THE APPROACH OF AN ENHANCED NUCLEAR SECURITY CULTURE

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ABSTRACT

Amid growing international awareness of the threat of malicious acts involving nuclear materials, it is the responsibility of governments to ensure that nuclear and other radioactive material and their associated facilities and activities, are managed safely and properly protected by well-trained expert staff. Rapid technological change increases the need for experts with state-of-the-art knowledge. The problem of security and physical protection of nuclear facilities, the security of radioactive sources, as well as the security in transport of radioactive material (RAM) have to be approached as an integrated system to protect against potential malicious acts. The IAEA Vienna underlined that: *"Strengthening nuclear security throughout the world remains a challenge for all of us".* Taken into consideration the above statement, an enhanced nuclear security culture will provide a much greater assurance that an integrated nuclear system will fulfill its main functions: *to detect, to delay and responding to potential theft, sabotage, unauthorized access, illegal transfer of other malicious acts involving RAM and the associated nuclear facilities.*
The paper present some consideration on the enhancement of nuclear security measures of the Romanian nuclear facilities, security aspects taken during transportation of RAM, the vulnerabilities. This paper presents certain results, by courtesy of the IAEA, coming from a Scientific Research Contract, ended in 2012, on The State Management of Nuclear Security Regime (Framework) where the author was the Chief Scientific Investigator.

Key words: Radioactive Material, Security Culture, Challenge

INTRODUCTION

What is a Nuclear Security Culture? *It could be defined as the combination of physical security programme and personal diligence that creates a consistently secure environment*, or be thought of , *as a system approach, where secure facilities, technologies and individual profesionalism are mutually reinforcing and apeared towards a single objective-protective sensitive assets*. The risk that nuclear or other radioactive material (RAM) could be used in

malicious acts remains high as a serious threat to international peace and security. It is well recognized that the responsibility for nuclear security rests entirely with each Member State (MS) and that appropriate and effective national systems for nuclear security are vital in facilitating the peaceful use of nuclear energy and enhancing global efforts to combat nuclear terrorism and to assure an effective nuclear security.

Member States have to work in guiding the nuclear industry, to promote and sustain strong nuclear security culture and corporate commitment to implement robust security practices, including regular exercises and performance testing of nuclear security features consistent with national regulations.

One of the important goals of the IAEA Nuclear Security Programme 2010-2013 [1], *is to provide guidance and assistance in order to help MS to establish a strong nuclear security culture*. The IAEA international conference on Nuclear Security (March 2005) stated: *"The fundamental principles of nuclear security include embedding a nuclear security culture throughout the organizations involved. By the coherent implementation of a nuclear security culture, staff remain vigilant of the need to maintain a high level of security."*[2]. The IAEA Code of Conduct on the Safety and Security of Radioactive Sources contains the following basic principle:

"Every State should, in order to protect individuals, society and the environment, take the appropriate measures to ensure ... the promotion of safety culture and of security culture with respect to radioactive sources." [Basic Principle].

The basic concepts and elements of nuclear security culture and how they relate to arrangements and policies for other aspects of nuclear security are explained in the Implementing guide series no. 7 "Nuclear Security Culture" [2], as follow:

NUCLEAR SECURITY REGIME VS. NUCLEAR SECURITY CULTURE

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. It should be noted that '*nuclear security*' includes '*physical protection*'

Nuclear Security Culture: The assembly of characteristics, attitudes and behaviour of individuals, organizations and institutions which serves as a means to support and enhance nuclear security.

A Nuclear Security Regime (Framework) includes a range of elements and activities, such as: *legislation and regulation; intelligence gathering; assessment of the threat to radioactive material and associated locations and facilities; administrative systems; various technical hardware systems; response capabilities and mitigation activities*. No single government or industry organization or subsection of such an organization can address these elements in isolation.

An effective *Nuclear Security Culture* is dependent on *proper planning, training, awareness, operation and maintenance, as well as on people who plan, operateand maintain nuclear security systems.*

Taken into consideration the above statement, en *enchanced security culture* will provide a much greater assurance that an integrated nuclear system will fulfil its main functions: to detect, to delay and responding to potential theft, sabotage, unauthorized acces, illegal transfer of other malicious acts involving radioactive material and the associated facilities and transport.

