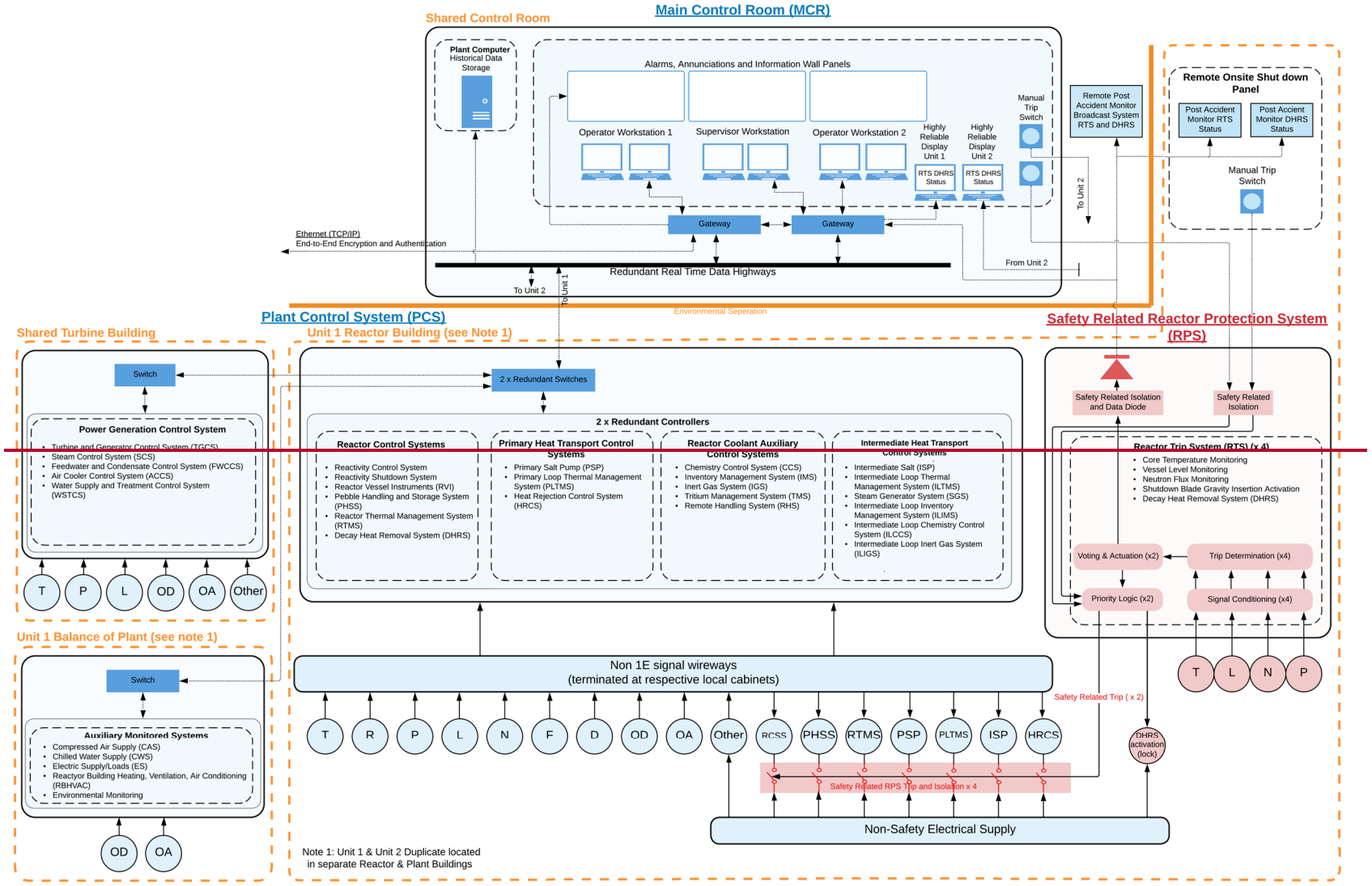
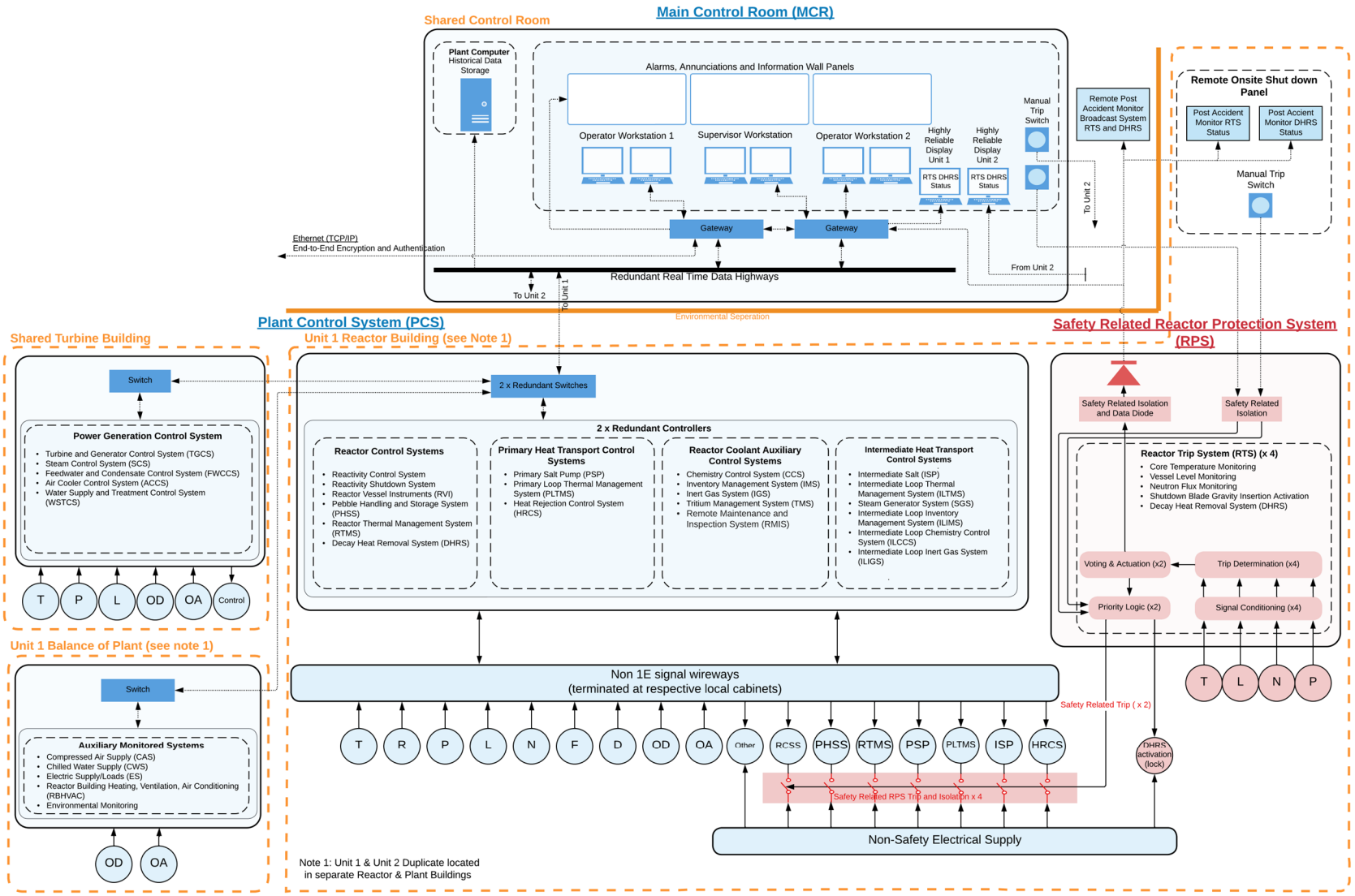
Enclosure 1
Changes to Hermes 2 PSAR Chapter 7
(Non-Proprietary)

