STATUS AND PROPOSALS TO ENHANCE NUCLEAR SECURITY CULTURE AT RADIATION AND NUCLEAR FACILITIES IN VIETNAM

Bui Thi Thuy Anh[1]
Vietnam Agency for Radiation and Nuclear Safety

Abstract:

Nowadays, along with the development of application of radiation and nuclear technology, the issue of ensuring nuclear safety and security for nuclear and radiation facilities becomes more urgent. To ensure nuclear safety and security, building a nuclear security culture plays a very important role. However, the nuclear security culture is a new concept for Viet Nam and even the world, so research on nuclear security culture, first of all, evaluating the status of nuclear security culture, is essential. This paper presents the results of a study conducted by the Vietnam Agency for Radiation and Nuclear Safety on the assessment of nuclear security culture in 18 out of 28 radiation facilities using radioactive sources at security level A, 6 out of 24 facilities use radioactive sources at security level B[2] *across the country and in the Vietnam's only nuclear facility*[3]*; and the solutions proposed by the research team to enhance the nuclear security culture in Vietnam's nuclear and radiation facilities in the coming time.*

Keywords: *Nuclear security culture; Radiation and Nuclear Facility; Radiation and nuclear safety and security.*

Code: *16122801*

1. Overview

Nowadays, nuclear technology is applied effectively in many different fields of production as well as in human life of most countries around the world. However, along with the development and application of nuclear technology, the risks of nuclear security incidents have increased, especially in the recent time when terrorism spreads worldwide. Therefore, at the General Assembly meeting of the International Atomic Energy Agency (IAEA) in September 2012, IAEA Member States agreed to adopt a resolution which included integrated methods to against nuclear terrorism. One of the goals of the IAEA's nuclear security program is to provide

[1] The author's contact email address: thuyanhvov5@gmail.com, btanh@varans.vn

[2] According to the Circular No. 23/2010 dated 29th December 2010 of Ministry of Science and Technology on guidelines for ensuring security of radioactive sources, there are four levels of nuclear security, of which level A corresponds to the group of radioactive sources which have the highest hazard level and level D is the lowest ones.

[3] The only nuclear facility in Vietnam is the Dalat Nuclear Research Institute, under the Vietnam Atomic Energy Commission, which is home of the existing research nuclear reactor.

guidance and assistance to help member states to establish a high nuclear security culture. This will facilitate and optimize the human aspects of the national nuclear security program. An effective nuclear security culture can greatly increase the effectiveness of nuclear security measures for radiation and nuclear security.

In Vietnam, the application of radiation and nuclear science and technology (S&T) in life as well as in production has been developing strongly. As of March 2016, there were 3,909 radioactive sources (2,069 sources in use and 1,840 sources in storage) in the country, according to statistics from the Vietnam Agency for Radiation and Nuclear Safety (VARANS) with different levels of radiation hazards. Along with that, Vietnam has also initially approached and implemented several initial activities to ensure security of radioactive and nuclear materials. The Ministry of Science and Technology (MOST) has issued a number of legal documents to improve the implementation of nuclear security culture in facilities such as Circular No. 23/2010/TT-BKHCN dated 29th December 2010 on "Guidelines for security of radioactive sources" and Circular No. 24/2010/TT-BKHCN dated 29th December 2010 on providing regulations for classification and definition of categories of radioactive sources according to security requirements, etc. However, due to limited knowledge and low awareness practice in of the radiation and nuclear facilities, the implementation of regulations on security still has many inadequacies, so in the past time, there has been happening some radioactive source security incidents (loss of radioactive sources). Recently, a number of incidents with radioactive sources have been reported and the typical case was the loss of radioactive sources which had happened with APAVE Asia Pacific Ltd in Ho Chi Minh City on 12th September, 2014. Its employees violated security guidelines while dealing with a mobile radioactive sources (namely, a device with an enclosed Ir-192 radioactive source used in industrial imaging), so that the radioactive sources was stolen while kept at home. The incident did not cause any damage to human health and the environment but caused a great psychological concern to the people in the city, and took much effort and resources in the search and recovery activities. A loss of Co-60 radioactive source used to measure the molten steel level had been recently reported to occur in Pomina Steel Refining Plant, April 2015. The plant detected the loss of radioactive sources in March 2015 when it handled between the former radiation safety officer and the new employee. This outage was reported very late (April 2015), causing a lot of difficulties in search activity. The occurred incidents have shown the limited awareness of security issues, especially the nuclear security culture of the facilities has not been effectively implemented, causing the risk to human health and the environment.

