ArevaEPRDCPEm Resource

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Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 383, FSAR Ch. 18
Attachments: RAI 383 Response Draft Response.pdf

Getacchew,

Attached is a draft response to RAI 383 for the NRC to review. This information will be discussed during the Chapter 18 bi-weekly phone calls. On June 1, 2010 a final response date of July 1, 2010 was provided for this RAI. Let me know if additional interactions are needed to address any staff questions in order to support the final response date.

Thanks,

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Response to

Request for Additional Information No. 383 (4249), Revision 1

4/30/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 18 - Human Factors Engineering
Application Section: 18.7
QUESTIONS for Operating Licensing and Human Performance Branch
(AP1000/EPR Projects) (COLP)

Question 18-162:

General question related to AREVA minimum inventory descriptions:

AREVA's FSAR markup submitted as part of the response to RAI 240, sub-section 18.7.4.4, discusses the concept of minimum inventory of alarms, controls, and displays. The FSAR also includes lists of MI alarms, controls, and displays for the main control room and the remote shutdown workstation as Tables 18.7-1 and 18.7-2. The FSAR further indicates that the "US EPR Human System Interface Design Implementation Plan" (IP), Rev 002, sub-section 5.1.2.3 describes the methodology for "selecting the final minimum inventory." However, the IP only briefly acknowledges the minimum inventory and, in turn, references AREVA NP Document, "US EPR Main Control Room and Remote Shutdown Station Minimum Inventory" (NP document) as providing the methodology for selecting the minimum inventory (MI) of alarms, controls, and displays (ACDs). AREVA made the NP document available for staff audit.

Although AREVA states that the NP document provides the methodology for selecting the MCR and RSS MIs, staff review determined that the NP document does not provide a sufficient level of detail (i.e., descriptions comparable to implementation plans prepared for NUREG-0711 elements). For example, the descriptions contained in the FSAR, IP and NP document do not explain how the ACDs contained in the Tables 18.7-1 and 18.7-2 were actually derived; the alarms, controls, and displays merely "appear" in the Tables and have no correlation with a process used for their selection. The methodology should be detailed enough for the staff to understand the rationale for how and why particular parameters were selected and how and why a parameter was determined to be an ACD and, for individuals experienced in the needed technical disciplines to develop the MI to satisfactorily execute the plan.

While in section 3.0 of the NP document AREVA cites several sources (e.g., SECY 92-053, ISG-05, Rev.0, NUREG-0800) as regulatory bases and guidance for preparing the minimum inventory, the methodology description does not clearly explain how AREVA used these sources to prepare the minimum inventory for the MCR and RSS. Nor is it clear to the staff whether AREVA used an alternative approach (es) to prepare the MCR and RSS minimum inventories. In either case, AREVA should provide an implementation plan with sufficient level of detail for the staff to understand:

1) what source documents AREVA used as the basis for the methodology;

2) how AREVA used the source documents to prepare the methodology; and

3) how the methodology was used to prepare the MCR and RSS inventories contained in Tables 18.7-1 and 18.7-2. (This will allow for verification that the implementation plan methodology was used to develop the MCR and RSS minimum inventories.).

Response to Question 18-162:

1. The source documents used as a basis for the AREVA NP MI methodology are described in the revised U.S. EPR Human System Interface (HSI) Design Implementation Plan, which was submitted in the Response to RAI 350, Supplement 2.
2. The method for using the MI source documents to prepare the methodology is described in the revised U.S. EPR HSI Design Implementation Plan.

3. The main control room (MCR) and the remote shutdown station (RSS) minimum inventories in U.S. EPR FSAR Tier 2, Table 18.7-1 and Table 18.7-2 will be deleted, including the references to those tables. The current MI methodology submitted as a part of the revised U.S. EPR HSI Design Implementation Plan does not include an initial MI list in the U.S. EPR FSAR. The revised methodology indicates that the final MI list, which is an output of the HSI design process, will be provided and verified through ITAAC. Because the initial MI list will be removed and there will only be one MI list, the word "final" will be removed from the U.S. EPR FSAR regarding MI.

