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Security Culture Mosaic: Teaching Security Culture Concepts in Content Courses*

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Introduction: Definition of Security Culture

A security culture, when it applies to the security of nuclear sites, is a concept that links together many aspects related to the management of nuclear materials and installations.

Because of growing global instability and terrorist threats, increasing attention is being given to improving the nuclear security culture, particularly the human factor. However, regular training and refresher courses in specific disciplines, for example in control and accounting of nuclear materials, are not enough to guarantee a secure operation of a nuclear facility. At the same time, culture can not be imposed from the outside; it has to be nurtured, and that is a time-consuming and cumbersome process.

Culture is a combination of principles and values including the attitude particular individuals and organizations have toward a certain problem. In addition, the concept includes tacit knowledge of a field—that is, experience and intuition. Culture is what lies beneath the actions, what predetermines the behavior of an individual in specific situations.

Hence, culture is determined by a variety of components, each of which can be well described and interpreted. But as soon as we attempt to combine these components into one definition, difficulties arise. The concept of culture is not simply a sum of its parts. It is more like a very complex and multi-leveled mosaic infused with many difficulties. For example, how does one measure individual values in order to determine the level and stability of a security culture within an organization--and can this be taught? This is very important, because culture can be more stable than subject knowledge expertise, which swiftly shifts within generations.

The concept of "security culture" is determined by a multitude of components, related to national and other traditions, technological characteristics of the specific nuclear site, the political environment, and the personal characteristics of the employees.[i]

It is essential to point out that the importance of this culture of security at nuclear sites is more and more acknowledged by specialists from various fields.[ii] But because of its multi-dimensional nature, the concept has not yet acquired a singular interpretation or definition. It is customary to assume that the concept of security culture at nuclear sites includes not only guidelines and the readiness to follow them, but also the moral values of the personnel of a nuclear site. The importance of moral values is evident, because every step a person takes cannot be procedurally

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described, and it is impossible to teach an individual which way to behave in all situations. Behavior is determined by a whole range of factors, one of which is the values an individual upholds. Values must be taken into account as much as possible in setting up secure handling of nuclear materials and installations and, especially, in the training of nuclear industry specialists.

Training of specialists in this field should begin with explanations of all the elements that comprise the general security culture. Since security at a nuclear site is provided by a wide range of services, each targeted at carrying out specific tasks, it is important to draw attention to this fact and to explain the way in which each service serves the common goal of ensuring security.

Elements of Security Culture

The elements of security culture include:

- nuclear safety;
- environmental safety;
- physical security;
- fire safety;
- economic security;
- accounting and control of nuclear materials.

Nuclear safety

This aspect of the security system deals with organization of the work in such a way, so that physical processes, which occur in the reactor and take place when handling nuclear materials, would not cause accidents with radiological consequences.

Environmental safety

This aspect of the security system deals with organization of work, including the daily use of equipment, in such a way that consequences of possible accidents would not impact the surrounding environment and population.

Physical security (physical protection of a nuclear site)

This aspect of the security system takes into consideration the planning, installation, and use of the systems of physical protection of a nuclear site from unsanctioned access, including the guarding system and response forces.

Fire safety

This aspect of the security system deals with the installation and use of the fire safety systems.

Economic security

This aspect of security system deals with the appropriation of sufficient funds to critically important work and the governance of these resources.

Accounting and control of nuclear materials

This aspect deals with the development and maintenance of the systems of accounting and control of nuclear materials.

The security culture also involves many elements that contribute to the implementation of the above components. They include:

- particularities of national culture, traditions, customs, moral values;
- leadership style specific to the enterprise;
- organization of the technological process specific to the enterprise;
- system of personnel training and, in particular, the attitude of the leadership towards personnel professional development;
- a variety of other elements.

In each of the aforementioned components, one can highlight the elements of the security culture. For example, if an incident at a nuclear enterprise is due to human error, then it is important to determine all the reasons that have caused this error. Was it caused by carelessness and inattention of an employee due to inaccurate execution of the set procedures and rules, either through malpractice or other circumstances? When errors occur, one should spend less effort on assigning the blame and more on how to learn from the experience.

International organizations offer a variety of definitions of security culture. Nevertheless, their main point is the same – highest priority in all types of activities at an enterprise should be given to security. The purpose of this article is not to convince the reader of the necessity of professional knowledge and skills, but the necessity for a certain "goal orientation" toward a security culture at an enterprise.

