Nuclear safeguards culture: Roles and responsibilities

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A B S T R A C T

The nuclear and radiological regulatory body [RB] in a State is the official authority in that State to control nuclear materials [NMs] and other radioactive materials [RMs] and all nuclear facilities in that State. In such capacity the RB may use information about the quantity, type and characteristics of every and all NMs and RMs that may exist in nuclear and radiation facilities in the State, and the flow of such materials through those facilities inside or to outside the State. Elements of nuclear safeguards culture [SGC] would not replace these technical criteria. Rather, it would be aimed to raising awareness of nuclear safeguards [SG] requirements and functions, and strengthening technical capacity of staff to meet those requirements. This study proposes a definition and the task of SGC to the attention of national and international SG communities. The roles, responsibilities of various disciplines and organizations, and the public nuclear awareness could be enforced with SGC. This would improve the effectiveness and efficiency of SG implementation in the State.

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1. Introduction

Culture is generally defined as the behaviors and beliefs characteristic of a particular group or community. Characteristics of culture include shared beliefs, values, knowledge, and attitudes that characterize the functioning of a group or organization (Schein, 2004). The best organizations value fairness, encourage taking responsibility for one's behavior, promote the feeling that individuals matter in an organization, teach the need to maintaining a questioning attitude, have a common goal of excellence in operations, and meet stakeholders' expectations. Promoting and building this kind of organizational culture is the key point and the best way to achieve all the goals of a nuclear power programme, including its economic sustainability. Experts who study the role of culture in the use and management of NMs and nuclear facilities have developed definitions of several types of culture, including safety culture and security culture. Safety Culture refers primarily to the safe operation of civilian nuclear power plants [NPPs]. The concept began receiving significant attention after workers' lack of attention to safety rules led to some NPP accidents in the last thirty years. According to the International Atomic Energy Agency (IAEA), a robust nuclear safety culture is defined as "the assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance"

(International Atomic Energy Agency (IAEA), 1991). Security Culture is defined as "the assembly of characteristics, attitudes and behaviour of individuals, organizations and institutions which serves as a means to support and enhance nuclear security." All organizations involved in implementing physical protection of nuclear materials [NMs], radioactive materials [RMs] and nuclear facilities should give due priority to the security culture; to the development and maintenance necessary to ensure its effective implementation in the entire organization. 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 the use of NMs and/or RMs for malicious acts (International Atomic Energy Agency (IAEA), 2008).

The concepts of nuclear safety and nuclear security cultures are well established; however, a common understanding of nuclear safeguards culture [SGC] is not yet internationally recognized. International SGC is different from the concepts of nuclear safety and nuclear security cultures. For example, nuclear safeguards [SG] are not as well understood by individuals outside of specialized groups dealing with nuclear material, primarily because there are no parallels to it outside of the nuclear industry. The application of international safeguards by the IAEA depends on national accounting for and control of nuclear material. Detailed nuclear material accountancy is unique to nuclear energy, and there is nothing equivalent to it in other industries as there is for safety and security. This is because nuclear material is unique in that it can be created or consumed by decay or transmutation, it can

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Nomenclature

IAEA	International Atomic Energy Agency [a branch of the United Nations Organization, Vienna- Austria]	SG	Nuclear Safeguards
		SGC	Nuclear Safeguards Culture
INSAG	International Nuclear Safety Advisory Group (IAEA)	RB	Nuclear and Radiological Regulatory Body
NMs	Nuclear Materials	RMs	Radioactive Materials
NRRA	Nuclear and Radiological Regulatory Authority, Cairo-Egypt	SSAC	State's System of Accounting For and Control of Nuclear Materials

