
REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 294-8302
SRP Section: 07.05 – Information Systems Important to Safety
Application Section:
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Question No. 07.05-7

Clarify in the APR1400 FSAR, the instrumentation provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as required by GDC 13.

10 CFR Part 50, Appendix A, General Design Criteria 13, "Instrumentation and Controls," requires, in part, instrumentation to be provided to monitor variables and systems over their anticipated ranges for normal operation, anticipated operational occurrences, and accident conditions. Is the Information Flat Panel Display (IFPD) in combination with the ESF-CCS Soft Control Module (ESCM) used as the primary controls for safety-related equipment during normal, abnormal, and accident conditions? If so, revise the APR1400 FSAR and associated technical reports to show the IFPD/ESCM are the primary controls for safety-related equipment during normal, abnormal, and accident conditions, or point to the locations in the FSAR indicating they are the primary controls. If IFPD/ESCM are not the primary controls for safety-related equipment, identify the display and control systems that would be the primary controls.

Response – (Rev. 1)

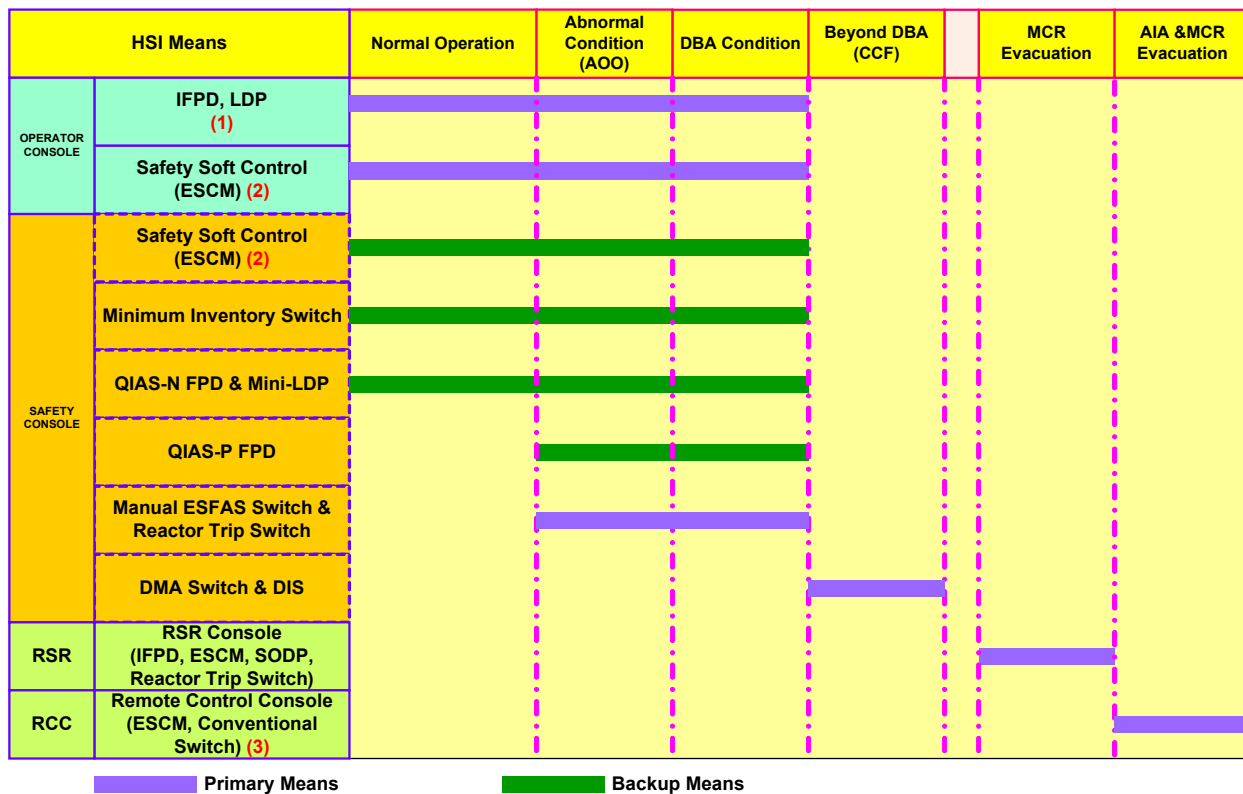
The information flat panel displays (IFPDs) and engineered safety features - component control system (ESF-CCS) soft control modules (ESCMs) on the operator console are used as the primary means of operation as follows:

- The IFPDs are used for non-safety components controlled by the process-component control system (P-CCS) during normal, abnormal, and accident conditions.
- The ESCMs are used for safety components controlled by the ESF-CCS during normal, abnormal, and accident conditions, except during a common-cause failure (CCF) of digital safety instrumentation and control (I&C) systems.

The I&C systems to protect against potential CCF of digital safety I&C systems is described in APR1400 DCD Tier 2, Subsection 7.8.

The safety console provides the operator with credited backup control, alarm, and indication.

The following diagram shows the concept for HSI primary and backup means during normal, abnormal, and accident conditions.



- (1): Operator Console is used for primary means for the plant operation when the Operator Console is available.
- (2): ESCM can be used in all mode of operation condition except CCF condition of ESF-CCS.
- (3): RCC provides manual control and monitoring means to achieve plant hot shutdown and maintain this condition.

Figure 07.05-7-1 HSI Primary and Backup Means

The IFPD sends the identification data for safety-related components to the ESCM. This identification data is used for bringing up the control template on the ESCM.

If the identification message format of the IFPD is not valid, an error message will be displayed in the ESCM's FPD stating that the message is invalid.