   The following is an excerpt from the U.S. EPR HSI Design Implementation Plan MI source document information:

   "Applicable Minimum Inventory Guidance

   The following is a list and description of applicable minimum inventory guidance that is used to develop and perform the minimum inventory methodology. The parent requirement for a review of minimum inventory comes from SECY 92-053. This requirement is elaborated upon in NUREG-0800, NUREG-0711, and ISG-05. In addition, the minimum inventory overlaps and includes post-accident monitoring (PAM) variables discussed in Regulatory Guide 1.97.

   NUREG 0800, Rev. 1 Standard Review Plan (SRP)

   Chapter 14, Section 14.3.9 of NUREG-0800 specifies that a minimum inventory of displays, controls, and alarms is included as a part of HFE Inspections, Tests, Analysis, and Acceptance Criteria (ITAAC). The methodology described in this plan is used to develop the minimum inventory to meet the ITAAC.

   Also, a draft Branch Technical Position (BTP) 18-1 to NUREG-0800 was provided to the industry for public review. This document provides more specific guidance to minimum inventory and supersedes previous regulatory guidance. This document is used to develop the minimum inventory methodology to verify the required acceptance criteria are met.

   NUREG 0711, Rev. 2 – Human Factors Engineering (HFE Program Review Model)

   The development of minimum inventory is a part of the HSI design element of the HFE program described in NUREG-0711. Task analysis is the primary input into HSI design because it defines the task support requirements for the operators. These tasks include normal and emergency operations. The task analysis process is used for the development of minimum inventory. The parameters required to support the identified manual operator actions are determined.

   NRC Digital I&C Interim Staff Guidance (ISG) – 05, Rev. 01

   The HFE and I&C divisions of the NRC combined with the industry to form task working groups to develop guidance for issues that did not have clear regulatory paths with relation to a highly-integrated control room. MI was one of the issues that the NRC provided further guidance beyond what was provided in the SECY and NUREG

documents. ISG-05 added many criteria that were not previously included as part of the MI in previous DC submittals.

Although this guidance is superseded by the draft BTP 18-1, this document is used to verify that the U.S. EPR minimum inventory development methodology takes into account the required aspects of the process that are reviewed by the NRC, including the subsequent ITAAC.

NRC Regulatory Guide 1.97, Rev. 4 – Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants

This Regulatory Guide references IEEE 497, which focuses on post accident monitoring (PAM) variables. Due to the overlap of goals for PAM variables and EOP implementation, this guidance is used to verify the appropriate PAM variables are included as a part of the minimum inventory. The results of the PAM variable identification process are used as input to the minimum inventory identification process. PAM variable types A, B, and C are considered for minimum inventory in accordance with NUREG-0800."

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 14.3-7, Table 18.7-1, Table 18.7-2, Section 18.7.4.4, and Section 18.7.4.5 will be revised as described in the response and indicated on the enclosed markup.

Question 18-163:

Detailed question related to AREVA minimum inventory description (note that these detailed questions represent examples of issues the staff has identified with the descriptions provided by AREVA and are not meant to be inclusive:

a. With respect to the FSAR markup submitted as part of the response to RAI 240, p.18.7-19, provide the definitions of: "readily accessible HSIs;" "credited set of alarms, controls, and displays needed to implement the plant emergency operating procedures;" "normal or preferred safety means;" and "Fixed alarms, controls, and displays".

b. In the FSAR markup submitted as part of the response to RAI 240, p.18.7-20, what is meant by, "The methodology for selecting the final minimum inventory is described in US EPR Human System Interface Design Implementation Plan"? Is the "methodology" contained in the NP document the same methodology used to develop the MCR and RSS MIs contained as Tables 18.7-1 and 18.7-2 in FSAR Revision 2-Interim or was a different methodology used to prepare the MIs contained in the tables? In addition, if the methodology proposed in the NP document is for selecting the "final minimum inventory," what do the MIs contained in Tables 18.7-1 and 18.7-2 represent. Are these MIs the same or different from the "final" MIs? If the MIs contained in the tables are different from the "final" MIs, please explain how and why they differ.

c. In the FSAR markup submitted as part of the response to RAI 240, p.18.7-20, please clarify the meaning of the sentence, "Thus, the minimum inventory is the portion of the SICS inventory credited for EOP actions to bring the plant to a safe condition or to carry out risk-important operator actions that readily accessible to the operators and does not need to be selected from a menu or screen hierarchy."

