

The Self-Assessment of Nuclear Safety Culture based on IAEA SCART Methods at Center for Radioactive Waste Technology in Indonesia

Adi Wijayanto^{a,b*}, Hyun-Koon Kim^c

^aBadan Tenaga Nuklir Nasional (BATAN), National Nuclear Energy Agency; Indonesia

^bKorea Advanced Institute of Science and Technology (KAIST), NQE Dept. Daejeon; South Korea

^cKorea Institute of Nuclear Safety (KINS), Daejeon; South Korea

*Corresponding author: adiw@kaist.ac.kr, adi_w@batan.go.id

Abstract

A nuclear safety culture has always been a focus of the Center for Radioactive Waste Technology-BATAN in Indonesia. IAEA Safety Culture Assessment Review Team (SCART) methods are used to evaluate the success of safety culture implementation. There are several characteristics and attributes, frequently cited in IAEA literature, which provide criteria for evaluating safety culture. The results of the 2018 self-review survey indicate that the Center for Radioactive Waste Technology is in the A scoring range with a total value of 92.2%. Based on the received score of 93.2% safety is a clearly recognized value. In addition, the weakness of the attribute characteristic of 91.4% shows that safety is integrated into all activities. The suggestions that should be considered to strengthen weak attributes like the division of work in accordance with the competence and position, communication between the leadership and employees should be improved, the planning and implementation of corrective actions from the evaluation of an event should be more orderly, and employees need facilities to learn from incidents that have occurred. Furthermore, open communication in order to evaluate the cause of the incident and provide space for employees to provide input for improvement, so discussions of incidents that occur are not taboo.

Keywords: nuclear safety culture, self-assessment, characteristic, attribute, IAEA SCART

1. Introduction

Since it was first commissioned in 1988, the Center for Radioactive Waste Technology at the National Nuclear Energy Agency (BATAN) in Indonesia has processed and managed the radioactive waste from internal and external organizations and industries on an annual basis. The Center for Radioactive Waste Technology-BATAN in Indonesia has several huge potentially hazardous processing facilities in operation. These facilities include incinerators, evaporators, and boilers. The safe operation of these facilities cannot be separated from the worker awareness of safe behavior. Consistent safety behavior from employees will form an organization's strong nuclear safety culture [3].

A nuclear safety culture has always been a focus of the Center for Radioactive Waste Technology-BATAN. IAEA Safety Culture Assessment Review Team (SCART) methods are used to evaluate the success of nuclear safety culture implementation. There are several characteristics and attributes, frequently cited in IAEA literature, which provide criteria for evaluating safety culture. The methods of the Center for Radioactive Waste Technology-BATAN safety culture self-assessment have the purpose of indicating and enhancing nuclear safety culture in the organization. Following the implementation of the nuclear safety culture development program, the Center for Radioactive Waste Technology-BATAN conducted a nuclear safety culture self-assessment online survey to

evaluate the development status of their nuclear safety culture as of 2018.

2. Regulation and Definitions

2.1 Role and Regulations

The role and regulations regarding nuclear safety culture in Indonesia :

- IAEA, Services Series No. 16, Reference Report for IAEA Safety Culture Assessment Review Team (SCART), July 2008.
- IAEA, TECDOC-1329, Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture, Vienna, 2002.
- BATAN Chairman Regulation No. 200/KA/X/2012. The Guidance for Implementation of Safety Culture Assessment.

2.2 Term and Definitions

According to IAEA, Services Series No. 16, the definition of safety culture includes the traditions, values, custom, goal, and practices of an organization define the culture of an organization and are reflected in the behavior of its agents. A good safety culture in the nuclear installation is a reflection of values, which are shared throughout all levels of the organization and which are based on the belief that safety is important and that it is everyone's responsibility [2].

As stated in IAEA, TECDOC-1329, the regulatory body defines nuclear safety culture as the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure the protection of people and the environment.[3].

3. Methodology

The evaluation of nuclear safety culture implementation was conducted via an online survey. The following link to the survey form was uploaded to the National Nuclear Energy Agency (BATAN) website: <http://www.batan.go.id/ptlr/safetyculture>. The scoring of safety culture characteristics and attributes based on IAEA SCART are shown in Table I.

