The Present Status and Future Challenges of Nuclear Forensics in ROK

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1. Introduction

During the nuclear security summit process, we observed the emergence of various new nuclear security areas. Nuclear forensics is one of them. Nuclear forensics is the investigation of nuclear materials to identify the origin and history of radioactive materials out of the regulatory control (MORC). Therefore, it has a strong deterrence effect against illicit trafficking. Many states realized its necessity and joined efforts in international collaboration and research programs.

Analysis of nuclear materials is an important measure in the field of nuclear safeguards and has been developed so far. In the case of the ROK, we established nuclear materials analysis systems which can be adopted in nuclear forensics field. So far, we focused more on the technical aspect of nuclear forensics such as analytical techniques and establishment of the national nuclear forensic library (NNFL). For an effective implementation of the nuclear forensics, however, it needs to be bridged with the national response system.

In this paper, we will review what have been done and what needs to be done in view of the NNFL developer in ROK.

2. Evolution of nuclear forensics

In December 1991, the Soviet Union collapsed and was divided into several independent states while nuclear weapons and facilities were located outside of the Russian Federation. At the time, illegal nuclear materials were found in the European countries. Even though the nuclear materials were recovered, it was difficult to identify whether it was weapon grade or where it was from and so on. Therefore, these materials were sent to the Institute for Transuranium Elements (ITU) in Germany, which was the only laboratory that could do the job at the time of the seizures [1]. That became the first nuclear forensics activity. Then, nuclear forensics arose in response to various seizures of HEU and plutonium cases.

3. Nuclear forensic system in ROK

The NNFL in ROK was developed by KINAC, and KINAC classified the nuclear forensics into 4-tier system [2]. 4-tier system consists of 1) Legal basis, 2) radiological crime scene management, 3) nuclear forensics library and 4) analysis. Legal system means law enforcement against nuclear terrorism. Response has two complementary tiers. Radiological crime scene management includes the sampling of radiological nuclear materials as well as collection of other traditional forensic evidence. The NNFL is a database containing broad categories of information to identify and verify analysis results. Analysis is the base tier supported by technical capability and is essential in finding signatures. In the paper, it listed action items for each tier and evaluated the current nuclear forensics development and implementation status. Legal framework was established before the 3rd nuclear security summit.

Articles of International Convention on Suppression of the Act of Nuclear Terrorism(ICSANT) and amendment to the Convention on the Physical Protection of the Nuclear Material(CPPNM) were reflected in the domestic law.

Regarding the radiological crime scene management, we had already set up the procedure for collecting evidence and developed equipment.

Analysis parts and establishment of NNFL also showed rapid progress thanks to the nuclear security summit process.

Most of these efforts have been done in piecewise. Now we need more effort in putting the puzzle together. It means that we need interfaces between relevant tiers. According to the ICSANT, we already established the national law to set penalty for criminal offences, however, in case of such event, response procedure includes responsible organization and role. We need to include nuclear forensics in the national response plan to support investigations. Even though we have analytical capabilities, if the investigation team does not react or contact to the technical counterpart, technical capability cannot be used in timely manner. It needs to be simulated through exercise.

The US, a strong supporter in the field of nuclear forensics, actively encourages and supports the programs to boost the ROK's nuclear forensics capabilities. It includes exercises of incident responses where all the relevant personnel in various fields participate. This is partly because of the geopolitical circumstances we face now. We need to take full advantage of these environments to establish national response system and implementation plan.

In case of NNFL, we have a database of representative samples from nuclear fuel manufacturer. It is essential to establish nuclear forensic database through data compilation to support nuclear forensic interpretation. But, we have not yet specified in law on the responsibility to submit nuclear materials data for the NNFL. Therefore, our NNFL is insufficient.

We have the ability to analyze the signatures of the nuclear materials which is essential to the nuclear forensics, but we still need traditional forensic evidence. So, we should refine the procedure in the scene and establish cooperation system to analyze the combined evidence both from nuclear and traditional forensics. Regarding the analysis capability, we can do better once we set up the proper and timely procedures.

4. Conclusion

The newly issued Coordinated Research Project proposed by the IAEA lists technologies that can be used in the scene. To further develop the analysis capability, IAEA suggested using Gamma ray spectrometry to increase speed, accuracy and precision. It also emphasized the necessity to further research to identify signatures. To improve the on-scene response, various sampling and packaging ideas will be reviewed. NNFL needs to be an integrated information system combined with computerized algorithm with strengthened traditional evidence.

The efforts to refine the nuclear forensics system continues through the participation of leading countries. Likewise, we need to continue the efforts which would be the strong deterrence measure of the nuclear security.

REFERENCES

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