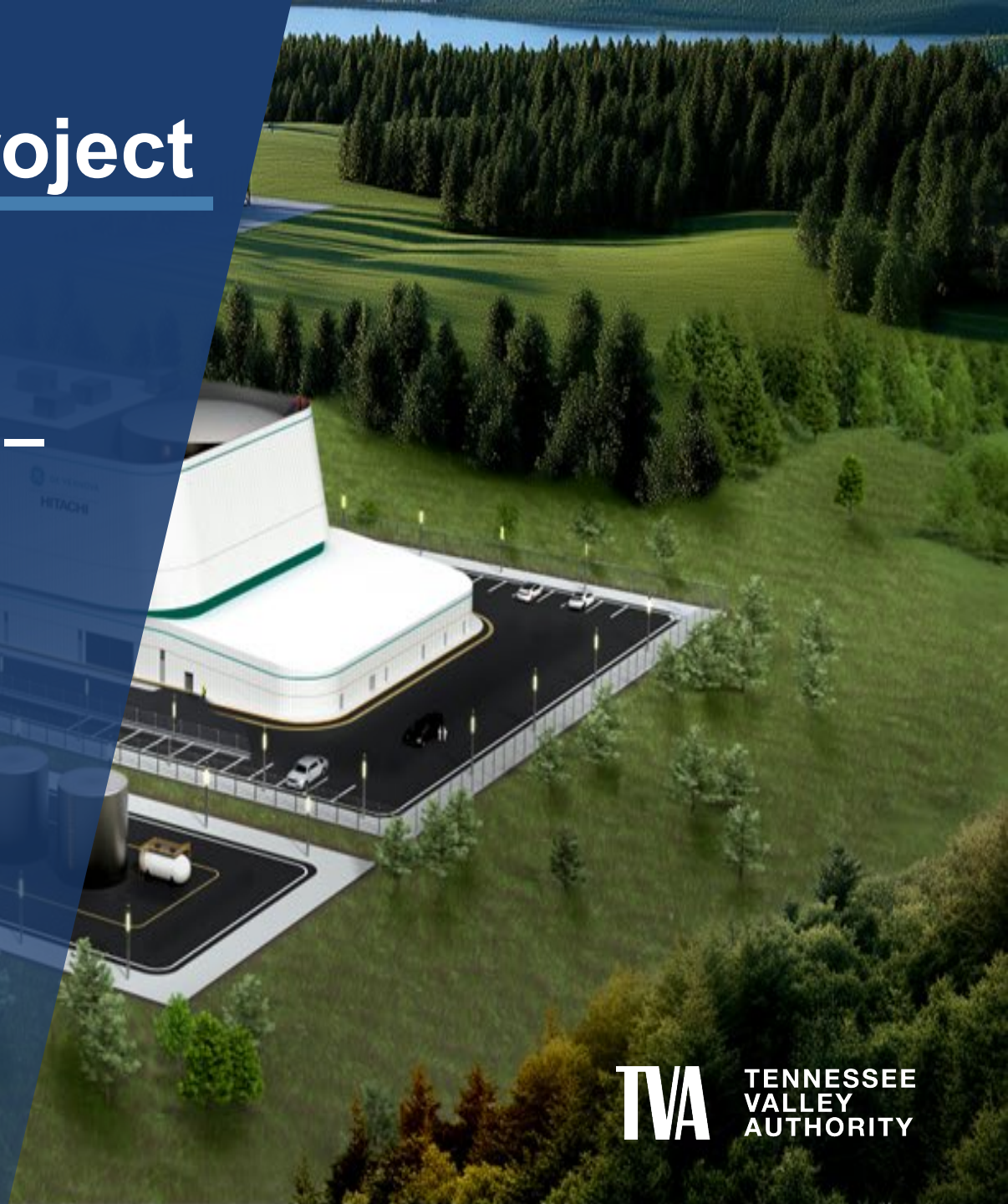
TVA Clinch River Nuclear Project

Construction Permit Application – Application Overview

Ray Schiele

Senior Licensing Manager



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Topics

Introductions

TVA Mission and the Role of New Reactors

Pathway from Early Site Permit to Construction Permit Application

Structure/Content of the Construction Permit Application

Questions

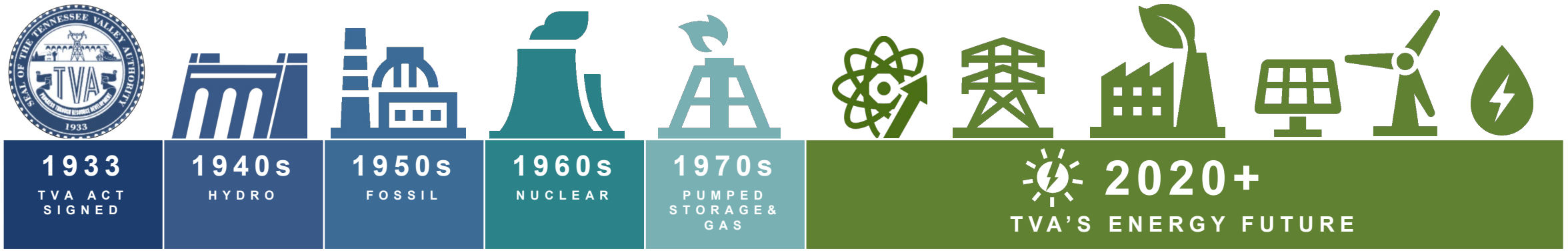
TVA Mission and the Role of New Reactors

BUILT FOR THE PEOPLE OF THE VALLEY

ENERGY — Electricity at the lowest feasible rate and highest feasible reliability

ENVIRONMENT — Stewardship of the natural resources for best use by the public

ECONOMIC DEVELOPMENT — To attract and retain good jobs and capital investment in the Valley



Since its inception, TVA has innovated to meet the needs of the Valley.

Today and in the future, the Valley needs **affordable, reliable, resilient, and secure energy** to **lead the nation in energy innovation and economic development**.