Table I: Likert scoring

Statistical Analysis	Strongly Disagree	Dis-agree	Undecided /Neutral	Agree	Strongly Agree
Likert	2	4	6	8	10
Percentage	20%	40%	60%	80%	100%

The safety culture was evaluated using IAEA Safety Culture Assessment Review Team (SCART) methods [1,2]. In order to enhance nuclear safety culture implementation, the assessment was necessary to identify the importance of nuclear safety culture characteristic and attributes.

4. Analysis and Results

The total radiation worker of Center for Radioactive Waste Technology-BATAN = 88 persons, interval of confidence = 95%, and error significant = 5%, so the total respondent minimum of self-assessment of nuclear safety culture using Slovin's Formula:

Total Respondents Minimum:

$$= \frac{88}{(88 \times (0.05^2)) + 1} = 72.13$$

The total respondents who have been surveyed are 72 persons of radiation worker at Center for Radioactive Waste Technology-BATAN. The data results of each nuclear safety culture characteristic were obtained from the online survey based on IAEA SCART [2,3] is shown in Table II-VI.

Table II: Characteristic A: Safety is clearly recognized value

Characteristic and Attribute Description	Result of Surveys		
	Ans.	Freq.	Score
A. Safety is a Clearly Recognized Value			
A.1: Center for Radioactive Waste Technology provides the highest level of safety priority, as outlined in documentation, communication and in the decision-making process.	8 10	21 51	9.42
A.2: Center for Radioactive Waste Technology determines safety to be the primary consideration in resource allocation.	8 10	24 48	9.33
A.3: Everything related to safety is contained in my work plan or Center for Radioactive Waste Technology work plan.	8 10	31 41	9.14
A.4: The implementation of safety and work in the Center for Radioactive Waste Technology harmoniously.	8 10	31 41	9.14
A.5: The high priority is given to safety is shown in documentation, communications and decision making.	8 10	24 48	9.33
A.6: Center for Radioactive Waste Technology supports obedience and safety behavior formally and informally.	8 10	17 55	9.52
Average			9.32

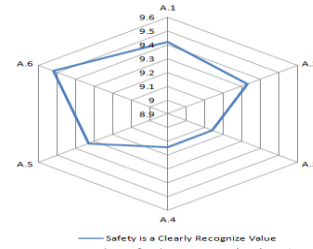


Fig. 1. The average result of characteristic A: safety is clearly recognize value

A suggestion to increase the scores for attributes A.3 and A.4 is to improve the work plan and safety job analysis before the beginning of work and implement the harmonious the safety relationship of work.

Table III: Characteristic B: Leadership for safety is clear

Characteristic and Attribute Description	Result of Surveys		
	Ans.	Freq.	Score
B. Leadership for Safety is Clear			
B.1: The Head of Center for Radioactive Waste Technology shows a clear commitment to safety.	8 10	17 55	9.52
B.2: The safety commitment of Center for Radioactive Waste Technology structural officials can be observed in the performance of its duties and responsibilities.	8 10	27 45	9.24
B.3: Leadership in safety in Center for Radioactive Waste Technology can be observed from the involvement of structural officials in safety-related activities.	8 10	34 38	9.05
B.4: Leadership skills in Center for Radioactive Waste Technology are developed systematically.	8 10	34 38	9.05
B.5: Head of Center for Radioactive Waste Technology ensures the availability of sufficient and competent employees.	8 10	31 41	8.96
B.6: The structural officers at Center for Radioactive Waste Technology attempt to involve employees to take an active role in improving safety	8 10	17 55	9.52
B.7: The Center for Radioactive Waste Technology has considered the implications for the safety of the change process occurring, whether changes to procedures and/ or equipment and/ or organization.	8 10	14 58	9.62
B.8: Structural Officials at Center for Radioactive Waste Technology demonstrate efforts to build openness and good communication.	8 10	21 51	9.43
B.9: Structural officials at Center for Radioactive Waste Technology-BATAN have the ability to resolve existing conflicts.	6 8 10	7 31 34	8.67
B.10: The working relationship between employees with superiors in Center for Radioactive Waste Technology is built on mutual trust	8 10	41 31	8.86
Average			9.19



Fig. 2. The average result of characteristic B: leadership for safety is clear

A suggestion to increase the scores for attributes B.5, B.9 and B.10 is to improve communication between leadership and employees. In addition, we suggest the division of work in accordance with competence and position, the creation of an official structure for conflict resolution, and development of mutual trust in order to increase good working relationships between employers and supervisors.