d. The FSAR markup submitted as part of the response to RAI 240, p.18.7-20, states, "The PICS is the primary non-safety-related HSI normally used for plant monitoring and control. Because the PICS is not credited for performance of safety-related functions, the minimum inventory includes alarms, displays, and controls that are required in addition to the PICS." IP sub-section 6.5.1 states that, "The PICS is primary system used to monitor and control the plant. Displays for the PICS are designed to provide operators the information and control capability required to safely monitor and control the plant during all modes of operation, including accidents." In addition, IP section 6.6, states that, "The U.S. EPR includes Conventional I&C (CNV I&C) in addition to the digital displays for monitoring and control. CNV I&C include items such as push buttons, switches, digital and analog meters, and illuminated indicators. These items are utilized for certain safety related functions that are required to shutdown the plant in the event of a PICS failure." Please clarify, is the MCR MI composed of only SICS alarms, controls, and displays (i.e., safety-related components) or are there/can there be PICS or CNV I&C alarms, controls, and displays that are included in the minimum inventory?

e. In the FSAR markup submitted as part of the response to RAI 240, p.18.7-21, two terms are used to describe the remote shutdown facility: remote shutdown workstation and RSS (remote shutdown station). Are they synonymous or different? Which is the correct term?

f. The FSAR markup submitted as part of the response to RAI 240, p.18.7-2, states that, "The minimum inventory of alarms, displays, and controls in the RSS meets criteria similar [emphasis added] to that in the MCR, but consists of only those functions necessary to attain safe shutdown following an MCR evacuation." Specifically, what

criteria are used to develop the RSS MI? In addition, the NP document appears to identify one method applicable to both the MCR and the RSS MIs.

g. The NP document is referenced by the IP. However the NP document does not have an effective date. Please explain how this NP document is used as a primary reference without having an effective date.

h. In sub-section 3.3.4 of the NP document, AREVA provides an explanation of US EPR design changes. AREVA states that, largely, 1) the thermo hydraulic processes for the US EPR are similar to those of the predecessor, 4-loop PWR plants and that 2) change to the predecessor plant EPGs (emergency procedure guidelines) is minimal. AREVA further states that they use the system design descriptions contained in the US EPR FSAR to identify changes and that a "gap analysis" will be performed, focusing on those areas where the change identified affects safety-related functions and systems. To better understand this process, the staff requests further explanation of how and when the "gap analysis" is conducted and, at minimum, examples of results from the analysis to date.

Response to Question 18-163:

a) The following terms in the U.S. EPR FSAR markups are addressed as follows:

- "Readily accessible HSIs" - "Readily accessible" refers to the varying accessibility requirements for the minimum inventory (MI) parameters based on their function. The criteria for determining the accessibility of MI parameters is defined in the revised U.S. EPR HSI Design Implementation Plan. The U.S. EPR FSAR will be revised to be consistent with the accessibility criteria in the revised U.S. EPR HSI Design Implementation Plan.
- "Credited set of alarms, controls, and displays needed to implement the plant emergency operating procedures" – The term "credited" will not be used and will be removed from the U.S. EPR FSAR. The location of MI on human system interface (HSI) platforms is determined during the HSI design process.
- "Normal or preferred safety means" - These terms refer to the shutdown of the reactor using integrated operating procedures as opposed to emergency operating procedures (EOPs) (using actions such as reactor trip). These terms are used in conjunction with the next bullet, reactor trip, to illustrate the two types of shutdown.
- "Fixed alarms, controls, and displays" – The term "fixed" will not be used and will be removed from the U.S. EPR FSAR. The accessibility requirements for each MI parameter are evaluated as a part of the MI methodology as described in the revised U.S. EPR HSI Design Implementation Plan.

b) The main control room (MCR) and the remote shutdown station (RSS) inventories in U.S. EPR FSAR Tier 2, Table 18.7-1 and Table 18.7-2 will be deleted (See the Response to Question 18-162). The current MI methodology submitted as a part of the revised U.S. EPR HSI Design Implementation Plan does not include an initial MI list in the U.S. EPR FSAR. The revised methodology indicates that the final MI list, which is an output of the HSI design process, will be verified through ITAAC. The AREVA NP document on MI provided for staff audit is no longer applicable.