INNOVATING FOR THE PEOPLE OF THE VALLEY

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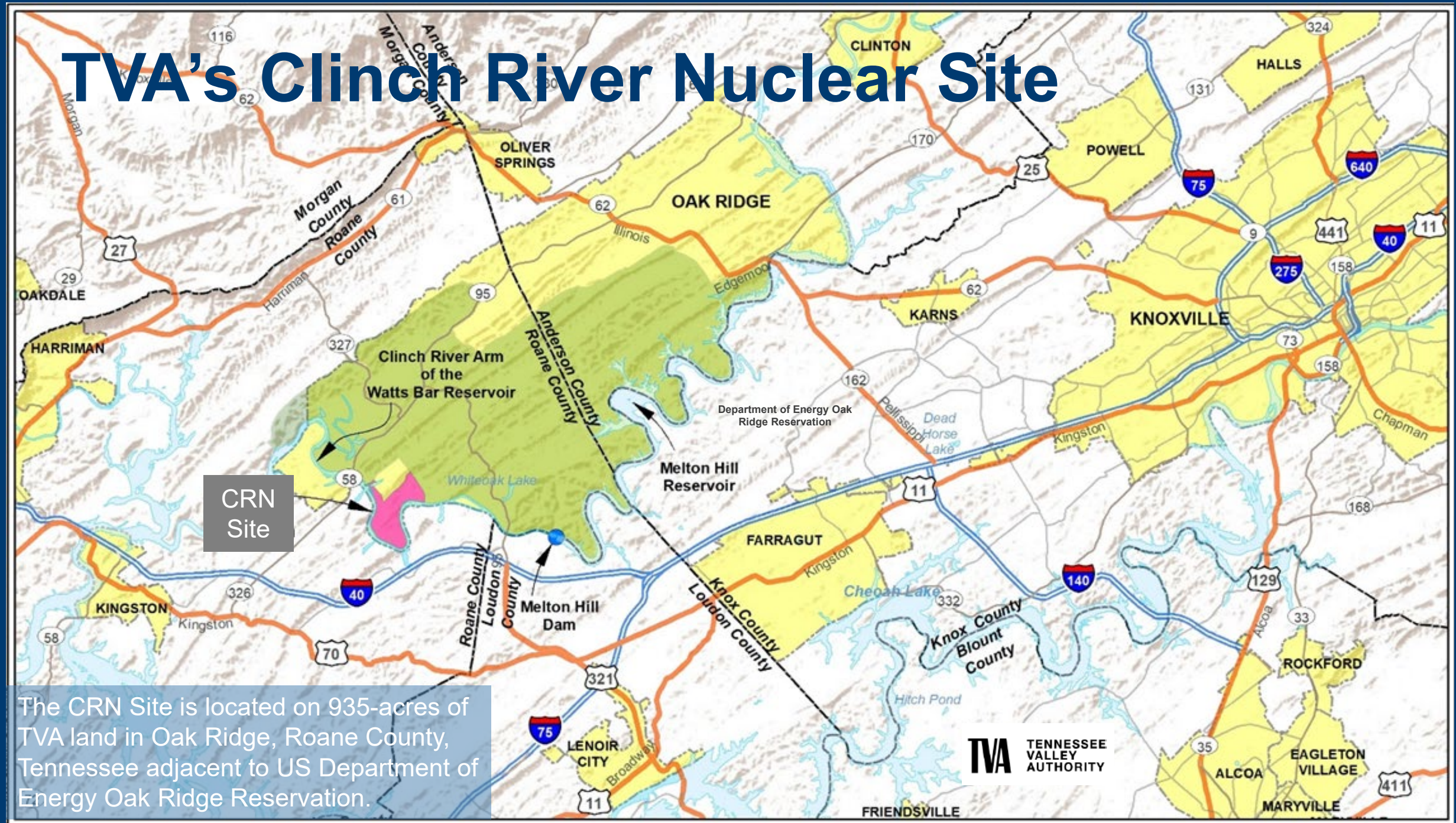
TVA's Clinch River Nuclear Site



The CRN Site is located on 935-acres of TVA land in Oak Ridge, Roane County, Tennessee adjacent to US Department of Energy Oak Ridge Reservation.

TVA's ESP to CPA Submittal Timeline

2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025

ESP Issued 12/2019

- Topical Report for NQA-1 CRN 1 Program
- Exemption Request 2.101(a)(5)
- Exemption Request Excavation
- TVA NEPA and Permitting

CPA 2 Parts:
- Part 1 ER 4/2025
- Part 2 PSAR 5/2025

ESP Issued → **SMR Technology Evaluation** → **CPA Scoping** → **CPA Development** → **CPA Submittal**

- LCOE
- Supply Chain Constraints
- Advanced Manufacturing
- Seismic Considerations
- Modular Construction
- Advance Construction Techniques

Annotated Outlines:
PSAR
- RG 1.70
- NUREG 0800

Environmental Report
- RG 4.2
- NUREG 1555

- Select GVH BWRX-300 Technology
- Development of Regulatory Framework Documents
- Develop an Environmental Report for CRN-1
- Develop 10 CFR 50 Construction Permit Application
- LIC 116 Readiness Assessment

CPA Acceptance Review
- ER 6/12/2025
- PSAR 7/9/2025

CPA Audit
- ER 7/14/2025
- PSAR 7/14/2025

Construction Permit Application Content (CPA)

Content of TVA CRN-1 CPA

Enclosure 1- General and Administrative Information

- 10 CFR 50.33 Contents of applications; general information

Enclosure 2 – Preliminary Safety Analysis Report [Non- Public]

- 10 CFR 50.34(a) Contents of applications; technical information.
- NUREG 0800 Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: (LWR Edition)
- Reg Guide 1.70 Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)

Enclosure 3 – Preliminary Safety Analysis Report [Public]

Enclosure 4 – Exemptions and Variances

- 10 CFR 50.12 Specific exemptions
- 10 CFR 52.39 Finality of early site permit determinations

Enclosure 5 – Environmental Report

- 10 CFR 51.50 Environmental report-construction permit, early site permit, or combined license stage
- NUREG 1555 Standard Review Plans for Environmental Reviews for Nuclear Power Plants
- Reg Guide 4.2 Preparation Of Environmental Reports For Nuclear Power Stations

