

## The awareness of employees in safety culture through the improved nuclear safety culture evaluation method

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### 1. INTRODUCTION

After the Chernobyl nuclear accident in 1986, nuclear safety culture terminology was at first introduced emphasizing the importance of employees' attitude and organizational safety. The concept of safety culture was spread by INSAG-4 published in 1991[1]. From that time, IAEA had provided the service of ASCOT\* for the safety culture assessment. However, many people still are thinking that safety culture is abstract and is not clear. It is why the systematic and reliable assessment methodology was not developed. Assessing safety culture is to identify what is the basic assumption\* for any organization to accept unconsciously. Therefore, it is very difficult to reach a meaningful conclusion by a superficial investigation alone. KHNP had been doing the safety culture assessment which was based on ASCOT methodology every 2 years. And this result had contributed to improving safety culture. But this result could not represent the level of organization's safety culture due to the limitation of method. So, KHNP has improved the safety culture method by benchmarking the oversea assessment techniques in 2011. The effectiveness of this improved methodology was validated through a pilot assessment. In this paper, the level of employees' safety culture awareness was analyzed by the improved method and reviewed what is necessary for the completeness and objectivity of the nuclear safety culture assessment methodology.

### 2. International nuclear safety culture trends

The position of the regulatory bodies about safety culture is changing. The possibility of its negative effect originally was considered when the regulation intervened to the safety culture. And the concerns about the regulation were raised due to subjectivity of the assessment result, uncertainty of the methodology, infringement of the management right, etc. However, the necessity of regulatory role is recently emphasized by a series of events intervened by safety culture. But the regulatory body is still respecting the utility's voluntary assessment for safety culture. IAEA developed SCART\* (2008) methodology and has provided the service to assess safety culture around the world. Several countries (South Africa, Spain, Romania, Mexico, etc) had received the service. In recent years, a SCART program has been suspended due to no country asking for the service. On the other hand, United States regulatory body is active in supervision for the utility's safety culture. The regulatory position on the safety culture

was turned by the Davis Besse incident in 2002. So, NRC has Reactor Oversight Program linked to safety culture.

### 3. Improvement the safety culture assessment method

Various aspects such as country, society, customs, organization, etc. are included in nuclear safety culture. so all these factors should be considered in the safety culture assessment and the assessment result should be interpreted with those factors. For this reason, it is very difficult to develop the methodology. Recently, the sophisticated methodology and strategy are developed in order to narrow the position difference between the regulatory body and utility worldwide. The safety culture assessment methods currently used in Europe and South America are listed in the following table 1.

Table 1. Safety Culture Method Comparison

Division	Method	Features
IAEA (SCART)	1. pre-assessment : pre-data research, a questionnaire survey 2. main assessment : interviews, behavior observation 3. post review : reviewing assessment results	<ul style="list-style-type: none"> <li>■ assessment team(5 people, behavioral scientists included)</li> <li>■ two-week evaluation</li> <li>■ qualitative comment and recommendations</li> </ul>
INPO (NSCA)	1. pre-assessment : a questionnaire survey, data analysis 2. main assessment : interviews, behavior observation 3. post review : reviewing assessment results etc.	<ul style="list-style-type: none"> <li>■ assessment team(5 people)</li> <li>■ one-week evaluation</li> <li>■ utility self assessment</li> </ul>

INPO[2] is similar to the method of IAEA, however evaluation period is shorter than that of IAEA.

This is because IAEA[3] put emphasis on observations. And the number of interviewer for INPO are larger than IAEA. The assessment results and recommendations presented from IAEA are somewhat qualitative and subjective. On the other hand, INPO presents quantitative assessment results by a large number of interviewers. KHNP considered the merits of the above methods and improved the assessment method. KHNP had introduced the interview and observation techniques and has developed the safety culture 6 principles and 23 attributes. (Table 2)

Table 2. KHNP Safety Culture Principle

Principle	Contents
K1 (Policy)	Nuclear safety should be considered as top priority in all work performed
K2	Managers should take the initiative in securing

\*ASCOT : Assessment of Safety Culture in Organization Team,

\*SCART: Safety Culture Assessment Review Team \*Organization psychologist Edgar Schein

(Manager)	nuclear safety
K3 (Employee)	Individuals always demonstrate a questioning attitude in all work by being responsible for nuclear safety.
K4 (Environment)	Safety-conscious work environment should be cultivated
K5 (Learning)	Continuous learning and improvement activities should be encouraged within the organization.
K6 (Management)	Effective safety monitoring and evaluation should be carried out continuously.

