

## 5.0 REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS

The reactor coolant system (RCS) and connected systems include those systems and components that contain or transport fluids coming from or going to the reactor core. These systems form a major portion of the reactor coolant pressure boundary (RCPB). This chapter provides information regarding the RCS and pressure-containing appendages out to and including isolation valves. This grouping of components is defined as the RCPB, as defined in 10 CFR 50.2(v).

### 5.1 Summary Description

This section of the North Anna 3 combined license (COL) Final Safety Analysis Report (FSAR) incorporates by reference, with no departures or supplements, Section 5.1, "Summary Description," of the Economic Simplified Boiling-Water Reactor (ESBWR) design control document (DCD), Revision 5. The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the application and considered the referenced DCD. The staff's review confirmed there is no outstanding information, outside of the DCD, related to this section.

The staff is reviewing Section 5.1 of the ESBWR DCD on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the summary description of the reactor coolant and connected systems incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff safety evaluation report (SER) on the design certification application (DCA) for the ESBWR. The SER on the ESBWR is not yet complete and being tracked as part of Open Item [1-1]. The staff will update Section 5.1 of this SER to reflect the final disposition of the DCA.

### 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*

###### 5.2.1.1.1 Introduction

This section of the North Anna 3 COL FSAR addresses the American Society of Mechanical Engineers (ASME) Code edition and addenda to be used at North Anna 3, in order to show compliance with NRC regulations in 10 CFR 50.55a.

###### 5.2.1.1.2 Summary of Application

Section 5.2.1.1 of the North Anna 3 COL FSAR incorporates by reference, with supplemental information, Section 5.2.1.1, "Compliance with 10 CFR 50.55a," of the ESBWR DCD, Revision 5.

#### Supplemental Information

- STD SUP 5.2-2

In FSAR Revision 1, Section 5.2.1.1, the applicant provided supplemental information that preservice inspection (PSI) and inservice inspection (ISI) of the RCPB is conducted in accordance with the applicable edition and addenda of the ASME Boiler and Pressure Vessel

(BPV) Code, Section XI, required by 10 CFR 50.55a. FSAR Section 5.2.1.1 also states that, as described in ESBWR DCD Tier 2, “Section 3.9.6 for pumps and valves, and in DCD Section 3.9.3.7.1 for dynamic restraints, preservice and inservice testing of RCPB components is in accordance with the edition and addenda of the ASME OM Code required by 10 CFR 50.55a.”

#### **5.2.1.1.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference is addressed within the Final Safety Evaluation Report (FSER) related to the ESBWR DCD.

NRC regulations in 10 CFR Parts 50 and 52 provide the regulatory basis for NRC staff review of the information provided in the North Anna 3 COL application. For example, NRC regulations in 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 1, “Quality Standards and Records,” require that nuclear power plant structures, systems, and components (SSCs) important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed. Further, NRC regulations in 10 CFR 50.55a, as related to the establishment of the minimum quality standards for the design, fabrication, erection, construction, testing, and inspection of nuclear power plant components, require conformance with appropriate editions of published industry codes and standards.

NRC staff followed the guidance in Standard Review Plan (SRP) Section 5.2.1.1, “Compliance with the Codes and Standards Rule, 10 CFR 50.55a,” and Regulatory Guide (RG) 1.206 in evaluating North Anna 3 FSAR Section 5.2.1.1 for compliance with NRC regulations.

#### **5.2.1.1.4 Technical Evaluation**

The NRC staff reviewed Section 5.2.1.1 of the North Anna 3 COL FSAR and the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to the review topic.<sup>1</sup> The NRC staff’s review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to compliance with the Codes and Standards Rule, 10 CFR 50.55a.

Section 5.2.1.1 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff’s technical evaluation of the information incorporated by reference related to compliance with the Codes and Standards Rule, 10 CFR 50.55a will be documented in the staff SER on the ESBWR DCA.

The staff reviewed the information in the COL FSAR as follows:

The FSAR incorporates by reference Section 5.2.1.1 of the ESBWR DCD, which refers to Table 3.2-1, “Classification Summary,” and Table 3.2-3, “Quality Group Designations – Codes and Industry Standards,” of the ESBWR DCD for the ASME Code applied to components in the ESBWR design with respect to Section III of the ASME BPV Code. In request for additional information (RAI) 05.02.01.01-1, NRC staff requested that Dominion address the application of

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<sup>1</sup> See Section 1.2.2, “Finality of Referenced NRC Approvals,” for a discussion on the staff’s review related to verification of the scope of information to be included within a COL application that references a design certification.

other sections of the ASME BPV Code and the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code)) in its implementation of the ESBWR reactor design. In response to this RAI, by letter dated September 11, 2008, the applicant stated that the FSAR would be revised to provide references to the appropriate sections that discuss compliance with the ASME BPV Code, Section XI, and the ASME OM Code. As a result, Revision 1 of FSAR Section 5.2.1.1 states that the and ISI of the RCPB will be conducted in accordance with the applicable edition and addenda of the ASME BPV Code, Section XI, required by 10 CFR 50.55a as described in FSAR Section 5.2.4. FSAR Section 5.2.1.1 also states that preservice and inservice testing (IST) of the RCPB components will be in accordance with the edition and addenda of the ASME OM Code required by 10 CFR 50.55a as described in DCD Section 3.9.6, for pumps and valves and DCD Section 3.9.3.7.1, for dynamic restraints. NRC staff has verified these revisions and finds that the reference to the applicable sections of the ESBWR DCD for the application of appropriate ASME Code editions and addenda is consistent with NRC regulations, and therefore is acceptable. Therefore, this RAI is closed.

