2.7 Control Panels

2.7.1 Main Control Room Panels

Design Description

The Main Control Room Panels (MCRP) consist of the main control console, the large display panel, the supervisor's console, the auxiliary or back panels and their respective internal wiring.

The MCRP locates and configures the alarms displays and controls for plant systems. Those parts of the MCRP that contain Class 1E equipment are classified as Seismic Category I.

Non-Class 1E and divisional Class 1E control and instrument power is provided for the MCRP. Independence is provided between Class 1E divisions and also between the Class 1E divisions and non-Class 1E equipment.

The MCRP has, as a minimum, the fixed alarms, displays, and controls shown on Table 2.7.1a.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.7.1a provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria, which will be undertaken for the MCRP.

Table 2.7.1a Main Control Room Panels Fixed Position Alarms, Displays and Controls

A. Fixed Position Controls		
Manual Scram Initiation Switch (A)	DG (A) Start Switch	Div. I Manual/Auto Main Steamline Isolation Reset Switch
Manual Scram Initiation Switch (B)	DG (B) Start Switch	Div. II Manual/Auto Main Steamline Isolation Reset Switch
Reactor Mode Switch	DG (C) Start Switch	Div. III Manual/Auto Main Steamline Isolation Reset Switch
Div. I Main Steamline Manual Isolation Switch	RCIC System Standby Mode Initiation Switch	Div. IV Manual/Auto Main Steamline Isolation Reset Switch
Div. II Main Steamline Manual Isolation Switch	Condensate Pump Standby Mode Initiation Switches	Primary Containment Div. I Isolation Reset Switch
Div. III Main Steamline Manual Isolation Switch	Reactor Feedpump Standby Mode Initiation Switches	Primary Containment Div. II Isolation Reset Switch
Div. IV Main Steamline Manual Isolation Switch	Condensate Pump Startup Mode Initiation Switches	Primary Containment Div. III Isolation Reset Switch
Primary Containment Div. I Manual Isolation Switch	Reactor Feedpump Startup Mode Initiation Switches	RHR (A) Shutdown Cooling Mode Initiation Switch
Primary Containment Div. II Manual Isolation Switch	SLC (A) Pump Control Switch	RHR (B) Shutdown Cooling Mode Initiation Switch
Primary Containment Div. III Manual Isolation Switch	SLC (B) Pump Control Switch	RHR (C) Shutdown Cooling Mode Initiation Switch
RCIC Initiation Switch	ADS (A) Inhibit Switch	ARI (A) Manual Initiation Switch
HPCF (B) Initiation Switch	ADS (B) Inhibit Switch	ARI (B) Manual Initiation Switch
HPCF (C) Initiation Switch	RHR (A) Standby Mode Switch	Recirculation Runback Initiation Switch (A)
RHR (A) Initiation Switch	RHR (B) Standby Mode Switch	Recirculation Runback Initiation Switch (B)
RHR (B) Initiation Switch	RHR (C) Standby Mode Switch	RIP Start/Stop Control Switch (10)
RHR (C) Initiation Switch	Main Steam Isolation Valve Control Switch (8)	ARI (A) Logic Reset Switch

Table 2.7.1a Main Control Room Panels Fixed Position Alarms, Displays and Controls (Continued)

A. Fixed Position Controls (Continued)		
ARI (B) Logic Reset Switch	RHR (A) Suppression Pool Cooling Mode Initiation Switch	Div. II ADS Manual ADS Channel 2 Initiation Switch
CRD Charging Water Pressure Low Scram Bypass Switch (A)	RHR (B) Suppression Pool Cooling Mode Initiation Switch	RCIC Div. I Isolation Logic Reset Switch
CRD Charging Water Pressure Low Scram Bypass Switch (B)	RHR (C) Suppression Pool Cooling Mode Initiation Switch	RCIC Div. II Isolation Logic Reset Switch
CRD Charging Water Pressure Low Scram Bypass Switch (C)	RHR (B) Primary Containment Vessel Spray Mode Initiation Switch	RCIC Inboard Isolation Control Switch
CRD Charging Water Pressure Low Scram Bypass Switch (D)	RHR (C) Primary Containment Vessel Spray Mode Initiation Switch	RCIC Outboard Isolation Control Switch
Manual Scram Reset Switch	SGTS (B) Initiation Switch	Fire Protection System Motor Pump Control Switch
RPS Div. I Trip Reset Switch	SGTS (C) Initiation Switch	Fire Protection System Diesel Pump Control Switch
RPS Div. II Trip Reset Switch	Div. I Manual ADS Channel 1 Initiation Switch	
RPS Div. III Trip Reset Switch	Div. I Manual ADS Channel 2 Initiation Switch	
RPS Div. IV Trip Reset Switch	Div. II Manual ADS Channel 1 Initiation Switch	

