

## Development and Application of Web Based K-HPES for Human Error Analysis

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### 1. Introduction

K-HPES has been used to find the root causes of human errors in nuclear power plants since 1995. About 500 reports have been reported with K-HPES. There have been, however, complains that K-HPES is difficult to apply, and that its reports is large with a lot of trivial questionnaires. K-HPES is now upgraded into web based system with introducing systematic approach for root cause analysis. This paper will explain the web based K-HPES, which is supposed to be applied in 2007.

### 2. K-HPES Characteristics

#### 2.1 Human Error Analysis

One of the misunderstandings is that K-HPES can find out the root cause of human errors automatically if analyst applies human factor principles or psychology. The previous K-HPES has maintained this view point. But human errors are not as simple as only human factors can elucidate.

There is such an accident that can be described in single sentence. It has very complex context, so that the context should be decomposed hierarchically. During the decomposition, human factors like other science can be useful for the analysis.

When either human error occurs or equipment is out of order, it is the nuclear power plant which shows their effect. Thus all accidents should be analyzed by scrutinizing systems of the nuclear power plant. During the analysis process, it would be clear whether human is involved or not. When human commits errors, that person might be further interviewed.

When human errors occur and analyzed, there are two inevitable things. One is reports and the other is techniques to fill the reports. Without them, analyst might publish empty report. Traditionally human factor engineers have tried to combine the report form and investigation techniques. That attempt makes analyst confused.

#### 2.1 Report Template

Reports for accidents should have full context of the accident. It includes at least the name of accident, the name of nuclear power plant, date of accident, root causes, corrective action [1]. Those attributes should be orderly assembled to form coherent context like in Fig.1

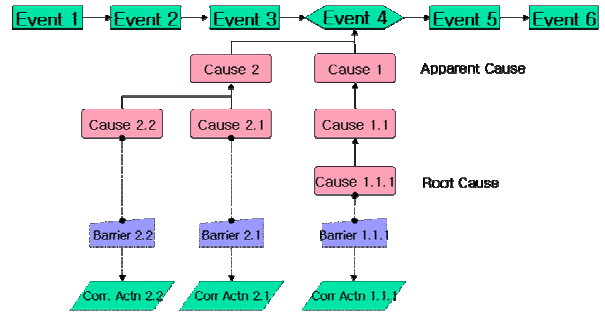


Figure 1. Decomposition of human errors

#### 2.2 Investigation method

The investigation method is needed to fill the report. The events in Fig.1 are not fiction, but facts which should be found through the investigation method. The causes, barriers, and corrective actions are filled in too. Most documents regard these investigation methods as root cause analysis. This concept makes peoples confused. This paper claims that root cause analysis is the report form showing cause of accidents, not investigation methods.

The method includes reviewing relevant documents, interviewing witness, task analysis, demonstration, change analysis etc.

While building the structure in Fig.1, these methods can be selectively applied to find clues.

#### 2.3 Software Architecture and Man machine Interface

Web Based K-HPES is designed on the basis of internet. Thus, everyone can access the K-HPES only with internet explorer as Fig.2

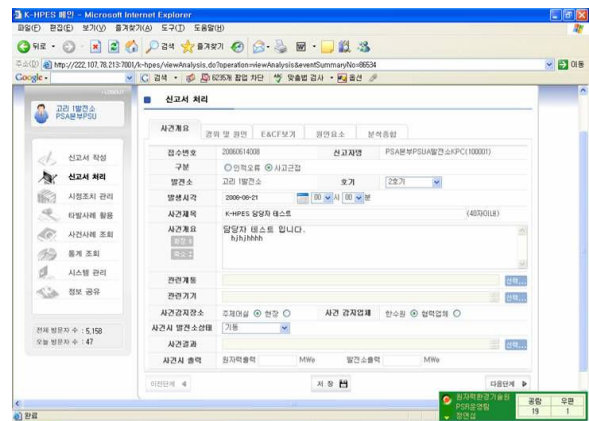


Figure 2. Web Based K-HPES

The K-HPES server is built in Java and Struts technology. Oracle DBMS are connected to store data for human error. The data can be transformed word document finally.

K-HPES can be regarded as workflow software. If notification of human error is issued, then this is accepted by one who is in charge of K-HPES. After accepting, this error is further analyzed by designated human error analyst. This workflow can be handled by commercial workflow software such as JBPM. In the beginning stage of K-HPES, JBPM had been utilized but was removed because of response delay.

Web based K-HPES has been reviewed repeatedly for usability. All the components are coherently related one another. The events and causes of Fig.1 are rendered in tree and table format. Each node can be easily inserted or removed. The attributes of cause nodes is filled in by popup dialog.

Most database applications are programmed in text user interface, but K-HPES is in graphic user interface. Cause classification tree, E&CF, and figures of evidence are shown in graphics. These are also inserted in the human error reports.

#### *2.4 Software Validation*

Web based K-HPES has been reviewed repeatedly for usability. All the components are designed and arranged to give maximum coherence. All possible navigations in the workflow are tested.

While 20 users are accessing the K-HPES during the beta test, its response is delayed. This is due to poor server specification and no optimized source code. Afterward, the code was optimized with removing the 3<sup>rd</sup> party components and adding JSP source code.

#### *2.5 Applicability of K-HPES*

KHNP(Korea Hydro Nuclear Power Company) put great emphasis on human performance. K-HPES is one of such efforts to reduce the human error. In addition to K-HPES, KHNP is introducing CAP(Corrective Action Program) or RCA(Root Cause Analysis). But thorough study will reveal that HPES, CAP and RCA have the similar purpose and origin. Thus K-HPES can be used instead of CAP and RCA.

### **3. Conclusion**

Web based K-HPES has been developed. It has been beta tested by real user. It will be applied at all sites in 2007.

### **REFERENCES**

[1] Yeonsub Jung, MoonGoo Chi, JaeSung Lee, MyungSub Roh, Web Based Root Cause Analysis Tool for Human Errors in the Nuclear Power Plants, ICAPP 2005