

## The e-HFMP MCR Navigator Development for Main Control Room Improvement and an Evaluation

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### 1. Introduction

HFMP(Human Factor Management Program) is under development in order to apply the principal human engineering easily. And e-HFM is simultaneously developed together with HFMP. The e-HFMP is web-based and equivalent system for HFMP. It is including the functions of the issue tracking management, the design document management, MCR navigator, and human engineering guideline management. Especially the MCR Navigator function shows overview and each instrument of main control room without visiting plant MCR directly. Therefore it helps performing efficiently the various evaluations relating to the control room, operator's training, and design change.

### 2. The necessity of the Navigator for MCR improvement and an evaluation

Evaluating Main Control Room becomes the important work in view of safety of nuclear power plant. The evaluation must apply the human engineering guide accurately to MCR. But there are many instruments more than 3,000 in MCR. Therefore the frequent MCR entrance is inevitable for their detail evaluation and independence confirmation verification. This frequent entrance might bring about disturbance in plant operation and cause a problem in power plant security. Consequently the web based MCR Navigator is developed to solve this problem and for efficient evaluation.

### 3. Man Machine Interface and Evaluation Element of PSR(Periodic Safety Review)

There are a lot of reasons to evaluate the MCR. They are the aging of instruments, change of the safety standard caused by advance of technology. According to the aging and obsolescence of the MCR's instruments or the new human engineering standard, the reappraisal of instruments is necessary. Therefore the periodic safety review is required consequently even in the human engineering field. The control panels which the human engineering principal must be applied to could be the main control panel, remote shutdown panel, safety parameter display system and local panel.

The human engineering evaluation is mainly carried out to confirm and verify the indicator or controller of control panel visually. But it will not be able to evaluate immediately from site MCR because the indicators or

the controllers are too many and the memory of the person is limited. Consequently it is essential to take the photograph.

The Navigator will be used to enhance evaluating detail instruments of the MCR panel. And it will show the MCR's layout sketch, unit panels, and detail instruments by providing the same format page as the plant site.

### 4. Development Procedure of e-HFMP Navigator

The Navigator is composed of about 3000 screens which are constructed with hierarchy. The whole layout screen is located in top class and the detail instrument screen is located in subordinate class.

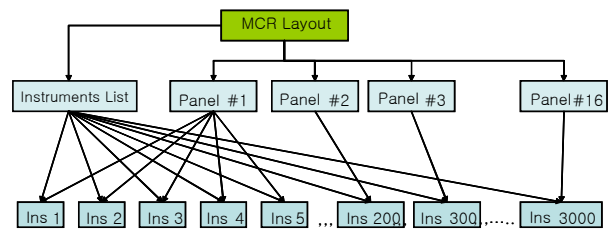


Figure 1. Screen type and conversion

After reviewing the corresponding MCR layout drawing, it must be photographed with the whole screen of the MCR, the whole screen of the specific control panel and the set of specific instruments in order.

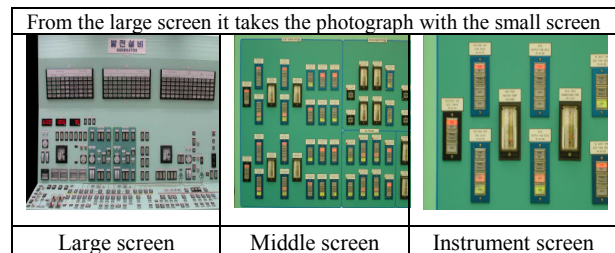


Figure 2. Types of photograph

The whole screen of the specific control panel must be made panorama screen. And the detail instrument screen must be made by cutting the adjacent photographing screens. The file size of the instrument screen must be optimized in order to be used for web traffic.

And the MCR arrangement screen is to be linked to panorama picture and then the panorama picture is to be linked the detail instruments by using image-mapping function.

