

RESEARCH ON NUCLEAR SECURITY
CULTURE IN MEDICAL INSTITUTIONS USING
RADIOACTIVE SOURCES AND MATERIALS
BADANIA NAD KULTURĄ BEZPIECZEŃSTWA
W INSTYTUCJACH WYKORZYSTUJĄCYCH
ŹRÓDŁA I MATERIAŁY RADIOAKTYWNE

Małgorzata WIŚNIEWSKA*

ABSTRACT

The first self-assessments of nuclear security culture in a medical facility in Poland (2017–2018) have become the milestone for this small organization. It enabled the personnel to understand nuclear security culture and encouraged the managers to plan further improvements in nuclear security culture in the future. The research project titled “The Enhancement of Nuclear Security Culture in Medical Institutions Using Radioactive Sources and Materials” was conducted by Poznan University of Technology, with strong support from the IAEA. According to that project the first part of the article presents and explains the substance of the nuclear security culture, and also shows the differences between concepts of *safety culture* and *security culture*. The next part of the article presents objectives, describes the methodology as well as the results of work carried out as part of the research and development project. The content of the last part of the publication results from the author’s research experience, as well as lessons learned in the field of security culture.

* Dr Małgorzata Wiśniewska, Poznan University of Technology; correspondence address: Wydział Inżynierii Zarządzania Politechniki Poznańskiej, ul. Strzelecka 11, 60-965 Poznań, Poland

KEY WORDS

nuclear security culture, medical security culture, security culture, self-assessment, radioactive sources

ABSTRAKT

Pierwsza w Polsce samoocena kultury bezpieczeństwa w instytucji medycznej wykorzystującej źródła i materiały radioaktywne miała miejsce w latach 2017–2018 i może być uważana za przełom w funkcjonowaniu tak małej organizacji. Prace nad kształtowaniem kultury bezpieczeństwa wszczęły proces zmian w sposobie myślenia personelu szpitalnego o bezpieczeństwie poprzez podjęcie problematyki wykraczającej poza bezpieczeństwo pracy. Projektem zatytułowanym „Wzmocnienie kultury bezpieczeństwa w instytucji medycznej wykorzystującej źródła i materiały radioaktywne” kierował zespół Politechniki Poznańskiej wspierany przez MAEA. W nawiązaniu do ww. projektu w pierwszej części artykułu zaprezentowano i wyjaśniono zagadnienie kultury bezpieczeństwa jądrowego, a także wykazano różnice pomiędzy pojęciami *safety culture* i *security culture*. W kolejnej części artykułu przedstawiono cele, opisano metodologię oraz rezultaty prac prowadzonych w ramach wspomnianego projektu naukowo-badawczego. Treść ostatniej części publikacji wynika z badawczych doświadczeń autorki, a także wyniesionych z nich lekcji z zakresu kultury bezpieczeństwa.

SŁOWA KLUCZOWE

kultura bezpieczeństwa jądrowego, kultura bezpieczeństwa, samoocena, źródła promieniotwórcze

INTRODUCTION TO SECURITY CULTURE

According to the International Atomic Energy Agency's Code of Conduct on the Safety and Security of Radioactive Sources¹, “in every State, due to protection of individuals, society and the environment, appropriate measures should be taken to promote the safety and security culture with respect to radioactive sources”.

Security culture is a set of traits, attitudes and behaviors of people, organizations and institutions, serving as a means to strengthen security.

¹ International Atomic Energy Agency, *Code of Conduct on the Safety and Security of Radioactive Sources*, Vienna 2004.

The term *security* is to be understood as preventing, detecting and reacting to theft, sabotage, unauthorized access, unlawful transfer or other harmful actions related to radioactive sources or materials and related devices. The so-called harmful action is an action referring to radioactive sources or materials, done deliberately, which is not legally justified, and its intention may be to cause death, injury to the human body or damage to property or the environment. This term also means unauthorized removal, i.e. theft or other unlawful removal of a radioactive source or material².

