
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

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

Docket No. 52-046

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Question No. 18-106

NUREG-0711, Criterion 8.4.4.5(1), states, “The applicant should describe how the HSI provides a design capability for remote shutdown of the reactor outside the main control room.” Also, NUREG-0711, Section 1.2.2, “Review Elements,” also states that an acceptable implementation plan (IP) describes the methodology in a step-by-step format to ensure that design personnel can reliably use the IP consistent results will be obtained from executing the methodology.

DCD Tier 2, Table 7.4-1, “Remote Shutdown Console Instrumentation and Controls for Hot Shutdown,” lists the indications and controls provided in the remote shutdown room (RSR). The inventory includes manual reactor trip switches (i.e., conventional switches). The Basic HSI TeR Section 4.11.3, “Conventional Switch Configuration,” states that some spatially dedicated and continuously visible (SDCV) switches will be available on the safety console (SC) or remote shutdown console (RSC); however, The Basic HSI TeR, Section 4.16.4, “Remote Shutdown Console,” does not list conventional switches as being available on the RSC. This seems to contradict the information in Section 4.11.3 and DCD Tier 2, Table 7.4-1. Also, the HD IP, Section 4.2.8, “Central Facilities,” does not include the inventory listed in DCD Tier 2, Chapter 7, as an input to the detailed design documentation for the remote shutdown console. Because the inventory for the RSC has already been identified in DCD Tier 2 Table 7.4-1, it’s not clear to the staff why the HD IP does not point to this information or provide it.

[Question 1] Align the information in DCD Tier 2, Table 7.4-1, with the information in the Basic HSI TeR and HD IP. [Question 2] Provide the RSC inventory in the HD IP either by listing where it can be found or by including the information directly. Revise the submittal as necessary.

Response

Question 1

The Basic HSI TeR Section 4.11.3 incorrectly states that there are SDCV switches on the RSC. The following revisions will be made to APR1400-E-I-NR-14011-P, "Basic Human-System Interface" TeR to correct this error and explain the basis for providing only selectable HSI on the RSC:

4.11.3 Conventional Switch Configuration

All non-safety and safety components and functions have soft controls, either through IFPDs or ESCMs, respectively. Some of those soft controls for components or functions are duplicated on the SC or remote shutdown console as SDCV conventional switches. The conventional switch configuration, including controls, backlight indications and nameplate conventions are the same as the soft control.

4.16.1 Configuration

The RSR consists of the remote shutdown console (RSC), and tables for operator support as depicted in Figure 3-4. A dedicated LDP, as in the MCR, is not provided for the RSR, because a high level of situation awareness for other plant disturbances is not required, as it is in the MCR. The design basis of the RSR does not require consideration of concurrent transients or accidents, and safe shutdown operations from the RSR are clearly directed by operating procedures. Similarly, SDCV conventional switches are not provided for the RSR, because the basis for including SDCV conventional switches in the MCR, as defined in Section 4.3, is not applicable to the RSR. Since transients or accidents are not considered concurrent with MCR evacuation, the RSR design basis excludes the need for pre-emptive RT and ESF actuation, continued stable operation with loss of the IFPDs, and SDCV conventional switches to support the IHAs identified in the TAA, D3CA and PRA.

Question 2

The HSI inventory for the RSR is the same as the HSI inventory for the MCR, as stated in the following sections of the Basic HSI TeR:

3.2 Remote Shutdown Room

The RSR includes the remote shutdown console (RSC). The RSC is a sit-down OC with the same functionality as a MCR OC, including four IFPDs, four ESCMs, voice communications and laydown space.

4.7.1 Contents and Organization

The APR1400 Basic HSI utilizes a large number of IFPD display pages. The displays provide the operator with the necessary supporting data and information to help operate the plant in a safe and efficient manner. The displays are organized into a hierarchical structure to allow for logical and convenient access by the operator. The display inventory includes:

- System displays
- Task displays
- Application displays

- Critical safety function displays
- Large display panel
- Alarm displays
- Computer-based procedure displays

Each type of display is described in the following sections. [editorial correction]

To clarify that the IFPDs include the hot shutdown inventory identified in DCD Tier 2, Table 7.4-1, APR1400-E-I-NR-14007-P, “HSI Design Implementation Plan” (HD IP), will be revised as follows:

3.6.2 Plant System Designs

APR1400 plant system designers define requirements for instrumentation, alarms, and controls. If the TA is conducted before the I&C design, the TA establishes HSI inventory requirements that are fulfilled by the plant system designs. If the TA is conducted after the I&C design has been developed for a specific plant system, the TA confirms that the I&C design is acceptable to support the HSI inventory; if it is not, HEDs are generated as the conclusion of the TA. Therefore, for all plant systems, the P&IDs and plant system descriptions, including those in the APR1400 DCD Tier 2, are the starting point input for creating the APR1400 HSIS during the HD. Any discrepancies between these HSI designs and the TA are identified during the design verification conducted during the V&V PE.