change from one element to another. This can be a limiting factor in how well the need for nuclear material accounting can be understood and accepted by facility staff (Kovacic, 2015). In addition, nuclear safeguards extends beyond a nuclear facility and includes the government, its agencies, the regulatory bodies, academia and commercial and private entities. Nuclear safeguards includes adherence to bilateral, multilateral and international treaties, agreements and norms. It includes not only the NPT and the statute of the IAEA, but also national security and control of illicit trafficking in material and information. So, sustaining and promoting strong SGC is rooted in operational performance rather than personal safety or national security. The SGC should be promoted not only among those individuals who are involved in routine activities of SG implementation and NMs accountancy but also those who are not directly involved in these activities, i.e. the public at large. NMs accountancy is defined as the practice of nuclear material accounting as implemented by the facility operator and the State system of accounting for and control of nuclear material (SSAC), inter alia, to satisfy the requirements in the safeguards agreement between the IAEA and the State (International Atomic Energy Agency (IAEA), 2001). In fact, convincing the people of the importance of the peaceful uses of nuclear energy under SG for the welfare and development of human life is an important issue, especially, for electricity generation, production of desalination water, for the development in health care, agriculture, industry and many other applications. The SGC has aimed to raising awareness of SG requirements and functions and strengthening technical capacity of staff to meet those requirements to maintain and improve the effectiveness and efficiency of SG implementation in State (Doyle and Mladineo, 1998; Kovacic et al., 2009; Mladineo and Frazar, 2011; Naito, 2011).

In the present work, a proposed definition of SGC was introduced. Also, the roles and responsibilities were clarified for various disciplines and organizations that should work together to maintain and improve the effectiveness and efficiency of SGC.

2. Definition

The international SG community has not established yet an official definition for SGC. However, some experts have proposed definitions for consideration by the SG international community.

Kovacic et al., defined SGC as: "A unifying commitment by an organization and its members to the effective and continuously improving implementation of material control and accounting practices; the prevention of misuse of facilities; and prevention of the dissemination of sensitive technology. It also includes not just the establishment and enforcement of strong regulatory requirements but also voluntary adherence to standards, best practices, and self-evaluation aimed at non-tolerance of mistakes or deliberate disregard. Therefore, safeguards culture has to be inherent in the thoughts and actions of all the individuals at every level in an organization and must be supported by top management" (Kovacic et al., 2009).

Mladineo and Frazar defined SGC as: "A shared belief among individuals, organizations, and institutions that strict attention to international safeguards requirements and affirmative cooperation with safeguards authorities will enhance their nonproliferation stature and benefit their missions" (Mladineo and Frazar, 2011).

Naito K., defined SGC as: "The assembly of characteristics, attitudes and behavior of individuals, organizations and institutions which serves as a means to support and enhance safeguards or to achieve effective and efficient safeguards" (Naito, 2011).

Each definition addresses individuals, organizations, and institutions, either explicitly or implicitly. Each definite considers aspects of organizational culture and emphasizes beliefs, attitudes, and behaviors or activities, while each author may have slight preferences for one word or phrase over another (Mladineo and Frazar, 2013). By taking the proposed definitions into account, the present work proposes the following definition to the international SG community to negotiate and agree upon a formal definition of SGC. It is defined as: "the assembly of characteristics, knowledge, attitudes, beliefs and behaviour of individuals, organizations and institutions to raising awareness of SG requirements and functions and strengthening technical capacity of staff to maintain and improve the effectiveness and efficiency of SG implementation in a State."

3. Organizational culture models

Organizational culture literature is extensive, and there are numerous models that describe different types of organizational culture. A few examples are given in the following items.

3.1. Schein's model

Schein's model is described as a triangle with artifacts at the top, espoused values in the middle, and underlying assumptions at the base. The underlying assumptions and beliefs of the organization enable staff to understand the organization's rationale, its mission, and their individual roles within that organization. These assumptions and beliefs are reflected in the espoused values, which are passed down within the organization in the form of policy documents, instructions, guidelines, and orders, and reinforced through qualification certificates, performance evaluations and praise, self-audits, and training workshops. The resulting artifacts are the statements and activities communicated and performed by the organization and its staff, telling others about the espoused values and underlying assumptions and beliefs of that organization (Schein, 2004).

3.2. Hierarchical model

Hierarchical model it includes the State and the Nuclear and Radiological Regulatory Authority (NRRA) of the State, organizations, managers, and individuals, with requirements ascribed to each tier. In this approach, the actions of the individuals in an organization are assumed to be influenced by the policies established at the top political level, and affected through the actions of manage-