Table 2.7.1a Main Control Room Panels Fixed Position Alarms, Displays and Controls (Continued)

B. Fixed Position Displays		
RPV Water Level	RCIC Flow	SRV Positions
RCIC Turbine Speed	RCIC Injection Valve Status	Suppression Pool Level
Wetwell Pressure	HPCF (B) Injection Valve Status	Main Steamline Flow
Suppression Pool Bulk Average Temperature	HPCF (C) Injection valve status	SLC Boron Tank Water Level
HPCF (B) Flow	RHR (A) Flow	Recirculation Pump Speeds
HPCF (C) Flow	RHR (A) Injection Valve Status	Average Drywell Temperature
RPV Pressure	RHR (B) Flow	Wetwell Hydrogen Concentration Level
Drywell Pressure	RHR (B) Injection Valve Status	Drywell Hydrogen Concentration Level
Reactor Power Level, (Neutron Flux, APRM)	RHR (C) Flow	Drywell Oxygen Concentration
Reactor Power Level (SRNM)	RHR (C) Injection Valve Status	Wetwell Oxygen Concentration
Reactor Thermal Power	Emergency Diesel Generator (A) Operating Status	
MSIV Position Status (Inboard And Outboard Valves)	Emergency Diesel Generator (B) Operating Status	
Reactor Mode Switch Mode Indications	Emergency Diesel Generator (C) Operating Status	Main Stack Radiation Level
	Primary Containment Water Level	Time
Scram Solenoid Lights (8) Status	Condensate Storage Tank Water Level	Drywell Radiation Level
Manual Scram Switch (A) Indicating Light Status	SLC Pump (A) Discharge Pressure	Wetwell Radiation Level
Manual Scram Switch (B) Indicating Light Status	SLC Pump (B) Discharge Pressure	
RPV Isolation Status Display	Main Condenser Pressure	

Table 2.7.1a Main Control Room Panels Fixed Position Alarms, Displays and Controls (Continued)

C. Fixed Position Alarms *		
Indicated RPV Water Level Abnormal	RPV Water Level Low (ECCS Initiation)	CAMS H_2/O_2 Level High
RPV Water Level Low (Scram Level)	Control Rod Not Inserted To/Beyond MSBWP	CAMS (A) System Abnormal
RPV Pressure High	RPV Water Level High	CAMS (B) System Abnormal
Drywell Pressure High	Fire Protection System Status	Reactor Building ΔP Low
Neutron Flux High–High	ADS (A) Logic Initiated	Area Temperature High
Neutron Monitoring System Inoperative	ADS (B) Logic Initiated	Area HVAC ΔT High
MSIV Closure	SRV Open	R/B HVAC Exhaust Radiation High
CRD Charging Water Pressure Low	Main Steam Line Flow High	Reactor Building Area Radiation High
Rapid Core Flow Decrease	HPIN (A) System Status	Reactor Building Floor Drain Sump Water Level High–High
Main Turbine Trip	HPIN (B) System Status	R/B HVAC System Status
Main Generator Trip	Leak Detection Isolation	Stack Radioactivity High
	RWCU System Status	RCW Radioactivity High
Reactor Scram	Reactor Period Short	Radwaste Effluent Radioactivity High
RPV Low Level Isolation Incomplete (Scram Water Level)	ADS Div. I Inhibited/Auto Out Of Service	Turbine Building Ventilation System (TBVS) Status
RPV Low Level Isolation Incomplete (ATWS Scram Level)	ADS Div. II Inhibited/Auto Out Of Service	Radiation Monitor High
RPV Low Level/Drywell Pressure High Isolation Incomplete	Suppression Pool Bulk Average Temperature High	RCIC System Status
RPV Water Level Low (ATWS Scram Level)	Drywell Average Temperature High	HPCF (B) System Status
RPV Water Level Low (HPCF Initiation Level)	Suppression Pool Water Level High/Low	HPCF (C) System Status

* Functional Definitions

Table 2.7.1b Main Control Room Panels

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
1. Equipment comprising the MCRP, as defined in Section 2.7.1, is available in the MCR.	1. Inspections of the as-built system will be conducted.	1. The as-built MCRP conforms with the description in Section 2.7.1.
2. Non-Class 1E and divisional Class 1E control and instrument power is provided for the MCRP. In the MCRP, independence is provided between Class 1E divisions, and between Class 1E divisions and non-Class 1E equipment.	2. a. Tests will be conducted on the MCRP by providing a test signal to only one Class 1E division at a time. b. Inspections of the as-built Class 1E divisions in the MCRP will be conducted.	2. a. The test signal exists only in Class 1E division under test in the MCRP. b. In the MCRP, physical separation or electrical isolation exists between Class 1E divisions. Physical separation or electrical isolation exists between these Class 1E divisions and non-Class 1E equipment.