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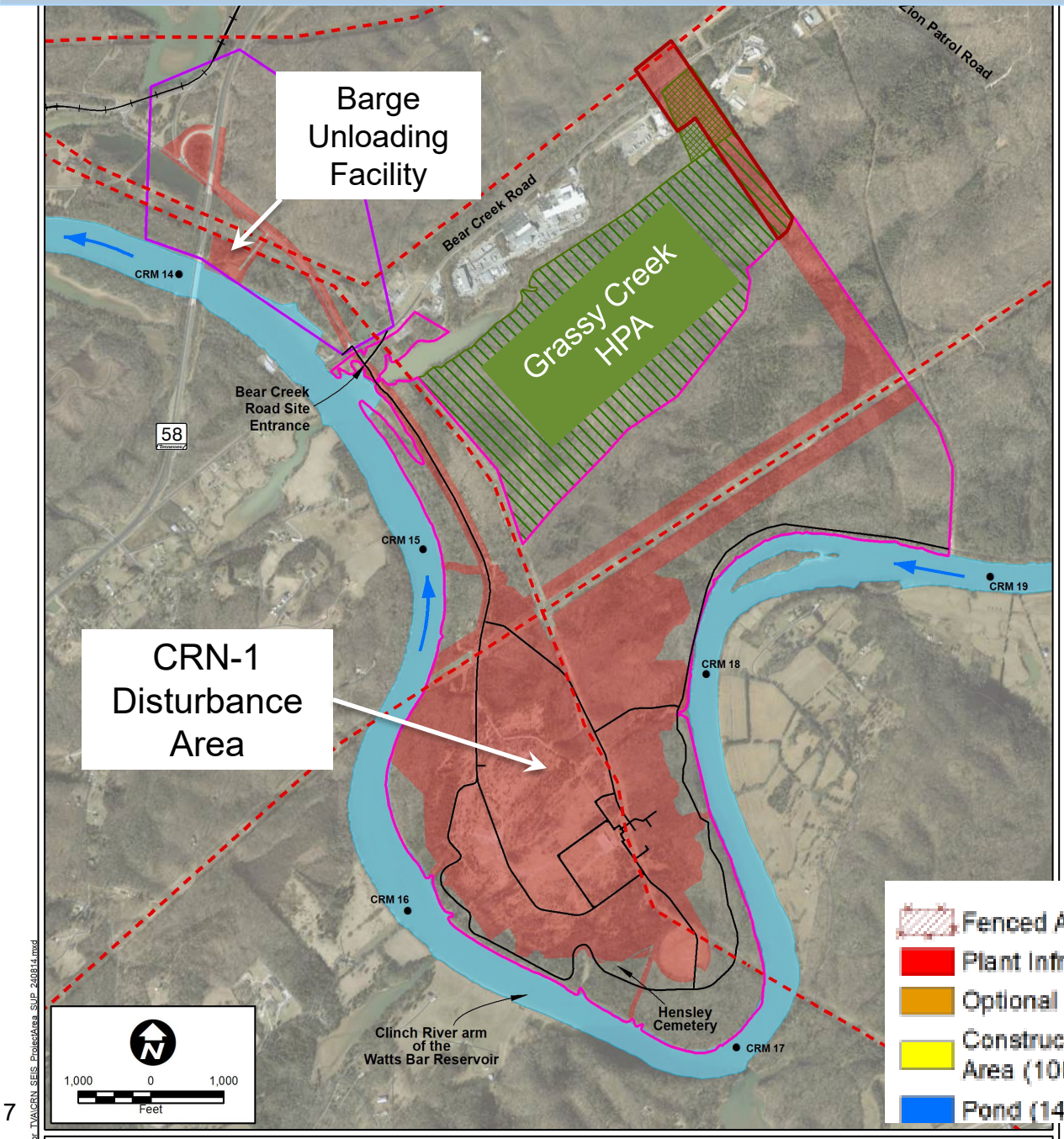
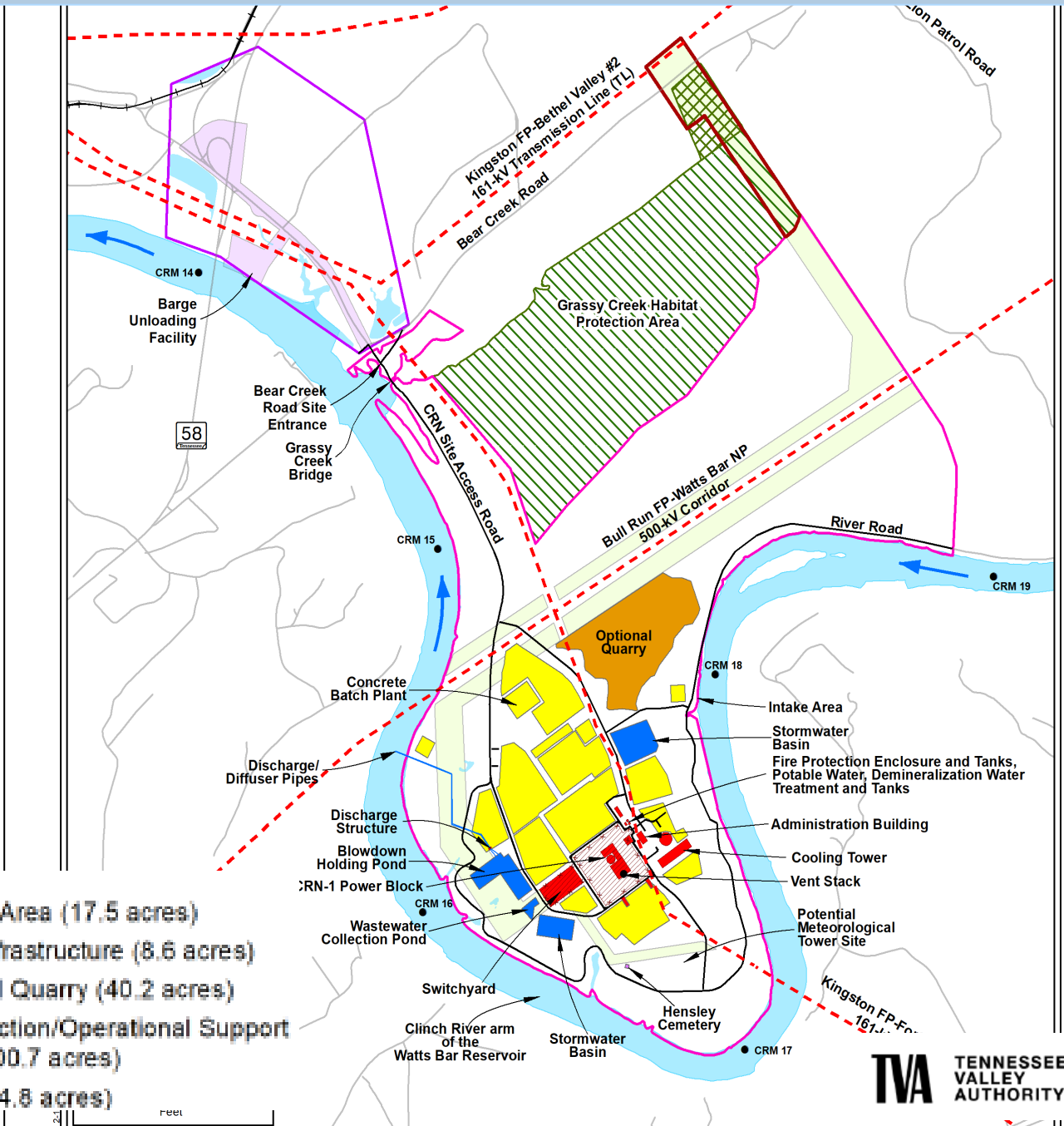
PSAR Chapter 1 Introduction and General Plant Description

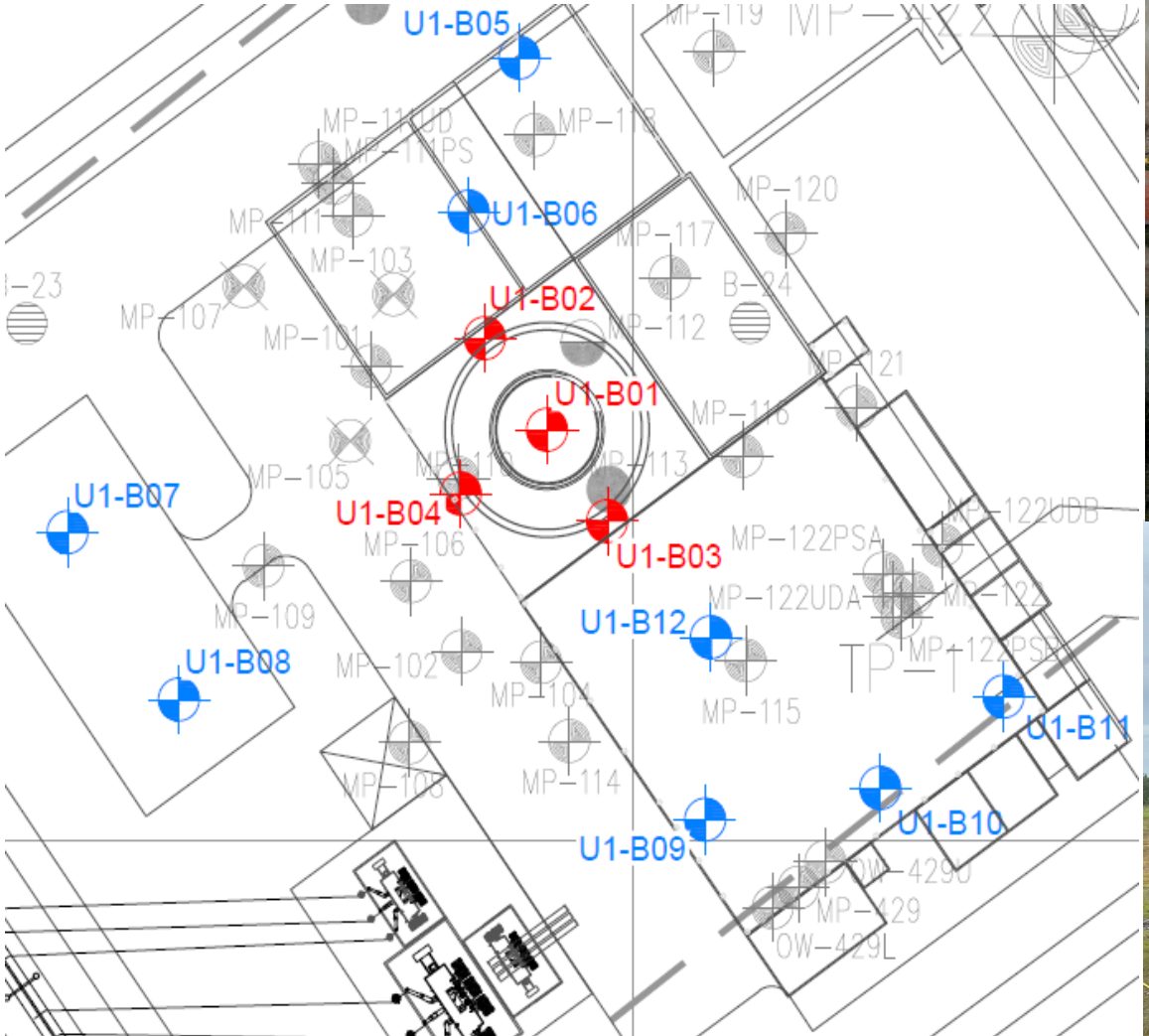




PSAR Chapter 2 – Site Characteristics and Site Parameters

- Dispositions ESP-006 Permit Conditions and COL Action Items
- Updated CRN Site Characteristics and Parameters
- Aspects of CRN ESPA Site Safety Analysis Report Incorporated by Reference
- PSAR Table 1.8-1 provides a cross reference of Site Safety Analysis Report information that is incorporated by reference into this PSAR:
  - 2.0 Plant Parameter Envelope Evaluation
  - 2.1 Geography and Demography
  - 2.2 Nearby Industrial, Transportation and Military Facilities
  - 2.3 Meteorology
  - 2.4 Hydrologic Engineering
  - 2.5 Geology, Seismology, and Geotechnical Engineering
  - 13.3 Emergency Preparedness
  - 13.6 Physical Security