Figure 7.1-1: Instrumentation and Controls System Architect




Shared Control Room
Main Control Room (MCR)
Plant Computer
Historical Data Storage
Alarms, Annunciations and Information Wall Panels
Operator Workstation 1
Supervisor Workstation
Operator Workstation 2
Highly Reliable Display Unit 1
Highly Reliable Display Unit 2
RTS DHRS Status
Manual Trip Switch
Remote Post Accident Monitor Broadcast System RTS and DHRS
Remote Onsite Shut down Panel
Post Accident Monitor RTS Status
Post Accident Monitor DHRS Status
Manual Trip Switch
To Unit 2
From Unit 2
Gateway
Gateway
Ethernet (TCP/IP)
End-to-End Encryption and Authentication
Redundant Real Time Data Highways
To Unit 2
To Unit 1
Environmental Seperation
Plant Control System (PCS)
Safety Related Reactor Protection System (RPS)
Shared Turbine Building
Unit 1 Reactor Building (see Note 1)
Switch
Power Generation Control System
Turbine and Generator Control System (TGCS)
Steam Control System (SCS)
Feedwater and Condensate Control System (FWCCS)
Air Cooler Control System (ACCS)
Water Supply and Treatment Control System (WSTCS)
T
P
L
OD
OA
Control
2 x Redundant Switches
2 x Redundant Controllers
Reactor Control Systems
Reactivity Control System
Reactivity Shutdown System
Reactor Vessel Instruments (RVI)
Pebble Handling and Storage System (PHSS)
Reactor Thermal Management System (RTMS)
Decay Heat Removal System (DHRS)
Primary Heat Transport Control Systems
Primary Salt Pump (PSP)
Primary Loop Thermal Management System (PLTMS)
Heat Rejection Control System (HRCS)
Reactor Coolant Auxiliary Control Systems
Chemistry Control System (CCS)
Inventory Management System (IMS)
Inert Gas System (IGS)
Tritium Management System (TMS)
Remote Maintenance and Inspection System (RMIS)
Intermediate Heat Transport Control Systems
Intermediate Salt (ISP)
Intermediate Loop Thermal Management System (ILTMS)
Steam Generator System (SGS)
Intermediate Loop Inventory Management System (ILIMS)
Intermediate Loop Chemistry Control System (ILCCS)
Intermediate Loop Inert Gas System (ILIGS)
Safety Related Isolation and Data Diode
Safety Related Isolation
Reactor Trip System (RTS) (x 4)
Core Temperature Monitoring
Vessel Level Monitoring
Neutron Flux Monitoring
Shutdown Blade Gravity Insertion Activation
Decay Heat Removal System (DHRS)
Voting & Actuation (x2)
Trip Determination (x4)
Priority Logic (x2)
Signal Conditioning (x4)
T
L
N
P
Unit 1 Balance of Plant (see note 1)
Switch
Auxiliary Monitored Systems
Compressed Air Supply (CAS)
Chilled Water Supply (CWS)
Electric Supply/Loads (ES)
Reactor Building Heating, Ventilation, Air Conditioning (RBHVAC)
Environmental Monitoring
OD
OA
Non 1E signal wireways
(terminated at respective local cabinets)
Safety Related Trip (x 2)
T
R
P
L
N
F
D
OD
OA
Other
RCSS
PHSS
RTMS
PSP
PLTMS
ISP
HRCS
DHRS activation (lock)
Safety Related RPS Trip and Isolation x 4
Non-Safety Electrical Supply
Note 1: Unit 1 & Unit 2 Duplicate located in separate Reactor & Plant Buildings

7.2.1.1 Reactor Control System

The RCS controls and monitors systems and components that support normal operation, planned transients, and normal shutdown of the reactor. The RCS controls the systems listed in Figure 7.1-1 and supports the following capabilities:

- Reactivity control and planned transients/adjustments in power level
- Monitoring of core neutronics
- Pebble handling and storage
- Monitoring and control of temperature in the reactor

The RCS controls reactivity for normal operations and normal shutdown using reactor control elements and reactor shutdown elements in the reactivity control and shutdown system (RCSS) (see Section 4.2). The RCS is capable of incrementally changing the position of reactor control elements and of releasing the control and shutdown elements. The RCS is only capable of withdrawing elements one at a time and the RCS includes a limit on the rate at which a control element can be withdrawn, as also discussed in Section 4.2.2. In this way the design precludes, with margin, the potential for prompt criticality and rapid reactivity insertions. The RCS inputs include reactor outlet temperature and reactor inlet temperature sensors and source and power range neutron excore detectors. The RCS also provides a reactor monitoring function to monitor plant components that are associated with reactor functions. The RCS uses source and power range sensors that are located outside the reactor vessel for reactor control.

