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Developing Nuclear Security Capacity of Indonesia’s Police and Security Officer: Lessons from Universitas Gadjah Mada’s Pilot Training

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Cover Page Footnote

The excellent collaboration of BAPETEN, POLDA DIY, and Faculty of Engineering UGM is acknowledged. Hopefully, we could improve our relationship in the next training.

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Abstract

Due to an increase in global nuclear security issues, there need to be improvements in human resources and security measures. The Republic of Indonesia is an archipelago country, which makes surveilling for nuclear security threats complicated. Recent radioactive material smuggling incidents proved that Indonesian police and security officers' knowledge in nuclear security has been challenged and must be improved. In response, Universitas Gadjah Mada's Nuclear Engineering Program composed a three-day pilot training program for local police and UGM's security officers in 2018. The objective of the training was to improve their capabilities in dealing with nuclear security issues around where they work and serve.

Training materials were designed to introduce nuclear technology and provide the basic skills of handling nuclear security matters. The training was divided into 12 sessions, based on the needs stated by the Special Region of Yogyakarta's police chief. Lessons were delivered through traditional teaching, table-top exercises, exercises, and discussion. Fifteen-question pre-tests and post-tests were conducted to assess the officers' knowledge of the training materials and the benefits of being trained. Based on the tests, we concluded that the participants' understanding of nuclear security had improved. This increase in understanding was because the training materials fit their job needs, presented in various methods, and the participants' awareness grew. It led to an increase in their awareness for securing the facilities utilizing radioactive sources in the Yogyakarta area. They said that the number of trainees in this event still does not meet the number of facilities that have to be secured. Therefore, the training should be carried out again and can be improved based on the participants' feedback. Furthermore, this training could be expanded and applied to the whole country.

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Keywords: Indonesia, nuclear security, Universitas Gadjah Mada, capacity development

I. Introduction

Though the number of nuclear security incidents reported to the International Atomic Energy Agency's (IAEA) Incident and Trafficking Database (ITDB) has decreased, global nuclear security issues continue to be a concern. This is especially concerning in regard to the use of nuclear energy for peaceful purposes **[*1*]**. It also continues to be an issue in Indonesia. The issues are primarily due to terrorism and radioactive source theft. For example, in early 2020, an orphan radioactive source was discovered that was suspected to have originated from the theft of used radioactive sources. According to ITDB, most thefts reported involve used radioactive sources in industrial or medical applications. This indicates the applications lack a control system and security **[*1*]**.

The Republic of Indonesia is an archipelago country comprised of approximately 17,000 islands, of which 6,000 are inhabited. Indonesia lies along 5,150 km between the Australian continent and the Asian continental mainland. Its geography makes nuclear security surveillance complex.

According to data provided by the Nuclear Energy Regulatory Agency of Indonesia (BAPETEN), there are 13,294 licenses released for using ionizing radiation sources; these are spread across 3,695 industrial and medical facilities **[*2*]**. Among these facilities, 90 are located within the Special Region of Yogyakarta (DIY). These license holders include universities, laboratories, hospitals, and industries. However, the radiation sources in these facilities are not protected appropriately due to Indonesian police and security officers' lack of nuclear security knowledge. As far as the officers know, the radioactive source is only utilized in nuclear power plants and nuclear submarines. Therefore, radioactive material theft and terrorism come from the facilities mentioned above, and the officers are unaware. Consequently, there is a possibility that some events go undetected. As previously mentioned, the event in 2020 made them aware of the need for increased knowledge for how to secure radioactive materials in these facilities.

UGM's nuclear engineering program is a member of the International Nuclear Security Education Network (INSEN) and takes action to help solve Indonesia's nuclear security problems. This is in line with the 2018-2021 IAEA Nuclear Security Plan because one of the plan's objectives is to achieve effective nuclear security through capacity building, including education and training **[*3*]**.

This paper shares the Nuclear Engineering Program's experience while conducting the pilot three-day training for local police and UGM's security officers. This paper also explains how the training was conducted and evaluated. The training objective was to improve officers' capabilities when dealing with nuclear security issues around their jurisdiction. The training was supported by BAPETEN and the Special Region of Yogyakarta's Police (POLDA DIY).

II. The Training

The training targeted members of the Special Region of Yogyakarta's Police and UGM's officers who are responsible for protecting facilities. After discussion with the Special Region of Yogyakarta's police chief, we concluded that the officers were not familiar with nuclear technology, especially for nuclear security. Therefore, the training materials were designed to introduce nuclear technologies and provide basic nuclear security skills.

The lessons were divided into 12 sessions, shown in Table 1. Sessions 1, 2, and 3 were intended to build the foundation of nuclear technology, and the rest provided the basic skills of nuclear security.