CRN-1 Site Plan Confirmatory Core Bores



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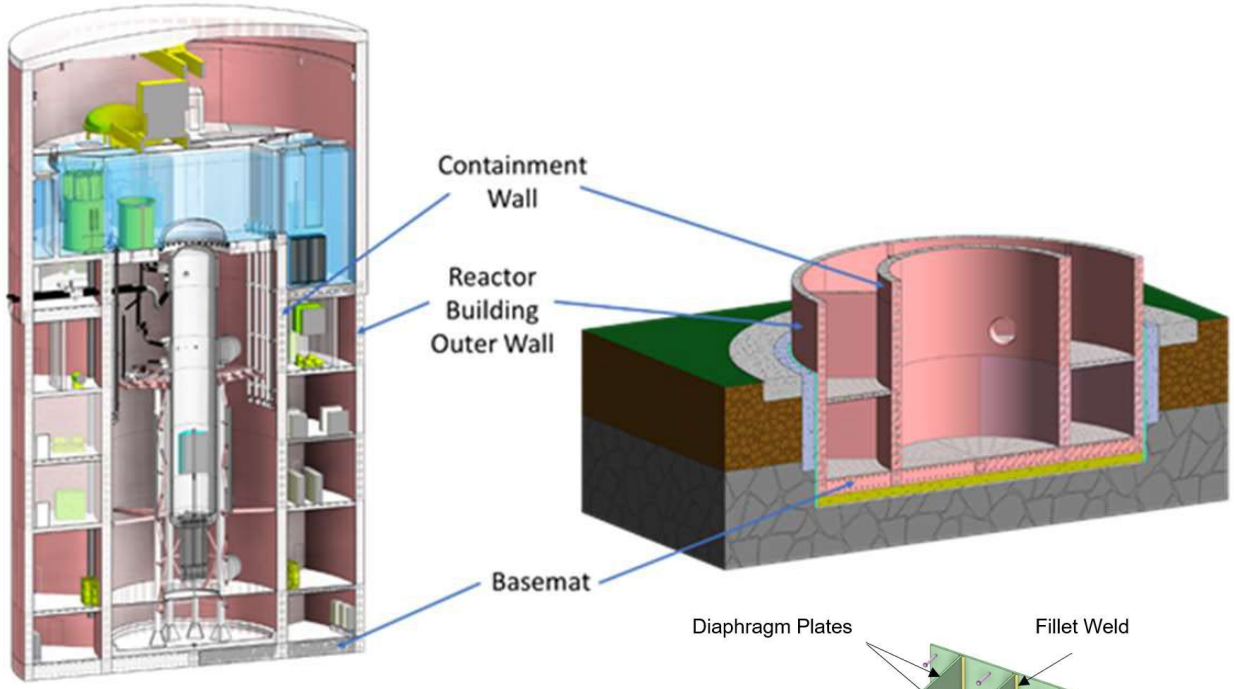
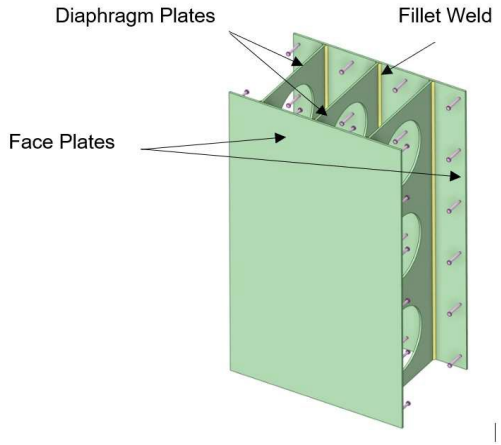
Chapter 3-Design of Structures, Systems, and Components

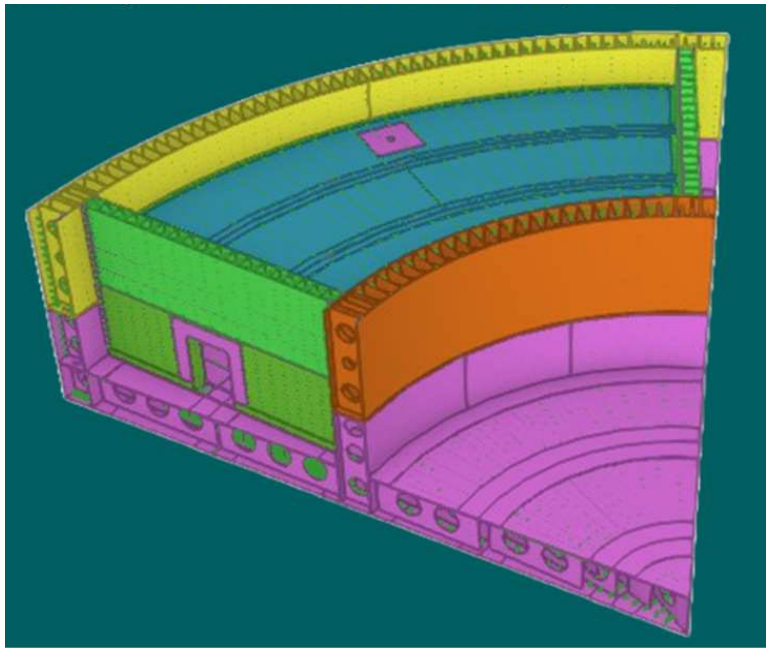


BWR-300 Reactor Building



<u>BWRX-300 Design Feature</u>

- Safety Strategy LTR in Review (Section 3.2)
- DPSC LTR Rev 3 in Review (Section 3.8)



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Chapter 4 – Reactor & Chapter 5 – Reactor Coolant System and Connected Systems

