Development of the Continued Improvement System for Nuclear Safety Culture

H. C. Park, H. G. Park, Y.W. Park, J.Y. Park
BEES Inc. L508, KAIST Munji Campus 193 Munjiro, Yuseong, Daejeon 34051 Korea
Tommy@bees.pro

1. Introduction

It has been found that almost 80 % of the incidents and accidents occurred recently, such as the Fukushima Daiichi disaster and Domestic SBO accident etc. were analyzed to be caused from human errors. (IAEA NES NG-G-2.1) Which strongly claims the importance of the safety culture system. Accordingly, it should be away from a cursory approach like one-off field survey or Snap shop which were being conducted at present for the continued improvement of safety culture. This study introduces an analytical methodology which approaches the generic form of the safety both consciously and unconsciously expressed with behavior, thoughts, and attitude etc.

2. Nuclear Safety Culture Framework

One sample of overseas trend says that the strong safety culture has contributed to the higher operational availability factor, which are resulted from the self-evaluation of NEI/INPO in the US (2015). (US Nuclear Plant Reliability, Safety Better Than Ever In 2014).
As seen from that NRC and INPO has recently developed the framework (Common Language) of shared concepts, which started from the first development from both NRC and INPO independently, including four times of Public workshops, through the collaboration between the regulatory authority and the industry, the importance and the necessity of safety culture could be confirmed. Unlike IAEA GS-G-3.5, INPO, WANO, NRC, this shared frame of safety culture has not been defined yet from both the regulatory authority and the licensee in Korea. Framework which can show how to define the safety culture for the systematic approach to it will be needed. This paper introduces a developed framework which reflected Korean culture traits with flow diagram method as shown in Fig. 1.

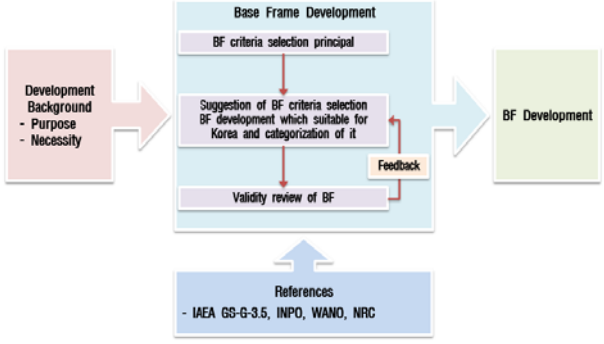

Fig.1 Framework Set Up Process

2.1 Base Frame

Framework is necessary to define the boundary of the nuclear safety culture should reach and to find the influence factors with certain criteria.

Through this study, by developing the Process of Framework Set Up as shown in Flow diagram of Fig. 1 and also by reflecting the Korean culture traits(1. The clarified a methodology, subject, objectives, 2. Added to reflecting the characteristics of the Korean Organizational culture, 3. It represents a clear expression) Nuclear Safety Culture Base Frame: Principles(3), Traits(12), Attributes(39) has been established. This Base Frame

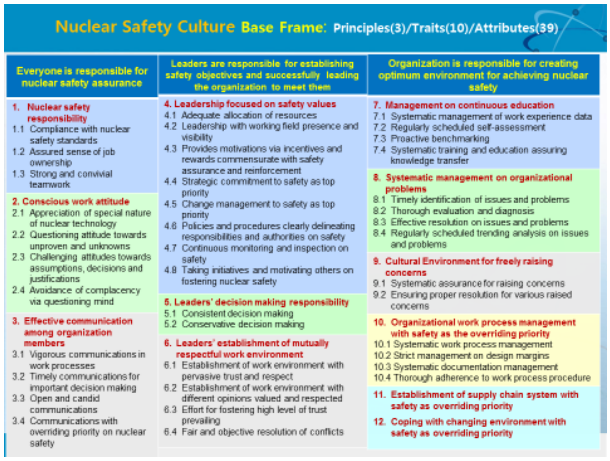

Fig.2 Nuclear Safety Culture Base Frame

3. Safety Process Inputs Definition

It is very important factor in analyzing safety culture to use which data. There shall be limitations to safety culture which shall need generic approach while using analytical methods like survey in part, Snap shot.