Even if a valid message including component ID brings up the control template on the ESCM, the confirmation step by the message window on the ESCM requires the operator to confirm whether the message is correct or not. The control template would not be enabled for the operator to perform manual control unless the operator confirms with the "YES" button on the message window on the ESCM.

APR1400 DCD Tier 2, Subsection 7.7.1.2 will be revised to include the information presented above.

Impact on DCD

APR1400 DCD Tier 2, Subsection 7.7.1.2 will be revised as indicated in the Attachment associated with this response.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

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HSI Means		Normal Operation	Abnormal Condition (AOO)	DBA Condition	Beyond DBA (CCF)	MCR Evacuation	AIA &MCR Evacuation
OPERATOR CONSOLE	IFPD, LDP (1)	Primary Means					
	Safety Soft Control (ESCM) (2)	Primary Means					
SAFETY CONSOLE	Safety Soft Control (ESCM) (2)	Backup Means					
	Minimum Inventory Switch	Backup Means					
	QIAS-N FPD & Mini-LDP	Backup Means					
	QIAS-P FPD		Backup Means				
	Manual ESFAS Switch & Reactor Trip Switch		Primary Means				
	DMA Switch & DIS			Primary Means			
	RSR Console (IFPD, ESCM, SODP, Reactor Trip Switch)					Primary Means	
RCC Remote Control Console (ESCM, Conventional Switch) (3)						Primary Means	

Primary Means Backup Means

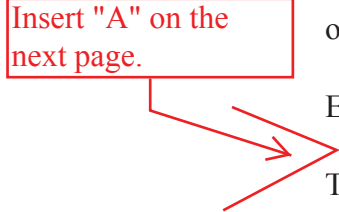
- (1): Operator Console is used for primary means for the plant operation when the Operator Console is available
- (2): ESCM can be used in all mode of operation condition except CCF condition of ESF-CCS.
- (3): RCC provides manual control and monitoring means to achieve plant hot shutdown and maintain this condition.

Figure 7.5-3 HSI Primary and Backup Means

New figure 7.5-3 is added on the page 7.5-24 of DCD Tier 2, Section 7.

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Insert "A" on the next page.



The MCR provides operator consoles, safety console, LDP, auxiliary panel, and other equipment necessary for the safe and reliable operation of the plant.

Each operator console contains IFPDs, pointing devices, and ESCMs.

The safety console contains ESCMs, a mini-LDP, QIAS-N FPDs, QIAS-P FPDs, operator modules, diverse manual ESF actuation switches, DIS FPDs, and minimum inventory switches.

The MCR operator consoles and safety console are seismically qualified to perform their safety functions during and following a seismic event.

To minimize the potential for multiple channel damage within the MCR console or RSC, the following design features are employed:

- 1) Low energy circuits (switch contact and lamps) are used to the maximum extent practical.
- 2) Fire retardant non-metallic materials meeting UL-94 rating or equivalent are used throughout the MCR operator consoles, LDP, safety console, and RSC enclosures. The enclosures are equipped with smoke detectors. Fire-resistant insulation material for MCR operator consoles, safety console, and RSC wiring meets the applicable requirements of IEEE Std. 383 (Reference 12).
- 3) Electrical independence of channelized circuits is maintained throughout the MCR operator consoles and safety console enclosures.

Although the design features above minimize the potential for multiple redundant channel damage, the following design features accommodate such a catastrophic event:

- 1) All MCR circuits (e.g., flat panel displays, switches) are isolated from the electronics (e.g., controller cabinets, monitoring systems, instrumentations) to which they interface. Similarly, all RSC circuits are isolated from the electronics. Therefore, the MCR operator consoles, LDP, safety console, and RSC circuits are inherently isolated from each other.
- 2) All MCR operator consoles, safety console, and RSC circuits are designed passively. Momentary contacts are used for all switches, and the memory of

"A"

The IFPDs and ESCMs on the operator console are used as the primary means of operation as follows:

- a) The IFPDs are used for non-safety components controlled by the P-CCS during normal, abnormal, and accident conditions.
- b) The ESCMs are used for safety components controlled by the ESF-CCS during normal, abnormal, and accident conditions, except during a common-cause failure (CCF) of digital safety I&C systems.

The I&C systems to protect against potential CCF of digital safety I&C systems is described in Section 7.8.

The safety console provides the operator with credited backup control, alarm, and indication.

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system is assumed to be in the automatic mode of operation if that mode of operation makes the consequences of a transient more adverse.

7.7.2.3 Effects of Control System Failures

The control system failures due to a single failure do not cause plant conditions that are more severe than those described in Chapter 15. The single failure list for the safety analysis is provided in Table 15.0-4. The safety analysis of Chapter 15 does not require these systems to remain functional.

Control groups of major control functions and postulated events due to a single failure of a control group are described in Table 7.7-1. The evaluation results of multiple function failures due to a single failure of a shared signal are described in the Control System CCF Analysis Technical Report (Reference 10).

The following expected failures caused by control system ~~common cause failure (CCF)~~ are evaluated to confirm that the event consequences of Chapter 15 are still effective and the analysis acceptance criteria are met.

- a. The results of multiple failures of a single control group due to control system CCF meet the AOO acceptance criteria of Chapter 15.
- b. The results of multiple failures of more than one control group due to control system CCF meet the PA acceptance criteria of Chapter 15.
- c. The results of multiple failures of IFPD control commands due to control system CCF meet the PA acceptance criteria of Chapter 15.

The Control System CCF Analysis Technical Report describes the detailed assumptions and evaluation results for the above postulated control system CCFs.

7.7.2.4 Effects of Control System Failures Caused by Accidents

For the non-safety system, the controllers are located in mild environment locations and are not affected by AOOs and PAs. The worst-case non-safety control system single failure that would aggravate the accident condition is assumed in the Chapter 15 safety analysis to