울진1-2 Navigator HOME				<Tag name >			
<T0T203>	<T04T05>	<T06T07>	<T08T09>	<T10T11>	<T12T13>	<T14T15>	<T16T17>
KSC012EN	KRT005EN	AHP001EN	KSC004EN	RCP411EN	RCP401EN	ETV401EN	RG1508LA
KSC010EN	KRT006EN	KRG005EN	GMA004EN	RCP406Z0	RPN402EN	ETV402EN	RG1509LA
DEG1021D	RRI001EN	APP001EN	GRP001MP	RPE008MN	RPN403EN	ETV001EN	RG1509LA
DEG2021D	STY004EN	REI002EN	GRP001MP	RPE008MN	RPN404EN	EAS028LA	RG1509LA
DEG3021D	KRY001EN	REN003EN	GRY001MP	RPE011MT	RPN405EN	EAS028LA	RG1508LA
KS4033D	KRT003EN	REN003EN	GRY001MP	RPE003MP	RPN406EN	EAS036LA	RG1508LA
KS4055D	KRT002EN	REN003EN	GGP001D	RCP023MN	KSC404EN	EAS028LA	RG1510LA
EPP005TL	KRY004EN	ARE410D	SGR003D	RCP022MT	KSC405EN	EAS021LA	RG1511LA
EPP002TL	EVH001EN	ARE410D	GGP002D	RCP418Z0	RPN407EN	EAS027LA	RG1512LA
EPP008TL	KSC005EN	ARE402D	GGP003MP	RCP421Z0	RCP407EN	EAS031LA	VVP539LA
EPP006TL	KSC007EN	ARE403D	VVP401D	RCP423Z0	REN012D	EAS033LA	VVP504LA
EPP013TL	KSC006EN	ARE413D	VVP001EN	RCP406Z0	RCP405EN	EAS030LA	VVP507LA
KS4081D	KSC008EN	ARE404D	VVP002EN	RCP418Z0	RCP402EN	EAS022LA	VVP503LA
DEG101TL	RRI001D	ARE405D	GMA005EN	RCP418Z0	RCP468D	EAS032LA	VVP502LA
DEG201TL	RRI002D	ARE406D	GSS001EN	RCP402Z0	RCP470D	EAS026LA	VVP510LA
DEG301TL	RRI003D	ARE416D	VVP403D	RCP408Z0	RCP472D	EAS018LA	VVP533LA
DEG102TL	RRI003D	ARE407D	VVP403D	RCP418Z0	RCP385MD	EAS024LA	VVP501LA
DEG202TL	RRI004D	ARE408D	VVP001MD	RCP481CC	RCP027MD	EAS028LA	VVP508LA
DEG302TL	RRI005D	ARE409D	VVP002MD	RCP482CC	RCP040MD	EAS030LA	VVP536LA
DEG302TL	RRI005D	ARE409D	VVP003MD	RCP457CC	RCP042MD	EAS010EN	VVP524LA
	RRI007D	REN004EN	VVP418D	RCP451CC	RCP083MD	RIS113LA	VVP511LA
	JRP001D	DFI001D	VVP025MP	RCP403EN	RCP054MD	RIS504LA	VVP533LA
	RPM001D	DFI002D	GMA003MP	RCV403EN	PTR021MN	RIS13LA	VVP506LA
	EVCO01EN	APP003EN	GMA045MP	GRH002EN	PTR019MN	RCY510LA	VVP509LA

Figure 3. Tag-name search webpage.

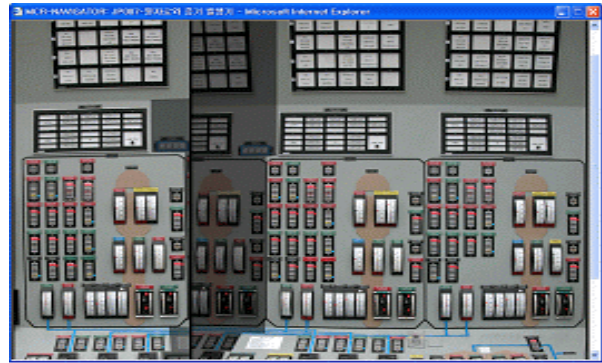


Figure 5. Navigator Panorama picture

The specific instrument can be also searched by using tag-name. The tag-name is linked to detail picture name. And instrument's name by list structure is created because many instruments can be appeared in a detail picture.

### 5. e-HFMP Navigator Structure

The Navigator is consisted of whole picture and unit instrument picture. The whole picture is used for evaluating the arrangement controller, and the unit instrument picture is used for evaluating attribute of individual controller and indicator.

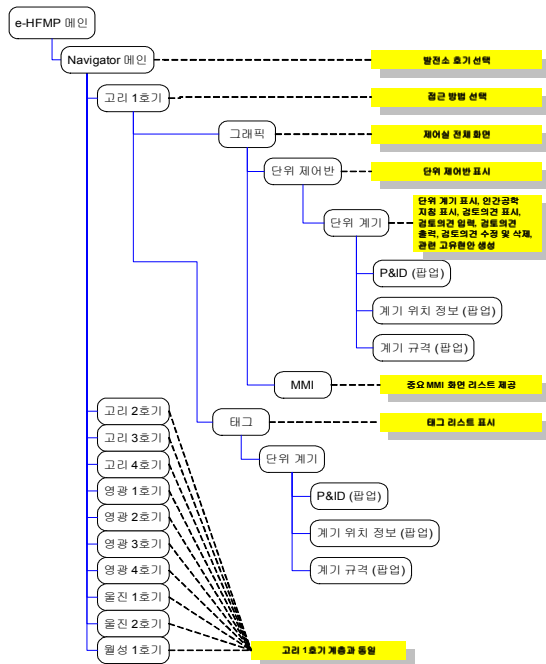


Figure 4. e-HFMP Navigator Structure

Figure 4 is Navigator's hierarchical structure in e-HFMP. The contents of MCR navigator contains pictures, and documents such as P&ID, and review contents, and guidelines.

If a control board is clicked in Navigator, the panorama picture of each control board is showed as Fig 5. All instruments have unique linker through image-mapping.



Figure 6. Opinion registration window

The detail screen window for unit instrument is appeared as Fig.6. The window is divided into several regions. Human engineering guideline for the selected device appears in one of the section. Therefore any person can register easily reviewed opinion about instrument on this window. Furthermore, P&ID drawing and control logic for the instrument is available.

The registered review comments for instruments may be solved by engineers or can be transformed into the human engineering issue. These human engineering issues are managed through the issue tracking module in e-HFMP.

### 6. Conclusion and examination

Evaluating Main Control Room is the important task. However plant's entrance becomes difficult day after day because plant's security is strengthened. Therefore the MCR Navigator was developed in order to review and evaluate MCR's instruments in time without visiting power plant's MCR. It is accessible everywhere on web.

The Navigators for kori-unit-1, wolsung-unit-1, uljin-unit-12 have been developed and the other power plant will be developed as soon as plant's picture is available.

### REFERENCES

[1] USNRC, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, 10CFR54, 1995.  
 [2] USNRC, Human-System Interface Design Review Guidelines, NUREG-0700, Rev.2, 2002