**Efforts of the ROK to enhance nuclear security awareness**

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Abstract

There have been many cases reported on security breached accident due to the lack of security awareness around the world. This awareness on security that was called security culture was especially important in the nuclear facility since its consequence was huge compared to other ones. The international community including the IAEA has been making efforts to enhance the awareness of nuclear security by discussing it as main agenda at nuclear security summit and publishing guidebook as one of the nuclear security series. The ROK, which has 24 nuclear power plants, has recognized the importance of nuclear security culture and has been conducting many activities to increase the awareness of nuclear security of those who works at nuclear facilities. The most effective ways to enhance the nuclear security culture is to provide education and training to the staff including managing members. The ROK had prepared legal base for mandatory training program on nuclear security in 2012. Every staff who works at nuclear facility should take training class for 2 hours to 8 hours depending on his/her job position mandatorily. A lot of hands-on activities were included in the program using the SETT (**SE**curity research, **T**raining and **T**est facility) located in the KINAC. In addition, the ROK had developed questionnaires to evaluate awareness of the nuclear security of the staff and has been conducting survey annually since 2009. The survey was made up of a series of questionnaires that were divided into four categories, beliefs and attitude, operating systems, leadership behaviors and staff behaviors. More than 800 persons who worked at nuclear facilities from over 10 different facilities had participated in the survey. Score of the awareness increases gradually. Analysis was performed on the results of survey to figure out what measures should be taken to enhance the awareness of nuclear security. Analysis results showed that the respondents satisfied the items like responsibility of mission, training & exercises, supervision & management, and awareness of information security. On the other hand, items such as job definition, motivation for those who work in the security area, importance of duties, and expertise were analyzed as those of which should be improved. The ROK has a plan to develop customized training program depending on the kinds of audience such as for senior management and safeguards officer. The survey will be also conducted continuously with more sophisticated questionnaires.

1. **Introduction**

The breach of the Y-12 facility in the US by a nun and her supporter had made people to realize the importance of security awareness. Three layer of protection wall and a state of art detection equipment were useless. Compared to safety culture, security awareness (or security culture) has not been noticed since there was a strong belief that security can be achieved by advanced equipment such as intelligence access control system, high-tech detection system and intelligence CCTV camera. However, many accidents related to security show that a state art technology can’t protect facility without raising awareness level of the people who operate the equipment. The importance of security culture at nuclear facility was emphasized at the Nuclear Security Summit that was held from 2010 to 2016. The security of nuclear facility is more important than other facilities because it can cause accident like the Fukusima. The international community including the IAEA have been many efforts to improve the security awareness of those who work at nuclear facility. More than 30 countries had promised to construct training center to open to the world. The main purpose of the establishment of training center after the Nuclear Security Summit was to provide education and training course for raising awareness of nuclear security. The IAEA has also provided workshops and meetings, and developed documents to raise the awareness of nuclear security. In cope with the efforts of the international community, the ROK promised to establish the international training center called INSA (International Nuclear Security Academy) for nuclear security and it opened in 2014. The INSA has provided more than 10 international training courses every year. The INSA is used not only for the international training but also as a place for education courses for those who work at nuclear facilities. The ROK is taking a variety of measures to improve the awareness of nuclear security. All the personnel who work at nuclear facility should take training course from 2 to 8 hours annually depending on their role and position in accordance with the revised Act (Act on Physical Protection and Radiological Emergency). The degree of nuclear security awareness for those who work in the nuclear facility can be evaluated by the survey. The ROK had developed questionnaire and the survey has been carried out every year since 2009. Hosik Yoo analyzed the result of the survey and published it in 2015 and 2019[1,2]. Due to these efforts, awareness of nuclear security has been improved.

1. **Legal Framework for nuclear security culture**

The APPRE (Act on Physical Protection and Radiological Emergency) was entered into force in 2004. However, there was no article on education of those who work at the nuclear facility. Legal framework on education and training was prepared in the enforcement regulation and Notice (Regulations on education and training of persons who perform functions related to physical protection measures) in 2010. In this enforcement regulation, all the personnel who work at nuclear facility should take training course on physical protection from 2 to 8 hours annually depending on their role and responsibility. Legal base for mandatory education was invigorated in 2015 by inserting related paragraph in the APPRE. Curriculum on cyber security was included in 2015 after there was an attempt to hacking to the nuclear power plant in 2014.

1. **Implementation of mandatory education program**

All the personnel who work at nuclear facility should take a compulsory education in accordance with the Act regardless of their role and responsibility. However, education time is not the same to all. Those who are newly assigned or recruited as guards must take 8 hours’ course before they do their work. Those who already work as guards should enroll 4 hours’ program annually. The other worker who is responsible for other business such as researchers, administrator and technicians take 2 hours’ course. The contents of the program are composed of several topics such as ‘Fundamental of physical protection’, ’International framework for nuclear security’, ‘Domestic legal base’, ‘Experience on physical protection’ and ‘Security culture. Curriculum on cyber security was included in 2015 after attempts of cyber hacking against nuclear power plant occurred in 2014. KINAC is responsible for designing and developing the curriculum and contents of these program. KINAC also developed e-learning program and provided it to the listener. A total of 2,194 people took the mandatory course over the 39 times in 2018 and 5,381 people completed their compulsory education through e-learning. It is expected that the number of participant to the mandatory education program increases gradually due to growing number of nuclear facility.