c) This statement is incorrect and will be revised. The MI methodology in the revised U.S. EPR HSI Design Implementation Plan will be used to determine the correct platform(s) and the accessibility requirements for the parameters identified for the MI list. The MI list and its implementation will be evaluated throughout the human factors engineering (HFE) process. References to the process information and control system (PICS) or the safety information and control system (SICS) as the specific platform for MI will be removed from the U.S. EPR FSAR.

d) The MI identification and requirements are design inputs into the overall HSI design process. These inputs are used to determine the platform where the MI is displayed and the type of controls/indications needed (digital display or conventional). An output of the detailed design process will be the location and implementation of the parameters in the MI list. The U.S. EPR FSAR will be revised to agree with the revised MI methodology.

e) These terms are synonymous, but the RSS is the more accurate term. The U.S. EPR FSAR will be revised to correct this discrepancy and to maintain consistency.

f) The revised U.S. EPR HSI Design Implementation Plan includes RSS MI methodology with separate RSS MI identification criteria. The U.S. EPR FSAR will be revised to agree with this methodology.

g) The AREVA NP document on MI provided for staff audit is obsolete and is not applicable. The MI methodology is contained in the revised U.S. EPR HSI Design Implementation Plan. References to diversity and defense in depth analysis in the MI methodology of the U.S. EPR FSAR will be removed to be consistent with the revised U.S. EPR HSI Design Implementation Plan.

h) The methodology for MI has been revised and no longer relies on predecessor plant information. As mentioned in this response, the referenced NP document is no longer applicable. The current methodology does not require a gap analysis because MI is identified and evaluated throughout the iterations of the design process using the current information at that stage, until the design is finalized.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 18.7-1, Table 18.7-2, Section 18.7.4.4, and Section 18.7.4.5 will be revised as described in the response and indicated on the enclosed markup.

Question 18-164:

Question related to minimum inventory ITAAC:

a. The AREVA ITAAC for minimum inventory are contained as Entry 8 of the AREVA Tier 1, Table 3.4-1. "Commitment Wording" for this entry states, "The selection of the minimum inventory is performed in accordance with the HSI Design Implementation Plan." However, the HSI IP and FSAR, Rev 2-Interim, do not contain a process for selecting/developing the minimum inventory. These documents merely reference AREVA NP document (118-9098995-000, Rev 0). The staff reviewed the NP document and determined that it did not provide an acceptable level of detail (see previous RAI 18.13.x.). The "Commitment Wording" for Entry 8 should be revised to identify the accurate source document(s) that will contain the methodology AREVA uses to develop the minimum inventory (and that the staff will subsequently evaluate).

b. The "Acceptance Criteria" for Entry 8 does not identify that the summary report concludes that all MCR and RSS minimum inventory HSIs described in the AREVA EPR FSAR have been incorporated into the final inventory of HSIs. Revise the applicable criterion to address this discrepancy.

c. The "Acceptance Criteria" does not indicate ITAAC will verify that the as-built MCR and RSF contain, as a minimum, the HSIs identified using the implementation plan methodology in the DC. Revise the applicable criterion to address this discrepancy.

d. The "Acceptance Criteria" does not indicate that ITAAC will validate that the as-built MCR and RSF minimum inventories support operator performance of those EOP actions and PRA critical operator actions necessary to bring the reactor to a safe shutdown condition and maintain it in a safe shutdown condition. Revise the applicable criterion to address this discrepancy.

Response to Question 18-164:

a) See the Response to RAI 369, Question 18-140. The revised U.S. EPR HSI Design Implementation Plan contains the minimum inventory (MI) methodology in accordance with ITAAC. The MI ITAAC will be revised to be consistent with the MI methodology in the revised U.S. EPR HSI Design Implementation Plan.

b) The revised MI methodology does not include a table of MI in U.S. EPR FSAR Tier 2. This ITAAC is not applicable. See the Response to RAI 369, Question 18-140. The MI will be included as a part of the final results summary according to the current ITAAC.

c) This ITAAC will be added to U.S. EPR FSAR Tier 1, Table 3.4-1.

d) This ITAAC will be added to U.S. EPR FSAR Tier 1, Table 3.4-1.

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 3.4-1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

Table 3.4-1—Human Factors Engineering ITAAC (5 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
8.0	The selection of the minimum inventory is performed in accordance with the ~~HSI~~ U.S. EPR Human System Interface Design Implementation Plan.	An analysis is performed on the final HSI design results documents. **{{DAC}}**	A final results summary document exists that concludes that the HSI design process for the minimum inventory was conducted in accordance with the implementation plan and contains: • The detailed HSI description including its form, function and performance requirements and characteristics. • The basis for the HSI requirements and design characteristics. ~~• The records of the basis of the design changes.~~ • The outcomes of tests and evaluations. • The minimum inventory of main control room and remote shutdown station fixed alarms, displays, and controls. • Verification that the as-built MCR and RSS contain the minimum inventory and validation that the minimum inventory supports operator performance of EOP actions and PRA critical actions to bring the reactor to a safe shutdown condition and to maintain it in that condition. **{{DAC}}**

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Table 14.3-7—Licensing (Safety-Significant Features)

Item #	Tier 2 Reference	Design Feature	Value
7-1	Section 18.7.1.3.6~~, and Tables 18.7-1 and 18.7-2~~	Pressurizer safety relief valve position indication in the MCR and RSS.	
7-2	Section 18.7.1.3.7	Automatic and manual emergency feedwater system initiation.	
7-3	Section 18.7.1.3.7~~, and Tables 18.7-1 and 18.7-2~~	Emergency feedwater system flow indication in the main control room and remote shutdown station.	
7-4	Section 18.7.1.3.8	The MCR and RSS contain instrumentation to monitor: • containment pressure • containment water level • containment hydrogen concentration • containment radiation intensity • ventilation stack radiation monitoring	
7-5	Section 18.7.1.3.9 ~~and Table 18.7-1~~	The MCR contains instrumentation to monitor reactor vessel water level.	

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18.7.4.4 Minimum Inventory of Main Control Room ~~Fixed~~ Alarms, Displays, and Controls

Minimum inventory is defined as the ~~credited~~ set of alarms, displays, and controls needed to implement the plant emergency operating procedures (EOP) (refer to Section 15.0), bring the plant to a safe condition, and to carry out those operator actions shown to be risk important by the applicant's probabilistic risk assessment.

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The MCR minimum inventory includes the readily accessible HSIs that the operator needs to:

- Monitor the status of fission product barriers.
- Perform and confirm a reactor trip.
- Perform and confirm a controlled shutdown of the reactor using the normal or preferred safety means.
- Actuate safety-related systems that have the critical safety function of protecting the fission product barriers.
- ~~Analyze failure conditions of the PICS while maintaining the current plant operating condition and power level until the PICS can be restored in accordance with applicable regulatory requirements.~~
- Implement the plant emergency operating procedures.
- Bring the plant to a safe condition.
- Carry out those operator actions shown to be risk important by the applicant's probabilistic risk assessment.

~~The PICS is the primary non-safety-related HSI normally used for plant monitoring and control. Because the PICS is not credited for performance of safety-related functions, the minimum inventory includes alarms, displays, and controls that are required in addition to the PICS. Thus, the minimum inventory is the portion of the SICS inventory credited for EOP actions to bring the plant to a safe condition or to carry out risk-important operator actions that readily accessible to the operators and does not need to be selected from a menu or screen hierarchy. The SICS performs the functions described in Section 7.1 including both hardwired functions and QDS functions.~~

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~~A list of the minimum inventory on the MCR SICS is included in Table 18.7-1—Minimum Inventory of Main Control Room Fixed Alarms, Displays, and Controls—Table Deleted.~~ The methodology for selecting the ~~final~~ minimum inventory is described in the ~~HSI design implementation plan~~U.S. EPR Human System Interface Design Implementation Plan (Reference 15) and includes a description of:

- The selection criteria.

- How the functions and tasks that need to be supported by the ~~SICS~~ minimum inventory are identified.

- The technical requirements that apply to the design of the ~~SICS~~ minimum inventory including those imposed by regulatory requirements, and particularly address requirements related to qualification, independence, and accessibility.

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- How the plant-specific probabilistic risk assessment is used to identify operator actions or tasks that are risk important.

- How the guidance provided in RG 1.97 relating to defining postaccident monitoring variables is addressed (see Section 7.5).

- The operator actions credited in the safety analysis or plant-specific EOPs for safety and non-safety success paths.

- ~~How the diversity and defense-in-depth evaluation is used to identify any specific operator actions credited for coping with common cause failures of the protection systems.~~

- The criteria that are used to determine which ~~SICS~~ components need to be spatially dedicated, continuously visible~~, continuously available,~~ or accessible by taking only one action (i.e., MCR design and concept of operations).

18.7.4.5 Remote Shutdown ~~Wo~~Workstation~~n~~Station Alarms, Displays, and Controls

The MCR provides the capability for safe shutdown, even assuming a safe-shutdown earthquake (SSE), a loss of offsite power, and the most limiting single failure. Localized emergencies which make the environment unsuitable for the operators and require evacuation of the MCR are not postulated concurrent with other design basis events. If evacuation of the MCR is required, the operators can establish and maintain a safe shutdown from outside the MCR through the use of the HSIs~~PICS and SICS~~ in the RSS.

The minimum inventory of alarms, displays, and controls in the RSS ~~meets criteria similar to that in the MCR, but~~ consists of only those functions necessary to attain safe shutdown following an MCR evacuation. The RSS minimum inventory includes the readily accessible HSIs that the operator needs to:

- Perform and confirm a reactor trip.

- Place and maintain the reactor in a safe condition using the normal or preferred safety means.

Section 7.4.1.3 describes safe shutdown from outside the MCR by use of the RSS.

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~~A list of the minimum inventory on the RSS SICS is included in Table 18.7-2 Minimum Inventory of Remote Shutdown Station Fixed Alarms, Displays, and Controls Table Deleted~~. The methodology for selecting the ~~final~~ minimum inventory

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for the RSS is ~~similar to that~~ described in the U.S. EPR HSI Design Implementation Plan (Reference 15). ~~Section 18.7.4.4~~.

18.7.5 Human Factors Design for the Non-Human System Interface Portion of the Plant

A style guide provided by the HFE and Control Room Design Team is used in the design of HSI features. It also provides guidance on such issues as general plant layout design, equipment accessibility requirements, coding and labeling, and environmental issues such as lighting, acoustics, personnel protection equipment, and ambient conditions suitable for personnel. The style guide is a design guideline applicable to engineering disciplines (e.g., structural engineers) who are required to follow the style guide for plant and equipment layout decisions.

18.7.5.1 Plant Layout Design and Equipment Accessibility

System engineers specify space requirements for their equipment during the plant layout phase taking into account maintenance, testing, and component replacement. The HFE style guide provides guidance for these space requirements. Location of interfaces also considers the general physical layout of the system. HSIs are placed in easy to access locations (e.g., manual valve operators will not be located where access requires the use of a portable ladder or scaffold).

18.7.5.2 Coding, Language, and Information Presentation

Rules for coding, labeling, and presenting information on HSIs, local control stations, and on most equipment are specified in the HSI style guide. The nomenclature and terminology used in operating procedures and design documentation (e.g., system manuals and plant drawings) shall be consistent with those used for operator interfaces.

Unique equipment identifiers shall be established in the equipment database early in the design phase, and those identifiers shall be maintained throughout the design, manufacture, construction, testing, procedure development, and operational staff training. In conformance with NUREG-0711 (Reference 4) and consistent with NUREG-0700 (Reference 6), the HSI style guide specifies requirements for the use of symbols, abbreviations, syntax, and color schemes.

18.7.5.3 Lighting of the HMI Rooms and Workspaces

The lighting in the control rooms and workstations, including local control stations, provides suitable working conditions for personnel by:

Table 18.7-1—~~Minimum Inventory of Main Control Room Fixed Alarms, Displays, and Controls Sheet 1 of 2~~Table Deleted