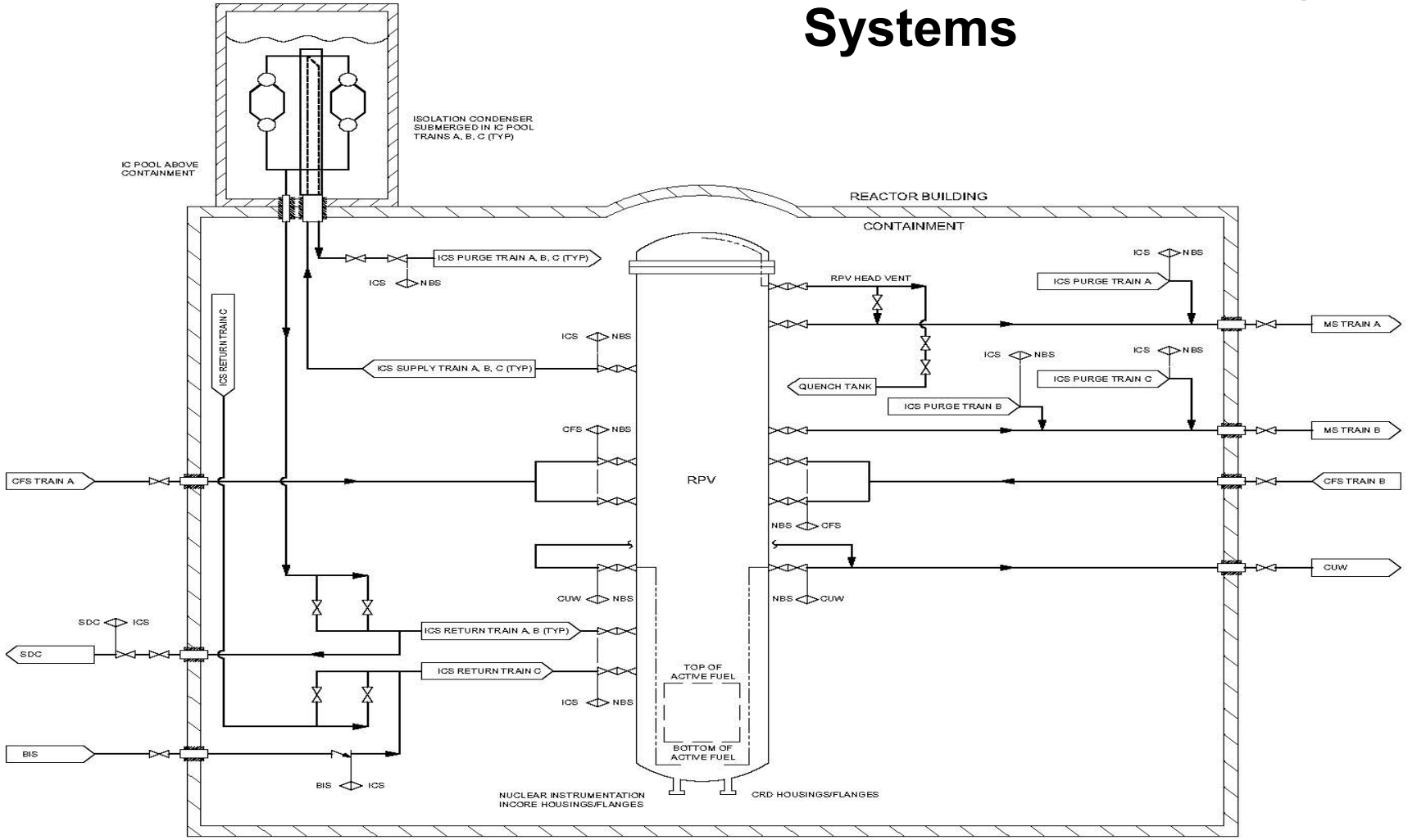

Figure 5.1-2 BWRX-300 Reactor Coolant Pressure Boundary Simplified Diagram

BWRX-300 Design Feature

- Natural Circulation BWR
- Increased RPV height
- Tall chimney
- Reactor Isolation Valves
- Flow Stability LTR In Review
- Reactor Isolation Valves

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Chapter 6 – Engineered Safety Features

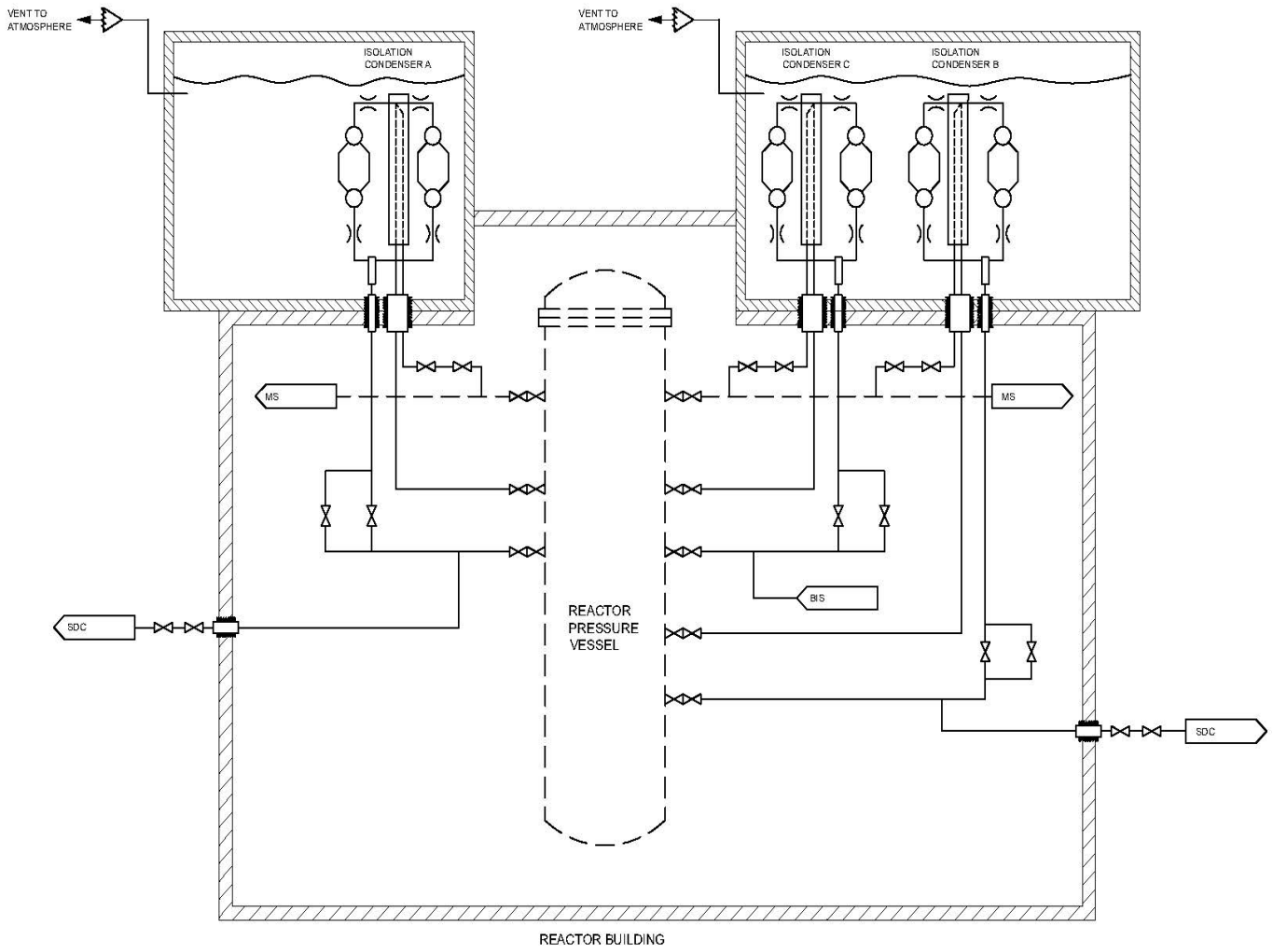
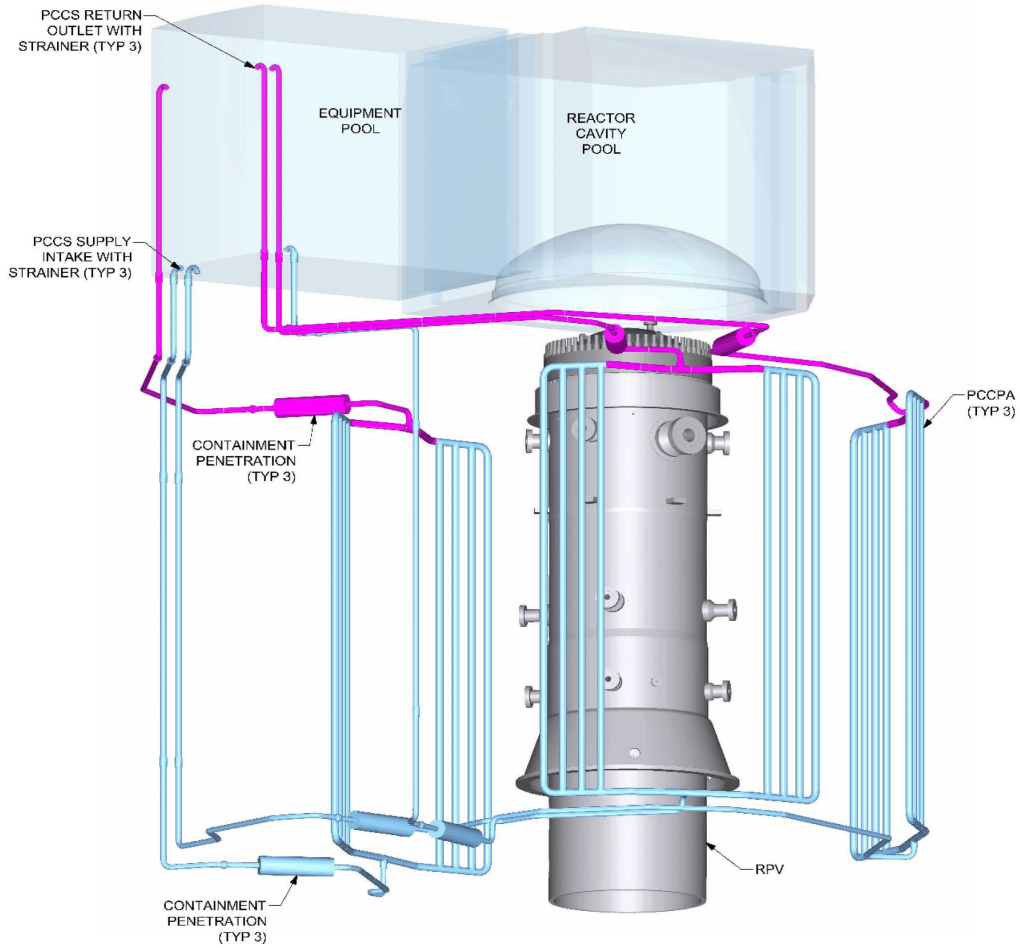