Table IV: characteristic C: accountability for safety is clear

Characteristic and Attribute Description	Result of Surveys		
	Ans.	Freq.	Score
C: Accountability for safety is clear			
C.1: The Center for Radioactive Waste Technology maintains a good relationship with the supervisory (internal external) so that safety accountability is maintained in accordance with prevailing regulations/ permits.	6 8 10	3 24 45	9.28
C.2: The roles and responsibilities in the Center for Radioactive Waste Technology are defined and clearly understood.	8 10	24 48	9.33
C.3: Every individual within Center for Radioactive Waste Technology has a high level of compliance with applicable rules and procedures (SOPs)	6 8 10	3 21 48	9.24
C.4: The structural officers at Center for Radioactive Waste Technology delegate responsibilities to employees with appropriate authority so that accountability can manifest clearly.	8 10	27 45	9.24
C.5: Everyone (both structural officials and employees) at the Center for Radioactive Waste Technology has a high sense of concern for safety.	8 10	27 45	9.24
Average			9.27

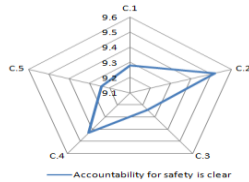


Fig. 3. The average result of characteristic C: accountability for safety is clear

Characteristic C required no suggestions for improvement due to receiving a high score.

Table V: Characteristic D: safety is integrated into all activities

Characteristic and Attribute Description	Result of Surveys		
	Ans.	Freq.	Score
D: Safety is integrated into all activities			
D.1: The attitude of trust has been pervasive to all employees in Center for Radioactive Waste Technology-BATAN.	6 8 10	7 21 45	9.13
D.2.: The Center for Radioactive Waste Technology has implemented safety, nuclear safety and environmental safety	8 10	14 58	9.62
D.3: The documentation and work procedures (SOPs) in Center for Radioactive Waste Technology are good quality in accordance with applicable terms and regulations	6 8 10	3 21 48	9.24
D.4: The flow of activities/ work processes in the Center for Radioactive Waste Technology, from planning, implementation to evaluation and review, has worked as well	6 8 10	3 24 45	9.14

D.5: Each individual in Center for Radioactive Waste Technology has sufficient knowledge and understanding to carry out the work	4 8 10	3 21 48	9.14
D.6: Structural officials at Center for Radioactive Waste Technology take into account and consider factors that may affect employee's motivation and job satisfaction.	4 8 10	3 27 41	8.95
D.7: Center for Radioactive Waste Technology seeks good working conditions by considering time pressure, workload and perceived stress in the execution of work.	4 8 10	7 24 41	8.95
D.8: Cooperation involving inter-field and expertise has worked well in Center for Radioactive Waste Technology - BATAN	4 8 10	3 27 41	9.05
D.9: The Outcomes of commitment to quality is evident from housekeeping activities and maintenance of existing facilities/ equipment conditions.	4 8 10	3 27 41	9.05
Average			9.14

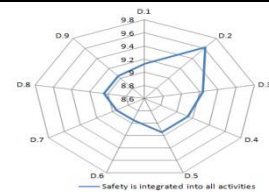


Fig. 4. The average result of characteristic D: safety is integrated into all activities

A suggestion to increase the scores for attributes D.1 D.4 D.5 D.6 D.7 D.8 D.9 is to improve open communication in order to evaluate the cause of the incident and provide space for employees to provide input for improvement, so discussions of incidents that occur are not taboo. the planning and implementation of corrective actions from the evaluation of an event should be more orderly, and employees need facilities to learn from incidents that have occurred, and the management must provide the knowledge and understanding training for each individual to increase safety leadership.

Table VI: Characteristic E.:safety is learning driven

Characteristic and Attribute Description	Result of Surveys		
	Ans.	Freq.	Score
E: Safety is Learning Driven			
E.1: The attitude of inquiring has awakened to everyone in Center for Radioactive Waste Technology - BATAN.	6 8 10	3 24 45	9.14
E.2: Center for Radioactive Waste Technology encourages everyone to report unsafe and open conditions and/ or unsafe behavior.	6 8 10	3 17 51	9.33
E.3: Center for Radioactive Waste Technology uses audit results, internal and external assessments and self-assessment results to evaluate the performance of the work.	8 10	17 55	9.52
E.4: Center for Radioactive Waste Technology uses safety related experiences, both within and outside BATAN as a learning process.	8 10	24 48	9.33
E.5: The learning process at Center for Radioactive Waste Technology is done by the ability of diagnostic deviations, formula and implementation of corrective actions and monitoring the results of improvements	6 8 10	3 31 38	8.95