The paper will present some consideration to be made on the enhancement of nuclear security measures for the Romanian nuclear facilities. Apresentation of some security aspects taken

during transportation of radioactive material in Romania, the vulnerabilities of such transportation routes it is also approached.

Nuclear Security Culture

The principal *objective of security culture and safety culture is to limit the risk resulting from radioactive material and associated facilities.* This objective is based on common principles, as a questioning attitude, rigorous and prudent approaches, and effective communication and open, two way communication.

While both **nuclear safety** and **nuclear security** consider the risk of inadvertent human error, *nuclear security places additional emphasis on deliberate acts that are intended to cause harm.*

Security is dealing with deliberate acts, security culture requires different attitudes and behaviour, such as confidentiality of information and efforts to deter malicious acts, as compared with safety culture.

Safety and security cultures coexist and need to reinforce each other because they share the common objective of limiting risk. An organization in charge of nuclear matters has to foster an approach that integrates safety and security in a mutually supporting manner.

Many diverse organizations are concerned with nuclear security as individuals, organizations and institutions engaged in protecting radioactive material and their associated locations, facilities and transport; some of these bodies may have little technical knowledge about nuclear or other radioactive material. *This lends greater weight to the need for the integration of the functions of diverse organizations into a unified nuclear security culture.*
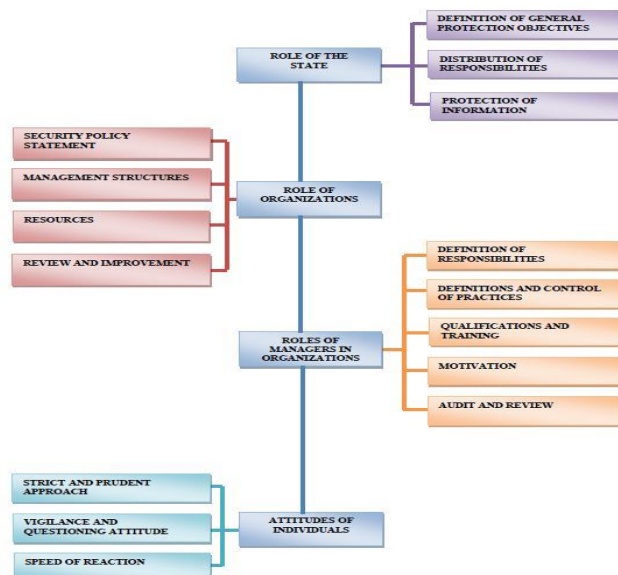The features of nuclear security culture are presented in Figure 1:

Figure 1. The main features of Nuclear Security Culture (as adapted after the IAEA NSS no. 7) [2]

Security culture has three major components:

- *the first concerns the policy* that the State wishes to put into practice, in particular given the national and international contexts;
- *the second is the organization* introduced within each body concerned, particularly to apply the policy fixed by the State. In this component, a distinction must be made between what comes under the organization itself and what concerns its managers.
- *the third component is the attitude adopted by the various individuals at all levels* to implement this policy and to incorporate it into their work.

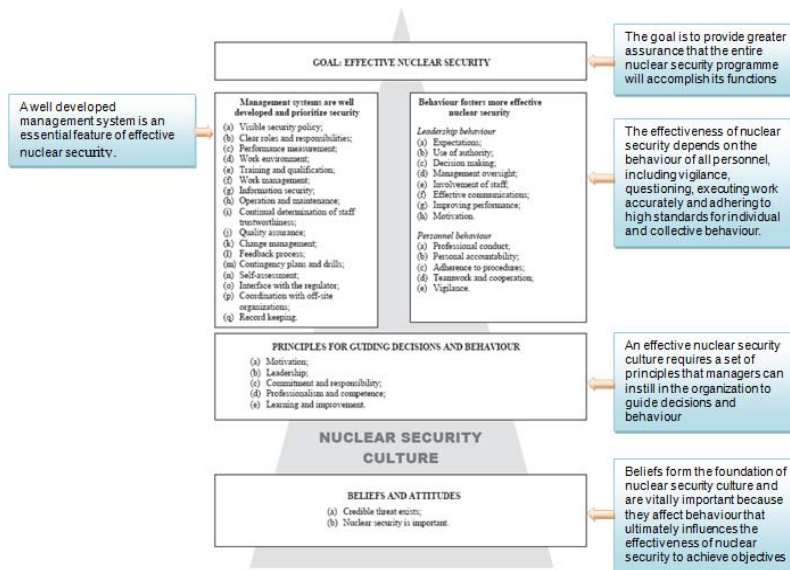The most useful characteristics of nuclear security culture are show in Figure 2, as follow:

