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Suggestions on the Development of Safety Culture Assessment Method

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1. Introduction

Several efforts have been made to assess safety culture of organization that operates nuclear power plants in Korea. The MOST and KINS played a major role to develop assessment methods and KHNP applied them to its NPPs. This paper explains the two methods developed by KINS briefly and presents the insights obtained from the two different applications. It concludes with some suggestions for safety culture assessment based on the insights.

2. Safety Culture Assessment Tool

2.1 Development of Assessment Tool

In 1995, the MOST made a decision that the safety culture of the operating organization needs to be assessed and asked KINS (Korea Institute of Nuclear Safety) to develop detailed assessment procedures. Based on the INSAG report [1] and ASCOT Guidelines [2] of the IAEA, KINS developed a Questionnaire and a checklist with some modifications to reflect the Korean situation. The Safety Culture Questionnaire and checklist had 8 assessment areas, 43 key items supported by 181 specific questions and check items. The following table shows the structure of questionnaire and checklist.

Table 1. Structure of Assessment Items

8 areas	**43 key assessment items**	**181 Specific check items**
1. Highlighting safety	Safety policy	E-1, D-1, D-2 *(See note 2)*
	Activity of safety meeting	M-1, M-2
	Propagation	E-2, E-3
	Safety attitude of non-technical staff	E-4, E-5
	Effectiveness of reporting system	E-6, E-7, E-8, E-9
	Rewards and sanctions	E-10, E-11, D-3
	Safety responsibility	D-4, D-5, D-6, D-7
	Selection of managers	E-12, E-13
2. Relations between plant management and regulators	Openness	M-3, R-1, R-2
	Communication	R-3, R-4
	Confidence in regulator	M-4, M-5
3. Review of safety performance *(See Note 1)*		
4. Education and training		
5. Local practices		
6. Field supervision by management		
7. Attitude of managers		
8. Attitude of individuals		

Note)
1. No items listed in detail due to the space limitation
2. 'E' denotes questions to which employees would respond, 'M' to managers and 'R' to resident inspector (regulator). 'D' denotes documents review.
3. A few examples of specific questions or check items are given below.

(E-1) Do you think that the plant manager has effective plan to enhance safety and to keep safety goal?
①Yes he has. ②Yes he has but not effective one.
③ No ④Don't know

(D-1) Review and confirm the safety policy statement of headquarter and the plant
① The plant has a clear statement.
② Only headquarter has a statement.
③ No statement

2.2 Application of the assessment tool and its results

In May 1997, a special inspection on safety culture was carried out using the assessment tool at the four nuclear power plant sites. The survey data were analyzed using the scheme shown in Table 2..

Table 2. Quantification Scheme

Area	Item	Response	Weighting Value (A)	No. of response (B)	Effective response (C)	Response rate (D=B/C)	Item score (E=A×D)	Score (F)	Final area score
1	E-1	①	a_1=5	b_1	$C=\sum b_i$	$d_1=b_1/C$	$e_1=a_1/d_1$	$f_{(E-1)}=\sum e_i$	*Average of f_i*
		②	a_2=3	b_2		$d_2=b_2/C$	$e_2=a_2/d_2$		
		③	a_3=0	b_3		$d_3=b_3/C$	$e_3=a_3/d_3$		
		④	Exclude			-			
	…								
	D-1	①	5	NA	NA	NA			
		②	3						
		③	0						
	…								
…	…								
8	…								

The assessment tool was proven adequate to assess the safety culture status of the operating organization. However, safety culture assessment administered by the regulatory body would not be appropriate and might not represent the real safety culture status due to the strategic biases such as intended response to questionnaire and short-time efforts for safety culture. Moreover, it is said that safety culture could be best developed by voluntary efforts. Considering the relatively good safety culture (all the scores of 8 areas

were over 3) and the importance of voluntary efforts, the regulatory body decided it would not intervene to operator's safety culture directly and the assessment tool would be transferred to the operating organization to encourage self-assessment.