#### Interfaces for Standard Design

ESBWR DCD Tier 2, Section 1.8, "Interfaces with Standard Design," identifies site-specific interfaces with the standard ESBWR design. NRC staff reviewed the North Anna 3 applicant's proposal to satisfy the interfacing requirements with the standard design of the ESBWR design using the review procedures described in SRP Section 5.2.1.1. The staff finds that the applicant's consideration of design interface items to be acceptable based on compliance with NRC regulations in 10 CFR 50.55a and 10 CFR Part 50, Appendix A, GDC 1.

##### **5.2.1.1.5 Post Combined License Activities**

There are no post COL activities related to this section.

##### **5.2.1.1.6 Conclusion**

The NRC staff reviewed the application and the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to compliance with the Codes and Standards Rule, 10 CFR 50.55a, and there is no outstanding information expected to be addressed in the COL FSAR related to this section.

The staff is reviewing Section 5.2.1.1 of the ESBWR DCD on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to compliance with the Codes and Standards Rule, 10 CFR 50.55a, incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and being tracked as part of Open Item [1-1]. The staff will update Section 5.2.1.1 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the information presented with the North Anna 3 COL FSAR, Revision 1 is acceptable and meets the requirements of the Codes and Standards Rule, 10 CFR 50.55a.

## **5.2.1.2 Applicable Code Cases**

### **5.2.1.2.1 Introduction**

This section of the North Anna 3 COL FSAR addresses ASME Code Cases. This section also addresses NRC RGs that indicate the acceptance of ASME Code Cases with or without conditions. In general, a Code Case is developed by ASME based on inquiries from the nuclear industry associated with Code clarification, modification or alternate to the Code. All Code Cases will remain valid and available for use until annulled by the ASME BPV Standards Committee. ASME Code Cases acceptable to the NRC staff are published in RG 1.84, "Design and Fabrication Code Case Acceptability, ASME Section III, Division 1", RG 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1", and RG 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code", in accordance with requirements of 10 CFR 50.55a(b)(4), 10 CFR 50.55a(b)(5) and 10 CFR 50.55(b)(6).

### **5.2.1.2.2 Summary of Application**

Section 5.2 of the North Anna 3 COL FSAR incorporates by reference, with supplemental information, Section 5.2.1.2, "Applicable Code Cases," of the ESBWR DCD, Revision 5.

#### Supplemental Information

- STD SUP 5.2-3

In FSAR Section 5.2.1.2, the applicant provided supplemental information stating that RG 1.192 lists those ASME OM Code Cases that are acceptable to NRC staff for use in the preservice and IST of pumps, valves, and dynamic restraints in light water cooled nuclear power plants.

### **5.2.1.2.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the DCD.

NRC regulations in 10 CFR Parts 50 and 52 provide the regulatory basis for the NRC staff review of the information in the North Anna 3 COL application. For example, 10 CFR Part 50, Appendix A, GDC 1 requires that nuclear power plant SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed. Further, NRC regulations in 10 CFR 50.55a, as related to the establishment of the minimum quality standards for the design, fabrication, erection, construction, testing, and inspection of nuclear power plant components, require conformance with appropriate editions of published industry codes and standards.

As one acceptable means of meeting the applicable NRC regulations, RG 1.84 lists ASME BPV Code, Section III Code Cases related to design, fabrication, materials, and testing, which are acceptable with applicable conditions for implementation at nuclear power plants. RG 1.147 lists ASME BPV Code, Section XI Code Cases, which are acceptable with applicable conditions for use in the ISI of nuclear power plant components and their supports. RG 1.192 lists Code Cases related to the ASME OM Code for operation and maintenance of nuclear power plant components, which are acceptable with applicable conditions for implementation at nuclear power plants.

NRC staff followed the guidance in SRP Section 5.2.1.2, "Applicable Code Cases," and RG 1.206 in evaluating North Anna 3 FSAR Section 5.2.1.2 for compliance with NRC regulations.

#### **5.2.1.2.4 Technical Evaluation**

The NRC staff reviewed Section 5.2.1.2 of the North Anna 3 COL FSAR and the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to the review topic.<sup>1</sup> The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to applicable Code Cases.

Section 5.2.1.2 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to applicable Code Cases will be documented in the staff SER on the DCA for the ESBWR.

The staff reviewed the information in the COL FSAR as follows:

The North Anna 3 FSAR incorporates by reference Section 5.2.1.2 of the ESBWR DCD, which indicates that the various ASME Code Cases that may be applied to components in the ESBWR design are listed in Table 5.2-1 of the DCD. Section 5.2.1.2 also notes that NRC RG 1.84 and RG 1.147 provide a list of ASME Code design and fabrication Code Cases that have been generically approved by NRC staff. In RAI 05.02.01.02-1, the staff requested that the applicant discuss the use of any Code Cases related to the ASME BPV Code and OM Code not listed in the Table 5.2-1 of the ESBWR DCD. In the letter dated September 11, 2008, responding to this RAI, the applicant stated that no ASME Section III or Section XI Code Cases other than those listed in Table 5.2-1 of the ESBWR DCD had been identified as necessary. The applicant stated that other Code Cases approved by the NRC in RG 1.147 might be used during development and implementation of the preservice and inservice inspection programs. ESBWR DCD Section 3.9.3.7.1b, "Inspection, Testing, Repair, and/or Replacement of Snubbers," references RG 1.192 for use of Code Cases (such as Code Case OMN-13) applicable to IST of dynamic restraints, and Section 3.9.6.6, "10 CFR 50.55a Relief Requests and Code Cases," indicates that the IST program for the ESBWR reactor does not use any ASME Code Cases. The applicant stated further that other Code Cases approved by the NRC in RG 1.192 might be used during the development and implementation of the preservice and IST programs for North Anna 3. In the RAI response, the applicant indicated that the FSAR would be revised to reference RG 1.192 in Section 5.2.1.2. As a result, Revision 1 of FSAR Section 5.2.1.2 supplements the ESBWR DCD to include RG 1.192 in the list of regulatory guides to be used in meeting the requirements of GDC 1 and 10 CFR 50.55a to indicate that the ASME OM Code Cases that might be used at North Anna 3. The NRC staff finds that the description of the planned use of ASME Code Cases to be consistent with the applicable NRC regulations and RGs, including the planned revision to the North Anna 3 FSAR. Therefore, this RAI is closed.