Security culture is also understood as a set of basic values, attitudes and behaviors which focus on prioritizing goals connected with protection and security over other goals; this set can pertain either to whole groups or to individuals³. Thus, security also includes so-called physical protection of persons and property.

Threats to security are criminals or terrorists acquiring and using for their purposes:

- material suitable for the production of nuclear weapons (after processing),
- nuclear material for building a draft nuclear explosive device,
- radioactive material for constructing a radiological weapon (eg. a dirty bomb) and harming people and the environment.

Such hazards may also include: the spread of radioactive material by sabotage in facilities in which the radioactive material is found or during its transport.

In every state, to protect society and the environment, appropriate measures should be taken to promote a security culture among organizations and people using radioactive sources and materials in their activities⁴.

There are a number of references in IAEA's publications considering nuclear security culture important concerning radioactive sources and materials such as:

² PAA, „Projekt. Zabezpieczenie źródeł promieniotwórczych. Zalecenia organizacyjno-techniczne Prezesa Państwowej Agencji Atomistyki”, Warszawa 2017, s. 8.

³ Ibidem.

⁴ M. Wiśniewska, *Rola kultury bezpieczeństwa w organizacjach wykorzystujących źródła i materiały promieniotwórcze zgodnie z wytycznymi Międzynarodowej Agencji Energii Atomowej*, „Przegląd Naukowo-Metodyczny. Edukacja dla Bezpieczeństwa”, r. IX, nr 4/2016 (33), s. 469.

1. “Essential element 12: Sustaining a nuclear security culture regime... (c) Developing, fostering and maintaining a robust nuclear security culture⁵”.

2. “A nuclear security culture should be pervasive in all elements of the physical protection regime⁶”.

3. “All organizations and individuals involved in implementing nuclear security should give due priority to the nuclear security culture with regard to radioactive material⁷”.

4. “The State should implement relevant elements of the nuclear security culture for trustworthiness programme⁸”.

5. “Implementing a strong security awareness programme for staff and contractors contributes to an ongoing security culture within organization⁹”.

6. “Such methods are likely to include assessing the operator’s effort to develop detailed adversary scenarios on the basis of the (designed basis threat), to identify vital areas, develop strategies for physical protection and to create a security culture¹⁰”.

7. “A dynamic and effective security culture should exist at all levels of operator staff and management¹¹”.

8. “The State’s policy should recognize the need for a strong nuclear security culture to be established and maintained as a key part of an effective national nuclear security infrastructure¹²”.

⁵ International Atomic Energy Agency, *Objectives and Essential Elements of a State’s Nuclear Security Regime*, “IAEA Nuclear Security Series” 2013, no. 20.

⁶ International Atomic Energy Agency, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)*, “IAEA Nuclear Security Series” 2011, no. 13.

⁷ International Atomic Energy Agency, *Nuclear Security Recommendations on Radioactive Material and Associated Facilities*, “IAEA Nuclear Security Series” 2011, no. 14.

⁸ European Police Office et al., *Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control*, “IAEA Nuclear Security Series” 2011, no. 15.

⁹ International Atomic Energy Agency, *Preventive and Protective Measures Against Insider Threats*, “IAEA Nuclear Security Series” 2008, no. 8.

¹⁰ International Atomic Energy Agency, *Development, Use and Maintenance of the Design Basis Threat*, “IAEA Nuclear Security Series” 2009, no. 10.

¹¹ International Atomic Energy Agency, *Security of Radioactive Sources*, “IAEA Nuclear Security Series” 2009, no. 11.

¹² International Atomic Energy Agency, *Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme*, “IAEA Nuclear Security Series” 2013, no. 19.

In reference to the recommendations¹³ of the President of the National Atomic Energy Agency (PAA), organizational and technical measures should be implemented to achieve an adequate level of protection of radioactive sources.

