Table of Contents

5.0 Reactor Coolant System and Connected Systems 5–2

5.1 Summary Description 5–2

5.2 Integrity of the Reactor Coolant Pressure Boundary 5–2

5.2.1 Compliance with Codes and Code Cases 5–2
5.2.2 Overpressure Protection 5–2
5.2.3 Reactor Coolant Pressure Boundary Materials 5–2
5.2.4 Inservice Inspection and Testing of the RCPB 5–3
5.2.5 RCPB Leakage Detection 5–4
5.2.6 References 5–4

5.3 Reactor Vessel 5–4

5.3.1 Reactor Vessel Materials 5–4
5.3.2 Pressure-Temperature Limits, Pressurized Thermal Shock, and Charpy Upper-Shelf Energy Data and Analyses 5–5
5.3.3 Reactor Vessel Integrity 5–5
5.3.4 References 5–5

5.4 Component and Subsystem Design 5–6

5.4.1 Reactor Coolant Pumps 5–6
5.4.2 Steam Generators (PWR) 5–6
5.4.3 Reactor Coolant Piping 5–7
5.4.4 Not Used in U.S. EPR Design 5–8
5.4.5 Not Used in U.S. EPR Design 5–8
5.4.6 Not Used in U.S. EPR Design 5–8
5.4.7 Residual Heat Removal System 5–8
5.4.8 Not Used in U.S. EPR Design 5–8
5.4.9 Not Used in U.S. EPR Design 5–8
5.4.10 Pressurizer 5–8
5.4.11 Pressurizer Relief Tank 5–8
5.4.12 Reactor Coolant System High Point Vents 5–8
5.4.13 Safety and Relief Valves 5–8
5.4.14 Component Supports 5–8
5.4.15 References 5–8

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

5.0 REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS

This chapter of the U.S. EPR Final Safety Analysis Report (FSAR) is incorporated by reference with supplements as identified in the following sections.

5.1 SUMMARY DESCRIPTION

This section of the U.S. EPR FSAR is incorporated by reference.

5.2 INTEGRITY OF THE REACTOR COOLANT PRESSURE BOUNDARY

This section of the U.S. EPR FSAR is incorporated by reference with the following supplemental information.

5.2.1 COMPLIANCE WITH CODES AND CODE CASES

5.2.1.1 Compliance with 10 CFR 50.55a

The U.S. EPR FSAR includes the following COL Item in Section 5.2.1.1:

> A combined license (COL) applicant that references the U.S. EPR design certification will identify subsequent ASME Code editions or addenda that may be used and will determine the consistency of the U.S. EPR design with construction practices (including inspection and examination methods) reflected within subsequent code editions and addenda identified in the COL application.

This COL Item is addressed as follows:

The code of record for the design is the 2004 edition of the ASME Boiler and Pressure Vessel Code (no addenda). This code is consistent with the code established in U.S. EPR FSAR Section 5.2.1. No relief requests or alternatives are required.

5.2.1.2 Compliance with Applicable Code Cases

The U.S. EPR FSAR includes the following COL Item in Section 5.2.1.2:

> A COL applicant that references the U.S. EPR design certification will identify additional ASME code cases to be used.

This COL Item is addressed as follows:

No additional ASME code cases will be utilized.

5.2.2 OVERPRESSURE PROTECTION

No departures or supplements.

5.2.3 REACTOR COOLANT PRESSURE BOUNDARY MATERIALS

No departures or supplements.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

5.2.3.1 Material Specifications

The as-procured/as-built grade, type and final metallurgical conditions for reactor coolant pressure boundary components were not available at the time of this application. Any departures or differences between the as-procured/as-built grade, type and final metallurgical conditions for the reactor coolant pressure boundary materials from those listed in Table 5.2-2 of the U.S. EPR FSAR will be provided as an update to this document following procurement and fabrication of the reactor coolant pressure boundary components, and prior to fuel load.

5.2.3.2 Compatibility with Reactor Coolant

No departures or supplements.

5.2.3.3 Fabrication and Processing of Ferritic Materials

As-procured fracture toughness data for reactor coolant pressure boundary components (e.g., vessels, piping, pumps and valves) composed of ferritic materials was not available at the time of this application and will be provided as an update to this document following procurement of the reactor coolant pressure boundary components, and prior to fuel load.

5.2.3.4 Fabrication and Processing of Austenitic Stainless Steels

As-procured yield strength data for reactor coolant pressure boundary components (e.g., vessels, piping, pumps and valves) composed of austenitic stainless steel materials was not available at the time of this application and will be provided as an update to this document following procurement of the reactor coolant pressure boundary components, and prior to fuel load.

