IBIMA Publishing
Communications of International Proceedings
https://ibimapublishing.com/p-articles/38DigECO/2021/3863321/
Vol. 2021 (37), Article ID 3863321

Preliminary Research of a Medical Security Culture in A Private Radiotherapy Center in Poland

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* Presented at the 38th IBIMA International Conference, 23-24 November 2021, Seville, Spain

Abstract

We represent the first Polish academic team supported by the International Atomic Energy Agency to conduct the self-assessment of nuclear security culture in a hospital. In 2016 we began to carry out a project in cooperation with the International Atomic Energy Agency and the large private radiotherapy center in Poland, specializes in nuclear medicine. This paper addresses the approach of strategic thinking of a medical facility shaping its security culture. We describe our research process coming up with the developments of mission, vision, values and strategy statements. Moreover, we introduce the importance of medical security culture as well as the essentials of its self-assessment. The paper presents the essence of pretesting. We describe the methods used during the preliminary research, such as: and survey, document review and interview. We present the significant role of the hospital's supervisors in this project and the successful cooperation between three different types of organizations: international agency, hospital and university. This self-assessment of medical security culture proved to be a challenge for all of us. In conclusions we give recommendations for the purpose of other forthcoming similar studies based on what we have experienced and learned from this project.

Keywords: Medical Security Culture, Security Culture, Self-Assessment, Strategy

Introduction to medical security culture

Quoting Professor Igor Khripunov (2005): "Keeping nuclear facilities secure takes more than a few fences and guards. A new mind-set and culture are also needed".

The subject of nuclear security culture has been on the mind of security experts for years. Some have even said that a Security System may depend on the "human factor" for up to 50% of its effectiveness. In 2003 the International Atomic Energy Agency (IAEA) produced a "Code of Conduct on the Safety and Security of Radioactive Sources" which said "… every State should ensure the promotion of … the security culture…" All readers of this document said "What is that?" In 2005 the IAEA developed an Amendment to the CPPNM which quoted Fundamental Principal F "All organizations … should give due priority to security culture…" Readers again said "What is that?" The IAEA convened a group of technical experts in 2006 to answer just that question "What is Nuclear Security Culture?" In 2008 the "IAEA Nuclear Security Series No. 7 – Implementing guide – Nuclear Security Culture" (NSS-7) was published which answered the question "What is Nuclear Security Culture?" (Khripunov, Khairul, Ebel, Nikonov, 2013).

Cite this Article as: Malgorzata WISNIEWSKA, Vol. 2021 (37) "Preliminary Research of a Medical Security Culture in A Private Radiotherapy Center in Poland", Communications of International Proceedings, Vol. 2021 (37), ISBN: 978-0-9998551-7-1, ISSN: 2767-9640. Article ID 3863321

One of the mentioned above, basic principles of the IAEA Code of Conduct on the Safety and Security of Radioactive Sources and Materials (International Atomic Energy Agency, Code of Conduct on the Safety and Security of Radioactive Sources, IAEA/CODEOC/2004, IAEA, Vienna, 2004) states clearly that in each country, in order to protect people, society and the environment, appropriate measures should be taken by which to promote a safety and security culture with regard to radioactive materials. The International Atomic Energy Agency (IAEA) is an independent organization within the United Nations system. The activities of the IAEA are carried out under three pillars: nuclear verification, nuclear security and the promotion of science and peaceful uses of nuclear techniques.

Nuclear and radioactive materials should always be kept safe and secure in order to protect employees, the public, and the environment from undue exposure to radiation (Anhar, Khairul, Umbara, Kristuti, Purnomo, 2018).

Poland has been a member of the IAEA since its initiation. Pursuant to the definition of the Atomic Law and the Euratom Treaty (the treaty establishing the European Atomic Energy Community of March 25, 1957, which entered into force on January 1, 1958, the provisions of the Treaty are in force in Poland from the moment of accession to the European Union), the concept of drift material includes:

- ores (substances from which the starting materials can be obtained);
- starting materials (source, any substance containing uranium or thorium);
- special fissile materials (uranium-enriched uranium-235, plutton-239, thorium, and any substance containing any of the above isotopes).

Nuclear materials are distinguished from radioactive materials due to:

- their potential use for nuclear loads;
- limited technical possibilities of their detection in the field;
- a different way of their acquisition and activation of the response system (i.e. as a result of acting upon obtaining the information);
- the need to use forensic nuclear analysis methods to identify, trace back and trace material.

A radioactive source is a radioactive material prepared for the use of its ionizing radiation in industry, medicine, agriculture and science. Failure to comply with the requirements for safe work with ionizing radiation sources or inadequate protection of such sources may lead to permanent injuries, loss of health and even life, and environmental contamination. Hence, an appropriate culture of nuclear safety ensures that the implementation of nuclear safety measures receives weight justifying their importance.

