DG-1145: Combined License Applications for Nuclear Power Plants (LWR Edition)

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Section C.I.5, Reactor Coolant System and Connected Systems

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Technical Branch	SRP Section
• Engineering Mechanics (EEMB)	[5.2.1.1, 5.2.1.2]
• BWR Systems (SBWB)	[5.2.2,5.4,5.4.6,5.4.7,5.4.12]
• PWR Systems (SPWB)	[5.2.2,5.4,5.4.7,5.4.11,5.4.12]
• Piping & NDE (CPNB)	[5.2.3,5.2.4,5.4.8]
• Balance-of-Plant (SBPB)	[5.2.5]
• Vessels & Internals Integrity (CVIB)	[5.3.1,5.3.2,5.3.3]
• Flaw Evaluation & Welding (CFEB)	[5.4.1.1]
• SG Tube Integrity & Chemical Eng (CSGB)	[5.4.2.1,5.4.2.2]

Section C.I.5, Reactor Coolant System and Connected Systems

COL Application Final Safety Analysis Report (FSAR) Chapter 5 of FSAR:

- Reactor coolant system (RCS) and systems to which it connects
- RCS and pressure-containing appendages out to and including isolation valving which is the "reactor coolant pressure boundary" (RCPB) as defined in 10 CFR 50.2(v)
- Evaluations, with necessary supporting material, should demonstrate
  - Adequate to accomplish intended objective(s)
  - Maintain integrity under normal and accident conditions
- Information sufficient to permit independent determination that evaluations are correct and complete and all necessary evaluations have been performed

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COL Applications Referencing a Certified Design or Certified Design & Early Site Permit

- C.III.1, Chapter 5, Reactor Coolant System & Connected Systems
  - Additional information needed for application referencing CD
  - Topics for which additional information is needed are identified by [*] on the following slides
- C.III.2, Chapter 5, Reactor Coolant System & Connected Systems
  - Additional information needed for application referencing CD & ESP
  - Note: needed information is identical to that identified in C.III.1, Chapter 5

Section C.I.5, Reactor Coolant System and Connected Systems

5.1 Summary Description
- 5.1.1 Schematic Flow Diagram
- 5.1.2 Piping and Instrumentation Diagram
- 5.1.3 Elevation Drawing

5.2 Integrity of Reactor Coolant Pressure Boundary
- 5.2.1 Compliance with Codes and Code Cases
  - 5.2.1.1 Compliance with 10 CFR 50.55a **[SRP 5.2.1.1]**
  - 5.2.1.2 Applicable Code Cases **[SRP 5.2.1.2]**

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5.2.2 Overpressure Protection **[SRP 5.2.2]**
- 5.2.2.1 Design Bases
- 5.2.2.2 Design Evaluation
- 5.2.2.3 Piping and Instrumentation Diagrams
- 5.2.2.4 Equipment and Component Description
- 5.2.2.5 Mounting of Pressure-Relief Devices
- 5.2.2.6 Applicable Codes and Classification
- 5.2.2.7 Material Specification
- 5.2.2.8 Process Instrumentation
- 5.2.2.9 System Reliability
- 5.2.2.10 Testing and Inspection **[*]**

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5.2.3 RCPB Materials **[SRP 5.2.3]**
- 5.2.3.1 Material Specifications
- 5.2.3.2 Compatibility with Reactor Coolant **[*]**
- 5.2.3.3 Fabrication and Processing of Ferritic Materials
- 5.2.3.4 Fabrication and Processing of Austenitic Stainless Steels
- 5.2.3.5 Prevention of PWSCC for Nickel-Based Alloys (PWRs only)

5.2.4 Inservice Inspection and Testing of RCPB **[SRP 5.2.4]**
- 5.2.4.1 Inservice Inspection and Testing Program **[*]**
- 5.2.4.2 Preservice Inspection and Testing Program **[*]**

5.2.5 RCPB Leakage Detection **[SRP 5.2.5]**

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5.3 Reactor Vessels
- 5.3.1 Reactor Vessel Materials **[SRP 5.3.1]**
  - 5.3.1.1 Material Specifications
  - 5.3.1.2 Special Processes for Manufacturing & Fabrication
  - 5.3.1.3 Special Methods for Nondestructive Examination
  - 5.3.1.4 Special Controls for Ferritic and Austenitic Stainless Steels
  - 5.3.1.5 Fracture Toughness
  - 5.3.1.6 Material Surveillance **[*]**
  - 5.3.1.7 Reactor Vessel Fasteners

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5.3.2 Pressure-Temperature Limits, PTS, ... **[SRP 5.3.2]**
- 5.3.2.1 Limit Curves
- 5.3.2.2 Operating Procedures [*]
- 5.3.2.3 Pressurized Thermal Shock (PWRs only)
- 5.3.2.4 Upper Shelf Energy

5.3.3 Reactor Vessel Integrity **[SRP 5.3.3]**
- 5.3.3.1 Design
- 5.3.3.2 Materials of Construction
- 5.3.3.3 Fabrication Methods
- 5.3.3.4 Inspection Requirements [*]
- 5.3.3.5 Shipment and Installation [*]
- 5.3.3.6 Operating Conditions [*]
- 5.3.3.7 Inservice Surveillance [*]
- 5.3.3.8 Threaded Fasteners