5.2.3.5 Prevention of Primary Water Stress-Corrosion Cracking for Nickel-Base Alloys

No departures or supplements.

5.2.3.6 Threaded Fasteners

No departures or supplements.

5.2.4 INSERVICE INSPECTION AND TESTING OF THE RCPB

The U.S. EPR FSAR includes the following COL Item in Section 5.2.4:

> A COL applicant that references the U.S. EPR design certification will identify the implementation milestones for the site-specific ASME Section XI preservice and inservice inspection program for the RCPB, consistent with the requirements of 10 CFR 50.55a(g). The program will identify the applicable edition and addenda of the ASME Section XI, and will identify any additional relief requests and alternatives to Code requirements.

This COL Item is addressed as follows:

Preservice inspection and inservice inspection programs for the RCPB meet the requirements of 10 CFR 50.55a(g) (CFR, 2008), and comply with ASME Boiler and Pressure Vessel Code, Section XI, 2004 (ASME, 2004) edition. This code is consistent with that established in U.S. EPR FSAR Section 5.2.4. No relief requests or alternatives are required. The implementation milestones for the site-specific ASME Section XI preservice and inservice inspection programs for the RCPB are identified in Table 13.4-1.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

The initial inservice inspection program shall incorporate the latest edition and addenda of the ASME Boiler and Pressure Vessel Code approved in 10 CFR 50.55a(b) on the date 12 months before initial fuel load. Inservice examination of components and system pressure tests conducted during successive 120-month inspection intervals must comply with the requirements of the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b) 12 months before the start of the 120-month inspection interval (or the optional ASME Code cases listed in Regulatory Guide 1.147 (NRC, 2007), that are incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed in 10 CFR 50.55a(b)).

Should relief requests be required, they will be developed through the regulatory process and submitted to the NRC for approval in accordance with 10 CFR 50.55a(g)(5). The relief requests shall include appropriate justifications and proposed alternative inspection methods.

5.2.5 RCPB LEAKAGE DETECTION

No departures or supplements.

5.2.6 REFERENCES

{**ASME, 2004.** Rules for Inservice Inspection of Nuclear Power Plant Components, ASME Boiler and Pressure Vessel Code, Section XI, American Society of Mechanical Engineers, 2004.

CFR, 2008. Codes and Standards, Title10, Code of Federal Regulations, Part 50.55a, U.S. Nuclear Regulatory Commission, 2008.

NRC, 2007. Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1, Regulatory Guide 1.147, Revision 15, U.S. Nuclear Regulatory Commission, October 2007.}

5.3 REACTOR VESSEL

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

5.3.1 REACTOR VESSEL MATERIALS

No departures or supplements.

5.3.1.1 Material Specifications

No departures or supplements.

5.3.1.2 Special Processes Used for Manufacturing and Fabrication

No departures or supplements.

5.3.1.3 Special Methods for Nondestructive Examination

No departures or supplements.

5.3.1.4 Special Controls for Ferritic and Austenitic Stainless Steels

No departures or supplements.

5.3.1.5 Fracture Toughness

No departures or supplements.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

5.3.1.6 Material Surveillance

The U.S. EPR FSAR includes the following COL Item in Section 5.3.1.6:

> A COL applicant that references the U.S. EPR design certification will identify the implementation milestones for the material surveillance program.

This COL Item is addressed as follows:

The implementation milestones for the Reactor Vessel material surveillance program are provided in Table 13.4-1.

5.3.1.7 Reactor Vessel Fasteners

No departures or supplements.

5.3.2 PRESSURE-TEMPERATURE LIMITS, PRESSURIZED THERMAL SHOCK, AND CHARPY UPPER-SHELF ENERGY DATA AND ANALYSES

No departures or supplements.

5.3.2.1 Pressure-Temperature Limit Curves

The U.S. EPR FSAR includes the following COL Item in Section 5.3.2.1:

> A COL applicant that references the U.S. EPR design certification will provide a plant-specific pressure and temperature limits report (PTLR), consistent with an approved methodology.

This COL Item is addressed as follows:

A plant-specific PTLR will be provided in accordance with {NMP3NPP} Technical Specification 5.6.4, "Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)," and will be based on the methodology provided in ANP-10283P (AREVA, 2007).

5.3.2.2 Operating Procedures

No departures or supplements.

5.3.2.3 Pressurized Thermal Shock

No departures or supplements.

5.3.2.4 Upper-Shelf Energy

No departures or supplements.

5.3.3 REACTOR VESSEL INTEGRITY

No departures or supplements.