From the above analysis, it is necessary to study the current status of nuclear security culture to provide a basis for proposing solutions to enhance nuclear security culture in radiation and nuclear facilities of Vietnam in the coming time.

2. Nuclear security culture

2.1. Nuclear security culture concept

According to the International Atomic Energy Agency (IAEA), the nuclear security culture is defined as "the set of characteristics, attitudes and behaviour of individuals, organizations and institutions which serves as a means to support and enhance nuclear security"*(IAEA Nuclear Security Series No.20, 2013)*. The role of culture can be deduced from the Agency's definition of nuclear security defined as "the prevention and detection of, and response to theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear or other radioactive substances or their associated facilities" *(IAEA Nuclear Security Series No.20, 2013)*. Consequently, the influence of security culture affects the safety and security of all radiation facilities, nuclear facilities and nuclear activities.

2.2. Model of nuclear security culture

IAEA Model of nuclear security culture (Figure 1) was shown in IAEA Nuclear Security Series No.7, 2008.

Figure 1. IAEA model of nuclear security culture

This model can be applied extensively to nuclear facilities (nuclear power plants, fuel cycle facilities, research reactors, nuclear facilities, radiation facilities, other organizations dealing with radioactive materials, customs and border control organizations). The IAEA's model of security culture divides the cultural manifestations into five elements *(IAEA Nuclear Security Series No. 7, 2008),* which are: (i) beliefs and attitudes; (ii) principles for guiding decisions and behavior; (iii) leadership behavior; (iv) management systems; and (v) personal behavior. The above model is being disseminated and guided by the IAEA to help countries build nuclear security culture for radiation and nuclear facilities. In Vietnam, with support of the IAEA, a number of seminars and training courses on nuclear security culture were also organized with the participation of radiation and nuclear facilities.

3. Survey and assess of the practice of nuclear security culture at the radiation and nuclear facilities in Vietnam

3.1. Scope of the survey

Currently, according to the classification of security level of radioactive sources specified in the MOST's Circular No. 23/2010 dated 29th December 2010 on Guiding the Security of Radioactive Sources, Vietnam has 28 radiation facilities at the highest level of A security (the highest security level) and 24 facilities at level B. Within the scope of this study, the nuclear security survey was conducted at 18 radiation facilities at level A security, 6 facilities at level B security and at Da Lat Nuclear Research Institute - the radiation facility who is also the only nuclear facility of our country currently.

3.2. Survey respondents

The respondents of this study include individuals directly involved in nuclear security and radioactive source security, including: Leaders of facilities, managers of departments using the radioactive sources, people responsible for security at the facilities, employees working directly with radioactive sources.

3.3. Survey contents

The questionnaires for practice of nuclear security culture by radiation and nuclear facilities designed by the Vietnam Agency for Radiation and Nuclear Safety (VARANS) was developed on the basis of the guidelines of IAEA security culture. This self-assessment is aimed at understanding the perception and implementation of security culture of staff/managers working in radiation and nuclear facilities, including five questionnaires

corresponding to five elements of nuclear security culture. The answers to the questions were divided according to the level of agreement of the participants with the comments provided, including 5 levels from high to low, as follows: (i) Absolutely agree; (ii) Agree (agree basically but not completely); (iii) 50/50; (iv) Relatively agree (partially agree but less than 50%); (v) Absolutely disagree.

3.4. Survey results

Main results of 38 replies from the radiation and nuclear facilities under survey are listed as follows:

** Radiation facilities*

The results of the survey at 18 radiation facilities at level A security and 6 radiation facilities at level B security with the self-assessment questionnaires showed that the answer "Absolutely Agree" and "Agree" accounts for a large proportion, while the "50/50", "Relatively Agree" and "Disagree" answers only represent a small percentage (as in Chart 1). This shows that the nuclear security culture at radiation facilities at level security is being performed relatively well. However, in addition, with a small number of "50/50" answers, "Relatively Agree" and especially the "Disagree" answers has also shown some problems of inadequate implementation of nuclear security culture in the surveyed facilities. These are shortcomings in the issuance of regulatory documents, regulations on procedures and guidelines for security of radioactive sources, nuclear security, management systems and especially in employee behavior as well as the main managers of the facilities.