In RAI 05.02.01.02-2, NRC staff requested that the applicant discuss its compliance with the requirements regarding the use of annulled Code Cases specified in 10 CFR 50.55a(b)(4), (5), and (6). In the September 11, 2008 response to this RAI, the applicant stated that design, fabrication, and construction of safety-related components will be conducted in accordance with ASME Code requirements specified in Table 3.2-1, "Classification Summary," and Table 3.2-3, "Quality Group Designations – Codes and Industry Standards" of the ESBWR DCD. The applicant also noted that Section 5.2.1.1 specifies that the ESBWR meets the relevant requirements of 10 CFR 50.55a. The applicant added that this includes applications of any

limitations and modifications to the applicable Code edition and addenda as may be specified in 10 CFR 50.55a, including any limitations regarding the use of annulled Code Cases. With respect to PSI/ISI and testing of safety-related components, the applicant stated that the applicable edition and addenda of the ASME Code as identified in 10 CFR 50.55a is used, subject to the limitations and modifications specified in 10 CFR 50.55a, including those limitations specified in 10 CFR 50.55a(b)(4), (5), and (6) regarding the use of Code Cases. NRC staff finds that the plans, described by Dominion for use of ASME Code Cases at North Anna 3, meet the applicable NRC regulations. Therefore, RAI 05.02.01.02-2 is resolved. In addition, if the applicant determines the need to apply other ASME Code Cases in the future, the applicant may apply those ASME Code Cases in accordance with their acceptance criteria in RG 1.84, 1.147, or 1.192, including any applicable conditions, or must request NRC authorization to use those Code Cases.

#### Interfaces for Standard Design

NRC staff reviewed the applicant's proposal to satisfy the interfacing requirements with the standard design of the ESBWR design using the review procedures described in SRP Section 5.2.1.2. The staff finds that the applicant's consideration of design interface items to be acceptable based on compliance with the NRC regulations in 10 CFR 50.55a and 10 CFR Part 50, Appendix A, GDC 1.

##### **5.2.1.2.5 Post Combined License Activities**

There are no post COL activities related to this section.

##### **5.2.1.2.6 Conclusion**

The NRC staff reviewed the application and the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to applicable Code Cases and there is no outstanding information expected to be addressed in the COL FSAR related to this Section.

The staff is reviewing Section 5.2.1.2 of the ESBWR DCD on Docket No. 52-010. The results of the staff's technical evaluation of the information related to applicable Code Cases, incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete and being tracked as part of Open Item [1-1]. The staff will update Section 5.2.1.2 of this SER to reflect the final disposition of the DCA.

In addition, NRC staff concludes that the information presented with the North Anna 3 COL FSAR is consistent with the NRC regulations regarding the use of ASME Code Cases and, therefore, is acceptable.

## **5.2.2 Overpressure Protection**

This section of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements Section 5.2.2, "Overpressure Protection," of the ESBWR DCD, Revision 5. NRC staff reviewed the application including the corresponding sections in the referenced DCD. Specifically, the staff reviewed the sections of the DCD to ensure that the information contained therein is appropriate for incorporation by reference and that any supplemental information to be provided by the COL applicant has been addressed in the COL application. The staff's review

confirmed there is no supplemental information to be provided in the COL application related to this section.

The staff is reviewing Section 5.2.2 of the ESBWR DCD on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to reactor overpressure protection incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete and being tracked as part of Open Item 1-1. The staff will update Section 5.2.2 of this SER to reflect the final disposition of the DCA.

### **5.2.3 Reactor Coolant Pressure Boundary Materials**

This section of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements Section 5.2.3, "Reactor Coolant Pressure Boundary Materials," of the ESBWR DCD, Revision 5. NRC staff reviewed the application including the corresponding sections in the referenced DCD. Specifically, the staff reviewed the sections of the DCD to ensure that the information contained therein is appropriate for incorporation by reference and that any supplemental information to be provided by the COL applicant has been addressed in the COL application. The staff's review confirmed there is no supplemental information to be provided in the COL application related to this section.

The staff is reviewing Section 5.2.3 of the ESBWR DCD on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to the RCPB materials incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete and being tracked as part of Open Item 1-1. The staff will update Section 5.2.3 of this SER to reflect the final disposition of the DCA.

### **5.2.4 Preservice and Inservice Inspection and Testing of Reactor Coolant Pressure Boundary**

#### **5.2.4.1 Introduction**

This section of the North Anna 3 COL FSAR discusses components that are part of the RCPB, which must be designed to permit periodic inspection and testing of important areas and features to assess their structural and leak tight integrity. ISI programs are based on the requirements of 10 CFR 50.55a, "Codes and Standards," in that Code Class 1 components, as defined in Section III of the ASME BPV Code, meet the applicable inspection requirements set forth in Section XI of the ASME Code, "Rules for Inservice Inspection of Nuclear Power Plant Components."

#### **5.2.4.2 Summary of Application**

Section 5.2 of the North Anna 3 COL FSAR incorporates by reference Section 5.2.4 of the ESBWR DCD, Revision 5. Section 5.2 of the ESBWR DCD includes Section 5.2.4, "Preservice and Inservice Inspection and Testing of Reactor Coolant Pressure Boundary." In addition, in FSAR Section 5.2.4, the applicant provided the following information:

### COL Items

- STD COL 5.2-1-A Preservice and Inservice Inspection Program Description

The applicant provided information to address the PSI and ISI programs, applicable ASME Code Edition and Addenda, certification of nondestructive examination (NDE) personnel as amended by 10 CFR 50.55a, system leakage tests as amended by 10 CFR 50.55a, and the description of the PSI and ISI milestones.