International Journal of Nuclear Security, Vol.7, No.1, 2022

Table 1. The 12 Training Sessions

Session Number	Materials	Time (minutes)	Trainer
1	Introduction to Nuclear Radiation	90	UGM
2	Risks and Benefits of Nuclear Radiation	90	UGM
3	Introduction to Nuclear Radiation Detection and Detector for Nuclear Security	60	UGM
4	Radiation Detector Exercises	75	UGM
5	Nuclear Security Principles and Global Cases	60	UGM
6	Nuclear Emergency Procedures	60	BAPETEN
7	Psychology for Nuclear Security	75	UGM
8	Introduction to Nuclear Installations and Radiation Facilities	60	UGM
9	Introduction to Physical Protection Systems	60	UGM
10	Table-Top Exercises	120	UGM
11	Nuclear Security in Transportation	75	UGM
12	Nuclear Material Transportation Case Study	60	UGM

BAPETEN sent staff to teach a topic in the nuclear emergency procedures as this is their primary scope of authority. The materials were delivered in various methods (i.e., classical, hypothetical facility table-top exercises, case studies, and practical exercises) and were adjusted according to the topics.

The study was comprised of 16 police officers and four UGM officers. The security training was conducted on September 3-5, 2018. The police officers attending were ordered by their chief, and they came from several divisions (e.g., medical, forensic laboratory, special corps, and criminal investigation). Only a small portion of the attendees had minimal prior experience in nuclear security provided by their seniors at the police headquarters. Therefore, the training was a new experience for most.

The trainees appeared to be enthusiastic about the material provided by the trainers. They also asked questions proactively. We supposed that the material was new to them and could be used in their jobs. For example, the radiation detector shown in Figure 1 could be especially useful. Trainees looked excited when they tried using the radiation detector. Figure 2 shows when the assistants guided them using several types of radiation detectors such as a portable portal monitor, a personal radiation detector (PRD), a Radionuclide Identification Detector (RID), and a survey meter. In an exercise, the trainees practiced finding hidden sources (Figure 3).

The table-top exercise in Figure 4 attracted the trainees the most. The participants were asked to build physical protection in a hypothetical radiotherapy unit. We divided the trainees into four groups; each group was further divided into an attack group and a security group. One assistant guided each group during the exercise.

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Figure 1. UGM's staff showing a radiation detector in class, while introducing the principle of nuclear radiation detection and measurement

Figure 2. Explaining how to use several radiation detectors

Figure 3. A trainee exercises finding hidden radiation sources using PRD, RID, and a survey meter

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International Journal of Nuclear Security, Vol.7, No.1, 2022

Figure 4. A group's table-top exercise

Pre-tests and post-tests were conducted to comprehend trainee knowledge of the materials before and after the training, as well as the benefits in conducting their duties. There were 15 questions on the test, all different topics:

1. the nuclear technology
2. the radiation
3. the benefits of nuclear radiation
4. the radiation effects
5. the radiation detection
6. the nuclear security
7. the nuclear emergency procedures
8. the institutions related to nuclear emergency
9. the nuclear reactor
10. the facilities utilized radioactive materials
11. the motivation of nuclear security threatening persons
12. the physical protection system
13. the detect-delay-response
14. the role of equipment in a physical protection system
15. the radioactive transport security

The trainees must judge their knowledge on the 15 questions by choosing a point from 1 to 7 without point 4 in a circulated sheet. The point represents what they know about the information. For example, trainees who did not understand anything about nuclear technology chose point 1, and those who understood very well should select point 7. Point 4 was eliminated from the options to avoid any vague answers from the trainee. It was conducted before session 1 started and after session 12 ended. The number of answers for each point was then divided by the total number of answers in each question, so the percentage for each point was obtained, shown in Table 2.

Table 2 shows that most of the trainees said they did not understand the meaning of detect-delay-response (question number 13) on the pre-test; 85% of participants chose point 1. However, they roughly understood the nuclear radiation effects (question number 4) and institutions responsible for nuclear emergency response (BAPETEN) in question number 8. It was indicated by the presence of personnel who chose point 5.

It is noticeable in Figure 5 that the majority of point levels were shifted from point 1 to point 5, which shows that their knowledge improved. It matches the differences between pre-tests and post-test results shown in Table 2, especially in question number 14 (the role of equipment in a physical protection

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system). Based on the t-test, the P-value of question number 14 is less than α value (0.05), meaning there is significant different knowledge between pre-test and post-test. So, we can conclude that the training was successful and met its objective.

