

## Preliminary Study on Improving Safety Culture in Malaysian Nuclear Industries

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### Abstract

This paper presents preliminary study on safety culture and its implementation in Malaysian nuclear industries by realizing the importance of safety culture; identification of important safety culture attributes; safety culture assessment and the practices to incorporate the identified safety culture attributes in organization. The first section of this paper explains the terms and definitions related to safety culture. Second, for the realization of importance of safety culture in organization, the international operational experiences emphasizing the importance of safety culture are described. Third, important safety culture attributes which are frequently cited in literature are provided. Fourth, methods to assess safety culture in operating organization are described. Finally, the practices to enhance the safety culture in an organization are discussed.

### 1. Introduction

National authorities are necessary to boost the development and implementation of radiological safety and security in the organizations responsible for the uses of radiation sources. The objective of the action programme is to achieve greater awareness by managers and workers on the benefits of a safety culture, with a view to the more widespread adoption of the safety culture approach. A practical guide will also be developed to foster a commitment by managers and workers to the development of a safety culture approach at the enterprise level. These elements are already stressed in the license requirement and again will be taught and reminded in national courses, workshops and seminars to promote radiation safety including internal safety and health audits by workers and managers at the enterprise level. The introduction of the Atomic Energy Licensing Act, followed by the establishment of the Atomic Energy Licensing Board (AELB) in 1984 were serious initiatives taken by the Malaysian Government to regulate, safeguard and monitor the ionising radiation activities in Malaysia. In addition, AELB is to complement the functions of Malaysian Nuclear Agency (Nuclear Malaysia) that focuses on the application and promoting the peaceful uses of nuclear and related technologies for national development. There has been a significant increase in the industrial

applications of radiation sources in Malaysia. In 2008 there were about 2192 workplaces involved with ionizing radiation from 3 categories of job activities, namely medical, industrial and non-destructive testing, NDT. As results, the number of workers in this field is steadily increasing, with around 18,820 radiation workers in 2008. Approximately 40.9% of the total workers are from the industrial, 52% from medical and 7.1% from NDT sectors [1]. Therefore it needs to understand the importance of safety culture and try to implement it in Malaysian nuclear field.

### 2. Nuclear Safety Culture Concepts

The traditions, values, custom, goals and practices of an organization represent organization culture and are reflected in the behaviors of its employee [2]. The culture of an organization and allegedly its correlation to safety is interpreted as “Shared values (what is important) and beliefs (how things work) that interact with an organization’s structures and control systems to produce behavioral norms (the way we do things around here)” [3]. ‘Safety culture’ term was first appeared in International Safety Advisory Group (INSAG) report after the Chernobyl catastrophe in 1986 was intentionally to highlight management and organizational factors and non-compliant behaviors that are vital to safety [4]. In a fourth report drawn up by INSAG, the following definition was proposed: “safety culture is an assembly of characteristics and behaviors in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance” [5]. The U.K. Health and Safety Commission proposed definition of safety culture which was widely accepted as “the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization’s health and safety management” [6]. The Nuclear Regulatory Commission interprets safety culture in parallel way but in more concise manner, “A good safety culture in a nuclear installation is a reflection of the values, which are shared throughout all levels of the organization and based on the belief that safety is important and that it is everyone’s responsibility.” [7].