- STD COL 5.2-3-A Preservice and Inservice Inspection NDE Accessibility Plan Description

The applicant provided information to address Class 1 austenitic or dissimilar metal welds and preservation of accessibility during construction to enable the performance of ISI examinations during the operational phase.

### Supplemental Information

- STD SUP 5.2-1

The applicant provided information to address the relevant Technical Specification (TS) sections that address system pressure tests and RCS pressure and temperature (P/T) limits.

#### **5.2.4.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference will be addressed within the FSER related to the DCD. In addition, the relevant requirements of the Commission's regulations for the PSI/ISI and testing programs, and associated acceptance criteria, are given in Section 5.2 of NUREG-0800. The regulatory basis for acceptance of the supplemental COL information items are established in GDC 32 found in Appendix A to 10 CFR Part 50, as it relates to periodic inspection and testing of the RCPB; and 10 CFR 50.55a, as it relates to the requirements for testing and inspecting of the Code Class 1 components as specified in Section XI of the ASME BPV Code. In addition, SECY-05-0197 provides Commission policy for fully describing an operational program..

#### **5.2.4.4 Technical Evaluation**

The NRC staff reviewed Section 5.2.4 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to the review topic.<sup>1</sup> The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to Preservice and Inservice Inspection and Testing of RCPB.

Section 5.2.4 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to Preservice and Inservice Inspection and Testing of RCPB will be documented in the staff SER on the DCA for the ESBWR.

The staff reviewed the information in the COL FSAR as follows:



The specific version of the ASME Code, Section XI used as the baseline Code in the ESBWR certified design and the North Anna COL application is the 2001 Edition up to and including the 2003 Addenda. Accordingly, the staff's evaluation focuses on the acceptability of the COL applicant's supplemental information.

### COL Items

- STD COL 5.2-1-A Preservice and Inservice Inspection Program Description

In Section 5.2.4, the applicant stated that "the initial inservice inspection program incorporates the latest edition and addenda of the ASME BPV Code approved in 10 CFR 50.55a(b) on the date 12 months before initial fuel load." 10 CFR 50.55a(g)(4)(i) states that inservice examinations and pressure tests conducted during the initial 120-month inspection interval must comply with the requirements in the latest edition and addenda of the Code (or Code Cases) incorporated by reference in paragraph (b) of this section on the date 12 months before the date scheduled for initial loading of fuel under a COL under 10 CFR Part 52 of this chapter subject to the limitations and modifications listed in paragraph (b) of this section. The staff finds that the information provided by the applicant meets 10 CFR 50.55a(g)(4) and 10 CFR 50.55a(b). Therefore, the FSAR information is acceptable.

In Section 5.2.4.3.4, the applicant stated that "certification of NDE personnel shall be in accordance with ASME Section XI, IWA-2300, as modified by 10 CFR 50.55a(b)(2)(xviii)." The applicant also stated in Section 5.2.4.6 that "system leakage and hydrostatic pressure tests will meet all the requirements of ASME Code Section XI, IWA-5000 and IWB-5000 for Class 1 components, including the limitation of 10 CFR 50.55a(b)(2)(xxvi)." 10 CFR 50.55a(b)(2) imposes certain limitations or modifications on the use of this Code. The FSAR information is consistent with the requirements of the ASME Code, Section XI for the certification of NDE personnel and pressure testing of Class 1 components. In addition, the information reflects the appropriate regulations which modify the ASME Code for certification of NDE personnel and pressure testing. Since the FSAR information is consistent with ASME and the regulations, the FSAR information is acceptable.

In Section 5.2.4.11, the applicant stated that Section 5.2.4 of the ESBWR DCD "fully describes the Preservice and Inservice Inspection and Testing Programs for the RCPB and that the implementation milestones for the Preservice and Inservice Inspection and Testing Programs are provided in FSAR Section 13.4." Since the PSI program uses essentially the same elements of the ISI program and the PSI program requirements are stated under ASME Section XI, the staff concurs with the statement that the PSI/ISI programs are fully described. The staff reviewed Table 13.4 and found that the implementation milestones for the PSI/ISI operational programs are listed. The staff concludes that the information provided under STD COL 5.2-1-A and the supplemental information is acceptable.

- STD COL 5.2-3-A Preservice and Inservice Inspection NDE Accessibility Plan Description

The applicant stated in Section 5.2.4 that all Class 1 austenitic or dissimilar metal welds are included in the referenced certified design. The applicant described in Section 5.2.4.2 how anomalies and construction issues are addressed using change control procedures during the construction phase of the project. Procedures require that changes to approved design documents, including field changes and modifications, are subject to the same review and approval process as the original design. Control of accessibility for inspectability and testing

during licensee design activities affecting Class 1 components is provided via procedures for design control and plant modifications. The applicant explained that ultrasonic techniques (UT) will be the preferred NDE method for all PSI and ISI volumetric examinations; radiographic techniques (RT) will be used as a last resort only if UT cannot achieve the necessary coverage. The same NDE method used during PSI will be used for ISI to the extent possible to assure a baseline point of reference. If a different NDE method is used for ISI than was used for PSI, equivalent coverage will be achieved as required by the Code.

During normal plant operation, ultrasonic examination is the desired NDE method for austenitic and dissimilar metal welds due to ease in obtaining examination coverage of piping that is filled with water and as low as reasonably achievable considerations. The use of RT is an acceptable replacement for UT and is allowed under ASME Section XI, Table IWB-2500, since the examination technique specified for these welds is volumetric. The information provided by the applicant meets the requirements under 10 CFR 50.55a(g)(3), which requires that plants be designed to enable the performance of inservice examinations. The use of RT as a supplemental examination technique with 100 percent coverage meets the requirements of ASME Section XI, Table IWB-2500. The information provided by the applicant provides reasonable assurance that during construction, controls exist to maintain the accessibility to enable the performance of inservice examinations for austenitic and dissimilar metal welds. The information provided by the applicant meets 10 CFR 50.55a(g)(3) and ASME Section XI. The FSAR information is, therefore, acceptable.

