Display Section Arrangement for Large Display Panel Design of SMART

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1. Introduction

The Large Display Panel (LDP) can be viewed from anywhere in the Main Control Room (MCR) and its simplicity and fixed format makes plant status perceived at a glance. The LDP continuously displays spatially dedicated information that provides the status of the plants critical safety functions, plant operation mode, key operating parameters and status, trend display, etc. The LDP provides a common mental model of the plant to facilitate common plant visualization among all plant operational groups. This promotes a more effective communication process among plant personnel. The LDP consists of two major sections, Fixed Indication Section and Variable Display Section. [1, 2] The LDP arrangement is shown in Figure 1.

2. Methods and Results

Some of these positive characteristics of conventional CRs(control rooms) may be lost in CRs with computer-based workstations, resulting in the following types of problems:

1) Difficulty maintaining awareness of overall plants status,
2) Difficulty and time delay associated with accessing computer-based controls and displays,
3) Difficulty maintaining awareness of crew member actions,
4) Difficulty communicating. [3]

SMART incorporates a LDP design for the above reasons. The following are the design related to display section arrangement for LDP.

2.1 Selection of Information for LDP

Selection of information is following Information System Requirement of SMART. A comparative table of display information for other plants is shown in Table 1.

2.1.1 Selection basis of information

1) Key operating status information for safety and power production of plant
2) Information for plant personnel forming the same mental model of a plant status
3) Alarm which needs to be brought to the operator's attention
4) Status information of critical function, system and essential component

2.1.2 Display information selection of LDP

1) Status of critical system and essential component
2) Deviation and trend for key processing parameter value and setpoint
3) Operating Status for Critical Function of SMART
4) Alarm of priority I which needs to be brought to the operator's attention [6]
5) Bypassed Inoperable Status Indication (BISI) of Reg. Guide 1.47 [5]
6) Plant Operating Support Information

2.1.3 Operation support parameter

The operation support parameters (i.e., parameters of licensing and user requirement, parameters of safety and power production) reflects request of operator through result of function and task analysis or official estimation process. The operation support parameters shall examine and evaluated whether need to fix and indicate. The effect that gets in complexity of mimic is considered.

2.2 Design of Fixed Indication Section

The Fixed Indication Section of LDP provides plant process overview information to the operator. The LDP provide for the display of the operational status of a limited number of essential components controlled or monitored from the MCR. The LDP provide for the spatially dedicated display of certain key alarms or similar alarm-like information which needs to be brought to the operator's attention.

2.2.1 Grouping of system for Fixed Indication Section

The LDP provides a limited number of group parameter at system level. Subject of system for Fixed Indication Section is shown in Table 2.

2.2.2 Allocation of Fixed Indication Section

The Fixed Indication Section of LDP consists of two major sections, RO Section and TO Section. RO Section is used by reactor operator for monitoring NSSS. TO Section is used by TO for monitoring BOP. Grouping of Fixed Indication Section is shown in Table 3.

2.2.3 Arrangement of Fixed Indication Section

The Fixed Indication Section based on Table 3 consists of seven(7) major sections, Auxiliary Section, Safety Section, Containment System, Secondary Section, Electric Section, Sweet Water Section and Data Communication Section. The sweet water section presented overview information of sweet water facilities. Also, data communication section presented overall network status of SMART I&C equipment for MCR operators. The arrangement of Fixed Indication Section is shown in Figure 2.

3. Conclusion

This paper described to display design for Fixed Indication Section of LDP. The information of LDP selected through Information System Requirement of SMART. The information set of LDP laid emphasis on safety and power operation. We have been separated and allocated to system and parameter for Fixed Indication Section of LDP. Finally, each system and parameters arranged to Fixed Indication Section of LDP.

REFERENCES

[1] In Soo Koo et al., "Development of MMIS Design Technology for Integral Reactor", KAERI/RR-1901/98, 1999.
[2] In Soo Koo et al., "Development of MMIS Design Technology for Integral Reactor", KAERI/RR-2238/2001, 2002.
[3] NUREG-0700, "Guideline for Control Room Design Review"
[4] NUREG-0737, Supplement 1, "Clarification of TMI Action Plan Requirements"
[5] Reg. Guide 1.47, "Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems"
[6] Reg. Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions during and following an Accident"
[7] EPRI URD, Volume Ⅲ, Chapter 10, "Man-Machine Interface Systems"

Table 1. A comparative table of display information

	Nuplex 80+	KNGR	SMART	URD
MIMIC Diagram	○	○	○	○
PPS	○	○	○	○
CF & SP Alarms	○	○	○	
BISI	○	○	○	
PAMI	○	○	○	
Minimum Inventory	○	○		
Key operating parameters	△	○	○	○
Essential Component Status	○	○	○	○
System Group Alarms	○	○		
Operating Support Parameter		○	○	○
Variable Display		○	○	○

△ : a partial use

Table 2. Subject of system for Fixed Indication Section

	System
Subject of System	AP, CC, CD, CS, CW, DA, DC, DCN, DG, FC, FW, HG, IP, MP, MS, NT, PRHR, PX, RC, RCC, RWT, SC, SI, SW, SX, SY, TA

Table 3. Grouping of Fixed Indication Section

No	LDP Mimic Section	Grouping of Section	Pertinent System
1	RO Section	Auxiliary	CC, NT, RCC, SX
2		Safety	CS, PRHR, SC, SI
3		Containment	FC, FW, HG, PX, RC, RWT, MS, SI
4	TO Section	Secondary	CD, CW, FW, MS, TA
5		Electric	AP, DA, DC, DG, IP, MP, SY
6		Sweet Water	SW
7		Data Communication	DCN(Safety & Non-Safety)

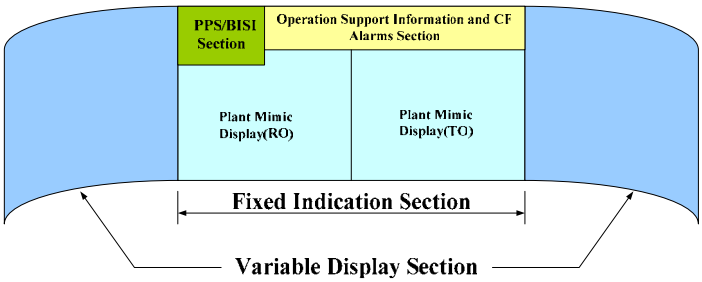

Figure 1. LDP Arrangement

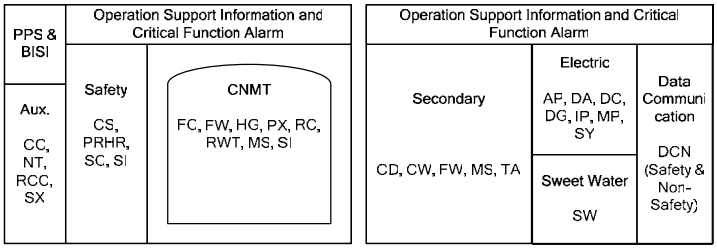

Figure 2. Arrangement of Fixed Indication Section