### 3. Realization of Importance of Safety Culture

The Three mile accident which occurred in Pennsylvania (USA) in March 26, 1979 was a reminder that human errors were still possible, despite the application of procedures. The NRC's investigation of the TMI accident was reported to the commissioners and public that "The one theme that runs through the conclusions we have reached is that the principal deficiencies in commercial reactor safety today are not hardware problems, they are management problems"[8]. It was also reported that "the NRC, for its part, has virtually ignored the critical areas of operator training human factor engineering, utility management and technical qualifications [9]. The Chernobyl accident in 1986, Russia revealed the presence of a close relationship between management style and safety, between the degree of commitment of each and the safety level. It showed the need for properly deploying the different players in the nuclear industry: having operator with real responsibility at all levels, a fully independent safety authority and a well-informed public. It is thus that a full understanding of safety was gradually developed. The provisions made at management level and full involvement of individuals complemented and reinforced the physical and organizational provisions. This new view of safety was the result of what is called "Safety Culture". The detailed analysis of the events which contributed to Chernobyl accident showed the absence of safety culture. For example, it was stated in INSAG-1 that blocking of the emergency core cooling system (ECCS) was a violation of procedures [10]. However, recent Soviet information confirms that blocking of the ECCS was in fact permissible at Chernobyl if authorized by the Chief Engineer, and that this authorization was given for the tests leading up to the accident and was even an approved step in the test procedure. INSAG believes that this point did not affect the initiation and development of the accident. However, it must be recognized that the plant was being operated at half power for the period of approximately 11 hours leading up to the accident, with the ECCS blocked out. This could be viewed as no violation only if the 11 hour period of half power operation were part of the planned test, which it clearly was not. Blocking the ECCS over this period and permitting operation for a prolonged period with a vital safety system unavailable were indicative of an absence of safety culture.

#### 4. Safety Culture Attributes and Survey Method

Survey method chosen for data collection in this study is scale based written questionnaire. The exclusively quantitative questionnaires are used because it is quick and easy to complete, which may be helpful in minimizing work disruption and encouraging a high response rate. It also can provide clear data, which can be rapidly analyzed. It allows respondents to remain anonymous so encouraging them to express critical views without fear of adverse consequences.

Questionnaire design is based on most frequently cited safety culture attributes by 12 authors. From 24 attributes, 7 most frequently cited attributes chosen to design the questionnaire. 35 sets of question are constructed based on proposed attributes:

Attributes	Keyword
Roles/responsibilities	Work coordination
High priority to safety	Safety Priority
Openness and Communication	Effective communication
Organizational Learning	Learning Culture
Top Management Commitment to Safety	Leadership
Initial and Continuing Training	Technical Knowledge
Employees have a questioning attitude	Problem identification

#### 5. Conclusion

Radiation protection is one of the factors that need to be addressed to protect the worker's overall health and safety. Because the number of radiation workers in Malaysia is steadily increasing, this paper starts to study how to improve safety culture in Malaysian nuclear field.

#### REFERENCE

- [1] Malaysian Nuclear Agency, The impact of nuclear technology to the national socio-economy in Malaysia, October 2010
- [2] A. Mengolini, L. Debarberis, Safety culture enhancement through the implementation of IAEA guidelines, Reliability Engineering and System Safety 92 (2007) 520-529
- [3] Ill-hoon Cho, Safety Culture Improvement Activities of YGN 3 & 4, Transactions of the Korean Nuclear Society Autumn Meeting Gyeongju, Korea, November 2-3, 2006
- [4] J.N. Sorensen, Safety Culture a survey of the state of the art, Reliability Engineering and System Safety 76 (2002) 189-204
- [5] J. Reason, Achieving A Safe Culture: Theory And Practice, WORK & STRESS, 1998, VOL. 12, NO. 3, 293-306
- [6] S.H. Cho, Kwang Sik Choi, Sociodramatic approach to enhance safety culture in nuclear communities, 63rd Annual Psychodrama Conference, American Society of Group Psychotherapy and Psychodrama (ASGPP) April 14 -18, 2005, Miami, Florida U.S.A
- [7] S. Tina Ghosh, and George e. Apostolakis, Organizational Contributions to nuclear Power plant safety, Nuclear Engineering And Technology, Vol.37 No.3, June 2005
- [8] International Atomic Energy Agency. Safety culture in nuclear installations: Guidance for use in the enhancement of safety culture, IAEA-TECDOC-1329, Vienna. December 2002
- [9] International Atomic Energy Agency, Self-assessment of safety culture in nuclear installations Highlights and good practices, IAEA-TECDOC-1321, Vienna. November 2002
- [10] Fifth National Report for Convention on Nuclear Safety, Republic of Korea (2010)