#### Supplemental Information

- STD SUP 5.2-1

Under Section 5.2.4.6, the applicant stated that system pressure tests and correlated technical specification requirements are provided in the plant TSs 3.4.4, "RCS P/T Limits," and 3.10.1, "Inservice Leak and Hydrostatic Testing Operation." The proposed change provides additional information with respect to system pressure testing that is located within the TS.

Since the location of additional information regarding pressure testing is at the discretion of the licensee, and, the proposed change under STD COL 5.2-1-A (discussed above) meets the ASME Code and the limitations under 10 CFR 50.55a(b)(2)(xxvi), the staff concludes that the supplemental information as it pertains to pressure testing is acceptable.

#### **5.2.4.5 Post Combined License Activities**

FSAR Table 13.4-201 identifies the PSI/ISI Programs as operational programs required by NRC regulations. Before finalizing the SER, the staff will determine the specific set of commitments to be included as conditions to the license to include operational programs related to PSI/ISI consistent with SECY-05-0197.

#### **5.2.4.6 Conclusions**

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to Preservice and Inservice Inspection and Testing of RCPB, and that there is no outstanding information expected to be addressed in the COL FSAR related to this section.

The staff is reviewing Section 5.2.4 of the ESBWR DCD on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to Preservice and Inservice Inspection and Testing of RCPB, incorporated by reference in the North Anna 3 COL FSAR, will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and being tracked as part of Open Item [1-1]. The staff will update Section 5.2.4 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the information provided in North Anna 3 COL FSAR Section 5.2.4, meets the relevant guidelines in SRP Section 5.2.4 and RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.4, and is thus, acceptable. The staff further concludes that the North Anna 3 COL FSAR PSI/ISI programs and implementation milestones are consistent with the policy established in SECY-05-0197. Conformance with these guidelines and policy provides an acceptable basis for satisfying in part, the requirements of GDC 32 and 10 CFR 50.55a.

## **5.2.5 Reactor Coolant Pressure Boundary Leakage Detection**

### **5.2.5.1 Introduction**

This section of the North Anna 3 COL FSAR discusses the RCPB leakage detection systems which are designed to detect and, to the extent practical, identify the source of reactor coolant leakage.

### **5.2.5.2 Summary of Application**

Section 5.2 of the North Anna 3 COL FSAR Revision 1 incorporates by reference Section 5.2.5, "Reactor Coolant Pressure Boundary (RCPB) Leakage Detection," of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 5.2 the applicant provided the following:

#### COL Item

- STD COL 5.2-2-H Leak Detection Monitoring

The applicant provided additional information to address STD COL 5.2-2-H. The applicant replaced Section 5.2.5.9 of the DCD with a paragraph that states that operators are provided with procedures and information to determine from parameter indications whether leakage rates are within the plant Technical Specifications. The applicant added that FSAR Section 13.5, "Plant Procedures" provides a description of the plant procedures program and implementation milestones.

### **5.2.5.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference will be addressed within the FSER related to the DCD.

The staff reviewed the RCPB leakage detection system in accordance with NUREG-0800, Section 5.2.5 "Reactor Coolant Pressure Boundary Leakage Detection," Revision 2, March 2007. Staff acceptance of the leakage detection design is based on its meeting the requirements of the following criteria:

- GDC 2, “Design Basis for Protection Against Natural Phenomena,” as it relates to the capability of the design to maintain and perform its safety function following an earthquake
- GDC 30, “Quality of Reactor Coolant Pressure Boundary,” as it relates to the detection, identification, and monitoring of the source of reactor coolant leakage

#### 5.2.5.4 *Technical Evaluation*

The NRC staff reviewed Section 5.2.5 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to the review topic.<sup>1</sup> The NRC staff’s review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to RCPB Leakage Detection.

Section 5.2.5 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff’s technical evaluation of the information incorporated by reference related to RCPB Leakage Detection will be documented in the staff SER on the DCA for the ESBWR.

The staff reviewed the information in the COL FSAR as follows:

#### COL Item

- STD COL 5.2-2-H Leak Detection Monitoring

NRC staff identified that the substitution of Section 5.2.5.9 of the ESBWR DCD with STD COL 5.2-2-H text appears to inappropriately limit the intended scope of the procedures contained in Section 5.2.5.9 of the ESBWR DCD. In addition, inclusion in FSAR, Revision 0 of the STD COL 5.2-2-H text of the examples “sump pump run time, sump level, and condensate transfer rate” without inclusion of “radioactivity,” also appears to inappropriately limit the scope of the procedures. In **RAI 05.02.05-1**, the staff requested the applicant to clarify the following:

- Revise the FSAR to clarify the scope of procedures relative to TSs. In addition to establishing the leakage rates for the limits in the TS, the operators should be able to use the procedures to identify and monitor the unidentified leakage at a level much lower than the TS limit so that the operator can monitor leakage, evaluate trends, determine the source of leakage, and evaluate potential corrective actions. This level to provide operators an early alert to initiate actions prior to the TS limit should be established as an alarm. The alarm level being established in an approved revision of the ESBWR DCD Section 5.2.5 is acceptable for the COL application.
- Confirm the procedure scope addresses the conversion of different parameter indications to include all three detection instrumentation in TS Limiting Condition for Operation 3.3.4.1, and clarify STD COL 5.2.2-H accordingly. The procedures should include indications from 1) the drywell floor drain high conductivity water sump monitoring system, 2) drywell air coolers condensate flow monitoring system, and 3) drywell fission product monitoring system.