Figure 2 The Main Characteristics of Nuclear Security Culture

Nuclear Security Regime (Framework)

Threats to nuclear security involve criminals acts or terrorists activities acquiring and using nuclear material or radioactive material for malicious purposes in order to manufacture nuclear explosive device or radiological device *so called "dirty bombs";* The economic consequences, and the impact upon human health and the environment, of the malicious acts by using radioactive material could be devastating. Taking into consideration the high potential radiological consequences, nuclear security regime (framework) plays an important role in ensuring that organizations and institutions sustained measures are taken to prevent and combat the threat of sabotage or by using radioactive material for malicious acts.

A nuclear security regime (framework) (*descriptions not included*) cover a wide range of elements and activities, such as: protection against theft and other unlawful taking of nuclear material and other radioactive material in use and storage, and during transport; legislation and regulation; ensuring implementation of rapid and comprehensive measures to detect, locate and recover, as appropriate, nuclear material and other radioactive material which is missing or stolen or otherwise not under regulatory control; ensuring implementation of rapid and comprehensive measures to mitigate or minimize the harm to persons, property and the environment from sabotage and the criminal and other unauthorized use of nuclear material and other radioactive marterial; intelligence gathering; assessment of the threat to radioactive material and associated locations and facilities; administrative systems; various technical hardware systems; response capabilities and mitigation activities.

An effective nuclear security culture is dependent on proper planning, training, awareness, operation and maintenance, as well as on people who plan, operate and maintain nuclear security systems. The human factor, including management leadership, must be addressed in any effort to enhance the existing nuclear security culture.

Nuclear security culture plays an important role in ensuring that individuals, organizations and institutions remain vigilant and that sustained measures are taken to prevent and combat the threat of sabotage or using *radioactive material* for malicious acts.

The entire nuclear security regime (framework) stands or falls because of the people involved and their leaders, for that is most important to enhance the existing nuclear security culture.

ROMANIAN CONTRIBUTION TO THE STATE MANAGEMENT OF NUCLEAR SECURITY REGIME

Nuclear Security is one part of a bigger global picture. Our security threats cover a broad spectrum and vary in nature and magnitude. It is to be recognized the increased security following the events of September 11, 2001 and now the nuclear crisis following the natural disaster from Japan-the earthquake of March 11, 2011 followed by a giant tsunami.

The IAEA's efforts to make nuclear facilities and borders more secure to reduce the threat of nuclear terrorism are recognized at the highest levels of government. The IAEA assists national efforts to enhance *nuclear security* through prevention measures-comprising both protection and risk reduction components-detection and response measures.

This paper presents certain results of the IAEA Scientific Research Contract on "***Romanian Contribution to the Development of Methodology for Risk Assessment and State Management of Nuclear Security Regime***" [4], where the main author of this paper is the Chief Scientific Investigator of this contract.

Among the objectives of the contract are the followings (description not included):

- available information and the data related to the risks associated with the transport of radioactive materials in/out of the nuclear fuel cycle facilities (uranium mining, uranium concentrate production, fresh fuel manufacturing, spent fuel handling, radioactive sources, etc.).
- Developing a methodology for selection of the most optimal routes for the transport of RAM with the lower risk by using dedicated computer codes and to mitigate the risks of malevolent acts involving radiological sources and naturally occurring material (NORM) by sub national actors.
- Analysis of State infrastructure, vulnerability assessment of possible routes for transport of RAM, different modes of RAM transportation, quantity and types of RAM (radionuclides) and the transportation packages;

The main transport routes of Radioactive Materials (RAM) and Nuclear Material (NM) in/out of Nuclear Fuel Cycle facilities in Romania are presented in Figure 3. and covers: (see Figure 3): *a) the transport of radioactive waste (by road) to the National* Repository-Baita, *b) transport of uranium ore by rail c) potential transport of a CANDU SPENT NUCLEAR FUEL (A BUNDLE) from NPP CANDU Cernavoda to INR Pitesti; d) transport of uranium concentrate (uranium powder) from Feldioara to Nuclear Fuel Plant Pitesti.*

