2.7 Control Panels

The information in this section of the reference ABWR DCD, including all subsections, tables, and figures, is incorporated by reference with the following standard departures.

STD DEP T1 2.3-1 (Table 2.7.1a)

STD DEP T1 2.14-1 (Table 2.7.1a)

STD DEP T1 3.4-1 (Table 2.7.5)

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

	A. Fixed Position Controls	
RPS Div. II Trip Reset Switch	Div. I Manual ADS Channel 1 Initiation Switch	~~*FCS (B) Control Switch*~~
RPS Div. III Trip Reset Switch	Div. I Manual ADS Channel 2 Initiation Switch	~~*FCS (C) Control Switch*~~
	B. Fixed Position Displays	
Reactor Thermal Power	Emergency Diesel Generator (A) Operating Status	~~*FCS (B) Operating Status*~~
MSIV Position Status (Inboard And Outboard Valves)	Emergency Diesel Generator (B) Operating Status	~~*FCS (C) Operating Status*~~
~~*Main Steamline Radiation*~~	Primary Containment Water Level	Time
	C. Fixed Position Alarms	
~~*Main Steam Line Radiation High*~~	RWCU System Status	RCW Radioactivity High

2.7.5 ~~*Multiplexing System*~~ Data Communication

The Design Description is replaced in its entirety with the following.

STD DEP T1 3.4-1

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 ~~or networks 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 ~~and control~~ 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 ~~2.7-1~~ 2.7.5 provides a definition of the visual inspections, tests and analyses, together with associated acceptance criteria, which will be undertaken for the ~~EMS~~ ECFs *and ~~NEMS~~* NECFs*.*

Table 2.7.5 ~~*Essential Multiplexing System*~~ Data Communication

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
1. The equipment ~~*comprising the Multiplexing System*~~ **providing the ECFs and NECFs** is defined in Section 2.7.5.	1. Inspection of the as-built ~~*EMS and NEMS*~~ **equipment implementing the ECFs and the NECFs** will be conducted.	1. The as-built ~~*EMS and NEMS conform*~~ **equipment implementing the ECFs and NECFs conforms** with the description in Section 2.7.5.
2. ~~*EMS*~~ **The ECFs** ~~*uses*~~ **use** ~~*a*~~ deterministic communications ~~**protocol**~~**protocols**.	2. Tests of the ~~*EMS*~~ **ECFs** communications ~~*protocol*~~ **protocols** will be conducted in a test facility.	2. ~~*EMS*~~ **The ECFs** ~~*uses*~~ **use** ~~*a*~~ deterministic communications ~~*protocol*~~ **protocols**.
3. Data communications from ~~*EMS*~~ **equipment implementing the ECFs** to non-safety-related systems or devices ~~*uses*~~ **use** an isolating transmission medium and buffering devices. Data cannot be transmitted from the non-safety-related side to ~~*EMS*~~ **equipment implementing the ECFs.**	3. Tests on the ~~*EMS*~~ **ECFs** ~~*data communications*~~ will be conducted in a test facility.	3. ~~*EMS communications*~~ **Equipment implementing the ECFs** only permits data transfer from the ~~*EMS*~~ **safety-related** to the non-safety-related systems or devices. **Control** or timing signals are not exchanged between ~~*EMS*~~ **safety-related** and non-safety-related systems or devices.

Table 2.7.5 ~~*Essential Multiplexing System*~~ Data Communication (Continued)

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
4. ~~*The EMS*~~ ~~**Equipment implementing the ECFs**~~ ~~features automatic self-test and automatically *reconfigures after detecting* **accommodates single** failure *of one channel* (either a cable break or device failure) within a division. The *system returns to* **ECFs continue** normal *operation* **function** after *reconfiguration* **the error is detected** with no interruption of data communication~~**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 contiue to function with no interruption in data communication.**	4. ~~Tests will be conducted on each as built *EMS* division **of equipment implementing the ECFs** by individually simulating the following, while simultaneously transmitting and monitoring test data streams:~~ ~~a. a.Single cable break.~~ ~~b. b.Loss of one *RMU* **local area cabinet implementing the ECFs.**~~ ~~c. c.Loss of one *CMU* **control area cabinet implementing the ECFs.**~~ **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 ~~*EMS*~~ **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.
5. Loss of data communications in a division of ~~*EMS*~~ **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 ~~*EMS*~~ **equipment implementing the ECFs** at a time. While simulated input signals are being transmitted cable segments in redundant paths will be disconnected and ~~*EMS*~~ **the ECFs** outputs monitored.	5. Data communication is lost without generation of transient or erroneous signals.

Table 2.7.5 ~~*Essential Multiplexing System*~~ Data Communication (Continued)

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
6. Each of four ~~*EMS*~~ divisions **of equipment implementing the ECFs** is powered from its respective division's **uniterruptible** Class 1E ~~*DC division*~~ ~~vital AC~~ power. ~~*In the EMS*~~ **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 ~~*EMS*~~ **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 ~~*in the EMS*~~ will be performed.	6. a. The test signal exists only in the Class 1E division under test in the ~~*EMS*~~ **equipment implementing the ECFs**. b. ~~*In the EMS*~~ **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 ~~*EMS*~~ **ECFs** are as defined in Section 2.7.5.	7. Inspections will be performed on the main control room alarms and displays for the ~~*EMS*~~ **ECFs**.	7. Alarms and displays exist or can be retrieved in the main control room as defined in Section 2.7.5.