In the medical arena, radioactive sources are mainly used for teletherapy and brachytherapy in the treatment of malignant diseases and for blood irradiation. They are classified as Category 1 sources (based on IAEA NSS 11 - The categorization and security level for radioactive sources). Category 1 sources are considered to pose a high risk to human health if not managed safely and securely.

Hospitals, medical institutions and research facilities use blood irradiators, primarily to inactivate lymphocytes in order to help prevent Transfusion Associated Graft Versus Host Disease (TA-GVHD) in patients receiving a blood transfusion.

At present existing blood irradiators mainly use Caesium-137 (Cs-137) as the radioactive source with activity ranging from 1000 to 12000 Ci (37 to 440 TBq), with a typical value of 7000 Ci (260 TBq). These sources are assigned to Category 1, corresponding to security Level A (IAEA NSS 11, Vienna, 2009).

Medical facilities are comparatively more accessible to the public, as being service oriented they accommodate anybody needing medical treatment and this may therefore lead to potential external threats.

Medical facilities that utilize and store radioactive sources require robust physical security features to prevent:

- unwarranted access or removal,
- sabotage,
- theft or
- any unsanctioned relocation of the radioactive sources.

Therefore, there is a need for a physical protection system for category 1 radioactive sources. Medical facilities with Category 1 radioactive sources comply with the basic security principles of detection, delay and response which is “to prevent unauthorized removal of radioactive sources” (IAEA Security of Radioactive Sources. Implementing guide - IAEA NSS 11 Vienna, 2009).

The examples of physical security features installed at the medical premises are:

- high security metal doors,
- balanced magnetic switches,
- motion detectors,
- fixed and mobile duress buttons,
- strobe lights,
- area radiation monitors,
- intrusion alarm system,
- door access systems,
- video surveillance,
- electronic sensors,
- seals and other tamper indicating devices.

In Poland there are over 3,000 facilities using ionizing radiation, including medical facilities. Therefore there is a great demand for the medical security culture (MSC) self-assessment (S-A) tool. The development of such a tool is essential in a country where the medical security culture is still unrecognized and undiscovered due to a small number of malicious actions. Developing such a self-assessment methodology seems to be crucial, especially in order to prevent unexpected activities.

Introduction to Research

In 2014, informal conversations with managers from several medical institutions have led to the conclusion that it was the right time to start measuring the culture of medical security in Polish facilities.

The research started in 2015, when a pilot self-assessment was carried out in Poznan (Poland) at the private hospital which is a radiotherapy center, specializes in nuclear medicine.

General objectives of the research were to:

1. Deliver self-assessment tool because of the new approach toward medical security culture (MSC).
2. Promote, strengthen and sustain MSC attitudes among personnel using or having access to radioactive sources and materials in medical facilities.
3. Emphasize the importance of the human factor in MSC and the value of self-awareness and responsibility of personnel using or having access to radioactive sources and materials in a hospital.

The addressee of this study were employees of all organizational levels, medical and non-medical, having access to radioactive sources and materials at the facility.

The hospital's supervisor became committed to the research and involved in the MSC research process by, inter alia, participating in consultation meetings held periodically by the functional manager and the research team to discuss current and previous issues.

The qualitative methods were applied during the study, such as questionnaire and interviews. These were to be called up for testing with the help of a functional manager and MSC team.

The first was intended to be a preliminary study, testing in order to tailor the methodology. Then, when the results were analyzed, appropriate research could begin. By analyzing the specific results the self-assessment (S-A) team of researchers was ready to create the list of self-assessment tools dedicated to the hospital's needs. Then it was a time to review each of S-A tools and make further conclusions about its strengths and weaknesses to improve it before starting the research process. Implementation of the MSC self-assessment tool started with training and consultancy meetings with personnel.

Above all, the MSC team expected the medical institution to understand the basic principle of the human factor in MSC. It was important to involve top management in MSC affairs in the daily life of the organization. Then, naturally staff would follow the supervisors, because "the example comes from the top".

An increase of self-awareness and responsibility on all organizational levels were significant. It was expected from staff to show an incredible earnestness to make medical security culture part of their working life in addition to their vital task of patient care. That is why, it was also very important to constantly promote the medical security, as well as to strengthen and maintain it in the future. Last but not least, the implementation of the MSC's self-assessment program in the institution was crucial.

There were three different types of cooperative parties involved in the project:

1. The two contracting institutions: International Atomic Energy Agency (Vienna, Austria) and the research team from Poznan University of Technology (Poland), and
2. Implementing institution: the private hospital, radiotherapy center, specializes in nuclear medicine (Poznan, Poland).