The organizational activities listed by the Polish Atomic Energy Agency in 2017 include, among others, the determination of the following methods:

- protection of radioactive sources during their manufacturing, processing, use and circulation as well as storage,
- the deployment of security measures and devices, how they function and how they work, and how the security service is deployed, where it is required,
- proceedings in the event of a threat or a radiation emergency (the procedure results from the company's emergency plan prepared in accordance with the Ordinance of the Council of Ministers of January 18, 2005 on emergency plans in the event of radiation emergencies),
- dealing in case of threat of theft, terror, subversion or sabotage or their occurrence,
- proceedings in case of attempts to enter or stay unauthorized persons in areas, facilities or other secured places.

Organizational activities that serve to secure radioactive sources are also carried out by the organization's management and they rely on the promotion of a security culture (in the part concerning the protection of ionizing radiation sources). The task of the unit's manager is to create a security management system that will ensure:

- high security priority,
- security problems are identified and corrected immediately,
- in a manner proportional to their seriousness,
- clear definition of the duties of security-related people, their training, qualifications and recognition as reliable,
- clarifying the authority to make security decisions,
- proper flow of security information within the entire organizational unit,
- protection of classified information, in accordance with the Act of August 5, 2010,

¹³ PAA, „Projekt...”, op. cit.

- management of radioactive sources in accordance with the security plan, i.e. a document approved by the head of the organizational unit, describing the source in detail.

Strengthening the security culture may be supported by the following activities:

- making employees aware that security is important and a real risk exists,
- assigning responsibility for the security of experienced employees,
- documenting the legal obligations of employees, managers and contractors related to security,
- regular training / courses for staff, management and contractors in the field of security,
- self-evaluation of the security culture of employees, superiors and contractors,
- maintaining technical infrastructure related to security in good condition while maintaining its full efficiency.

The protection of radioactive sources is influenced collectively by the security management system and the organization's security culture¹⁴.

This publication is intended to focus on assessing the nuclear security culture in small medical organizations using radioactive sources and materials. The aim of the author is to share the experience in self-assessment of nuclear security culture.

BACKGROUND AND OBJECTIVES OF THE RESEARCH

There are over 3,200 institutions using ionizing radiation in Poland, including medical facilities and activities. Therefore, there seems to be a great need to begin a process of promoting and shaping the nuclear security culture. The general aim of the project¹⁵ was to create a tool for the self-assessment of the nuclear security culture in medical institution using radioactive sources. Making such a tool appears to be vital in a country like Poland where nuclear security culture is still unrecognized and unexplored because of a small number of malicious acts. Informal discussions with a hospital manager led to conclusions that developing nuclear security culture self-as-

¹⁴ Ibidem, s. 5–7.

¹⁵ Projekt naukowo-badawczy pt. „Wzmocnienie kultury bezpieczeństwa w instytucjach medycznych wykorzystujących źródła i materiały promieniotwórcze”, finansowany i koordynowany przez MAEA w latach 2015–2018.

assessment methodology is crucial especially to raise people's awareness to prevent unexpected malicious acts.

Firstly, the key objective of the research was to deliver a self-assessment tool for the IAEA's nuclear security culture approach. Secondly, to promote, shape, enhance and sustain a nuclear security culture attitudes among personnel who use or have access to radioactive sources in medical institution. Thirdly, to emphasize the importance of the human factor in the nuclear security culture and the value of self-awareness and responsibility of personnel who use or have access to radioactive sources in hospital.

The whole research process took almost three years. It started in 2016 at a Poznan medical facility, radiotherapy department, where a methodology of nuclear security culture self-assessment was established for the first time. Then, in 2017, the research expanded into another department of positron emission tomography specializing in nuclear medicine. In 2018, the nuclear security culture self-assessment was also completed in another radiotherapy department of the same medical institution but different location.

METHODOLOGY

The methodology of nuclear security culture self-assessment was tailored to the hospital's needs. The research started with developing an action plan including a mission, vision, values and a research strategy. The self-assessment team analysed the hospital's status quo not only from the nuclear security perspective, but also the security background in general. Then, nuclear security culture principles were introduced together with possible research methodology such as document review, surveys and focus group interviews.