~~Description~~	~~Alarm~~	~~Display~~	~~Control~~
~~Reactor Power~~	~~X~~	~~X~~	
~~Startup Rate~~	~~X~~	~~X~~	
~~Incore Thermocouple Temperature~~	~~X~~	~~X~~	
~~Reactor Vessel Water Level~~		~~X~~	
~~Control Rod Position~~		~~X~~	
~~Reactor Coolant System (RCS) Pressure~~	~~X~~	~~X~~	
~~RCS Hot Leg Temperature~~		~~X~~	
~~RCS Cold Leg Temperature~~		~~X~~	
~~RCS Flow~~	~~X~~	~~X~~	
~~RCS Boron Concentration~~		~~X~~	
~~Pressurizer (PZR) Level~~	~~X~~	~~X~~	
~~PZR Pressure~~	~~X~~	~~X~~	
~~PZR Temperature~~		~~X~~	
~~PZR Heater Status~~		~~X~~	
~~PZR Spray Valve Position~~		~~X~~	
~~Pressurizer Steam Relief Valve (PSRV) Position~~	~~X~~	~~X~~	
~~Pressurizer Relief Tank (PRT) Temperature~~	~~X~~	~~X~~	
~~PRT Level~~		~~X~~	
~~PRT Pressure~~	~~X~~	~~X~~	
~~Medium Head Safety Injection (MHSI) Flow~~	~~X~~	~~X~~	
~~Low Head Safety Injection (LHSI) Flow~~	~~X~~	~~X~~	
~~In-Containment Refueling Water Storage Tank (IRWST) Level~~	~~X~~	~~X~~	
~~IRWST Temperature~~	~~X~~	~~X~~	
~~Chemical and Volume Control System (CVCS) Charging Flow~~		~~X~~	
~~Component Cooling Water System (CCWS) Flow~~	~~X~~	~~X~~	
~~CCWS Temperature~~	~~X~~	~~X~~	
~~CCW Surge Tank Level~~	~~X~~	~~X~~	
~~Essential Service Water System (ESWS) Flow~~	~~X~~	~~X~~	
~~ESWS Temperature~~		~~X~~	
~~Extra Borating System (EBS) Flow~~	~~X~~	~~X~~	
~~Containment Temperature~~		~~X~~	

Table 18.7-1—~~Minimum Inventory of Main Control Room Fixed Alarms, Displays, and Controls Sheet 2 of 2~~Table Deleted

~~Description~~	~~Alarm~~	~~Display~~	~~Control~~
~~Containment Pressure~~	~~X~~	~~X~~	
~~Containment Radiation Level~~	~~X~~	~~X~~	
~~Containment Isolation Valve Position~~		~~X~~	~~X~~
~~Steam Generator (SG) Level~~	~~X~~	~~X~~	
~~SG Pressure~~	~~X~~	~~X~~	
~~SG Blowdown Flow~~		~~X~~	
~~Main Steam Isolation Valve (MSIV) Position~~		~~X~~	~~X~~
~~Main Steam Safety Valve (MSSV) Position~~	~~X~~	~~X~~	
~~Main Steam Relief Isolation Valve (MSRIV) Position~~	~~X~~	~~X~~	~~X~~
~~Main Steam Flow~~		~~X~~	
~~Main Steam Line Radiation Monitors~~	~~X~~	~~X~~	
~~Main Feedwater (MFW) Flow~~	~~X~~	~~X~~	
~~Emergency Feedwater (EFW) Flow~~	~~X~~	~~X~~	
~~Main Generator Output and Exciter Breaker Position~~		~~X~~	
~~24 VDC I&C Power~~	~~X~~	~~X~~	
~~Emergency Power Supply System 6.9kV Bus Voltage~~	~~X~~	~~X~~	
~~Emergency Diesel Generator Actuation~~	~~X~~	~~X~~	~~X~~
~~Reactor Trip~~	~~X~~	~~X~~	~~X~~
~~Turbine Trip~~	~~X~~	~~X~~	~~X~~
~~Reactor Coolant Pump (RCP) Trip~~	~~X~~	~~X~~	~~X~~
~~EFW Actuation / Control~~	~~X~~	~~X~~	~~X~~
~~MSIV Control~~	~~X~~	~~X~~	~~X~~
~~EBS Actuation / Control~~	~~X~~	~~X~~	~~X~~
~~CVCS Letdown Isolation Valve Position~~		~~X~~	~~X~~
~~Main Steam Relief Train (MSRT) Setpoint Control~~	~~X~~	~~X~~	~~X~~
~~MFW Isolation Valve Position~~		~~X~~	~~X~~
~~MHSI Actuation / Control~~		~~X~~	~~X~~

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Next File

Table 18.7-2—~~Minimum Inventory of Remote Shutdown Station Fixed Alarms, Displays, and Controls Sheet 1 of 2~~Table Deleted