Figure 6.3-1 Isolation Condenser System Simplified Diagram



Note: Valves are not shown.

Figure 6.2-1 Passive Containment Cooling System Configuration

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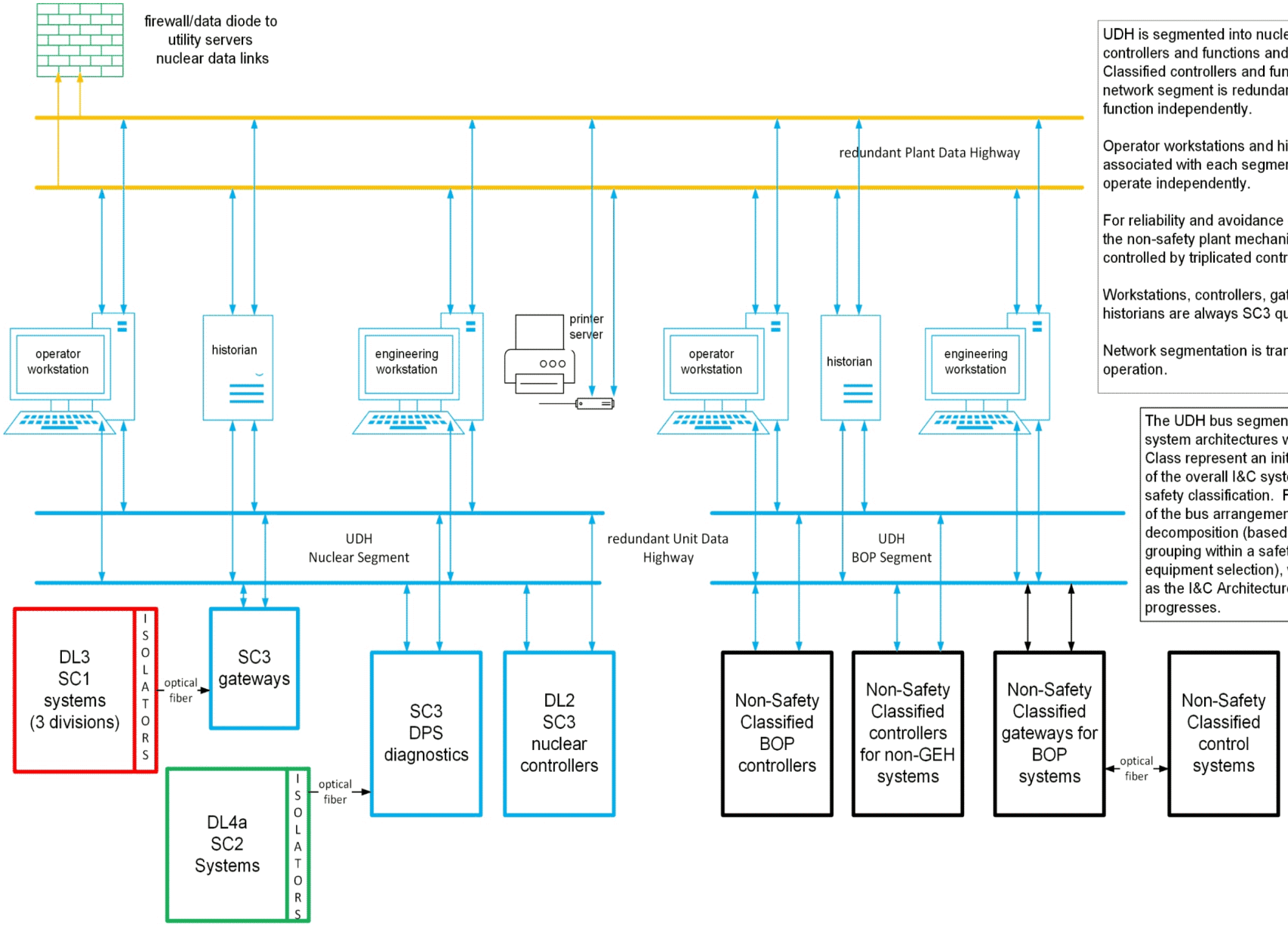
Chapter 7 – Instrumentation and Controls



UDH is segmented into nuclear SC3 controllers and functions and BOP Non-Safety Classified controllers and functions. Each network segment is redundant and can function independently.

Operator workstations and historians are associated with each segment and also operate independently.

For reliability and avoidance of AOO failures, the non-safety plant mechanical systems are controlled by triplicated controllers.

Workstations, controllers, gateways and historians are always SC3 quality.

Network segmentation is transparent in normal operation.

The UDH bus segmentation and the system architectures within a Safety Class represent an initial decomposition of the overall I&C systems based on safety classification. Further refinement of the bus arrangement and system decomposition (based on functional grouping within a safety class and equipment selection), will be performed as the I&C Architecture design process progresses.

