

## Operating Experience Review in Development of SMART MMIS

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### 1. Introduction

We have developed HFE(Human Factors Engineering) program plan for the purpose of implementing man-machine interface system in SMART plant systematically. Elements of the plan are compatible to those of NUREG-0711, Rev.1, and OER(Operating Experience Review) is one of them.

The main purpose of conducting an OER as part of HFE review is to identify HFE-related safety issues [1]. If identified, design alternatives are carefully reviewed and selected as the way of resolution for those issues. The performing model of OER is described in this paper, showing a series of works must be done to identify and resolve HFE-related issues within the scope of SMART HFE works. Then two key issues and design alternatives resolving them are presented for examples.

### 2. A Functional Model and Example

In this section the model of performing OER is described, and example is presented.

#### 2.1 A Functional Model of Performing OER

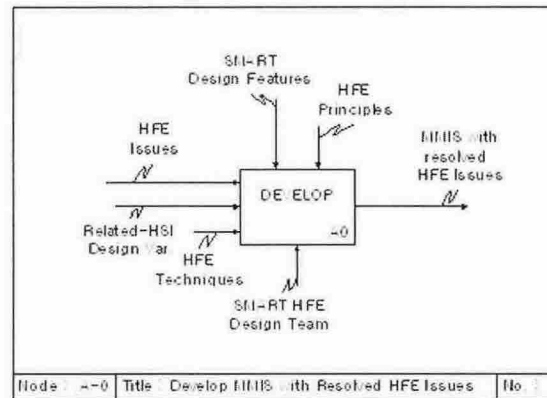
The model of performing OER was developed using a functional modeling method called IDEF(Integration DEFinition for function modeling) [2]. As shown in Fig. 1(a), we, the SMART HFE design team, are trying to design MMIS that HFE issues derived from operating experiences are resolved by applying advanced HFE techniques more aggressively. When design alternatives are selected or developed among many applicable HFE techniques, it should be done under the strong control of HFE design principles.

This activity is decomposed into four sub-activities as shown in Fig. 1(b). SMART HFE design team members are in charge of collecting HFE issues. The final decision whether the collected issues are applicable to SMART MMIS design or not is made by team leader. The followings are the scope of performing OER categories required by regulatory commission [1].

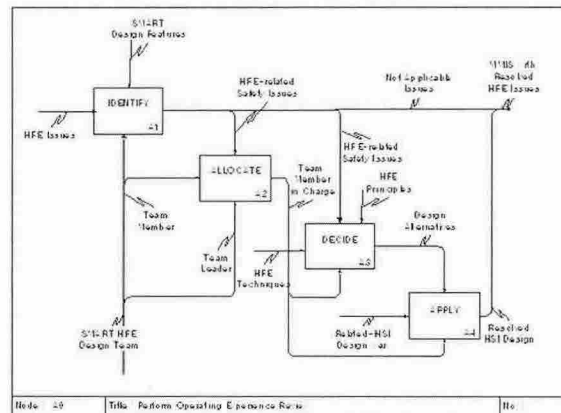
- recognized industry HFE issues (NUREG-6400) [3]
- related HFE technology
- predecessor/related plants and systems
- issues identified by plant personnel
- risk-important human actions

Once an issue identified, team leader allocate it to suitable team member. If he finds out the issue that should be resolved by several team members, he can allocate it to them as a group.

The team member or group in charge of resolving the issue has to survey or develop HFE techniques needed to resolve it. Then he evaluate which one is the most suitable to the issue considering HFE design principles, and setup the most desirable design alternatives. Finally he applies them to produce MMIS with resolved HFE issues.



(a) Top-level context diagram.



(b) Sub-diagram

Figure 1. The model of performing OER for developing MMIS in SMART.

This process of identifying HFE-related safety issues and resolving them was the design bases to develop ITS(human factors issue tracking system) of SMART [4]. The design requirements were derived from this model of performing OER. All issues identified are traced and managed within ITS.

#### 2.2 Example

In complex process control systems like nuclear power plant, a great number of alarms are produced especially under the plant upset conditions. It is very important

task which operators navigate alarm information on VDU-based user interface to find out what's really going on the system. Management and navigation of the displays can impose significant workload on the operator not related to the primary task of monitoring and supervising the plant [5].

This problem was collected by one of team members and stored ITS as an HFE issue titled "Tiled alarm navigation". Team leader evaluated and classified this issue as an HFE-related safety issue because navigating task load imposed on the operators could be critical to be aware of situation of safety system. He allocated this issue to one of team members specialized in human computer interface design.

The team member in charge of the issue decided to provide operator an effective interface which can reduce workload imposed on the secondary task. He setup the following guideline to invent a new navigating technique.

- The navigating technique provided should be done with little attention as operators can concentrate the primary task of being aware of system status.

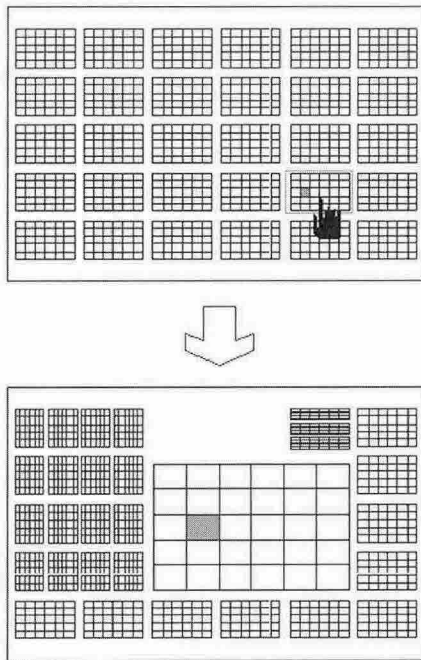


Figure 2 Elastic Tile Alarm: an effective technique of visualizing and navigating many tiled alarm information.

An elastic tile method was proposed, which can be used to visualize and navigate effectively many tiled

alarms information. The way of navigating tiled alarm information is illustrated in Fig. 2.

### 3. Conclusion

We described how OER activity could be done in the design process of SMART MMIS by presenting a functional model of performing OER. We found out this functional model can be a useful tool to derive some design requirements for developing ITS. As an example, we presented how HFE-related safety issue was identified and resolved using the model.

### REFERENCES

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