1. **Survey**

**4-1. Questionnaires for the survey**

The questionnaires for a survey on nuclear security culture has been developed since 2009. There have been many efforts to improve the questionnaires and it is identified that measures such as leadership management, security systems, and the behaviors of the facility’s staff are affected nuclear security culture. In order to reflect the international documents regarding security culture [3] and opinions of the respondents, the questionnaires had been modified. The questionnaires used in this study are comprised of four categories: beliefs and attitudes, operating systems, leadership behavior, and staff behavior. Each category has between eight (beliefs and attitudes) and twenty-three (operating systems) questions. Five categories (strongly disagree, disagree, neutral, agree, strongly agree) for answer were given to respondent. Table 1 shows the questionnaire sheet for beliefs and attitude as an example [1].

**4-2. Survey Results**

There were not any specific tendencies for the score of nuclear security awareness for four years as can be seen Figure 1. All the score were more than 80 points and except for 2015, the score exceeded 85 points for three years. Nuclear security awareness scores depending on gender and tenure can be seen in Figures 2 and 3.

Table 1. Questionnaire sheet for beliefs and attitude

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Belief and Behavior | | Answer | | | | |
| Strongly disagree | Disagree | Neutral | Agree | Strongly agree |
| I clearly know the difference between safety and  nuclear security | ①----②-----③----④----⑤ | | | | | |
| Nuclear security is as important as safety. | ①----②-----③----④----⑤ | | | | | |
| Threats on nuclear security are increasing domestically  and globally. | ①----②-----③----④----⑤ | | | | | |
| Our organization is ready to response appropriately to  threats from outsider as well as insider. | ①----②-----③----④----⑤ | | | | | |
| I feel a responsibility for nuclear security in  what I am doing | ①----②-----③----④----⑤ | | | | | |
| I think that my mission plays an important role in keeping  or strengthening our organization’s level of nuclear security | 1. ----②-----③----④----⑤ | | | | | |

Figure 1. Variations in security culture awareness over four years

In all four years, men’s nuclear security awareness was significantly higher than that of women. For those who worked for 9 to 11 years, there was no specific trend according to their work experience. However, those who worked for more than 11 years were highly aware of nuclear security. From the four-year survey on nuclear security awareness, it was found that the same items showed low score constantly. In order to obtain more definite results, the graph showing awareness scores by item in the leadership behavior category for 2016-2017 was shown in Figures 4. As shown in these Figures, the items on the upper right are the highest scores for two consecutive years and the items on the lower left have the lower scores. Motivation for those who work in the security area was low score. The items that showed low scores in consecutive years in other category were displayed and these are summarized in Table 2. Items that need to be supplemented are job definition, importance of mission and preparing of response against threats in beliefs & attitude category, evaluation of credibility in operating systems, motivation for those who work in the security area in leadership behavior, and expertise and wariness on duty in staff behavior.

Figure 2. Variations in security culture awareness depending on gender

Figure 3. Variations in security culture awareness depending on tenure

Figure 4. Analysis of the results in the leadership behavior category

Table 2. Items showing high and low scores in the category

|  |  |  |
| --- | --- | --- |
| Category | High Score | Low Score |
| Beliefs and Attitudes | ⬝ Responsibility of Mission  ⬝ Importance of Security Work  ⬝ Increasing Threats | ⬝ Job Definition  ⬝ Importance of Mission  ⬝ Preparing of Response  against Threats |
| Operating Systems | ⬝ Information Security  ⬝ Exercise and Training | ⬝ Evaluation of  Trustworthiness |
| Leadership Behavior | ⬝ Supervising & Management  ⬝ Communication Skill | ⬝ Motivation for those who Work in the Security Area |
| Staff Behavior | ⬝ Awareness on Information Security | ⬝ Expertise  ⬝ Wariness on Duty |

1. **Conclusions**

The ROK has been many efforts to enhance nuclear security awareness of those who work at nuclear facility. Legal framework was prepared for the mandatory education program on nuclear security and it was provided since 2012. KINAC played an important role in preparing for curriculum including hands-on program for compulsory education. All the employee and senior management who work at nuclear facility should take education program for 2 to 8 hours depending on their role and responsibility. KINAC has developed and provided e-learning program on nuclear security and more than 5,000 people are receiving nuclear security education through it every year. The subject of education includes from international framework to physical protection system. The ROK has started the survey to measure nuclear security awareness of those who work at nuclear facility in 2009. The questionnaires for survey was developed by the KINAC reflecting international documents and feedback from the respondent. The survey has been carried out once in a year and more than 800 people have participated. The survey results showed that Items such as job definition, importance of mission and preparing of response against threats in beliefs & attitude category, evaluation of credibility in operating systems, motivation for those who work in the security area in leadership behavior, and expertise and wariness on duty in staff behavior were needed to be supplemented.

References

[1] Hosik Yoo and Jeongho Lee ,’Results of nuclear security culture survey on personnel at nuclear power plant’, Annals of nuclear energy 85(2015) 398-402

[2] Hosik Yoo, Jeongho Lee and Jinho Chang,’An analysis of the survey results on nuclear security culture for personnel at nuclear facilities’, 112(2019) 75-79

[3] IAEA nuclear Security Series No. 7, Nuclear Security Culture