The research process started with the internal document review. Afterwards, the preliminary research was initiated. The pilot activity was aimed at producing the precise questionnaire for the nuclear security culture self-assessment. The content of the self-assessment questionnaire was based on two IAEA documents: IAEA Nuclear Security Culture Series No. 7¹⁶ and IAEA Draft Technical Guidance NST026¹⁷. According to

¹⁶ International Atomic Energy Agency, *Nuclear Security Culture*, "IAEA Nuclear Security Culture Series" 2008, no. 7.

¹⁷ International Atomic Energy Agency, *Self-Assessment Of Nuclear Security Culture In Facilities And Activities That Use Nuclear And/Or Radioactive Material*, IAEA Draft

recommended methodology, the statements put in the self-assessment questionnaire concerned the characteristics of nuclear security culture such as leadership and personnel behavior as well as management systems. The pilot survey consisted of 50 statements.

The opening stage contained two phases: a questionnaire survey to review the accuracy of suggested statements according to medical terminology, linguistic correctness or appropriateness, and a focus group interview to discuss the above issues once again and settle the list of the survey's statements.

As a result of the preliminary research the final self-assessment questionnaire was made of 30 statements, instead of 50. Scoring system employed a 7-point scale: Strongly Disagree (1), Disagree (2), Somewhat Disagree (3), Neither Agree Nor Disagree (4), Somewhat Agree (5), Agree (6), Strongly Agree (7). The box to make a comment was placed underneath each statement to explain why the respondent Neither Agreed Nor Disagreed (4).

In the final nuclear security culture self-assessments participated 79 employees (97% of personnel) considering all three departments. Each self-assessment had a voluntary character, was made individually, in small groups or in pairs, took about 50 minutes and was adjusted to the hours of work in a hospital. All occupational groups were involved in the research: doctors, medical physicists, technicians, nurses, and administration employees.

Addressees of the study were all employees of all levels in organizational hierarchy. Not only were employees the key elements in the whole research process, managers also played a great role, as it was not forgotten that examples come from the top. Therefore, personnel and management were involved in the nuclear security culture enhancement process by, *inter alia*, taking part in internal consultancy meetings organized to present previous results and to discuss nuclear security culture additional issues.

RESULTS AND FINDINGS

The results of nuclear security culture self-assessment were presented from two perspectives in three separate final reports for each department.

The first perspective consisted of:

- weaknesses of the nuclear security culture which need to be fixed,

Technical Guidance NST026, Vienna 2014.

- strengths of the nuclear security culture, the medical institution's practices, elements of the nuclear security culture which still need to be strengthened and sustained,
- neither weakness nor strength, which needs the increased interest of management; it results from the unformed employees' opinions about the nuclear security culture, and
- valuable respondents' comments worth examining.

The second perspective took into consideration:

- convergence – understood as the correspondence of answers (positive or negative) of the vast majority of respondents;
- discrepancy – understood as a clear division of the respondents' answers into positive or negative opinions about the statements.

The convergence of the majority of respondents is a clear message for the manager, which elements of nuclear security culture are weak (negative views) and which are strong (positive views).

In situations where negative feedback is predominant, it is usually advisable to organize meetings with employees, or conduct interviews to solve problems and/or work out new solutions.

On the other hand, when strengths are dominant, a manager is encouraged to continually promote, strengthen and sustain nuclear security culture using proven or new practices.

A divergent, contradictory message may be a prerequisite for further research to clarify emerging inconsistencies among staff regarding a security area, detecting gaps in communication systems, procedures, employee thinking, etc. Individual or group interviews with employees or small team meetings, confrontations, discussions, etc. are recommended.

The final reports also provided managers with the list of proposals and recommendations for the future nuclear security culture practices and improvements.

LESSONS LEARNED AND RECOMMENDATIONS

Example comes from the top – the first step was to discuss the importance of nuclear security culture and convince the manager that a credible threat exists. Management's appreciation, support and willingness to develop the nuclear security culture self-assessment tool was the key to success.