E.6: Center for Radioactive Waste Technology always monitors evaluate and improve safety performance indicators to achieve good results	8	17	9.50
E.7: Center for Radioactive Waste Technology develops the competence of each employee in a good and systematic way.	4	3	8.67
	8	38	
	10	31	
Average			9.21



Fig. 5. The average result of characteristic E: safety is learning driven

A suggestion to increase the scores for attributes E.1 E.5 and E.7 is to improve worker morale is to provide continuous training opportunities. Furthermore, the organization must develop the competence of each employee with good planning and a systematic strategy.

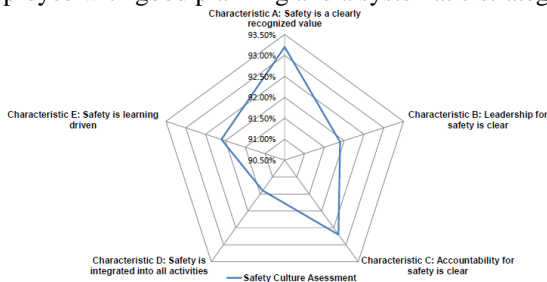


Fig. 6. The graphic average result of nuclear safety culture online survey assessment

The results of the online survey show the strength and weakness of the safety culture attributes. In order to incorporate identified safety culture attributes as key elements for aligning the Center for Radioactive Waste Technology-BATAN with continuous improvement in nuclear safety culture, an annual evaluation of safety culture practices is required. The results of the 2018 self-assessment survey assessment indicate that the Center for Radioactive Waste Technology-BATAN has rating A with a value of 92.2% based on Table VII.

Table VII: The Rating Expressed Qualitative Statement of Nuclear Safety Culture [4].

Rank A (100% <score> 80%)	In this rating, nuclear installations or facilities have safety performance above the required requirements. Topics or program reviews meet and consistently exceed performance requirements and expectations. Performance is fixed or increasing. Any rising or emerging problems or problems should be and can be resolved quickly, so these issues do not pose a risk to health, safety, environment or compliance with safety requirements.
Rank B (80% <score> 60%)	In this rating, nuclear installations or facilities have safety performance in accordance with the required provisions. Assessment topics or programs according to the content or purpose of performance requirements and expectations. The deviation is only minor deviations from the requirements or expectations of the design and or program implementation, but the deviation does not pose a risk to health, safety, security, the environment.

Rank C (60% <score> 40%)	In this rating, nuclear installations or facilities compliance rating safety requirement with this nuclear installation or facility has safety performance under the required conditions. Performance changes and falls below what is expected, or an assessment topic or program deviates from the content or purpose of the requirements. Such deviations will cause risks to health, safety, security, the environment, or compliance with the existing requirements. Although these risks are low, performance or program improvements are required to address them, so permit holders should take immediate corrective action.
Rank D (40% <score> 20%)	Topics or self-assessment programs are significantly below the requirements or from evidence in the field of low safety performance. Safety limits can be compromised. In the absence of corrective action, it is likely to lead to inefficiency and continue to pose a risk to health, safety, security, the environment, or compliance with existing requirements.
Rank E (score <20%)	Evidence of inefficiency, insufficiency, lack of control the topic or program. These have resulted in the greatest risks to health, safety, the environment. Fulfillment of safety requirements is not done at all. Rapid and appropriate response from the Supervisory Board is urgently needed, where legal action should be applied (the act of detention or revocation of a permit from the permit holder).

5. Conclusions

The results of the 2018 self-review survey indicate that the Center for Radioactive Waste Technology is in the A scoring range with a total value of 92.2%. Based on the received score of 93.2% safety is a clearly recognized value. In addition, the weakness attribute characteristic of 91.4% shows that safety is integrated into all activities. The suggestions that should be considered to strengthen weak attributes like the division of work in accordance with the competence and position, communication between the leadership and employees should be improved, the planning and implementation of corrective actions from the evaluation of an event should be more orderly, and employees need facilities to learn from incidents that have occurred. Furthermore, open communication in order to evaluate the cause of the incident and provide space for employees to provide input for improvement, so discussions of incidents that occur are not taboo.

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