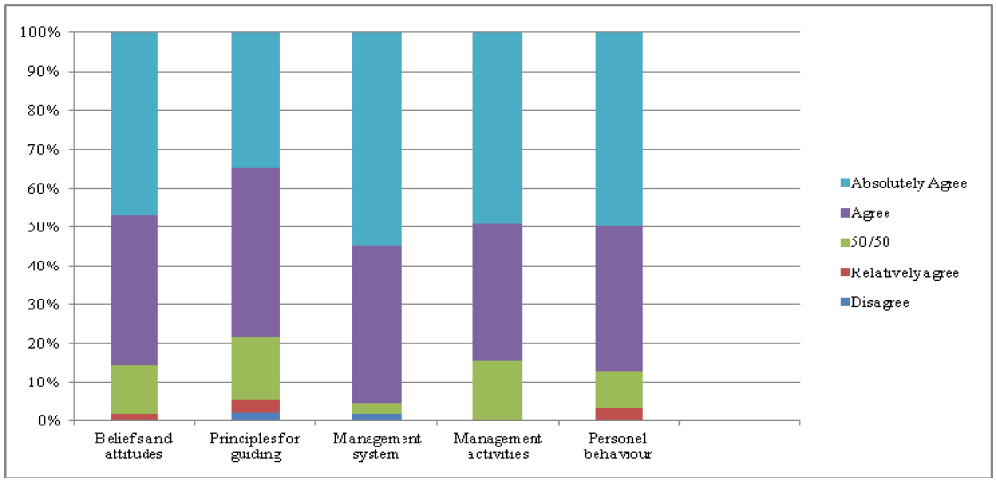

Chart 1. A graph summarizes nuclear security culture self-assessment at radiation facilities using security level A and B radioactive sources

** Nuclear facilities*

The survey results at the Dalat Nuclear Research Institute, the only nuclear facility in Vietnam also shows that the number of "Absolutely Agree" and "Agree" answers represent the largest proportion, followed by the "50/50", while the answers "Relatively Agree" and "Disagree" are very small (as shown in Chart 2). The results show that the implementation of nuclear security culture at the only nuclear facility in Vietnam is very good. However, with a large number of "50/50" answers and a very small number of "Relatively Agree" and "Disagree" responses, it is still very necessary to remain and enhance nuclear security culture at the Dalat Nuclear Research Institute.

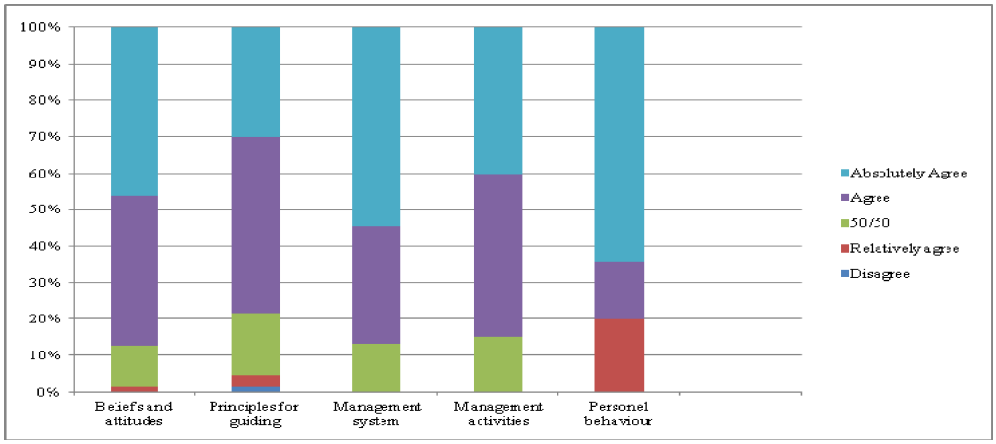

Chart 2. The graph summarizes nuclear security culture self-assessment results at Nuclear facility of Vietnam

3.5. Evaluation of the current status of security culture implementation in Vietnam's radiation and nuclear facilities

Through surveys at radiation facilities using security level A, B radioactive sources and nuclear facilities, we found some key issues related to the five elements of the security culture that are being evaluated as follows:

- On "Beliefs and attitudes": The beliefs and attitudes about the security of radioactive sources and nuclear security of the leaders, management staff and technical staff are correct, properly aware of the importance of security work at the facilities. This is the result of many training courses for the facility leaders and staff to be aware of the roles and responsibilities related to radioactive source security and nuclear security management organized by the regulatory body (here is VARANS) with the guidance of international and domestic experts. However, through the limited number of non-consensual responses, the

attitudes and perspectives of the managers as well as the staff at the facilities on the role and importance of ensuring nuclear security and security of radioactive sources should be further enhanced in the future;