5.3.4 REFERENCES

{**AREVA, 2007.** Reactor Coolant System (RCS) Pressure and Temperature Limits Report (PTLR), ANP-10283P, AREVA NP, 2007.}

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

5.4 COMPONENT AND SUBSYSTEM DESIGN

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

5.4.1 REACTOR COOLANT PUMPS

No departures of supplements

5.4.2 STEAM GENERATORS (PWR)

No departures or supplements.

5.4.2.1 Design Bases

No departures or supplements.

5.4.2.2 Design Description

No departures or supplements.

5.4.2.3 Design Evaluation

No departures or supplements.

5.4.2.4 Steam Generator Materials

No departures or supplements.

5.4.2.5 Steam Generator Program

No departures or supplements.

5.4.2.5.1 Steam Generator Design

No departures or supplements.

5.4.2.5.2 Steam Generator Program Elements

No departures or supplements.

5.4.2.5.2.1 Degradation Assessment

No departures or supplements.

5.4.2.5.2.2 Tube Inspection

The U.S. EPR FSAR includes the following COL Item in Section 5.4.2.5.2.2:

> A COL applicant that references the U.S. EPR design certification will identify the edition and addenda of ASME Section XI applicable to the site-specific SG inspection program.

This COL item is addressed as follows.

The initial Steam Generator Tube Inspection Program will comply with ASME Boiler and Pressure Vessel Code, Section XI, 2004 edition (ASME, 2004). This code is consistent with that established in U.S. EPR FSAR Section 5.4.2. No relief requests or alternatives are required.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

The Steam Generator Tube Inspection Program shall incorporate the latest edition and addenda of the ASME Boiler and Pressure Vessel Code approved in 10 CFR 50.55a(b) (CFR, 2008) on the date 12 months before initial fuel load. Inservice examination of components and system pressure tests conducted during successive 120-month inspection intervals must comply with the requirements of the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b) 12 months before the start of the 120-month inspection interval (or the optional ASME Code cases listed in Regulatory Guide 1.147 (NRC, 2007), that are incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed in 10 CFR 50.55a(b)).

Should relief requests be required, they will be developed through the regulatory process and submitted to the NRC for approval in accordance with 10 CFR 50.55a(g)(5). The relief requests shall include appropriate justifications and proposed alternative inspection methods.

5.4.2.5.2.3 Tube Integrity Assessment

No departures or supplements.

5.4.2.5.2.4 SG Tube Plugging

No departures or supplements.

5.4.2.5.2.5 Primary-to-Secondary Leak Monitoring

No departures or supplements.

5.4.2.5.2.6 Maintenance of SG Secondary Side Integrity

No departures or supplements.

5.4.2.5.2.7 Secondary Side Water Chemistry

No departures or supplements.

5.4.2.5.2.8 Primary Side Water Chemistry

No departures or supplements.

5.4.2.5.2.9 Foreign Material Exclusion

No departures or supplements.

5.4.2.5.2.10 Contractor Oversight

No departures or supplements.

5.4.2.5.2.11 Self Assessment

No departures or supplements.

5.4.2.5.3 Reporting

No departures or supplements.

5.4.3 REACTOR COOLANT PIPING

No departures or supplements.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

5.4.4 NOT USED IN U.S. EPR DESIGN

No departures or supplements.

5.4.5 NOT USED IN U.S. EPR DESIGN

No departures or supplements.

5.4.6 NOT USED IN U.S. EPR DESIGN

No departures or supplements.

5.4.7 RESIDUAL HEAT REMOVAL SYSTEM

No departures or supplements.

5.4.8 NOT USED IN U.S. EPR DESIGN

No departures or supplements.

5.4.9 NOT USED IN U.S. EPR DESIGN

No departures or supplements.

5.4.10 PRESSURIZER

No departures or supplements.

5.4.11 PRESSURIZER RELIEF TANK

No departures or supplements.

5.4.12 REACTOR COOLANT SYSTEM HIGH POINT VENTS

No departures or supplements.

5.4.13 SAFETY AND RELIEF VALVES

No departures or supplements.

5.4.14 COMPONENT SUPPORTS

No departures or supplements.

5.4.15 REFERENCES

{**ASME, 2004.** Rules for Inservice Inspection of Nuclear Power Plant Components, ASME Boiler and Pressure Vessel Code, Section XI, American Society of Mechanical Engineers, 2004.

CFR, 2008. Codes and Standards, Title10, Code of Federal Regulations, Part 50.55a, U.S. Nuclear Regulatory Commission, 2008.

NRC, 2007. Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1, Regulatory Guide 1.147, Revision 15, U.S. Nuclear Regulatory Commission, October 2007.}

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED