

Analysis of Employee's Survey for Preventing Human-Errors

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1. Introduction

Human errors in nuclear power plant can cause large and small events or incidents. These events or incidents are one of main contributors of reactor trip and might threaten the safety of nuclear plants. To prevent human-errors, KHNP(nuclear power plants) introduced 'Human-error prevention techniques' and have applied the techniques to main parts such as plant operation, operation support, and maintenance & engineering. This paper proposes the methods to prevent and reduce human-errors in nuclear power plants through analyzing survey results which includes the utilization of the human-error prevention techniques and the employees' awareness of preventing human-errors.

2. Survey fields

The survey for investigating the usability level of the techniques and the employees' awareness consisted of 7-categories and 32-questionnaires. But, this paper is focusing on the following fields [1],[2]:

- (1) Understanding & Utilization level of the human-error prevention techniques
- (2) Difficulties of applying the human-error prevention techniques
- (3) Employee's training(or education) level of the human-error prevention techniques and training effect
- (4) Root causes of human-errors and countermeasures

The human-error prevention techniques applied in Korean nuclear plants are 15 techniques which are divided into 2 groups. One group is basic techniques and the other is conditional techniques.

- Basic techniques :
Task Preview / Job Site Review / Questioning Attitude / Stop When Unsure / Self-Checking / Three-Way Communication / Phonetic Alphabet
- Conditional techniques :
Pre-job Briefing / Concurrent Verification / Independent Verification / Peer Checking / Flagging / Place Keeping / Turnover / Post-job Critique

3. Analysis of survey results

The survey was conducted in the 4 nuclear sites such as Kori, Hanbit, Wolsong, and Hanul. A total of 1,740 employees participated in the survey and participant ratio according to the job sectors is shown below table I.

Table I: Survey Participant Ratio according to Job Sector

Job Sector	Operation (Op)	Maintenance & Engineering (M&E)	Operation Support (O/S)	Safety (Sa)	Etc.
participant	829	448	310	145	8
Ratio (%)	47.6	25.8	17.8	8.3	0.5

3.1. Utilization level of the techniques according to job sector

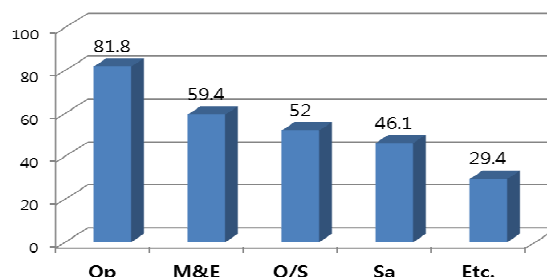


Fig.1. Utilization level of the human-error prevention techniques

Fig.1. shows utilization level of the techniques according to the job sector. The utilization level of operation sector was higher compared to other sectors. It proves that the human-error prevention techniques are mainly used in operation sector. In maintenance & engineering sector and operation support sector, the utilization level showed 59.4% and 52% respectively. Other sectors except operation need to raise utilization level even though each sector has different job characteristics. It is because human-error can occur in all sectors.

As to utilization level according to service year, the utilization level (Fig.2.) showed a rise form more than 5-year service and maintained a certain level. That is, for understanding and applying the techniques, it can be seen it takes more than 5 years at least. Thus,

employees under 5-year service need to reinforce education or training to raise utilization.

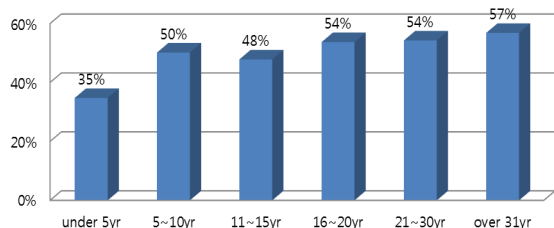
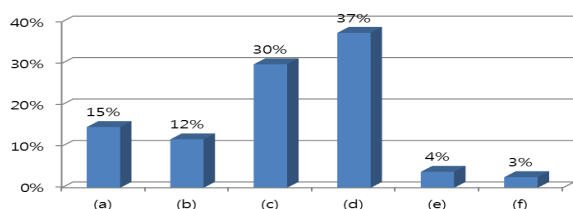


Fig.2. Utilization level according to service year

As fig.3, employees answered that the most difficulties of applying the techniques to their jobs were 'lack of time' and 'lack of manpower'. And next difficulty was that the human-error prevention techniques are complicated to apply.



(a) complicated to apply (b) inadequate job to apply
(c) lack of manpower (d) lack of time
(e) do not know the techniques exactly (f) Etc.

Fig.3. Difficulties of applying the techniques to actual jobs

3.2. Training level of the human error prevention techniques

Over the past three years, 93% employee of participant in the survey has taken training at least one or more times from team self-training or internal/external training institutions. About 40% of participant in the training answered that they were trained more than five times. It seems that training was done systematically and sufficiently.

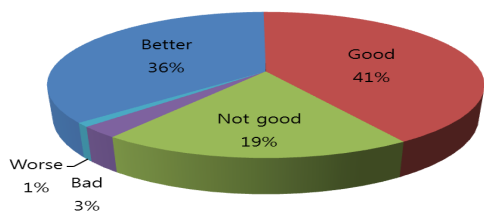
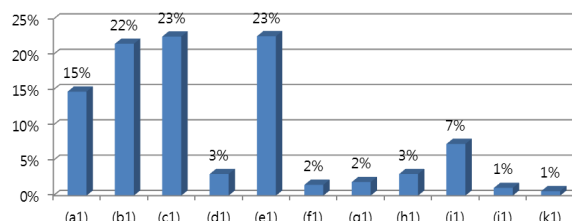


Fig.4. Satisfaction of the technique's training

After the training on the human-error prevention techniques, about 77% of the employees answered that the training was helpful to their job (Fig.4.). On the other hand, 23% of employees did not answer the training was very helpful. It would be said that 77% training effect on employee's actual work gets a good result.

3.3. Root causes of human-error

At the question about the root causes of human-error in nuclear power plants, employees mainly answered that the root causes are manpower shortage, tight process, excessive mission, lack of personal knowledge and poor communication. Fig.5. shows various root causes that employees answered.



(a1) lack of personal knowledge & skill
(b1) excessive mission (c1) tight process
(d1) lack of training (e1) manpower shortage
(f1) lack of management commitment
(g1) lack of HPES program (h1) absence of accountability
(i1) poor communication (j1) lack of teamwork
(k1) Etc.

Fig.5. Root causes of human-error that employees answered

4. Conclusions

With regard to human-error prevention, this survey analysis presented the status of the human-error prevention techniques and the employees' awareness of preventing human-errors. Employees' understanding and utilization of the techniques was generally high and training level of employee and training effect on actual works were in good condition. Also, employees answered that the root causes of human-error were due to working environment including tight process, manpower shortage, and excessive mission rather than personal negligence or lack of personal knowledge. Consideration of working environment is certainly needed.

At the present time, based on analyzing this survey, the best methods of preventing human-error are personal empowerment, training/education substantiality, private mental health check before starting work, prohibit of multiple task performing, compliance with procedures, and enhancement of job site review. However, the most important and basic things for preventing human-error are interests of workers and organizational atmosphere such as communication between managers and workers, and communication between employees and bosses.

REFERENCES

- [1] Questionnaires for Human Performance Enhancement in Nuclear Power Plants, KHNP, June, 2013
- [2] Human-Error Survey Analysis Report, KHNP-CRI, August, 2013