- On "Guiding Principles for Decisions and Behaviors": A system of principles guiding decisions and behaviors at the facilities has been established in accordance with existing national regulations and guidelines of International Atomic Energy Agency. However, the results also suggest that in the coming years, guidelines for decision-making and behavior to be better understood and implemented will need to be updated and revised, or re-issue regulatory documents on procedures and guidelines for ensuring security of radioactive sources and implementing nuclear security at the facilities, which will better support staff, especially new staff when operating and managing the system;
- On "Leadership Behaviors": Overall evaluation results show that facility's leaders are acting properly to improve radioactive source security and nuclear security standards. However, the results of the assessment also show that in order to have a more effective nuclear security management in the coming time, it is necessary to set a goal to periodically improve nuclear safety standards in the facilities, also to regularly share information on security issues and incidents occurring in the country as well as abroad in order to raise awareness and accountability of their employees;
- On "Management system": The management system for nuclear security culture at the facilities has defined the roles and responsibilities related to nuclear security and radioactive source security for each level of management. The facilities have installed a complete and modern physics protection system (PPS). However, the assessment results also show that in the coming time, the system of self-assessment of the operating systems, management of nuclear security and safety of radioactive sources in facilities to be more effective would need to be further improved and enhanced according to the practical requirements of security insurance;
- On "Behavior of staff": The assessment results showed that the staff directly involved in security management at the facilities are currently doing well to improve the standards of radioactive sources security and nuclear security. However, it is also necessary to improve some related knowledge and information such as knowledge of professional security of each employee for each position; human factors that may affect radioactive source security, nuclear security.

4. Policies and regulations affecting nuclear security culture in Vietnam's radiation and nuclear facilities

4.1. State management of radioactive sources

According to the Atomic Energy Law, VARANS is the agency to assist the MOST in performing state management of radiation safety and radioactive source security. At the provincial level, the Provincial Departments of Science and Technology are the agencies assisting the Provincial People's Committees of the provinces and cities directly under the Central Government in performing the function of State management over the safety and security of radioactive sources.

VARANS administers the online registration support system RAISVN (software for declaration, licensing management of radiation facilities, radiation equipment and radioactive sources of Vietnam prepared in accordance with the IAEA software). Local authorities can use the RAISVN system for licensing and to serve the management of radioactive sources in their respective jurisdictions. In addition, for the radiation facilities, RAISVN will help file online records when carrying out licensing procedures, facilitate the rapid assessment of licensing of establishments, improvement of administrative procedures, and to effectively support the business of facilities.

4.2. Legal documents system

In the management of safety and security of radioactive sources in general as well as nuclear security culture in particular, firstly, it must mention the legal corridor for management in this field. At present, equivalent legal documents on nuclear security culture have been issued.

In June 2008, Atomic Energy Law No. 18/2008/QH was passed by the National Assembly and officially came into force on 01st January 2009 including 11 chapters and 93 articles. Chapter 3 deals with ensuring radiation safety and security of radioactive sources. There are fundamental regulations on measures to ensure radiation safety and security, responsibilities of facilities using radioactive sources and responsibilities of state management agencies. This is the principle requirements to build a system of legal documents regulating radiation safety and security. Accordingly, the highest responsibility for the safety and security of radioactive sources lies with the facility operators who have been licensed to carry out radiation work related to radioactive sources.

On the basis of the Atomic Energy Law 2008, a number of under-law documents in the field of the management of radiation safety and radioactive source security have been issued, including:

- Decree No. 07/2013/ND-CP dated 25th January 2010 of the Government detailing and guiding the implementation of some articles of the Atomic Energy Law;
- Decree No. 107/2013/ND-CP dated 20th September 2013 of the Government stipulating sanctions against administrative violations in the field of atomic energy;
- Circular No. 08/2010/TT-BKHCN dated 22nd July 2010 of MOST guiding on the declaration and licensing of radiation work and the granting of radiation personnel certificates, including articles on assessment of radiation safety and security of radioactive sources at radiation facilities when granting license for carrying out radiation work;
- Circular No. 19/2010/TT-BKHCN dated 28th December 2010 of MOST guiding on specialized inspection on radiation and nuclear safety including articles on radiation safety and security inspection during the inspection process;
- Circular No. 23/2010/TT-BKHCN dated 29th December 2010 of MOST guiding on the measures to ensure security of radioactive sources including articles on security measures to ensure the security of radioactive sources at the highest security level (level A) to the lowest security level (level D) in the use, storage and transport of radioactive sources;
- Circular No. 24/2010/TT-BKHCN dated 29th December 2010 of MOST including articles on classification and categories of radioactive sources according to security requirements;
- Circular 27/2014/TT-BKHCN dated 10th October 2014 by the Minister of Science and Technology specifying a number of articles of Decree No. 107/2013/ND-CP dated 20th September 2013 to sanction administrative violations in the field of atomic energy including articles guiding the contents of sanctioning administrative violations in radiation safety and radioactive source security;
- Circular No. 22/2014/TT-BKHCN dated 25th August 2014 of MOST on regulating the management of radioactive waste and radioactive sources (Circular 22);
- Circular No. 13/2014/TT-BKHCN dated 09th June 2014 on providing guides on ensuring radiation safety in health.