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5.4 Component and Subsystem Design **[SRP 5.4]**
- Address each principal component or subsystem
- Provide respective design bases, description, evaluation, and tests and inspections
- Provide separate subsections (5.4.1 through 5.4.n) appropriate to specific reactor type and design
- Note: certain subsections in guidance may be "not applicable" and additional subsections may be necessary
  - e.g., Core Makeup Tanks, Automatic Depressurization System Valves, Passive Residual Heat Removal Heat Exchanger, Isolation Condenser System, Gravity-Driven Cooling System

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5.4.1 Reactor Coolant Pumps
- 5.4.1.1 Pump Flywheel Integrity (PWR) **[SRP 5.4.1.1]**

5.4.2 Steam Generators (PWR)
- 5.4.2.1 Steam Generator Materials **[SRP 5.4.2.1] [*]**
- 5.4.2.2 Steam Generator Tube Integrity Program **[SRP 5.4.2.2] [*]**

5.4.3 Reactor Coolant Piping

5.4.4 [Reserved]

5.4.5 [Reserved]

5.4.6 Reactor Core Isolation Cooling System (BWR) **[SRP 5.4.6]**
- 5.4.6.1 Design Bases
- 5.4.6.2 System Design
- 5.4.6.3 Performance Evaluation

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5.4.7 Residual Heat Removal System **[SRP 5.4.7]**
- 5.4.7.1 Design Bases
- 5.4.7.2 System Design
- 5.4.7.3 Performance Evaluation

5.4.8 Reactor Water Cleanup System (BWR) **[SRP 5.4.8]**
- 5.4.8.1 Design Bases
- 5.4.8.2 System Description
- 5.4.8.3 Performance Evaluation

5.4.9 [Reserved] – Isolation Condenser System

5.4.10 [Reserved]

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5.4.11 Pressurizer Relief Tank (PWR) **[SRP 5.4.11]**
- 5.4.11.1 Design Bases
- 5.4.11.2 System Description
- 5.4.11.3 Performance Evaluation
- 5.4.11.4 Instrumentation

5.4.12 Reactor Coolant System High Point Vents **[SRP 5.4.12]**
- 5.4.12.1 Design Bases
- 5.4.12.2 System Design
- 5.4.12.3 Performance Evaluation

5.4.13 [Reserved]

5.4.14 [Reserved]

Section C.I.6, Engineering Safety Features

- Technical basis
- Referencing a certified design as a COL applicant
- Pre-Workshop Comments
- Q&A

Section C.I.6, Engineering Safety Features

Technical basis:

- Regulatory Guide 1.70, Rev. 3, Nov. 1978
- ABWR, System 80+, AP1000/600, (ESBWR) Reviews
- Standard Review Plan

Section C.I.6

COL Applications Referencing a Certified Design (Section C.III.1, Chapter 6)

Note: COL applicants need to provide additional information for topics identified by [*] on the following slides

Section C.I.6, Engineering Safety Features

6.1 Engineered Safety Feature Materials*

- 6.1.1 Metallic Materials
  - 6.1.1.1 Materials Selection and Fabrication* (Relooking at this)
  - 6.1.1.2 Composition and Compatibility of Core Cooling Coolants and Containment Sprays*
- 6.1.2 Organic Materials*

Section C.I.6, Engineering Safety Features

6.2 Containment Systems

- 6.2.1 Containment Functional Design
- 6.2.2 Containment Heat Removal Systems.
- 6.2.3 Secondary Containment Functional Design
- 6.2.4 Containment Isolation System
- 6.2.5 Combustible Gas Control in Containment
- 6.2.6 Containment Leakage Testing*
  - 6.2.6.1 Containment integrated Leakage Rate Test*
  - 6.2.6.2 Containment Penetration Leakage Rate Test*
  - 6.2.6.3 Containment Isolation Valve Leakage Rate Test*
  - 6.2.6.4 Scheduling and Reporting of Periodic Tests*
  - 6.2.6.5 Special Testing Requirements*
- 6.2.7 Fracture Prevention of Containment Pressure Vessel

Section C.I.6, Engineering Safety Features

6.3 Emergency Core Cooling System*

6.4 Habitability Systems

6.5 Fission Product Removal and Control Systems

- 6.5.1 ESF Filter Systems
- 6.5.2 Containment Spray Systems
- 6.5.3 Fission Product Control Systems and Structures
- 6.5.4 Ice Condenser as a Fission Product
- 6.5.5 Pressure Suppression Pool as a Fission Product Cleanup System

Section C.I.6, Engineering Safety Features

6.6 In-service Inspection of Class 2 and 3 Components*

- 6.6.1 Components Subject to Examination
- 6.6.2 Accessibility
- 6.6.3 Examination Techniques and Procedures*
- 6.6.4 Inspection Intervals*
- 6.6.5 Examination Categories and Requirements*
- 6.6.6 Evaluation of Examination Results*
- 6.6.7 System Pressure Tests*
- 6.6.8 Augmented In-service Inspection to Protect Against Postulated Piping Failures*

Section C.I.6, Engineering Safety Features

6.7 Main Steam Line Isolation Valve Leakage Control Steam (BWRs)

6.8 Reactor Coolant Depressurization System (PWR)

- Incorrectly included in C.III.1. This section is not included in C.I.6. Staff is still determining the need for this.

Pre-workshop Questions/Comments

- **We have not yet formally addressed the pre-workshop questions and comments**
  - **Staff may be able to discuss them now**
- **Q&A Session on:**
  - Pre-workshop comments
  - Section C.I.6
  - Section C.III.1, Chapter 6
  - Section C.III.2, Chapter 6