The staff understands the principle of the human factor in nuclear security – the research objectives were to promote, enhance and sustain nuclear security culture attitudes among personnel in medical facilities

using radioactive sources. During the study, the importance of the human factor in the nuclear security and the value of self-awareness and responsibility of personnel was emphasized. The most challenging aim was to make the personnel of the hospital understand the importance of the nuclear security culture and the impact of the human factor on nuclear security in their small organizations. They did not experience any malicious acts in their facility before, therefore, encouraging them to cooperate and engage in the research process took some time. Moreover, they were much more familiar and concerned with safety issues or radiological safety than the security of the hospital.

Action plan – the first step taken into account by the researchers was to make an action plan. Generally, it concerned the following areas:

- forming the nuclear security culture self-assessment team,
- setting the research objectives, mission, vision and values,
- background analysis,
- training and consultancy meetings,
- research methodology,
- pre-testing,
- data analysis methodology,
- findings presentation,
- progress and final reporting.

Consultancy meetings and training – consultancy meetings for the self-assessment team appear to be very useful and effectively helped the researchers to plan, organize and conduct the nuclear security culture self-assessment survey. Training sessions provide team members with information and knowledge about nuclear security and nuclear security culture.

Preliminary research – the research started with the pilot part not only to develop the questionnaire, but also to make employees understand nuclear security area of interest. The pre-research methodology consisted of the survey, and the focus group interview to reduce and improve the list of questionnaire's statements. Thanks to the pilot survey and the focus group interview, the researchers were able to optimize, step by step, the meaning and structure of each statement to be clear enough from the medical and linguistic point of view.

Non-nuclear organization – there is a need while preparing the research on nuclear security culture to understand the differences in security between nuclear, e.g. power plant, and non-nuclear facilities such as hos-

pitals. Also, it is worth remembering that it is challenging to shape the security culture in the small organization where sometimes culture does not exist at all, so far, or is in the “birth stage”.

Summing-up the results – the focus on final numbers is not as significant as nuclear security culture values, exposed and enhanced in the facility during the whole research process. In the final reports the results were presented in tables with reference to strengths and weaknesses, convergences and discrepancies.

CONCLUSIONS

The self-assessment of the nuclear security culture in the medical facility using radioactive sources has been done for the first time in Poland. Therefore, this project was a great challenge for the research team from the very beginning. However, it was not very difficult to persuade the managers of the hospital to start with the project because they liked the idea of becoming the pioneers of nuclear security culture in Poland. The most challenging aspect was to make the personnel of the hospital understand the importance of the nuclear security culture, the impact of the human factor on nuclear security in their small organization, and the significant difference between safety and security in general. There is no difference in meaning between safety and security in the Polish language, therefore to distinguish them the term *security* is mostly associated with as a physical protection.

These first nuclear security culture self-assessments have become the milestones for these small medical institutions. The nuclear security culture self-assessment project has initiated the nuclear security culture understanding among personnel and management. The hospital’s supervisors declare to continue, extend and develop the research to enhance the nuclear security culture.

The final results presented in the reports may serve as an encouragement for managers to make a change in their medical facilities in terms of nuclear security culture.

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MAŁGORZATA WIŚNIEWSKA – dr nauk o zarządzaniu (Politechnika Poznańska), adiunkt w Katedrze Zarządzania i Systemów Informatycznych, specjalista w obszarze kultury bezpieczeństwa (*security culture*). Kierownik projektu (2015–2018) dotyczącego wzmocnienia kultury bezpieczeństwa w instytucjach medycznych wykorzystujących źródła promieniotwórcze. Ekspertka, konsultantka i uczestniczka wielu spotkań Międzynarodo-

wej Agencji Energii Atomowej z siedzibą w Wiedniu. E-mail: malgorzata.wisniewska@put.poznan.pl.

CITE THIS ARTICLE AS:

M. Wiśniewska, *Research on nuclear security culture in medical institutions using radioactive sources and materials*, „Kultura Bezpieczeństwa” 2019, nr 33, s. 154–166, DOI: 10.5604/01.3001.0013.1956.

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