The preparation for the preliminary research

The main goal of the pre-research was to develop a tailored self-assessment tool of the medical security culture based on the recommended IAEA's (International Atomic Energy Agency) security culture self-assessment methodology.

The mission of self-assessment (S-A) team was to provide the top management with a tailored self-assessment tool to measure the medical security culture in the hospital in order to promote, shape, strengthen and maintain the medical security culture.

Due to vision, the S-A team would like the medical facility be a pathfinder in Poland due to the development, implementation, maintenance and promotion of a s-a medical security culture.

The most important values were the following:

- managers and supervisors show their commitment to medical security through their actions.
- employees are encouraged by their leaders, peers and subordinates.
- staff members understand their roles and responsibilities for medical security.
- the hospital improves the medical security by continual self-assessment.

Thanks to the several meetings with hospital's supervisors we came up with conclusions about hospital's experiences with medical security culture. It was agreed that there is a little knowledge on medical security culture and MSC still unrecognized and unexplored because of a small number of malicious acts. The supervisor's asked for knowledge-sharing on MSC to equipped staff members with information. Finally, they approved to begin the process of the development of the MSC self-assessment tool.

During a consultancy meeting the S-A team introduced several potential methods for S-A like survey, document review, and interview. As a result of discussions, the S-A team decided that the research methodology are to be surveys (questionnaire) and document review.

The radiotherapy department (RD) was appointed to the initial survey. Table 1 presents the employment in the RD. Consequently, the next step was to choose employees for the preliminary examinations. So, the number of staff designated to the survey was 30% of all employees (13 people). The table presents the total and selected staff members.

Table 1. The employment in the RD (own work).

POSITION IN THE RADIOTHERAPY DEPARTMENT	NUMBER OF EMPLOYEES	NUMBER OF EMPLOYEES INVOLVED IN PRELIMINARY TESTS
Doctor	9	2
Medical physicist	8	4
Technician	12	5
Nurse	3	1
Administrative employee	3	1
Patient guardian	4	0
Total:	39	13

The action plan

The preparation for the survey consisted of the following actions:

1. Internal document review such as safety occupational health instructions on radiation protection and procedures on radiation protection. There were no documents relating to medical security in hospital's possession.
2. Preliminary project of a questionnaire based on the IAEA's Draft Technical Guidance Document NST026, including the following structural elements: Title, Introduction, Manual, Contact information, 50 statements (questions). The scoring system uses a 7-point scale (strongly disagree, disagree, somewhat disagree, neither agree nor disagree (explain why), somewhat agree, agree, definitely yes, "not applicable" (N/A) box to encourage respondents to use comment space.
3. Consultancy meetings to analyze each question in terms of its adequacy for better adjustment.
4. Correction and optimization of the questionnaire's draft.
5. Acceptance of preliminary questionnaire.
6. Plan for a preliminary survey course - agenda (Table 2).

Table 2: Plan of the introductory survey course (own work).

AGENDA	TIME (MINUTES)
Introducing the MSC Self-Assessment	5
Introduction of the MSC self-assessment survey	5
Discussion and explanation of the structure of the questionnaire	10
Answering questions	10
Processing the survey	30
Total time :	60

The pretesting

The preliminary survey was consisted of two parts, because of the absence at work. The Table 3 shows the participation of staff in the first and second try.

Table 3: Staff members participating in the preliminary survey (own work).

RADIOTHERAPY DEPARTMENT	FIRST TRY	SECOND TRY
Doctor	0	2
Medicine Physicist	4	0
Technician	2	3
Nurse	0	1
Administrative employee	1	0

Guardian for patient	0	0
Total:	7	6

During the first attempt there was a group of 7 participants. They were allowed to interact with each other and discuss. All of them had enough time spent on the questionnaire. They made a lot of useful comments.

In the course of the second attempt, the rest of participants (6 people) made survey individually. They were scattered, therefore there was no interaction between them. Moreover, they spent less than 30 minutes on the survey. As a result, there were only a few comments, so participants were not sufficiently motivated to provide feedback. Individual survey seemed to be less valuable than the group survey.

Conclusions and lesson learned from the preliminary research

The success of the preliminary research depended on the implementation of the action plan, what could be summarized as follows:

- Research team formed, educated and trained.
- Counseling meetings culminating in a team background analysis and discussion of MSC issues.
- The process of preparing the pre-questionnaire, consisting in reviewing internal documents and adjusting the questionnaire, allowed for the development of the final model of the questionnaire.
- Initial studies were based on IAEA's draft technical guidance document.

There were 13 respondents who donated one and a third of all staff. Due to the absence of personnel, the study had to be divided into two samples. The first attempt took place in a group of 7 respondents. Thanks to this, it was possible to interact with the participants, and the survey turned out to be very effective (lots of comments). The second sample was individual, which means that 6 respondents completed the questionnaires at the most appropriate time for them. Consequently, it was not possible to have discussions, which brought fewer comments and feedback.