2.7.2 Radioactive Waste Control Panels

No entry. Covered in Section 2.9.1.

2.7.3 Local Control Panels

Design Description

The Local Control Panels (LCP) consist of safety-related and non-safety-related local panels, control boxes, instrument racks and their respective internal wiring. LCPs function as protective housings and support structures for electrical and electronic equipment and facilitate local control operation.

LCPs that support safety-related equipment are classified as safety-related and Seismic Category I. Safety-related LCPs are located in Seismic Category I structures and in their divisional areas.

Safety-related LCPs are powered from their respective Class 1E divisions. Independence is provided between Class 1E divisions, and also between Class 1E divisions and non-Class 1E equipment.

LCPs which are located in areas designated as harsh environment areas are qualified for harsh environments.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.7.3 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria, which will be undertaken for the LCP.

Table 2.7.3 Local Control Panels

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
1. The basic configuration of the LCPs is described in Section 2.7.3.	1. Inspections of the as-built system will be conducted.	1. The as-built LCPs conform with the basic configuration described in Section 2.7.3.
2. Safety-related LCPs are powered from their respective Class 1E divisions. Independence is provided between Class 1E divisions and between Class 1E divisions and non-Class 1E equipment.	2. a. Tests will be conducted in the LCPs by providing a test signal to only one Class 1E division at a time. b. Inspections of the as-built Class 1E divisions in the LCPs will be conducted.	2. a. A test signal exists in only the Class 1E division under test in the LCPs. b. In the LCPs, physical separation or electrical isolation exists between as-built Class 1E divisions. Physical separation or electrical isolation exists between these Class 1E divisions and non-Class 1E equipment.

2.7.4 Instrument Racks

No entry. Covered in Section 2.7.3.

2.7.5 Data Communication

Design Description

The Data Communication functions are defined through the Essential Communication Functions (ECFs) and the Non-Essential Communication Functions (NECFs). The ECFs are accomplished as a part of the safety-related I&C systems and equipment that make up Safety System Logic and Control (SSLC). The NECFs are performed through a plant wide, distributed network identified as the Plant Data Network (PDN) system. The PDN supports the communication functions of the non-safety-related I&C systems and other plant data and information systems.

Essential Communication Functions (ECF)

The ECFs support the control and monitoring of the plant protection and safety systems. The ECFs are implemented through the use of divisionally dedicated networks and/or data links provided with the safety related digital system platforms. Some of the platforms use data links only and some of the platforms use a combination of both data links and networks. The networks and data links provide remote and local communication between the safety system modules. Information from remote units, typically input and output signals and digital based controllers, is sent to equipment that processes the data according to the system logic functions to determine the control output signals. The system signal inputs and outputs of the controllers connect to the process sensors and discrete devices located within the plant. The resulting control signals are sent back to the remote controllers, which distribute the signals to the final control elements of the supported systems. In addition, the dedicated networks and data links support the acquisition and transmission of safety-related signals for display and recording.

Data communication is provided between redundant safety-related divisions to support coincident logic functions. The data communication is implemented through fiber optic based data links to ensure interdivisional isolation. All communication is checked to prevent a division from impacting the performance of other divisions.

The equipment implementing the ECFs is classified as Class 1E safety-related.

The ECFs are implemented through dedicated equipment in each of the divisions, with no direct electrical interconnections among divisions. Each division of equipment has independent control of data acquisition and transmission. System timing is asynchronous among the divisions, so that timing and clock signals are independent of each other and only influence data transmission functions within that division. The ECFs are implemented with a deterministic communications protocol.

The ECFs for remote units within a division are implemented with redundant transmission paths and communication modules. The ECFs utilize self-diagnostics to detect a transmission path or communication module failure.

Data communication from safety-related to non-safety-related systems or devices is isolated through the use of an isolating transmission medium and buffering devices. Data cannot be transmitted from the non-safety side to safety-related equipment when the equipment is in service.