Assessment result is represented by a safety culture index. This index is purpose of comparing preliminary survey with understanding the level of employees' awareness. So this index should not be used for comparison purpose with the result of other nuclear power plants. IAEA also recommends that the evaluation results of SCART should not be used in comparison with other nuclear power plants. Safety culture index is expressed as shown in the following table 3.

Table 3. KHNP Safety Culture Index

Principle <sup>1)</sup>	I=1, 2 ... 6	Safety Culture Index <sup>3)</sup>
Attribute <sup>2)</sup>	J=a, b ... f	
Weighting factor	w <sub>1</sub> =100, w <sub>2</sub> =70, w <sub>3</sub> =40	
No of Positive response	P <sub>IJ</sub>	
No of Blank response	B <sub>IJ</sub>	
No of Negative response	N <sub>IJ</sub>	S <sub>IJ</sub> = w <sub>1</sub> ×P <sub>IJ</sub> + w <sub>2</sub> ×B <sub>IJ</sub> + w <sub>3</sub> ×N <sub>IJ</sub> T <sub>IJ</sub>
No of Total response	T <sub>IJ</sub> = ∑ <sub>j=a</sub> <sup>n</sup> P <sub>Ij</sub> + B <sub>Ij</sub> + N <sub>Ij</sub>	

Note)

- 1) 1: Policy, 2: Manager, 3: Employee, 4: Environment, 5: Learning, 6: Management
- 2) 23 Attributes of the KHNP Safety Culture
- 3) 70 points of this index mean neutral answer. This index increases more positive answerer. In other words, this index is the same concept of statistical average and it represents instead of three variables, positive, neutral, negative a safety culture. The range of this index has from 40 to 100.

#### 4. The awareness of employees in safety culture

KHNP conducted the safety culture assessment from 2011 to 2012 year. Interviews with about 380 people(group1: 160 people, group2: 220 people) were carried out. Preliminary survey was carried out one week ago before main assessment. Interviewer can refer to the survey results before assessment. Interviewees were selected randomly among employees of nuclear power plant. Observations were assigned randomly among the day's works. The safety culture assessment was conducted based on the 6 safety culture principle of KHNP and the following significant results were derived.

a) Highest safety culture index : K3(Employee)

b) Lowest safety culture index : K4(Environment)

The key words of K3 attributes are responsibility, regulation, ownership and questioning attitude. The employees in pre-survey and the interviews gave the most positive response about K3 principle. The key words of K4 attributes are openness, trust, welfare and personnel, business process and stress. The employees in pre-survey and the interviews gave the most negative response about K4 principle. The difference between the survey and interview results was as shown in the following table 4.

Table 4. Result of KHNP Safety Culture Assessment

Principle SC index	K3 (Group1)	K4 (Group1)	K3 (Group2)	K4 (Group2)
Pre-survey	90.3	80.3	92.1	80.3
Interview	79.7	74.2	83.6	64.3

The survey and interview results tend to be similar overall. But, the results of the survey are higher than the results of interview. This difference is due to the following reasons. The first is differences of understanding and standards on the safety culture principles of interviewer's and interviewee's. the second is human psychology typically generous to yourself and strict to others. Despite these differences of survey and interview, the safety culture principles which acquired the highest and lowest point from two groups are same. This means the value which two groups share is same despite of company's location and environment. The purpose of a safety culture assessment is to determine the level of employees' safety culture awareness and to derive improvement activities for safety culture. Therefore, the results of this assessment will be good motivation to enhance the safety culture of KHNP.

#### 5. Conclusion

KHNP have continuously performed various activities for improving employees' safety culture awareness. However, the prerequisites of these activities are to identify the exact awareness level of employees. So KHNP developed the unique safety culture principle and tried to understand exactly the level of employees' awareness through improved methodology. As a result, KHNP verified what is necessary for promoting the safety culture. The difference between the survey and interview results can be overcome through a complementary and completeness of methodology. In near future, safety conscious working environment will be realized.

#### REFERENCES

- [1] IAEA, International nuclear safety advisory group–*Safety Culture*, Safety Series, 75-INSAG-4, VIENNA, 1991.
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- [3] IAEA, SCART GUIDELINES–*IAEA Services Series No-16*, VIENNA, 2008.