The security culture must be viewed at various levels of responsibility, from the level of shaping the enterprise policies (statements on whether the issues of security should be of primary concern at a nuclear site), to high-level management (leadership should have a clear set of criteria to evaluate the level of security), to mid-level management (security responsibilities must be listed as part of job descriptions).

An analysis of publications[iii] over the last 10 years dedicated to the topic of the security of nuclear plants and other nuclear sites illustrates the multitude of viewpoints on the aforementioned elements of the overall security system. However, such a system is not often viewed as a whole by those who develop and use such security systems, as well as by those who teach security culture and develop training courses. This causes misconceptions to emerge, especially at the nexus where various multi-level components come together in the system. For example, sometimes it is difficult to draw a boundary between the accounting of nuclear materials and the control of nuclear materials. These spheres of activity are connected, but sometimes specialists working in these areas do not understand how their job relates to the larger whole.

The links in a security system are the personnel, which operate the equipment and bear cultural traditions, values, and views. Incidents occur most often at the junction of different areas of responsibility, especially when separate procedures for handling nuclear materials are not specific enough in description, and employees need to solve problems on the spot. An analysis of "risky" procedures can help discover their "weak links" and prompt changes to eliminate them. A number of specialized training courses and training centers in Russia in the area of accounting, control and physical protection of nuclear materials are solely devoted to how to behave in

specific cases and how to organize the work of each element in the security support system. To maintain and improve their professional skills, nuclear enterprises personnel regularly attend various professional development courses.

These statements may be illustrated by a certain selection of topics for training, necessary for increasing professional skills of employees in the security sphere. These topics make up a single image, which one can call a mosaic, vividly describing the importance of the introduction of a topic of the security culture. This mosaic represents a more or less integral portrait of a security system.

However, gaps exist between separate elements, which make the piecing of one element to another difficult. These gaps are noticeable only through a conceptual approach to security of a nuclear site and training of personnel. It is also worth remembering that matching elements, factoring in human motivations, is principally impossible. However, we must attempt to do so as precisely as possible. Nuclear technology is a complex field of study that encompasses a multitude of engineering solutions, and in the end, the security of the site depends both on the technology and the culture of the individuals handling it.

When speaking of a security culture, we must remember that it is not isolated from the common culture of an organization, city, or country. What is it composed of and where does it overlap with the common culture?

First of all, an organization needs to provide a simple and precise explanation of common ideals and goals so that every employee is able to compare the results of his/her individual activity to the declared goals. Such a declaration can be seen as the foundation of a security culture. In discussing common ideals, it is useful to specify a set of common values that would help employees realize corporate goals. For example, these could include the following:

- trust and respect towards immediate colleagues (independent of the place in the hierarchy of positions);
- respect for nuclear technology;
- responsibility;
- teamwork;
- aspiration to improve the quality of one's work;
- justification of common expenses (economic, material, operational).

These corporate goals are interconnected. In order to foster teamwork among employees, one can organize briefings, meetings and discussions. During these activities, soliciting opinions of individuals would help promote common cause and a sense of camaraderie. This, in turn, would help to engender satisfaction from teamwork. In certain government institutions of the Russian Federation, this mechanism is almost lost, and individualism has developed to the level of an absolute inability to accept opinions of others.

In an organization, it makes sense to create an internal communication network that facilitates personnel management and updates personnel with information regarding news, seminars, and recommendations to read a certain document, book, etc. This provides employees with the sense of the importance of their work and demonstrates respect for the employee. One of the strongest

personal motives is the desire to show one's knowledge of the subject matter and the ability to use that knowledge. If such channel is not present, then the knowledge, which should be spreading, is instead withheld and becomes useless. There is a whole range of ways to influence the level of the security culture of a nuclear enterprise, including:

- a more selective hiring process;
- development training and targeted professional development plans;
- engagement in exchange of non-sensitive information;
- development and execution of self-evaluation and independent evaluation programs;
- analysis of problems at an enterprise related to security as a whole;
- reminders (by various means) to personnel regarding the importance of the security culture of the enterprise;
- development of a specific concept of the enterprise security, if such work is not being conducted.

Maintaining the stability of accounting, control, and physical protection of nuclear materials (MPC&A) is the responsibility of the administration. Administration, to an extent, imposes traditions onto the enterprise, which are established among staff and over time determine the behavior of individual employees. If personnel are mostly supportive of these traditions and leadership styles, then an acceptable culture of not only workplace relationships, but also culture of work in handling of nuclear materials, is developed.

At the same time, system stability depends on efforts by personnel to commit to these traditions. It is important that even potential employees during the hiring process receive a general idea about the importance of the security culture. If (as widely occurs) insufficient time is spent on this, then the risk of incompatibility of a new employee with the existing system is high. This threatens to create conflict and trigger the departure of the employee from the enterprise.

Everyone's position carries a share of responsibility. But the cultural aspects of responsibility are not formulated anywhere. Who is accountable when an administrator fails to optimally organize the work on a database of items subject to accounting and control of nuclear materials? No one carries the blame for the confusion, loss of data, and poor quality control. Where is accountability when the leadership of an enterprise fails to prioritize security and raise the standards for MPC&A? If an incident occurs because of a lack of knowledge on the part of an employee or because "this wasn't in the manual," then no one is accountable.

It is difficult to educate an employee while maintaining an environment in which he/she would want to work and be committed to certain values, but there are plenty of practical ways to resolve this difficulty. For example, a simple way of doing this is putting appropriate posters in designated locations. This method is only simple on the surface. In reality, slowly, information from such posters integrates into the consciousness and begins to impact behavior of an individual.

Simple poster slogans (e.g., "Be vigilant!!" "Don't enter – mortal danger!" "Trust, but verify"[iv]) can serve as a deterrent to thoughtless actions. If an employee en route to the office sees a poster "Keep your workplace in order," there is hope that he/she won't let the paperwork clutter accumulate. If an employee working in nuclear materials accounting and control sees a daily

reminder "Don't put the safe box key into your lab coat pocket!" then, perhaps, it is possible that this will help him/her put away the key in an appropriate place on a daily basis.

Culture is stable. A change in even one of the components of organizational culture that deeply penetrates into an organization requires serious effort. Culture of an organization exists on a very deep level. It is difficult to change an opinion of even one person if he/she for many years has thought in a particular way. Culture is stable in its essence even if it is an unhealthy culture and its presuppositions prevent improvements.

The role of education and training in the shaping of culture is extremely important. The nuclear security education and training system must be carefully crafted. Currently in Russia are efforts to increase effectiveness of the use of systemic approaches to training, especially towards maintenance and professional development of personnel at nuclear sites. Concrete steps in this regard are directed towards the development of a range of conceptual documents, which contain general requirements to the system of training, maintaining, and improving qualifications of personnel and handling nuclear materials and equipment. In addition, there is ongoing development of requirements for qualifications of instructors and educators within educational institutions, who must, in addition to their own subject, have skills of teaching an adult audience—in other words, basics of the art of teaching.

Courses Aimed at Professional Development in MPC&A

Among the aforementioned components of the security system of a nuclear site one must highlight "accounting and control of nuclear materials" and "physical protection of nuclear materials." These two components weigh heavily in the security system, because they are directed towards provision of guaranteed security of nuclear materials and installations from unsanctioned use. Courses on security issues in the field of accounting, control, and physical protection of nuclear materials, as a rule, are taught at different training centers.

The last few years have seen development of a certain division of labor. The subject of accounting and control of nuclear materials is taught at centers of accounting and control, and physical protection of nuclear facilities is taught at centers of physical protection. Even if certain training courses are brought together under one roof, an integrated approach to at least the topic of "control of nuclear materials" remains almost unnoticeable. This tendency of separation of the subjects, unfortunately, is characteristic of many nuclear countries. However, an interdisciplinary approach to studying security gives the greatest guarantee of security of nuclear materials. With this goal, ten years ago Russian Obnisnk training centers on accounting, control, and physical protection started delivering a general lecture on the problems of nonproliferation in the beginning of a basic course. This lecture is presented as an introduction to the problems of security of nuclear materials. This positive way to introduce specialists to the role of nuclear materials in today's civilization needs to be continued. Such a continuation can help integrate the topic of "security culture" in professional development training for nuclear industry personnel. The topic could be presented in a number of ways, one of them being an introduction of this topic into a range of content courses.

As a rule, courses are divided by content. As an example, a physical protection training center generally offers courses on the basics of physical protection. Basic courses also include courses

on the assessment of the effectiveness of the physical protection system and its functioning. In addition, such centers teach courses on the organization of security at a nuclear site and work with special equipment. Accounting and control training centers offer courses on accounting of nuclear materials and inventory and measurement methods, as well as courses on the basics of control of nuclear materials and accounting systems performance testing.

As a result of this particular approach, courses such as "Basics of Vulnerability Assessment of Nuclear Sites," "Methods of Vulnerability Assessment," "Operation and Management of the Security System," and a range of others find themselves in between the two big areas of accounting and control and physical protection. In order to conduct a thorough vulnerability assessment of a security system at a nuclear site, one needs to approach the security system as an integrated system. This has been hard to do in the last few years because of the aforementioned separation of these spheres of activity.

In the mid-1990s there was a tendency to integrate the different facets of the security system. Now, after 10 years, the separation of these components (control and accounting and physical protection) of the security culture has again become apparent for many reasons, the discussion of which is beyond the scope of this article. When discussing the security culture, it should be noted that this area of training may be introduced as a topic that combines, in a certain way, all content courses. This can be done on the basis of almost 11 years of observations: many incidents occur because of a low technological culture, as well as low work ethics in this specific sphere of activity.

Integrating the Topic of Security Culture in Content Courses: A Possible Model

Every training course dealing with issues of accounting, control, and physical protection of nuclear materials, as well as nuclear nonproliferation in general, should have such topics as the role of the human factor and security culture. In each section of the course, the main challenges need to be identified, then certain aspects of the security culture need to be highlighted and illustrated with a variety of examples followed by several recommendations on how solve the problem.

Employees of a nuclear site must have a general idea of the following:

- **what** "security culture" and "culture of handling nuclear materials" are;
- **why** this topic is so important now;
- **how** to raise the culture in the areas of accounting, control, and physical protection of nuclear materials and equipment at a nuclear site;
- what the **role and responsibility** are of every employee of the nuclear site.

Definition of the Problem

We often deal with problems without attempting to clearly formulate them and without understanding what we want to have as a result – eliminate all problems or a specific one. We do not take into account that movement forward in any subject area is impossible without encountering problems. This is the price of progress. A big question is how to track these processes and how to learn not to create new serious and difficult problems while fighting the old ones. First of all, we must learn to clearly identify problems, clearly name them, and recognize

our abilities to overcoming these problems. From personal experience it is apparent that this particular approach is highly effective.

The model, briefly defined in this publication, suggests that the process should start from written recollection of the main problems by a specialist as part of his or her professional activity. These problems should not be confused with the main tasks he/she needs to accomplish.[v] Then, one can look at how this individual is dealing with them, including how problems were solved. These results are of particular interest to us. One needs to determine which of the subject areas has been examined, as well as which problems have emerged during this process. Then, one can select the most general problems that most people face, because these problems are related to the human factor in general, and not to a specific person.

As is often the case, there are several solutions to difficult situations. One can bypass the problem and take a completely different approach if it is impossible to solve it. One can back off and do something completely different. One can try to handle the problem by examining its origins and coming up with ways to overcome it.

This article examines the latter approach, where the author relies on 11 years of experience in teaching a training course on the basics of vulnerability assessments of nuclear sites. The course is taken by specialists from various nuclear sites, which hold various places on the hierarchical ladder. The topic of vulnerability analysis of nuclear sites presupposes the acquisition of methods of analysis of a variety of narrower subject areas, dealing with nuclear materials and installations, use and storage of nuclear materials, transportation, and all aspects of protection of nuclear materials from unsanctioned activity. One can say that it deals with the assurance that nuclear materials will not be proliferated with malicious intent.

The training course has a section dealing with the identification of problems. Criteria set forth to identify problems are based on the expected gravity of consequences from an unauthorized activity. All of the available procedures, related to the provision of security, are viewed from this perspective.

Highlighting the Topic of Security Culture

The isolation of security culture from the general subject area can be demonstrated with an example of an aforementioned training course. In almost every big section of this course, the topic of security culture is touched upon in the context of the subject of the course. However, the peculiarity of such an approach is that every subsequent mentioning of the security culture serves as a continuation of the previous reference, and towards the end of the training course the audience should develop not only an understanding of the importance of the security culture at nuclear sites but also the readiness to take certain steps in order to raise the level of security culture.

It is the low level of the security culture that may be the weakest link. Equipment may be fully functional, but if used incorrectly, it will not help.

The section of the training course “Introduction to the Vulnerability Assessment of Protective Measures” is dedicated to the issues discussed during the course as a whole: approaches,

organization of the protection system, the performance of the vulnerability assessment, benefits of the vulnerability assessment, and qualitative risk assessment. In this section the issue of the security culture is first introduced. In the context of the section content of this training course, this topic deals with the necessity of following instructions, as well as the importance of having instructions in writing, so that the responsibility is clearly defined and known to an individual employee. The security culture is also mentioned in general terms, and the culture of accounting, control, and physical protection is mentioned in particular terms.

In the section "Description of the Site" the topic "security culture" is also introduced. It discusses the creation of standard databases. It also emphasizes that an effective system of protection cannot be discussed without connection to the environment in which it functions. This means that discussion deals with personnel and traditions, particularly established practices in working with the security system equipment.

In the section "Development and Evaluation of Scenarios," the subject "security culture" includes discussions of commitment to priorities of security, analysis of accidents and lessons learned, and ability to engage in feedback as part of professional development.

Consideration of the human factor in a secure operation of a nuclear site is as important as the reliable functioning of equipment. For example, several publications have pointed out that at nuclear reactors in the Russian Federation in 2002 about 39% of the total of all violations occurred because of personnel. One-third of them had occurred at the fault of the operators; another one-third was the fault of maintenance personnel. The remaining violations were the fault of management.

The 2005 annual report on the activity of the Federal Service of Ecological and Nuclear Oversight of the Russian Federation noted that the root cause of most incidents in the functioning of nuclear power plants (even though such incidents are few) is in the errors of design, lack of management, and organization of operation. All these causes are the result of human error.

Prevention of security breaches is more important than dealing with their consequences. The most important concept in the "security culture" is the attitude of the personnel at the nuclear site towards safety and security. At present, in Rosenergoatom, for example, professional development courses for operators of the reactor unit control panel include topics "Operational Readiness," and "Team Interaction."[vi]

As a result, during the course, trainees, are effectively pushed to think about the role of the security culture in the organization of protection of a nuclear site from unsanctioned activities, not in the abstract, but in the context of the concrete materials studied.

Another way to introduce "security culture" is through the development and subsequent delivery of a separate lecture or a small lecture series, prior to the start of any training courses, intended for all trainees in the professional development programs. The objective of this lecture (or lecture series) is to get the students to pay attention to the problem as a whole, set principles of the security culture, and help listeners develop the understanding of their role in raising the level of the security culture at their enterprise.

To sum up, the model of the introduction of the security culture into basic professional development content courses for nuclear sites personnel is based on the following algorithm:

- develop a list of security problems at the enterprise;
- choose from this list problems related to motivations of personnel, personnel behavior, and values;
- deliver recommendations to improve the security by raising the level of labor culture in this field of activity;
- incorporate the topic "security culture" into the content of the specific training course with specific examples taken from the subject area of the training course.

The underlying principle of this model is the assertion that origins of serious accidents and various little breaches and violations, which occur at nuclear enterprises at the fault of personnel, are often the result of how personnel handles the systems and the equipment rather than the faultiness of the technical systems or more simple equipment. In this context, training courses should be revised and improved accordingly in a way that it not only looks at technical aspects of work in the process of training personnel but also pays necessary attention to the motivations and behaviors of the personnel.

What Is Next?

It appears that time has come to approach the issue of personnel training at nuclear sites in a more conceptual fashion, with consideration of such dimensions as personnel reliability in working with complex systems. These considerations have previously been outside the scope of attention of the designers of training courses.

It is known that even in optimal conditions, the risk of error by personnel always remains. It is part of human nature to err. Thus, it is essential to minimize this risk by approaching a specialist as a more complex subject rather than an appendage to the equipment of the security system. S.V. Lazarev (leading psychologist of one of the Mosenergo power stations) writes in the article "On Problems of Psychophysical Support of Personnel in the Energy Sector"[vii] that "…analysis of reasons of accidents shows that around 30% of workplace emergencies are related to the insufficient consideration of the human factor."

Hopefully, the introduction of special sections into MPC&A content courses or the introduction of individual lectures on security culture will help focus the attention on the role of the human factor in the security of nuclear sites and therefore increase the assurance of the adequate level of protection of these sites. In addition, such a course of lectures or special sections in subject courses will help identify what specific actions are required to raise the security culture at nuclear sites.

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