

## The Development of X-Ray Training Program for Physical Protection Training of Nuclear Security Guards

Hyun-Kyung Lee, Hyun-Chul KIM  
1534 Yuseong-daero, Yuseong-gu, Daejeon, Republic of Korea  
hklee@kinac.re.kr, hckim@kinac.re.kr

### 1. Introduction

The nuclear security has its objectives to effectively prevent, detect and respond to threats posed on nuclear materials and facilities. There is growing interest in nuclear security globally. Particularly, in the 2010 Nuclear Security Summit, there was a movement to strengthen the international effort to protect nuclear materials and other radioactive materials against malicious acts. By recognizing the importance of human resource development and training in nuclear security, the Republic of Korea (ROK) pledged to establish an international training center on nuclear security. Consequently, the International Nuclear Security Academy (INSA) was established in Korea Institute of Nuclear Nonproliferation and Control (KINAC) in February 2014. The INSA contributes to meet not only the domestic needs but also international needs for nuclear nonproliferation and security training. Meanwhile, since 2012, KINAC is the only physical protection training provider for nuclear facility operators designated by Nuclear Safety and Security Commission (NSSC). In this paper, we are going to introduce our four-year physical protection training activities for nuclear facility operators and describe X-Ray Web-Based Training (WBT) program to be used for physical protection training of nuclear security guards.

### 2. Overview of Physical Protection Training Program for Nuclear Facility Operators

By recognizing the importance of the training in nuclear security, the training is mandatory to all personnel of nuclear facility, pursuant to Article 9-2 of the Act on Physical Protection and Radiological Emergency (APPRE) [1]. The training requirement is applied to nuclear facilities dealing with not only nuclear materials but also radioactive materials. Those facilities include KAERI, KHNP, KEPCO NF, KORAD, SoyaGreenTec and Greenpia Technology. The category of trainees and the corresponding training hours are shown in Table I. Some part of hours can be substituted by remote training. The KINAC/INSA provides various e-learning courses in the area of nuclear nonproliferation and security through the website <http://elearn.kinac.re.kr>.

Table I: Category of trainees and training hours mandatory to nuclear facility operators

| Category of trainees          | Training Hours  |                           |
|-------------------------------|---|---------------------------|
|                               | Initial   | Refresh                   |
| Physical Protection Personnel | Eight hours or more within the period of six months after designation | Four hours or more a year |
| All other Personnel           | Two hours or more within the period of one year after designation     | Two hours or more a year  |

The goal of physical protection training for nuclear facility operators is to acknowledge the importance of physical protection and to improve national nuclear security culture.

The physical protection training activities for the last four years are listed in Table II. The training has been conducted not only at KINAC/INSA but also at nuclear power plant sites such as Wolsung, Hanul, Hanbit, or Kori site, considering convenience of trainees. The total number of trainees keeps increasing annually. It is due to the increase of nuclear facility operators by the growth of nuclear industry. In 2014, the number of trainees was rapidly increased due to the expanded scope of the trainees resulted from the revision of the APPRE in 2014. Accordingly, the number of trainings conducted has also been increased.

Table II: Physical protection trainings conducted by the KINAC/INSA

| Year | Number of Trainees | Number of Trainings conducted | Training Venue            |
|------|--------------------|-------------------------------|---------------------------|
| 2012 | 851                | 8                             | KINAC/INSA                |
| 2013 | 1,041              | 5                             | KINAC/INSA                |
|      |                    | 4                             | Nuclear Power Plant Sites |
| 2014 | 1,195              | 4                             | KINAC/INSA                |
|      |                    | 4                             | Nuclear Power Plant Sites |
| 2015 | 1,705              | 7                             | KINAC/INSA                |
|      |                    | 4                             | Nuclear Power Plant Sites |

We evaluate our training courses by conducting the survey to trainees at the end of the training event. The survey contains a set of questions to collect trainees' satisfaction and opinions on the training course and to improve the training course. Trainees' needs obtained from the surveys include development of hand-on exercises tailored to their duties, distribution of trainer's presentation material to participants, and provision of more training events at nuclear facility sites.

### 3. X-Ray WBT Program for Training of Nuclear Security Guards

The access control is to allow only authorized persons, packages and vehicles to move in and out through the boundary around the protection area. The contraband is any object deemed "prohibited" for a site, facility, or area. X-ray security screening has been widely used for detection of contraband items at the entrance or exit. Depending on the X-ray image interpretation, the security officer should make a decision on his/her actions to be taken. Table III is the example of what actions should be taken for different category of items in the bag. However, the detection and identification of such items in X-ray image is a challenging task and highly dependent on human operator and their competences regarding X-ray image interpretation since real item looks different from its X-ray image. Many X-Ray WBT programs have been developed to improve screening competences of x-ray screeners.

Table III: Actions to be taken for different category of items in the bag

|                                   | Bag opening for item identification | Acceptance |
|-----------------------------------|-------------------------------------|------------|
| Firearms, Explosives              | Close                               | Prohibited |
| Ammunitions, Flammable Substances | Open                                | Prohibited |
| Knife                             | Open                                | Restricted |
| Electronics                       | Open                                | Pass       |

KINAC/INSA has recently developed the X-Ray WBT program, so called XBT. The XBT contains X-Ray images taken from two-hundred items. As an example, the X-ray image of a bag containing explosives is shown in Fig. 1. The XBT can be operated in two training modes as in Table IV.



Fig. 1. Screenshot of XBT program (The figure on the left is the X-ray image of the bag containing the gun.)

Table IV: Feature of XBT in each training mode

| Mode     | Feature  |
|----------|--|
| Practice | To familiarize a trainee with X-ray images of various items                              |
| Test     | To test a trainee whether he can detect contraband items from the X-ray image of the bag |

At nuclear facilities, the security guards typically play a role of x-ray screeners. Meanwhile, one of trainees' needs obtained from surveys of KINAC/INSA physical protection training was the development of hand-on exercises tailored to their duties. Thus, KINAC/INSA will apply the XBT to the physical protection training of nuclear security guards. Each course will be provided to thirty nuclear security guards. This year course will be implemented as a pilot program. Then it will be begun in earnest in the following years, reflecting participants' feedback. This kinds of hand-on exercises will contribute to strengthening physical protection system at nuclear facilities.

### 4. Conclusions

KINAC/INSA, as the only physical protection training provider for nuclear facility operators designated by NSSC, puts emphasis on delivering effective and high-quality training program. We, open a door for nuclear facility operators to share lessons they learned. Considering the survey result on the training program, we will apply X-Ray WBT program for training of nuclear security guards. Efforts to improve training quality will be continued. Through the implementation and improvement of these training programs, KINAC/INSA will strengthen the nuclear nonproliferation and nuclear security regime within the ROK.

### REFERENCES

- [1] Act on Physical Protection and Radiological Emergency.