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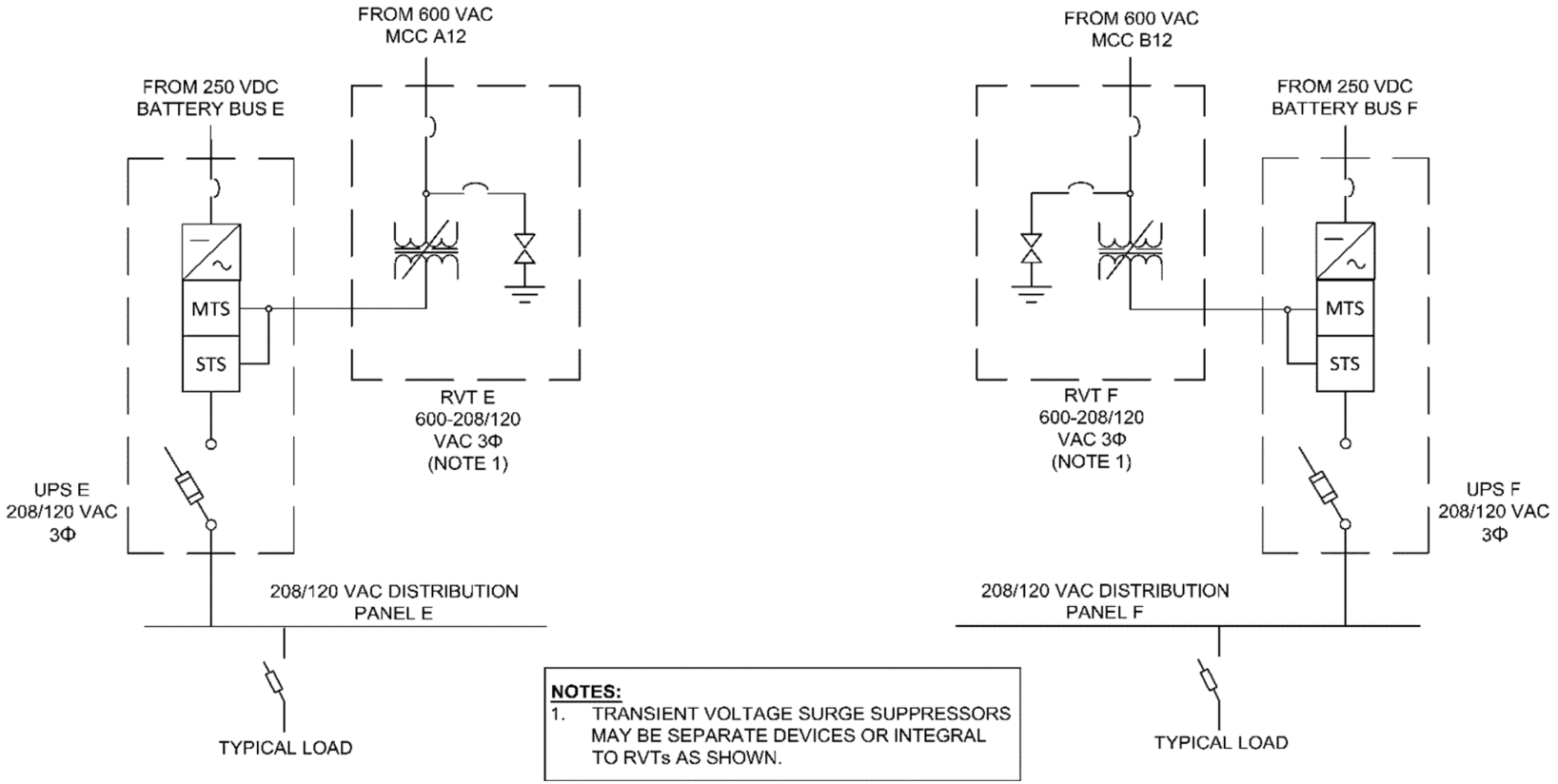
Chapter 8 – Electric Power

Chapter 8 Contents Includes:

- Offsite and Onsite Power Systems
- Uninterruptable Power Supply



BWRX-300 Design Feature

- The BWRX-300 does not require AC power to reach a safe, stable shutdown following an Anticipated Operational Occurrence or a Design Basis Accident
- Stored energy via batteries is provided:
  1. Ensure that all functions that maintain the plant in a safe condition are available
  2. Monitoring equipment can be powered for at least 72 hours following a Design Basis Accident.

Chapter 9- Auxiliary Systems

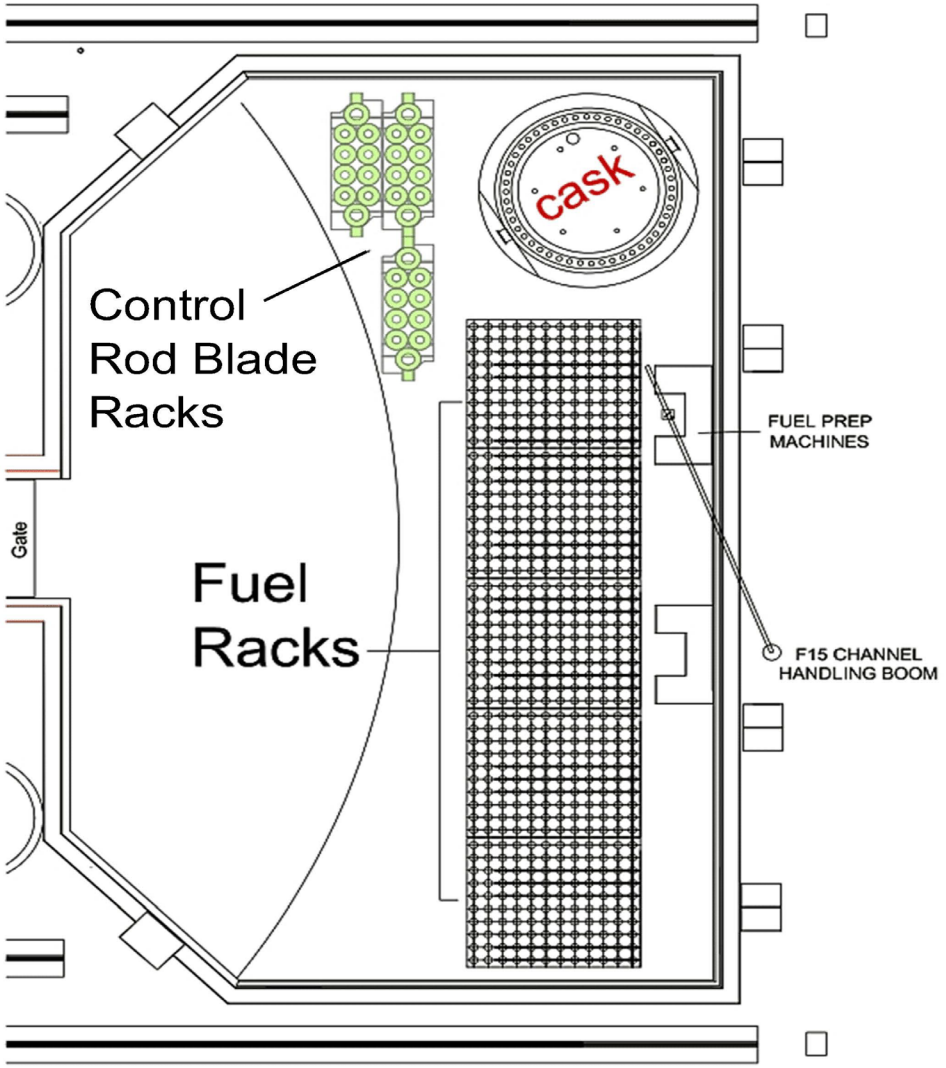


Figure 9.1-2 Fuel Pool Arrangement

BWRX-300 Design Feature

- Multiple credited Ultimate Heat Sinks
- BWRX-300 water is strategically located during operations in SC1 pools to last for 7 days until FLEX/EME replenishment

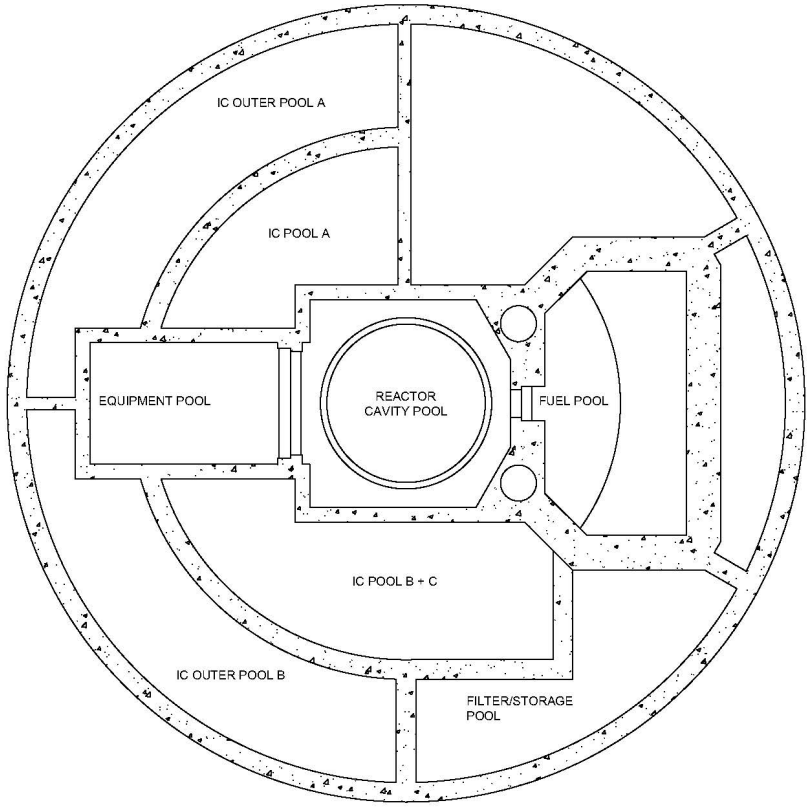


Figure 9.2-3 Ultimate Heat Sink Pools Simplified Diagram

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Chapter 10 – Steam and Power Conversion System