As a minimum, the APR1400 HSIS includes the HSI inventory defined in the APR1400 DCD Tier 2 Chapter 7. This encompasses the instrumentation, controls and alarms for achieving and maintaining safe shutdown, including the HSI inventory for hot shutdown, as defined in DCD Tier 2, Table 7.4-1.

4.2.1 Critical Safety Function Displays

The HD implementation requirements for CSF displays are applicable to the SDCV portion of the LDP, the QIAS-N SDCV display, and the SPDS display hierarchy within the IFPDs...

3. Inputs from the APR1400 plant design
 - a. Chapter 7 of the APR1400 DCD defines:
 - i. Accident Monitoring Type A and B variables
 - ii. Prompting alarms for credited operator actions from the TAA
 - iii. Bypass or inoperable status monitoring
 - iv. Unique information processing, such as for reactor vessel level and core exit temperature.

- v. Instrumentation, controls and alarms for achieving and maintaining safe shutdown...

4.2.2 System Displays

The HD implementation requirements for system displays are applicable to IFPDs, ESCMs, and QIAS-N selectable displays....

- 3. Inputs from the APR1400 plant design
 - a. P&IDs, electrical system one-line diagrams, system descriptions
 - b. Instrumentation, controls and alarms for achieving and maintaining safe shutdown...

4.2.3 Task Displays

The HD implementation requirements for task displays are applicable to IFPDs....

- 3. Inputs from APR1400 plant design
 - a. P&IDs, electrical system one-line diagrams, system descriptions
 - b. I&C block diagrams and control logic diagrams
 - c. Instrumentation, controls and alarms for achieving and maintaining safe shutdown...

4.2.5 Alarms

The APR1400 defines alarm presentation methods, audible characteristics and operator interaction for alarm acknowledgement and clearing. For each alarm, the HD defines alarm prioritization, applicability logic, alarm text, alarm grouping and navigational links to displays. The HD encompasses all alarms presented to plant operators on the LDP, IFPDs and QIAS-N displays.

- 3. Inputs from the APR1400 plant design
 - a. Chapter 7 of the APR1400 DCD defines:
 - i. Prompting alarms for credited operator actions from the TAA
 - ii. Prompting alarms for credited operator actions from the D3CA
 - iii. System level alarms for bypass or inoperable status monitoring
 - iv. Alarms for achieving and maintaining hot shutdown

Impact on DCD

There is no impact on the DCD.

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

Technical report APR1400-E-I-NR-14007-NP, Rev.0, "HSI Design Implementation Plan," Section 4.1.1 and 4.1.3.1, and technical report APR1400-E-I-NR-14011-NP, Rev.0, "Basic Human-System Interface," Section 3.1.3, will be revised, as indicated in the attachment associated with this response.

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Figure 4-46 Soft Control Template for Component Control with Interlock

4.11.3 Conventional Switch Configuration

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4.11.4 Overriding Automatic ESF Actuation

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4.15.6.4 Salience

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4.16 Remote Shutdown Room

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4.16.1 Configuration

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4.16.2 Environment and Communication

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4.16.3 Visibility and Mobility within the RSR

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4.7.1 Contents and Organization

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4.7.1.1 System Displays

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3.5.8 Human Factors Verification and Validation**TS****3.5.9 Design Implementation****TS****3.6 HD Interfaces with the APR1400 Plant Design**

The HD interfaces with the APR1400 plant design in the following key areas:

- I&C system designs
- Plant system designs

The interfaces are described in Subsections 3.6.1 and 3.6.2.

3.6.1 Instrumentation and Control System Designs**TS****3.6.2 Plant System Designs****TS****3.7 HD Input from Predecessor and Reference Plants****TS**

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4.2.1 Critical Safety Function Displays

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4.2.3 Task Displays

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4.2.5 Alarms

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4.2.6 Computer-Based Procedures

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