In the letter, dated August 8, 2008, the applicant responded to **RAI 05.02.05-1**. In the response, the applicant revised FSAR Section 5.2.5.9 and STD COL 5.2.2-H to clarify that the procedures will fully address the topics described in Items (a) and (b) of the **RAI** and will be consistent with

Section 5.2.5 of the ESBWR DCD, Revision 5. The revised FSAR Section 5.2.5.9 and STD COL 5.2.2-H states as follows:

“Operators are provided with procedures for detecting, monitoring, recording, trending, and determining the sources of RCPB leakage. Examples of parameters that are monitored are sump pump run time, sump level, condensate transfer rate, and process chemistry/radioactivity.

The procedures are used for converting different parameter indications for identified and unidentified leakage into common leak rate equivalents (volumetric or mass flow) and leak rate rate-of-change values, including indications from: 1) the drywell floor drain high conductivity water sump monitoring system, 2) the drywell air coolers condensate flow monitoring system, and 3) the drywell fission product monitoring system.

The procedures are used to monitor leakage at levels well below Technical Specifications limits and provide guidance for evaluating potential corrective action plans to prevent the plant from exceeding a Technical Specifications limit.

An unidentified leakage rate-of-change alarm provides an early alert to the operators to initiate corrective actions prior to reaching a Technical Specifications limit.”

NRC staff reviewed the applicant’s response to the above **RAI**. The staff found that the response addresses all the concerns identified in the **RAI**, and that the applicant committed to be consistent with ESBWR DCD Tier 2, Revision 5, Section 5.2.5. DCD Revision 5, Section 5.2.5 includes an alarm that annunciates if a step increase in the unidentified leak rate occurs (“reference DCD Section 5.2.5.4, Limits for Reactor Coolant Leakage Rates within the Drywell.”) The standard design and procedures will enable the operators to monitor leakage at levels well below TS limits, and initiate actions to prevent the plant from exceeding a TS limit. Based on the above, the staff finds **RAI 05.02.05-1** resolved and the staff confirmed the appropriate information is provided in FSAR Revision 1.

#### **5.2.5.5 Post Combined License Activities**

The following items were identified as the responsibility of the COL license holder:

- STD COL 5.2-2-H Leak Detection Monitoring

Before finalizing the SER, the staff will determine the specific set of commitments to be included as conditions to the license.

### **5.2.5.6 Conclusion**

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to RCPB Leakage Detection, and there is no outstanding information expected to be addressed in the COL FSAR related to this Section.

The staff is reviewing Section 5.2.5 of the ESBWR DCD on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to RCPB Leakage Detection, incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and being tracked as part of Open Item [1-1]. The staff will update Section 5.2.5 of this SER to reflect the final disposition of the DCA.

Based on the above evaluation, the staff concludes that the additional information and commitment pertaining to the North Anna 3 COL FSAR Section 5.2.5 is acceptable.

## **5.3 Reactor Vessel**

### **5.3.1 Reactor Vessel Materials**

#### **5.3.1.1 Introduction**

This section of the North Anna 3 COL FSAR addresses the reactor vessel material specifications, including weld materials, special processes used for manufacture and fabrication of components, special methods for NDE, special controls and special processes used for ferritic steels and austenitic stainless steels, fracture toughness, reactor vessel materials surveillance program (RVSP), and reactor vessel fasteners.

#### **5.3.1.2 Summary of Application**

Section 5.3.1 of the North Anna 3 COLA FSAR incorporates by reference Section 5.3.1 of the ESBWR DCD, Revision 5. Section 5.3.1 of the ESBWR DCD includes Section 5.3.1.8, "COL Information for Reactor Vessel Material Surveillance Program," (STD COL 5.3-2-A).

In addition, in FSAR Section 5.3.1.8, the applicant provided the following:

#### COL Item

- STD COL 5.3-2-A Materials and Surveillance Capsule

The applicant provided additional information in FSAR Section 5.3.1.8 to address COL Item 5.3-2-A, which states that the COL applicant will develop a description of the RVSP and milestones per Section 5.3.1.8.

#### **5.3.1.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference will be addressed within the FSER related to the DCD.

In addition, the regulatory basis for the acceptance of the RVSP Information is established in:

- GDC 32 found in Appendix A to Part 50, as it relates to the RVSP
- 10 CFR 50.60, as it relates to compliance with the requirements of 10 CFR Part 50, Appendix G
- 10 CFR Part 50, Appendix G, as it relates to materials testing and acceptance criteria for fracture toughness
- 10 CFR Part 50, Appendix H, as it relates to the RVSP
- 10 CFR 50.55a, as it relates to the requirements for testing and inspecting Code Class 1 components of the RCPB as specified in Section XI of the ASME Code
- SECY-05-0197, as it relates to fully describing an operational program

The regulatory basis for acceptance of the resolution to the COL Item (STD COL 5.3-2-A) is 10 CFR Part 50, Appendix G, as it relates to fracture toughness requirements and Appendix H, as it relates to the RVSP.

#### **5.3.1.4 Technical Evaluation**

The NRC staff reviewed Section 5.3.1 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to the review topic.<sup>1</sup> The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to Reactor Vessel Materials.

Section 5.3.1 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to Reactor Vessel Materials will be documented in the staff SER on the DCA for the ESBWR.

The staff reviewed the information in the COL FSAR as follows:

#### COL Item

- STD COL 5.3-2-A                      Materials and Surveillance Capsule

NRC staff reviewed STD COL 5.3-2-A related to reactor vessel materials included under Section 5.3.1 of North Anna 3 COL FSAR, Revision 0. Specifically, the applicant provided STD COL 5.3-2-A as a substitution for Section 5.3.1.8 of the ESBWR DCD, Revision 5, in order to fully describe their RSVP and its implementation.

