessity of accounting and control of SQNM. Also, the question related to regulatory penalty for violation of the SQNM users showed a low percentage of correct answer. Regarding to the degree of agreement on nonproliferation and IAEA's Safeguards, more than half of general public answered positively to ROK's compliance for the IAEA's inspections resulted from the NPT and necessity of ROK's own Safeguards regulatory inspection system. However, the percentage of negative answer to the question for possibility of IAEA's unannounced inspection to ROK's nuclear facility was slightly high. Comprehensively, the general public expressed that the radioactive risk of SQNM was high although the amount of SQNM was very small. A lot of people commented that appropriate and rigorous procedures should be needed for the disposal of SQNM. Regarding to the degree of agreement on IAEA's Safeguards applied to SQNM, many people generally agreed the necessity of reporting SQNM information to the IAEA. It was also commented that the national own regulation system for Safeguards to SQNM was needed. And, the percentage of positive answer for the question related to necessity of education for SQNM users was the highest. These results are summarized in Table IV.

Table IV: Summary of results from general public

<b>Check the degree of general understanding for accounting and control of SQNM</b>
<b>[Question for possibility of IAEA's inspection to SQNM]</b> Correct answer(76.1%), Wrong answer(23.9%)
<b>[Question for domestic law and authority regulating SQNM]</b> Correct answer(85.9%), Wrong answer(14.1%)
<b>[Question for necessity of accounting and control of SQNM]</b> Correct answer(24.1%), Wrong answer(75.9%)
<b>[Question for penalty about SQNM user's violation]</b> Correct answer(14.3%), Wrong answer(85.7%)
<b>Check the degree of agreement on nonproliferation and IAEA's Safeguards</b>
<b>[Degree of agreement on ROK's compliance for NPT]</b> Agree(77.4%), Normal(19.5%), Disagree(3.1%)
<b>[Necessity of the continuous IAEA's inspection in ROK]</b> Agree(63%), Normal(31.6%), Disagree(5.4%)
<b>[Possibility of IAEA's unannounced inspection in ROK]</b> Agree(47.7%), Normal(28.7%), Disagree(23.6%)
<b>[Necessity of ROK's own Safeguards regulation system]</b> Agree(78.5%), Normal(18.5%), Disagree(3%)
<b>Check the degree of awareness for safety of SQNM</b>
<b>[Radioactive risk of SQNM is low]</b> Agree(29.5%), Normal(27.5%), Disagree(42.9%)
<b>[National regulation for SQNM is unnecessary]</b> Agree(22.1%), Normal(23.9%), Disagree(54.1%)
<b>[No need to transfer SQNM to the radioactive disposal facility]</b> Agree(20.3%), Normal(22.3%), Disagree(57.5%)

<b>Check the degree of agreement on IAEA's Safeguards applied to SQNM</b>
<b>[Necessity of reporting to IAEA of SQNM which is not subject of licensing in domestic regulation]</b> Agree(63.8%), Normal(29.9%), Disagree(6.3%)
<b>[Necessity of IAEA's inspection for SQNM which has little relevance to nuclear weapon development]</b> Agree(55.5%), Normal(33.1%), Disagree(11.4%)
<b>[Necessity of expansion of education related to IAEA's Safeguards for SQNM users]</b> Agree(78.4%), Normal(18.6%), Disagree(3%)

### 3. Conclusion

The regulation system for Safeguards of nuclear materials used in major nuclear facilities such as commercial reactor, nuclear fuel fabrication plant, and research institute was established in domestic nuclear safety law. However, the regulation for SQNM should be further established because there is no appropriate legal framework specifically regulating SQNM. Therefore, the investigation for public awareness of SQNM was carried out, and the results from that were summarized in this study. The necessity of maintenance for the updated on-line system for accounting and control of SQNM was derived from the results of the SQNM users. And, it was confirmed that the most general public expected rigorous domestic regulation for control and disposal of SQNM. Both the SQNM users and general public commented that appropriate educations to introduce the regulation framework for SQNM was needed. The results of the investigation and conclusion of this study will contribute to improving the ROK's regulation system for SQNM.

### REFERENCES

- [1] Treaty on the Non-Proliferation of Nuclear Weapons, 1970.
- [2] IAEA, Agreement Between the Government of the Republic of Korea and the International Atomic Energy Agency for the Application of Safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, INFCIRC/236, 1975.
- [3] IAEA, Protocol Additional to the Agreement of 31 October 1975 between the Government of the Republic of Korea and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons, INFCIRC/236/Add.1, 2004.