Table 2. Trainee understanding differences between the pre-test and post-test

Question's number	Pre-test						Post-test						P-value (α: 0.05)
	1	2	3	5	6	7	1	2	3	5	6	7	
1)	55%	35%	10%	0%	0%	0%	6%	6%	24%	47%	12%	6%	0.653
2)	55%	25%	20%	0%	0%	0%	6%	6%	18%	53%	12%	6%	0.147
3)	60%	20%	20%	0%	0%	0%	6%	6%	18%	53%	12%	6%	0.177
4)	50%	35%	10%	5%	0%	0%	6%	6%	24%	35%	24%	6%	0.310
5)	65%	25%	10%	0%	0%	0%	6%	0%	25%	50%	6%	13%	0.288
6)	65%	30%	5%	0%	0%	0%	6%	0%	24%	53%	12%	6%	0.352
7)	70%	20%	10%	0%	0%	0%	6%	0%	29%	41%	18%	6%	0.336
8)	60%	25%	5%	10%	0%	0%	6%	0%	24%	35%	29%	6%	0.538
9)	65%	20%	15%	0%	0%	0%	6%	0%	29%	53%	6%	6%	0.340
10)	60%	30%	5%	5%	0%	0%	6%	0%	18%	47%	24%	6%	0.575
11)	65%	20%	15%	0%	0%	0%	6%	6%	24%	41%	18%	6%	0.173
12)	75%	15%	10%	0%	0%	0%	6%	6%	18%	53%	12%	6%	0.285
13)	85%	10%	5%	0%	0%	0%	6%	6%	18%	59%	6%	6%	0.371
14)	70%	30%	0%	0%	0%	0%	6%	6%	24%	35%	24%	6%	0.027
15)	75%	25%	0%	0%	0%	0%	6%	6%	18%	47%	12%	12%	0.058

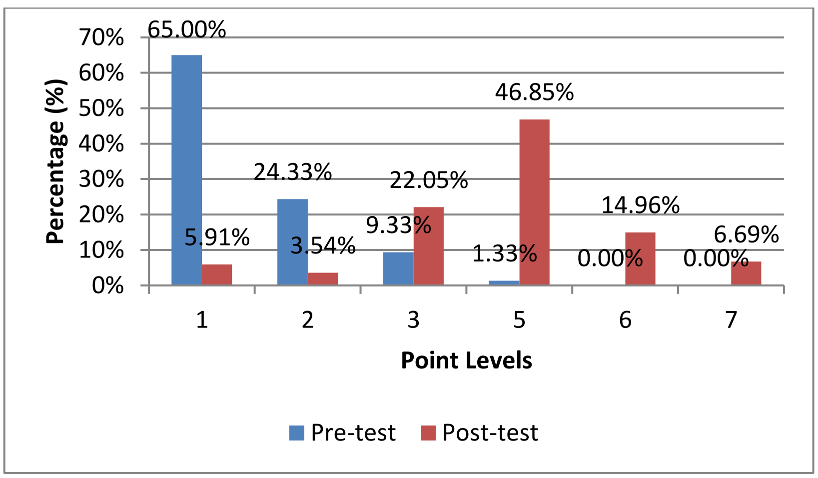

Figure 5. Trainee understanding based on pre-tests and post-tests

A questionnaire was given to participants for feedback regarding the quality of the materials and delivery method effectiveness. Figure 6 shows that the trainees felt that the Introduction to Nuclear Installations and Radiation Facilities material (session number 8) was the least attractive session. One reason for this could have been its unattractive traditional lecture-style delivery. A similar situation was seen in the Nuclear Security Principles and Global Cases section. This feedback is vital for the trainers to improve their methods. The participants were interested in the Radiation Detector Exercise, the Psychology for Nuclear Security section, the Introduction to Physical Protection System section, and the Table-Top Exercise. This could be because these topics are more fitting for their daily jobs. This feedback from the participants is valuable for arranging the next training.

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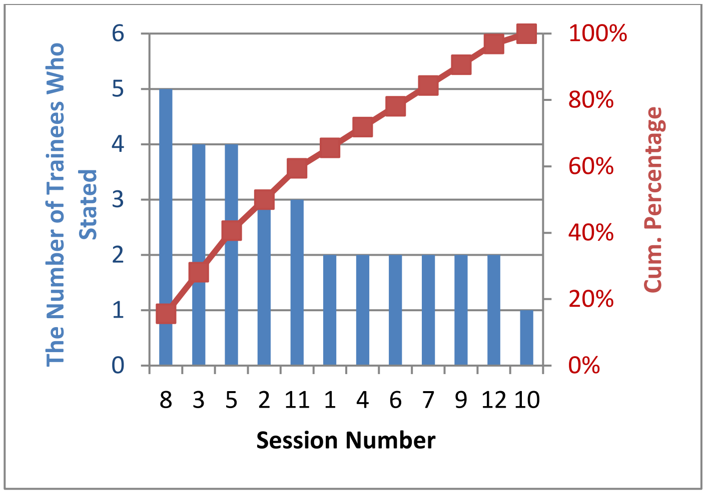

Figure 6. Trainee rankings of less attractive session numbers

III. Conclusions

Based on the pre and post-training tests, we can conclude that the trainees' knowledge on nuclear security improved. This improvement was due to the fact that materials fit their job needs, varied delivery methods, and the participant's awareness and attention. Their increased awareness led them to say that the number of trainees in this event does not meet the number of facilities utilizing radioactive sources in the Special Region of Yogyakarta. Therefore, the training should be conducted again in 2019 with improvements based on the feedback. Furthermore, the participants should come from not only the Special Region of Yogyakarta but the whole country.

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