After reviewing the information provided in North Anna 3 COLA FSAR Revision 0, Section 5.3.1, including the information referenced in the DCD Section 5.3.1, the staff found that the COL applicant had not met the minimum guidelines in RG 1.206 for a description of the RVSP and its implementation. The staff determined that more information was needed to fully describe the RVSP in accordance with SECY-05-0197 to reach a resolution for this COL item. Thus, the staff requested additional information in **RAI 5.03.01-1** in order to complete this review.

In **RAI 5.03.01-1**, the staff requested that the applicant provide additional information on the preparation of the surveillance capsule specimens, the surveillance capsule locations, and the number and type of specimens in each capsule associated with the RVSP.

In a letter dated September 3, 2008, the applicant responded to **RAI 5.03.01-1** and described in detail the preparation of the capsule specimens, the number and type of specimens, and the location of the specimen capsules in the core beltline region, and applicant agreed to update their FSAR. The staff determined that the applicant's response appropriately addressed RAI 5.03.01-1. The staff reviewed Revision 1 to FSAR Section 5.3.1 and confirmed that the information described in the response to RAI 5.03.01-1 was included in the FSAR. Therefore the staff finds that the applicant has adequately addressed this issue and RAI 5.03.01-1 is resolved.

### **5.3.1.5 Post Combined License Activities**

The applicant identified in FSAR Section 13.4, Table 13.4-201, that the Reactor Vessel Material Surveillance Program, required by 10 CFR 50.60 and Appendix H to 10 CFR 50, is to be required by a license condition. The staff finds it acceptable to require the Reactor Vessel Material Surveillance Program by a license condition and will include such license condition in the North Anna COL.

### **5.3.1.6 Conclusion**

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to Reactor Vessel Materials, and there is no outstanding information expected to be addressed in the COL FSAR related to this section.

The staff is reviewing Section 5.3.1 of the ESBWR DCD on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to Reactor Vessel Materials, incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and being tracked as part of Open Item [1-1]. The staff will update Section 5.3.1 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the applicant's proposed resolution to the COL Item STD COL 5.3-2-A meets the relevant acceptance criteria of SRP Section 5.3.1, and the guidance in RG 1.206 Section CIII.1 Chapter 5, C.I.5.3.1 and is thus, acceptable. Conformance with these guidelines provides an acceptable basis for satisfying, in part, the requirements of Appendices G and H to 10 CFR Part 50.

## **5.3.2 Pressure-Temperature Limits**

### **5.3.2.1 Introduction**

This section of the North Anna 3 COL FSAR discusses P/T limits which are required as a means of protecting the reactor vessel during startup and shut down to minimize the possibility of fast fracture. The methods outlined in Appendix G of Section XI of the ASME Code are employed in the analysis of protection against non-ductile failure. Beltline material properties degrade with radiation exposure, and this degradation is measured in terms of the adjusted



reference temperature, which includes a reference nil ductility temperature (NDT) shift, initial  $RT_{NDT}$ , and margin.

### **5.3.2.2 Summary of Application**

Section 5.3.2 of the North Anna 3 COL FSAR, incorporates by reference Section 5.3.2 of the ESBWR DCD, Revision 5 without any departures. In addition, in FSAR Section 5.3.1.3, the applicant provided the following:

#### COL Item

- STD COL 16.0-2-H 5.6.4-1 Pressure-Temperature Limit Curves

The applicant stated that the P/T limit curves are developed in accordance with the pressure-temperature limiting report (PTLR) as discussed in TS Section 5.6.4.

### **5.3.2.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

Appendix G to 10 CFR Part 50 provides the regulatory basis regarding P/T limits.

### **5.3.2.4 Technical Evaluation**

The NRC staff reviewed Section 5.3.2 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to the review topic.<sup>1</sup> The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to P/T limits.

Section 5.3.2 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to Pressure Temperature Limits will be documented in the staff SER on the DCA for the ESBWR.

The staff reviewed the information in the COL FSAR as follows:

#### COL Item

- STD COL 16.0-2-H 5.6.4-1 Pressure-Temperature Limit Curves

ESBWR DCD, Revision 5, Section 5.3.1.5, states that the COL applicant, in accordance with the ESBWR TS (Chapter 16, Section 5.6.4), will furnish bounding P/T curves either as part of the TS or as part of a pressure and PTLR submittal for NRC review. To address this item, North Anna 3 COL FSAR, Revision 1, Section 5.3.1.5 states that "the pressure-temperature limit curves are developed in accordance with the PTLR as discussed in North Anna Unit 3 TSs (Part 4 of the COL application) Section 5.6.4." In Section 5.6.4, the applicant states that the PTLR methodology is scheduled for submittal to the NRC in the second quarter of 2009. **This is being tracked as Open Item 5.3.2-2.**

In addition, the staff identified the need for the applicant to address the submittal of plant-specific P/T limits in the FSAR. Therefore, in **RAI 5.3.2-1** the staff requested that the FSAR be revised to provide a commitment to submit the P/T limits using plant-specific material properties before fuel loading. This RAI is **Open Item 5.3.2-1**. Contingent upon resolution of the open items, the staff finds that the applicant has adequately addressed this COL item.

### **5.3.2.5 Post Combined License Activities**

The following item was identified as the responsibility of the COL holder:

- STD COL 16.0-2-H 5.6.4-1 Pressure-Temperature Limit Curves

Before finalizing the SER, the staff will determine the specific set of commitments to be included as conditions to the license.

### **5.3.2.6 Conclusion**

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to P/ T limits, and there is no outstanding information expected to be addressed in the COL FSAR related to this section. However, as a result of Open Items 5.3.2-1 and 5.3.2-2 the staff is unable to finalize its conclusion.

The staff is reviewing Section 5.3.2 of the ESBWR DCD on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to Pressure-Temperature Limits, incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and being tracked as part of Open Item [1-1]. The staff will update Section 5.3.2 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that based on pending resolution of the two open items, the information provided in the FSAR meets the relevant acceptance criteria of SRP Section 5.3.2 and the guidance in RG 1.206, Section CIII.1, Chapter 5, C.I.5.3.2 and is thus, acceptable. Conformance with these guidelines provides an acceptable basis for satisfying, in part, the requirements of Appendix G to 10 CFR Part 50. However, as a result of Open Items 5.3.2-1 and 5.3.2-2 the staff is unable to finalize its conclusion.