That is why, further activities were decided to be developed such as group interviews. Thanks to them, the MSC team expected to gather more detailed information from participants to optimize the questionnaire.

Follow-up action plan

After the last optimization and approval of the questionnaire, the final survey were planned to be conducted for all personnel from radiotherapy department, in order to analyze data and information to prepare the final report.

The research team made the follow-up plan to reach the above goals:

1. Focus group interviews to adjust the questionnaire.
2. Participants carefully recruited, 5 to 10 people per group, preferably 6-8 people.
3. Similar types of people.
4. Regular groups.
5. Optimize the questionnaire.
6. Confirm the questionnaire.
7. Carry out a post-survey.
8. Analyze the data.
9. Finish, report.

The objectives of the general research were to promote, strengthen and maintain the MSC, thanks to the successful conduct of self-assessment methodology among personnel who used or had access to radioactive sources and materials in a medical institution. Moreover, the additional purpose of the research was also to raise awareness among staff to make them constantly responsible for their work with radioactive sources and materials. In addition, to make the hospital's personnel understand what might be the consequences of their irresponsible behavior.

The goal of the preliminary research was to create a tailored questionnaire to be an optimized tool for the self-assessment of medical security culture.

The preliminary research was addressed to selected (one-third) personnel of a radiotherapy department uses radioactive sources and materials.

According to described circumstances (i.e. absence of employees), the preliminary survey had to be divided into two stages. Likewise, the extra interviews had been scheduled to get satisfactory results.

Following the Malaysia, the first country to introduce security culture self-assessment at medical facilities and continue to expand this assessment to encompass all medical facilities with radioactive sources, we also came up with several conclusions from the documents review. The most important was the fact that there was a lack of security documents at the hospital. Therefore, we have seen a need for the development of security documents, especially the following:

1. Radiation Safety and Security Policy Statement
2. Guidance Document on Security For Blood Irradiators (mainly based on the recommendations from the IAEA Code of Conduct on the Safety and Security of Radioactive Sources and IAEA Nuclear Security Series 11):
3. Implement security features and management of radioactive sources.
4. Assist in preventing unauthorized access to radioactive sources.
5. Enhance security awareness of the personnel by providing adequate education and training.
6. Promote security culture.
7. Establish contingency plans for emergencies.
8. Security Plan (for all medical facilities with radioactive sources following the IAEA recommendations in ref. with International Atomic Energy Agency, Security of Radioactive Sources. Implementing guide. IAEA Nuclear Security Series No. 11. IAEA, Vienna, 2009)
9. Guidance Document on Radiological Emergency Preparedness for Medical Physicists (to increase their awareness on the need for preparedness and to improve their capability and competency to handle any unfortunate incident).

Summarizing, in general, the effectiveness of the research depended on the following issues:

- the region of world and country;
- type of a company, i.e. distinguish whether it is a nuclear power plant or a hospital using radioactive sources/materials;
- organizational structure;
- size of an organization;
- organization culture (if already exists);
- management approach towards security,
- categories of radioactive sources;
- recent experiences in nuclear security;
- systems of communications;
- stakeholders' relations.

The above areas of interest are to be carefully analyzed and investigated through several consultancy meetings between S-A team of medical security culture and the management.

In a small organization, where the culture is in the birth stage, one of the major condition of success is to start shaping medical security culture through promotion, trainings, education and self-assessment. Preparation for medical security culture self-assessment is a very valuable and profitable process for the organization, however, time consuming as well. Thanks to medical security culture self-assessment, people start to understand the possible threats and change their attitudes from passive into active approach towards medical security.

The accomplished preliminary research let us enter the core stage of the medical security culture self-assessment with the tailored questionnaire.

Acknowledgements

We thank Ms. Kazuko Hamada, Nuclear Security Culture Officer, Nuclear Security of Materials and Facilities Section (MAFA), Division of Nuclear Security, Department of Nuclear Safety and Security, International Atomic Energy Agency (IAEA) and Mr. Yo Nakamura, Nuclear Security Culture Officer, Nuclear Security of Materials and Facilities Section (MAFA), Division of Nuclear Security, Department of Nuclear Safety and Security, International Atomic Energy Agency (IAEA), for assistance and support. We thank Mr. Łukasz Szczurek, Specialist of the Medical Physics, Affidea Poznan for his cooperation. This work was performed under the Research Project entitled "Enhancement of Nuclear Security Culture in Medical Institutions Using Radioactive Sources and Materials" which formed a part of the IAEA's Coordinated Research Project "J02007", entitled "Development of Nuclear Security Culture Enhancement Solutions".

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