Object of a range for Process Input Data of usual safety culture shall be all of data produced at NPP with which the influence factor for safety culture could be identified, such as every results from the daily works(documents, meeting minutes, reports etc.), the evaluation of safety culture, survey data, reports for the incidents and accidents in NPP, audit and QA reports etc. QA has been added in a range of Process Input Data, through the comparison of 13 items with Exelon in this study.

This study was implemented only for open materials because of the limitation in accessibility to data.

Classification	Exelon	BEES
1. NRC Inspection Reports	O	O
2. NRC Allegations	O	X
3. External Evaluations	O	O
4. Corrective Action Program (CAP) inputs	O	X
5. Management Observations	O	X
6. Operating Experience (OPEX)	O	O
7. Nuclear Oversight (NOS) reviews	O	X
8. Self-Assessments (SA) and Benchmarking Reports	O	X
9. Site Performance Trends	O	X
10. Employee Feedback	O	X
11. Workforce Issues	O	X
12. Employee Concerns Program (ECP)	O	X
13. Safety Culture Surveys	O	X
14. Quality Assurance (QA)	X	O

Fig.3 Comparative Table of Process Inputs

4. Safety Culture Feedback System

As shown in Fig.4 Feedback system, analysis of data has been implemented for the process of safety culture after defining Process Input Data first. Because Process Input Data do not include the point of view of safety culture, screening work shall be needed to select data which include safety culture factor.

Then through the connectivity with base frame, safety culture factor shall be read out followed from filtering.

Currently, there is a tendency that one safety culture description is matched to the nearest one factor, and the other factors might be masked. The method of this study assigns weighting factor to the factors which were went through the base frame, which are able to revive the second and the third safety factor.

That is, instead of analyzing one incident and accident with only one influence factor, a methodology which can show the accumulated data as trend analysis rather that one-off analysis result, by using systematic approach which maximizes in taking all things related to safety culture factors.

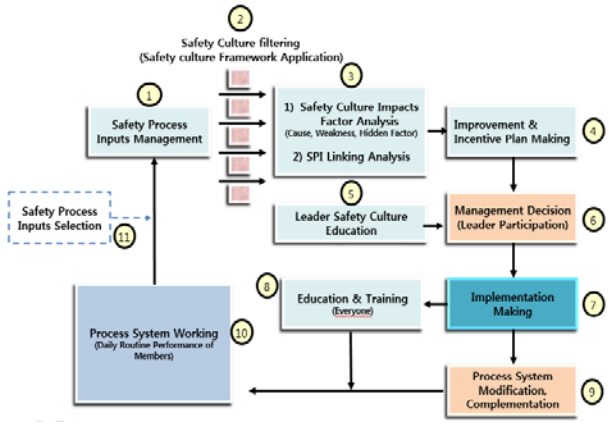

Fig.4 Safety Culture Feedback System

For example, after the analysis results of data are summarized as in Fig. 5, being able to analyze them diversely and draw improvements, advantages, items to be trained, items relevant to individuals and leaders.

The example of analysis below shows that the details can confirmed through the paper of Case Study on Influence Factor Trend Analysis of the Accidents & Events of NPPs by Applying Nuclear Safety Culture Framework.

Plant	Initial / Post Event	Safety Culture Weakness	Base Frame connectivity			Weighting Factor Rate	Weighting factor (%)
			Principles	Traits	Attributes		
Kori 4	Initialing Event	Leader of generation team should give directions to team members and confirm and supervise its fulfilment.	Member	1	1-2	1	25.0
		After team leader gave instruction to reactor operator and turbine operator to starting operation, he didn't check status of major operation parameter like main steam line pressure and execution status of each steps in procedure because he carry out administrative work such as access approval prior to confirmation.	Leader	4	4-2	3	75.0

Fig.5 Base Frame Analysis Using Weighting Factors

4. Results

This study was implemented only for open materials such as Inspection report, incidents and accidents reports, QA documents because of the limitation in accessibility to data. More effective use with securing operational data will be possible in future.

5. Conclusion & Discussion

Analysis of the Continued Improvement System for Nuclear Safety Culture is a methodology which enables to do trend analysis of individual, leader, organization by analyzing process data which has been accumulated, based on Framework, being away from a cursory approach like one-off field survey or Snap shop which were being conducted at present, approaching all influence factors systematically with the generic form of the safety both consciously and unconsciously expressed with behavior, thoughts, and attitude etc.

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