

An Enhancement of Campaign Posters for Human Error Prevention in NPPs

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1. Introduction

Accidents in high reliability systems such as nuclear power plants (NPPs) give rise to not only a loss of property and life, but also social problems. One of the most frequently used techniques to grasp the current situation for hazard factors in the NPPs is an event investigation analysis based on the INPO's Human Performance Enhancement System (HPES), and the Korean Human Performance Enhancement System (K-HPES) in Korea, respectively.

There are many methods and approaches for an HE assessment that is valuable for investigating the causes of undesirable events and counter-plans to prevent their recurrence in the NPPs. They differ from each other according to the objectives of the analysis; the explanation of the event, the investigation of the causes, the allocation of the responsibility, and the establishment of the counter-plan. Event databases include their own events and information from various sources such as the IAEA, regulatory bodies, and also from the INPO and WANO.

As many as 111 reactor trips have occurred in the past 5 years ('01~'05), and 26 cases of them have occurred due to HE. The trend of human error rate didn't decrease in 2004, so the KHNP started to make efforts to decrease HEs. The KHNP created as many as 40 posters for human performance improvement in 2006. The INPO has been using a traditional form of poster; additionally, the Central Research Institute of Electric Power Industry (CRIEPI) developed a type of caution report. The caution report is comprised of a poster name, a serial number, a figure, work situations, the point at issue, and a countermeasure.

The preceding posters which KHNP developed in 2006 give a message about specific information related to HE events. However, it is not enough to arouse interest in the effectiveness of the posters because most people are favorably disposed toward a simple poster with many illustrations. Therefore, we stressed the need for worker's receptiveness rather than notification of information and also emphasized on visual characteristics for the new types of posters. The incident reports were reinterpreted in view of HE preventive tools for the posters.

2. HE Precursors of the Posters

We considered the INPO's error precursors for the factors can be potential causes of HE as performance-shaping factors (PSF) or behavior-shaping factors (BSF). The error precursors listed in table 1 were compiled from a study of the INPO's event database as well as reputable sources on

human performance, ergonomics, and human factors. We used error precursors as the main topic to develop new types of posters. Unfavorable conditions embedded in job sites that create mismatches between a task and the individual are known as error precursors. Error precursors interfere with successful performance, and increase the probability for error. Undesirable job-site conditions can be categorized into one or more of the four categories.

The category of the Task Demands represents specific mental, physical, and team requirements to perform an activity that may either exceed the capabilities or challenge the limitations of human nature of the individual assigned to the task. The Work Environment stands for general influences of the workplace, organizational, and cultural conditions that affect individual behavior. The Individual Capabilities comprises unique mental, physical, and emotional characteristics of a particular person that fail to match the demands of the specific task. Finally, the Human Nature represents generic traits, dispositions, and limitations that may incline individuals to error under unfavorable conditions.

Table 1 HE precursors

Category	HE precursors
Task Demands	Time pressure, High workload, Simultaneous tasks, Repetitive actions, Irrecoverable acts, Interpretation requirements, Unclear goals & responsibilities, Unclear standards
Work Environment	Distractions/Interruptions, Changes/Departure from routine, Confusing displays, Work-arounds instrumentation, Hidden system response, Unexpected equipment condition, Lack of alternative indication, Personality conflict
Individual Capabilities	Unfamiliarity with task, Lack of knowledge, New technique not used before, Imprecise communication habits, Lack of proficiency, Indistinct problem-solving skills, "Unsafe" attitude for critical tasks
Human Nature	Stress, Habit patterns, Assumptions, Complacency, Mind-set, Inaccurate risk perception, Mental shortcuts (biases)

3. The Current Posters

Figure 1 shows the current poster. The posters were distributed to all Korean NPPs, and were displayed on the wall in 80 places. Also, the KHNP has conducted a poster e-mail system to approximately 7500 workers from June in 2006. These posters focused on worker's attitude rather than

the system's improvement because an improvement of the system or equipment can be sufficiently done through a system modification and a proposal activity etc. However, it is short of arousing an interest because most people are favorably disposed toward a simple poster with many illustrations.



Fig. 1 Examples of the current posters

The current posters can express clearly detailed information. But these posters have several defects as follows; Decline visibility, drop in attention, information overload to transfer a large amount of information.

4. The Developed Posters

We put emphasis on individualized illustration which gives rise to some awareness. Furthermore, the posters maximize the effectiveness through a visual color scheme and a metaphorical content in order to strengthen the impact of the countermeasures of the HE. We try to maximize the image of the posters as a multiplicity of a literal fun (humorous fun, metaphorical fun, comparative fun, and accentuate fun). The developed posters illustrated the HE precursors to express effectively the primary intention and to make up for discrepancies in the current posters. The posters will arouse workers' attention through the directional visual appeal. First, poster in Figure 2 illustrates unexpected equipment conditions that system or equipment status not normally encountered creating an unfamiliar situation for the individual. The poster emphasizes an image arousing worker's attention to the situations of unexpected equipment's failure, malfunction, etc.

We have to consider activities for the poster effectiveness after developing the posters. For examples, there are possibly an e-mail type of posters, an exhibition of posters, T-shirts of posters, and a digital poster. In case of the present posters, it is difficult to arouse the worker's interest about the HE because the present e-mail form of each present poster follows a same fixed form. The new type of email form includes the topic, the core image, the error causes, the case I, the case II, and a big size of a poster as shown in figure 3. We tried to find accident cases related with HE precursors from to give attention through the

indirect experience of HE accident and finally deducted two possible HE accident cases associated with each poster in each email form.



Fig. 2 Examples of the developed posters



Fig. 3 Examples of the poster utilization

5. Conclusion

This paper suggests new types of HE related posters as a part of the countermeasures by giving rise to some awareness in the NPPs. We expect an improvement of safety and reliability in the NPPs by making the best use of the developed posters. For further research, it is necessary to formalize a system searching for a more suitable source to build a HE related poster. Also, applications of the posters should be explored to obtain the desired results.

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