3. Safety Culture Indicators

2.1 Background: Why assess SC again?

Attention has been paid to regulator's role in promoting safety culture of operating organization since several recent events at Davis-Besse in the US, Brunsbuetell in Germany, Dampierre in France and Paks in Hungary were found to have important implications for safety culture. Moreover, regulator's response strategy to deteriorating safety culture was emerged as one of key issues at international meetings and organizations such as IAEA and OCED/NEA. Nuclear regulators started to consider whether it is necessary to intervene into operator's safety culture, and if necessary, when and how to make intervention. Although there is no agreement about the necessity and effects of regulatory intervention, it is recognized that practical methods rather than conceptual rhetoric to foster safety culture is necessary.

2.2 Assessing SC with Indicators

Korean regulator deliberated about the pros and cons of regulatory intervention and also the current possible methodology to assess safety culture. After reviewing literature on safety culture and collecting opinions and comments from social-psychology scholars, it is concluded that some aspects of safety culture can be measured using proper methods and some elements can be assessed with quantitative and manifest indicators and others can be analyzed with existing tool of questionnaire survey. This conclusion is mainly derived from the literature of INSAG-4, IAEA Safety Report Series No. 11 (SRS-11) and Dr. Edgar Schein's model of 3 level of safety culture.

The early attempt in the late 1990's to assess safety culture was based on the assumptions that survey questionnaire is the best way to measuring the features of safety culture and employee's attitude and that employees will answer honestly the questionnaire. This is still valid assumption but not when discussing regulator's role in measuring and promoting operator's safety culture. In 2003, six areas were identified where indicators would be developed to measure SC level directly from quantitative and observable data. Three exemplar indicators are shown below:

- Effective Implementation of Safety-related Decision, which can be probed by the % of completed actions ordered by Plant Nuclear Safety Committee
- Active Feedback of Lessons Learned which can be probed by the % of follow-up actions over relevant events/lessons selected for further analysis and action
- Corrective Action Closed-out in Target Dates, which can be probed by the % of corrective action closed-out, which were required/recommended from self-audit and by regulator

2.3 Pilot-test

In 2003, the SC indicators were applied to two NPPs for pilot-test. The resulting values of the indicators were between 90 and 100 (for non-% indicators some conversion were conducted setting target values), which showed quite good performance. The results were reported to NSC sub-committee, which questioned the discriminative power of the indicators. It also indicated that indicators were too narrowly focused on quantitative parts of safety culture, recommended that indicator-type assessment should not be used solely, and suggested that more improvements in assessing safety culture would be needed.

4. Conclusion: Survey methodology not susceptible to strategic bias should be developed to assess the whole aspects of Safety Culture.

One of findings from the pilot-test of indicators was that it is indispensable to employ survey and interview in order to understand the whole feature of safety culture particularly, the lower level of culture. However, the problem is the strategic response that operating organization would make if such survey would be conducted by regulator. Thus a mechanism enforcing respondents to respond honestly should be designed. Such mechanism is under development using mutual assessment between separated groups within operating organization. The following figure shows the idea of mutual assessment. Statistical methods and survey technique will be developed and a pilot test will be planned.

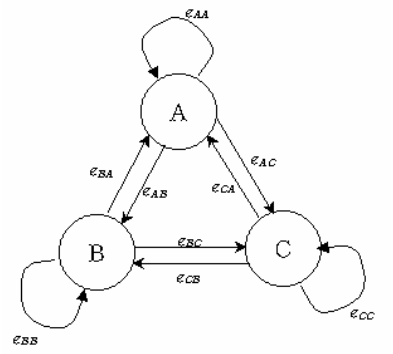

Figure 1. Schematic diagram of mutual assessment

References

[1] Safety Culture, IAEA Safety Series 75-INSAG-4 (1991)

[2] ASCOT Guidelines, IAEA-TECDOC-743 (1994) and its revised edition, IAEA-TECDOC-860 (1996)