Figure 3 The main transportation routes of RAM and NM in Romania

The Development of the Methodology for Risk Assessment uses the available information and data related to from the *Possible Nuclear Security Regime (Framework) Approach* (adapted after an idea of Dr. Cojazzi-JRC (Joint Research Centre), ISPRA, Italy), as presented in Figure 4:
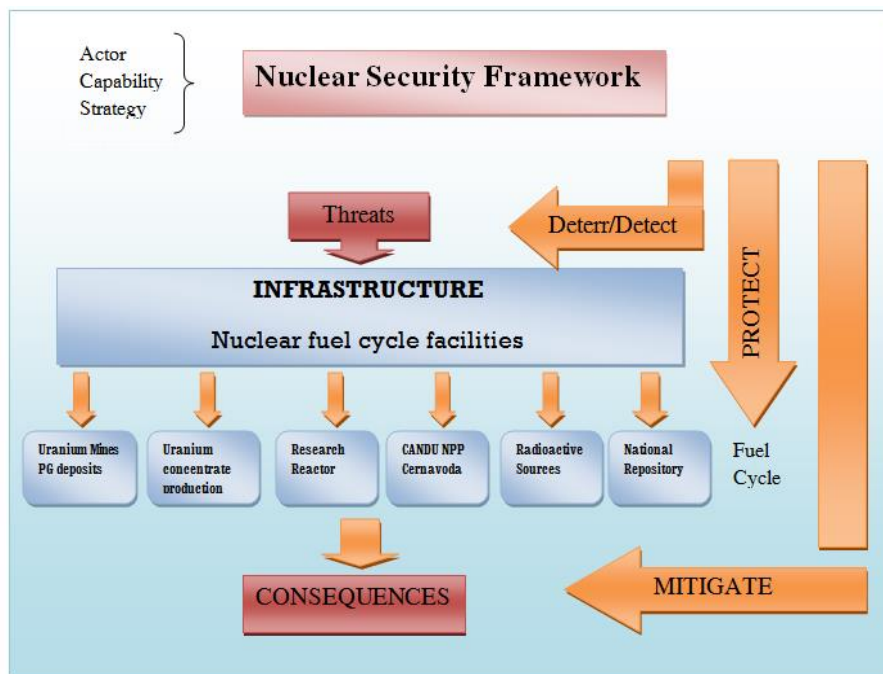

Figure 4 Possible Nuclear Security Regime (Framework) Approach in Romania

The ***risks assessment methodology*** for RAM transportation was adapted after the DOE Transportation Risk Assessment-A Resource Handbook (2002).

A draft methodology for selection of the most optimal routes for the transport of RM and NM in Romania, at the lowest possible risk has been developed (not to be described).

The following routes used for transport of RAM and NM there were analyzed: a) the transport by road of radioactive waste-Bucharest to Baita; b) transport of uranium ore by rail; c) possible transport of A CANDU SPENT NUCLEAR FUEL (*a bundle*); d) transport of URANIUM concentrate (URANIUM powder) from Feldioara to Nuclear Fuel Plant Pitesti.

A summary of the results are to be recommended to the Romanian Nuclear Regulatory Body (CNCAN) in order to be applied and help the state to improve its nuclear security regime (framework), the management of the potential risk associated with the TRANSPORT of RAM/NM since a malicious act involving RAM taken without authorization during transport may well involve the intentional dispersion of such material over a large area by using a RDD (A Radiological Dispersal Device) as a possible scenario to be considered; the potential radiological consequences could result in severe deterministic health effects to an individual in terms of doses, evaluation of the risk factor (person Sv/y, annual collective doses and/or expected cancer fatalities/y).

CONCLUSIONS

The objective of Nuclear Security Culture is to increase the State awareness and ability to control and protect nuclear and other radioactive materials, nuclear installations and transports, from terrorist acts and/or other illegal activities; to detect and respond to such events and provide engineering safety measures, as necessary.

A human factor is generally a contributor to all nuclear security related to potential incidents as well as malfunctions related to activities involving radioactive material.

In this regard, leadership and management can be vital components, and a sustainable security culture is needed in the management of activities involving nuclear or other radioactive material.

An enhanced nuclear security culture will provide greater assurance that the entire nuclear security system will accomplish its functions of preventing, detecting, delaying and responding to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving radioactive material and their associated facilities and transport.

ACKNOWLEDGEMENTS

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