Self diagnostics monitor the operation of the ECFs. The equipment implementing the ECFs in each of the four divisions is powered from its respective division's uninterruptible Class 1E power. Independence is provided between Class 1E divisions, and also between Class 1E division and non-Class 1E equipment.

The equipment implementing the ECFs is located in the Reactor Building, the Control Building and the Ultimate Heat Sink (UHS).

The ECFs are monitored within each system and have the following alarms and displays in the main control room:

- Inoperative indication for equipment implementing the ECFs.
- Individual communication channel availability for each division.
- Display of data transmission parameters and display and control of off-line self-test functions.

Non-Essential Communication Functions (NECFs)

The NECFs support the data communications for non-safety-related plant functions. The NECFs are implemented through the use of a distributed Plant Data Network (PDN) that provides high speed data communications throughout the plant. The PDN provides the physical and logical data communications networks and connectivity to support the non-safety-related control and monitoring functions. The PDN supports the acquisition of non-safety-related data from process sensors and discrete devices, connected to remote input and output devices located throughout the plant, and sends the data to the non-safety-related control systems for control function processing. The PDN supports the communication between the control room monitoring, alarm, recording, and display devices, as well as the Emergency Response Facilities data systems. The PDN also provides non-safety-related control signals to the final control and monitoring elements such as valves, motor drives, alarms, monitors and indicators of the interfacing systems.

The equipment implementing the NECFs is redundant.

The equipment implementing the NECFs is classified as non-safety-related, and is powered from non-Class IE uninteruptible power.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.7.5 provides a definition of the visual inspections, tests and analyses, together with associated acceptance criteria, which will be undertaken for the ECFs and NECFs.

Table 2.7.5 Data Communication

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
1. The equipment providing the ECFs and NECFs is defined in Section 2.7.5.	1. Inspection of the as-built equipment implementing the ECFs and the NECFs will be conducted.	1. The as-built equipment implementing the ECFs and NECFs conforms with the description in Section 2.7.5.
2. The ECFs use deterministic communications protocols.	2. Tests of the ECFs communications protocols will be conducted in a test facility.	2. The ECFs use deterministic communications protocols.
3. Data communications from equipment implementing the ECFs to non-safety-related systems or devices use an isolating transmission medium and buffering devices. Data cannot be transmitted from the non-safety-related side to equipment implementing the ECFs.	3. Tests on the ECFs will be conducted in a test facility.	3. Equipment implementing the ECFs only permits data transfer from the safety-related to the non-safety-related systems or devices. Control or timing signals are not exchanged between safety-related and non-safety-related systems or devices.
4. The ECFs utilize self-diagnostics to detect a transmission path or communication module failure. The ECFs for remote units within a division accommodate a single failure (either a cable break or communication module failure), and will continue to function with no interruption in data communication.	4. Tests will be conducted on all as-built ECFs for remote units within a division simulating the following, while transmitting and monitoring test data streams: a. Single cable break. b. Loss of a communication module, such as a fiber optic modem.	4. There is a valid system response generated for each test with no loss of essential data communication as a result of the fault. Fault occurrence is identified by the system self-diagnostics and displayed in the main control room.

Table 2.7.5 Data Communication (Continued)

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
5. Loss of data communications in a division of equipment implementing the ECFs does not cause transient or erroneous data to occur at system outputs.	5. Tests will be performed in one division of equipment implementing the ECFs at a time. While simulated input signals are being transmitted cable segments in redundant paths will be disconnected and the ECFs outputs monitored.	5. Data communication is lost without generation of transient or erroneous signals.
6. Each of four divisions of equipment implementing the ECFs is powered from its respective division's uninterruptible Class 1E power. For the ECFs, independence is provided between Class 1E divisions, and between Class 1E divisions and non-Class 1E equipment.	6. a. Tests will be performed on equipment implementing the ECFs by providing a test signal in only one Class 1E division at a time. b. Inspection of the as-installed Class 1E divisions will be performed.	6. a. The test signal exists only in the Class 1E division under test in the equipment implementing the ECFs. b. For equipment implementing the ECFs, physical separation or electrical isolation exists between Class 1E divisions. Physical separation or electrical isolation exists between these Class 1E divisions and non-Class 1E equipment.
7. Main control room alarms and displays provided for the ECFs are as defined in Section 2.7.5.	7. Inspections will be performed on the main control room alarms and displays for the ECFs.	7. Alarms and displays exist or can be retrieved in the main control room as defined in Section 2.7.5.

2.7.6 Local Control Boxes

No entry. Covered in Section 2.7.3.