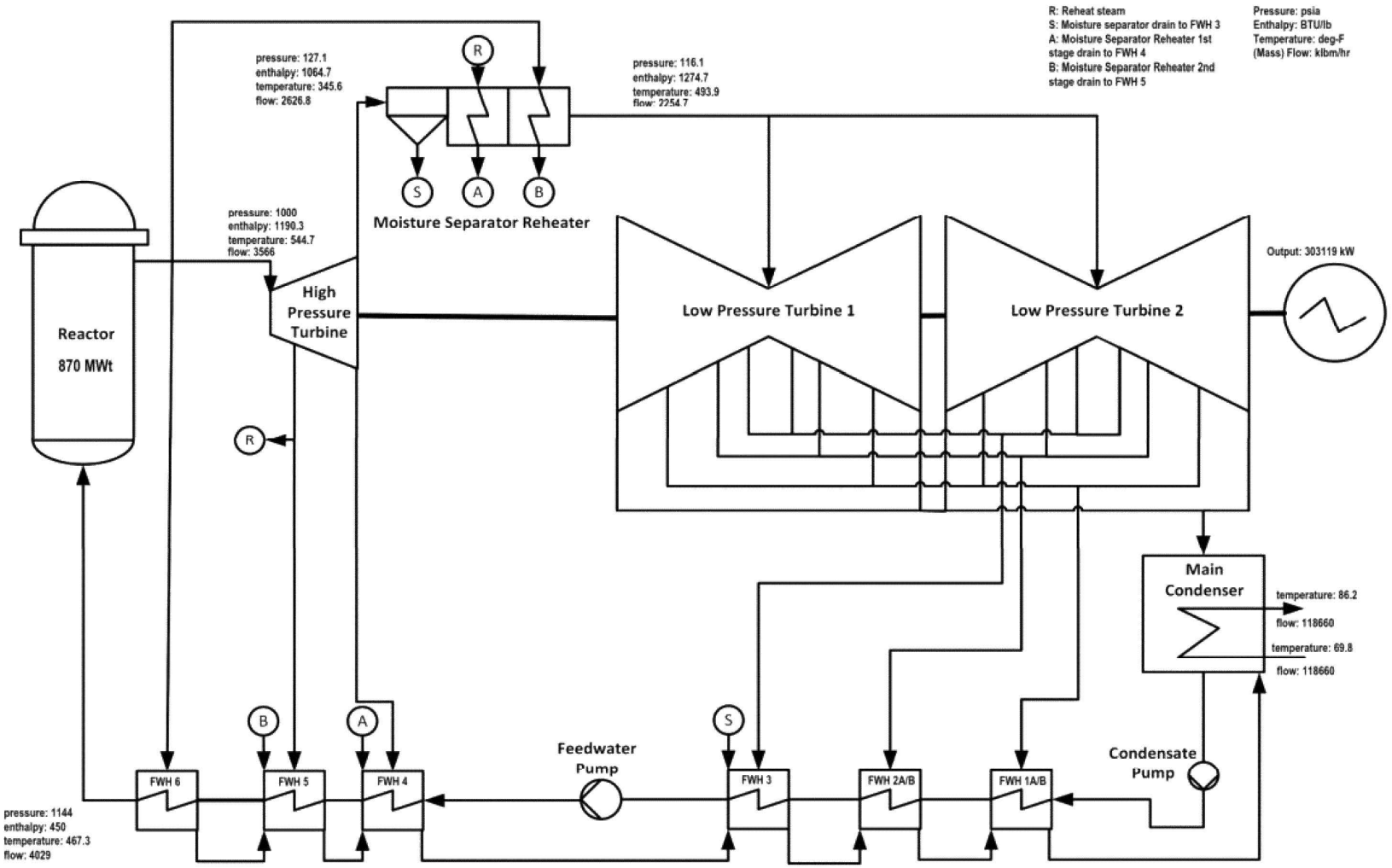

Figure 10.1-1 Simplified Flow Diagram with Representative Heat Balance of the Steam and Power Conversion System

Chapter Contents Includes:

- Turbine Generator
- Main Steam System
- Additional Steam and Power Conversion Systems

Chapter 11 – Radioactive Waste Management

Chapter Contents Includes:

- Source Terms
- Liquid Waste Management System
- Gaseous Waste Management System
- Solid Waste Management System
- Process Radiation Monitoring

Chapter 12 –Radiation Protection

Chapter Contents Includes:

- Occupational Radiation Exposure ALARA
- Radiation Sources
- Radiation Protection Design Features
- Dose Assessment
- Health Physics Program

Chapter 13 – Conduct of Operations

Chapter Contents Includes:

- Organizational Structure
- Training
- Emergency Preparedness
- Operational Programs
- Plant Procedures
- Physical Security
- Fitness for Duty

Chapter 14 – Initial Test Program

Chapter Contents Includes:

- Scope of Initial Test Program
- Design Features that are Specific, Unique or First of a Kind
- Conformance of Test Programs with Regulatory Guides
- Test Program Schedule
- Augmenting Staff During Test Program

Chapter 15 – Safety Analyses

Chapter Contents Includes:

- Considerations of the BWRX-300 Safety Analysis
- Identification, Categorization and Grouping of Postulated Initiating Events and Accident Scenarios
- Safety Objectives and Acceptance Criteria
- Human actions
- Deterministic Safety Analyses
- Probabilistic Safety Assessment
- Results of Deterministic Safety Analyses and Probabilistic Safety Assessment

BWRX-300 Design Feature

- Re-characterization of Safety Related/Non-Safety Related to the Safety Class 1, 2, 3, N structure

Chapter 16 – Technical Specifications

Chapter Contents Includes:

- Preliminary Safety Analysis Report Requirements
- Regulatory Guidance for Preliminary Technical Specification Contents
- Conformance with Industry Standards and Practices
- Methodology for Selection of Preliminary Technical Specification Contents
- Results of Selection Methodology Application

Chapter 17 – Quality Assurance

Chapter Contents Includes:

- Quality Assurance During Design and Construction Phases
- Design Reliability Assurance Program
- Quality Assurance Program Description-New Reactor Applicants

Topical Report - NNP-TR-001-NP

- Quality Assurance Program Description for TVA New Nuclear incorporated by reference.
- Final Safety Evaluation contains Limitations and Conditions (PSAIs) and are disposition in Chapter 17.5

Enclosure 4 – Exemptions and Variances

Exemptions

- Reactor Vessel Material Surveillance Program

Variances

- CRN ESP VAR 2.0-1 Site Grade Level
- CRN ESP VAR 2.0-2 Ground Water Level
- CRN ESP VAR 2.0-3 Single Unit Thermal Megawatts
- CRN ESP VAR 2.1-1 2020 Census Data
- CRN ESP VAR 2.2-1 Nearby Industrial, Transportation and Military Facilities
- CRN ESP VAR 2.4.12-1 Groundwater Level Models
- CRN ESP VAR 2.4.12-1 C-1Groundwater Vistas Version 8.19 Build 4

Questions/Comments/Actions

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