~~Description~~	~~Alarm~~	~~Display~~	~~Control~~
~~Reactor Power~~	~~X~~	~~X~~	
~~Startup Rate~~	~~X~~	~~X~~	
~~Control Rod Position~~		~~X~~	
~~RCS Pressure~~	~~X~~	~~X~~	
~~RCS Hot Leg Temperature~~		~~X~~	
~~RCS Cold Leg Temperature~~		~~X~~	
~~RCS Flow~~	~~X~~	~~X~~	
~~RCS Boron Concentration~~		~~X~~	
~~Pressurizer Level~~	~~X~~	~~X~~	
~~Pressurizer Pressure~~	~~X~~	~~X~~	
~~Pressurizer Temperature~~		~~X~~	
~~Pressurizer Heater Status~~		~~X~~	
~~Pressurizer Spray Valve Position~~		~~X~~	
~~Pressurizer Steam Relief Valve Position~~	~~X~~	~~X~~	
~~Pressurizer Relief Tank Temperature~~	~~X~~	~~X~~	
~~Pressurizer Relief Tank Level~~		~~X~~	
~~Pressurizer Relief Tank Pressure~~	~~X~~	~~X~~	
~~Medium Head Safety Injection Flow~~	~~X~~	~~X~~	
~~Low Head Safety Injection Flow~~	~~X~~	~~X~~	
~~In-Containment Refueling Water Storage Tank Level~~	~~X~~	~~X~~	
~~In-Containment Refueling Water Storage Tank Temperature~~	~~X~~	~~X~~	
~~Chemical and Volume Control System Charging Flow~~		~~X~~	
~~Component Cooling Water System Flow~~	~~X~~	~~X~~	
~~Component Cooling Water System Temperature~~	~~X~~	~~X~~	
~~Component Cooling Water Surge Tank Level~~	~~X~~	~~X~~	
~~Essential Service Water System Flow~~	~~X~~	~~X~~	
~~ESWS Temperature~~		~~X~~	
~~Extra Borating System Flow~~	~~X~~	~~X~~	
~~Containment Temperature~~		~~X~~	
~~Containment Pressure~~	~~X~~	~~X~~	
~~Containment Radiation Level~~	~~X~~	~~X~~	

Table 18.7-2—~~Minimum Inventory of Remote Shutdown Station Fixed Alarms, Displays, and Controls Sheet 2 of 2~~Table Deleted

~~Description~~	~~Alarm~~	~~Display~~	~~Control~~
~~Containment Isolation Valve Position~~		~~X~~	
~~Steam Generator Level~~	~~X~~	~~X~~	
~~SG Pressure~~	~~X~~	~~X~~	
~~SG Blowdown Flow~~		~~X~~	
~~Main Steam Isolation Valve Position~~		~~X~~	
~~Main Steam Safety Valve Position~~	~~X~~	~~X~~	
~~Main Steam Relief Isolation Valve Position~~	~~X~~	~~X~~	
~~Main Steam Flow~~		~~X~~	
~~Main Steam Line Radiation Monitors~~	~~X~~	~~X~~	
~~Main Feedwater Flow~~	~~X~~	~~X~~	
~~Emergency Feedwater Flow~~	~~X~~	~~X~~	
~~Main Generator Output and Exciter Breaker Position~~		~~X~~	
~~24 Vdc I&C Power~~	~~X~~	~~X~~	
~~Emergency Power Supply System 6.9 kV Bus Voltage~~	~~X~~	~~X~~	
~~RCS Pressure Comparison Status (Hot Shutdown to Cold Shutdown Transition) (P12 Permissive)[1]~~		~~X~~	
~~RCS Hot Leg Temperature/Pressure Comparison Status (RHR Initiation) (P14 Permissive)[1]~~		~~X~~	
~~RCP Current and RCS Hotleg Temperature/Pressure Comparison Status (SI Actuation) (P15 Permissive)[1]~~		~~X~~	
~~RCS Cold Leg Temperature Comparison Status (Brittle Fracture Prevention) (P17 Permissive)[1]~~		~~X~~	
~~Reactor Trip~~	~~X~~	~~X~~	~~X~~
~~Turbine Trip~~	~~X~~	~~X~~	~~X~~

~~**Note:**~~

1. ~~See Section 7.2 for a description of permissives.~~

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