The RCS controls pebble insertion and extraction, in-vessel pebble handling, and ex-vessel pebble handling in the pebble handling and storage system (PHSS) (see Section 9.3). The RCS is capable of counting linearized pebbles external to the vessel, controlling the rate of pebble insertion and removal from the vessel, and controlling pebble distribution within the PHSS.

The RCS controls the reactor thermal management system (RTMS) (see Section 9.1.5) to monitor the temperature of the primary system to maintain it within the normal operating envelope and to implement planned transients. The RCS controls external heating elements in the RTMS to prevent overcooling.

The RCS provides the capability for event monitoring and active actuation of the decay heat removal system (DHRS) (See Section 6.3.1).

7.2.1.2 Reactor Coolant Auxiliary Control System

The RCACS controls and monitors systems and components that support normal operation in the core. The system supports the following capabilities in the core:

- Chemistry control in the primary system
- Inventory management system control
- Inert gas system control in the primary loops
- Tritium management system monitoring and control
- Remote ~~handling~~ maintenance and inspection system monitoring and control

Highlighted text was previously changed. Submitted on 1-3-24 (ML24003A766).

The RCACS controls the chemistry control system (see Section 9.1.1) to monitor reactor coolant chemistry. The monitoring systems provide information to facilitate maintaining coolant purity and circulating activity within specifications for the system.

The chilled water system, as discussed in Section 9.7.4, is controlled and monitored to supply cooling water to non-safety related SSCs.

The electrical supply, as discussed in Chapter 8, is controlled and monitored to support the non-safety related normal and backup power supply.

The RBHAVAC is controlled and monitored to supply reactor building HVAC, as discussed in Section 9.2.

The environmental monitoring system, as discussed in Section 11.1.7, monitors radiation levels in unrestricted areas and radioactive material in effluents.

Highlighted text was previously changed. Submitted on 1-3-24 (ML24003A766).

7.2.2 Design Bases

Consistent with Principal Design Criteria (PDC) 13, the PCS is designed to monitor variables and systems over their anticipated ranges for normal operation, and over the range defined in postulated events.

7.2.3 System Evaluation

The PCS is designed to monitor plant and unit parameters and maintain systems within normal operating range. The PCS is also designed to control planned transients associated with anticipated operational occurrences and maintain the affected reactor in a shutdown state. These functions are consistent with PDC 13. The PCS does not perform a safety-related function. Finally, the PCS is designed so that it cannot interfere with the RPS's ability to perform its safety functions; see Section 7.3 for more information about the isolation of the RPS from the PCS.

The PCS is a digital system that controls the reactor power about a point set by the operator. The control system uses linear average temperature and flow rate in the primary system as variable inputs to control power level so that it remains within the normal operating envelope. The PCS controls electrical power generation about a point set by the operators using steam flow rates, feedwater flow rates, and feedwater temperatures as inputs to control the positions of turbine control valves, turbine bypass valves, and feedwater regulating valves to balance the turbine load from each unit. The system design meets the applicable portions International Electrotechnical Commission (IEC) standard 61131 for industrial controllers (Reference 1), and the applicable portions of the cyber security standard IEC 62443 (Reference 2). Table 7.2-2 lists other standards applied to the PCS. Applicable portions of IEEE 1012-2017 (Reference 3) are used for verification and validation of PCS components, which is consistent with the non-safety related classification of the PCS.

Action in the PCS is designed to accurately and reliably provide control signal for all modes of normal operation. The PCS is also designed to provide timely control signals, with further analysis of timeliness to be provided in an application for the Operating License.

The PCS includes interlocks and inhibits that prohibit or restrict operation of the reactor, PHSS, and the power generation system unless certain operating conditions are met. The following interlocks are included in the control system design:

- An interlock that prohibits reactivity control element withdrawal until there is sufficient neutron count rate to ensure that nuclear instruments are responding to neutrons.
- Interlocks are also provided related to startup power level and pebble handling as detailed in Table 7.2-3.
- An interlock that prevents the opening of a unit's main steam isolation valve following a reactor trip until there is sufficient steam production to ensure that a turbine imbalance will not occur.