The above-mentioned legal documents clearly define the responsibilities of individuals, organizations and regulatory bodies in ensuring the safety and security of radioactive sources and guiding organizations and individuals in relation to radioactive sources to implement measures to ensure the safety and security of radioactive sources, as well as detailing the acts and forms of sanctioning administrative violations of radioactive source safety and security. This is the basis for the development of the procedures of the radiation and nuclear facilities on the implementation of nuclear safety and security in general as well as security culture in particular.

Through the survey results, the research team found that the understanding and implementation of legal documents at the current facilities is relatively equivalent and sufficient. However, the survey results also showed that some regulations and guidelines in the legal documents are unclear as well as not suitable to the conditions and circumstances of the radiation and nuclear facilities in Vietnam. Managers as well as direct staff at the facilities encountered some difficulties in the implementation process. Therefore, in the coming time, these legal documents need to be further revised and improved.

5. Propose solutions to enhance nuclear security culture in Vietnam's radiation and nuclear facilities

Through the assessment of the implementation of nuclear security culture in radiation and nuclear facilities in Vietnam as well as the policies and legal documents affecting nuclear security culture in the facilities, the research team proposed the following measures to strengthen nuclear security culture in Vietnam in the coming time:

- Bringing the concepts and contents of nuclear security culture into relevant legal documents and policies in the field of nuclear energy; revising and finalizing relevant legal documents to increase the efficiency and effectiveness of nuclear security and the building of nuclear security culture in the facilities; enhancing the information and communication on nuclear security culture; ensuring the resources to execute these regulations effectively;
- It is necessary to build efficient nuclear security culture in each facility to support the State in the effective management of security work. The key to strengthen the nuclear security culture is the leadership of the management team that maintains close links and coordinates the implementation of nuclear security, sharing experiences, and developing security techniques;

- Enhancing capacity and awareness on nuclear security culture for security staff at radiation and nuclear facilities in Vietnam, through which will minimize the likelihood of incidents that cause unsafety and security of facilities. At the same time, enhancing the response capability of staff during incidents, there are also timely response actions, minimizing the consequences caused by incidents;
- Installing and upgrading modern security equipment system, ensuring funding for maintenance of security equipment so that the security equipment always operate properly;
- Regulatory body should plan regular security inspection at the facilities in accordance with the approved standard security procedures. VARANS should prepares and provide guides on the nuclear security culture self-assessment on the basis of the IAEA guidelines for dissemination to radiation and nuclear facilities;
- Radiation facilities and nuclear facilities should periodically carry out self-assessment in accordance with VARANS's guideline on nuclear security culture self-assessment to overcome problems arising in their operation at the facilities;
- Viet Nam needs regular and continuous information exchanges with the IAEA to update and revise the guiding documents for the implementation of safety and security in general as well as nuclear security culture in particular in radiation and nuclear facilities in accordance with the practice in Vietnam as well as in the world./.

REFERENCES

1. IAEA. 1968. The Project and Supply Agreement for TRIGA Mark II reactor, INFCIRC/106, 12th January 1968.
2. IAEA. 1983. The Project and Supply Agreement for Dalat IVV-9 reactor, INFCIRC/308, December 1983.
3. IAEA. 2008. Implementing Guide. Nuclear Security Culture. IAEA Nuclear Security Series No.7, Vienna.
4. IAEA. 2013. *Nuclear Security Fundamentals. Objective and Essential Elements of a State's Nuclear Security Regime*. IAEA Nuclear Security Series No.20, Vienna.
5. IAEA. 2013. *Nuclear Security Plan for 2014-2017*, GOV/2013/42-GC (57)/19.