## **5.3.3 Reactor Vessel Integrity**

### **5.3.3.1 Introduction**

This section of the North Anna 3 COL FSAR discusses all factors related to reactor vessel integrity.

### **5.3.3.2 Summary of Application**

Section 5.3 of the North Anna 3 COL FSAR incorporates by reference Section 5.3.3 of the ESBWR DCD, Revision 5.

In addition, in the North Anna 3 COL FSAR Section 5.3.3, the applicant provided the following:

Supplemental Information:

- STD SUP 5.3-1

In FSAR Section 5.3.3.6 the applicant provided supplemental information regarding operating procedures and TS to address P/T limits.

**5.3.3.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference will be addressed within the FSER related to the DCD.

In addition, the regulatory basis for the additional reactor vessel integrity COL item and operational program is established in the following:

- GDC 14, as it relates to testing to ensure an extremely low probability of abnormal leakage, rapid propagation failure, and of gross rupture of the RCPB
- GDC 30, as it relates to the test standards to ensure the quality of the reactor vessel materials
- GDC 31, as it relates to ensuring that the RCPB will behave in a nonbrittle manner and that the probability of rapidly propagating fracture is minimized
- GDC 32, as it relates to the requirements for a RSVP
- 10 CFR 50.55a, as it relates to the requirements for testing and inspecting Code Class 1 components of the RCPB as specified in Section XI of the ASME Code
- 10 CFR 50.60, as it relates to reactor vessel fracture toughness and material surveillance requirements of 10 CFR Part 50, Appendix G and Appendix H
- The regulatory basis for acceptance of the resolution to the COL Item (STD COL 5.3-2-A) is Appendix G to 10 CFR Part 50 as it relates to fracture toughness requirements and Appendix H as it relates to the RVSP

**5.3.3.4 Technical Evaluation**

The NRC staff reviewed Section 5.3.3 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to the review topic.<sup>1</sup> The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to Reactor Vessel Integrity.

Section 5.3.3 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to Reactor Vessel Integrity will be documented in the staff SER on the DCA for the ESBWR.

The staff reviewed the information in the COL FSAR as follows:

Supplemental Information:

- STD SUP 5.3-1

In STD SUP 5.3-1, the COL applicant has proposed that information be added to FSAR Section 5.3.3.6, "Operating Conditions," to state that the development of plant operating procedures is addressed in Section 13.5. These procedures require compliance with the TS. The TS (which are developed by the methodology also identified in the TS) are intended to ensure that the P/T limits identified in DCD Section 5.3.2 are not exceeded during normal operating conditions and anticipated plant transients.

NRC staff reviewed STD SUP 5.3.1 related to reactor vessel integrity included under Section 5.3 of North Anna 3 COL FSAR. The information to be added by this Supplemental Information is acceptable.

**5.3.3.5 Post Combined License Activities**

There are no post COL activities related to this section.

**5.3.3.6 Conclusion**

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to Reactor Vessel Integrity, and there is no outstanding information expected to be addressed in the COL FSAR related to this section.

The staff is reviewing Section 5.3.3 of the ESBWR DCD on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to Reactor Vessel Integrity, incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and being tracked as part of Open Item [1-1]. The staff will update Section 5.3.3 of this SER to reflect the final disposition of the DCA.

**5.4 Reactor Coolant System Component and Subsystem Design**

NRC staff reviewed Section 5.4 of the North Anna 3 COL FSAR including the corresponding sections in the referenced DCD. Specifically, the staff verified that the following sections of the DCD contained information appropriate for incorporation by reference and that any supplemental information to be provided by the COL applicant has been addressed in the COL application:

- 5.4.1 Reactor Recirculation System
- 5.4.2 Steam Generators (not applicable to ESBWR)
- 5.4.3 Reactor Coolant Piping
- 5.4.4 Main Steamline Flow Restrictors
- 5.4.5 Nuclear Boiler System Isolation
- 5.4.6 Isolation Condenser System
- 5.4.7 Residual Heat Removal System
- 5.4.8 Reactor Water Cleanup/Shutdown Cooling System
- 5.4.9 Main Steamlines and Feedwater Piping
- 5.4.10 Pressurizer (not applicable to ESBWR)

- 5.4.11 Pressurizer Relief Discharge System (not applicable to ESBWR)
- 5.4.12 Reactor Coolant System High Point Vents
- 5.4.13 Safety and Relief Valves and Depressurization Valves
- 5.4.14 Component Supports
- 5.4.15 COL Information
- 5.4.16 References

The NRC staff reviewed Section 5.4 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to the review topic.<sup>1</sup> The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to Reactor Coolant System Component and Subsystem Design.

Section 5.4 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to Reactor Coolant System Component and Subsystem Design will be documented in the staff SER on the DCA for the ESBWR.

Section 5.4 of the North Anna 3 COL FSAR incorporates by reference Section 5.4 of the ESBWR DCD, Revision 5. In addition, in the North Anna 3 COL FSAR Section 5.3.3, the applicant provided the following supplemental information:

Supplemental Information:

- STD SUP 5.4-1

In FSAR Section 5.4.8, the applicant stated that operating procedures will provide guidance to prevent severe water hammer caused by mechanisms such as voided lines.

The NRC staff finds that supplement STD SUP 5.4-1 is acceptable because water hammer is to be addressed in the plant operating procedures.

- STD SUP 5.4-2

In FSAR section 5.4.12, the applicant stated that human factors analysis of the control room displays and controls for the RCS vents is included as part of the overall human factors analysis of the control room displays and controls described in DCD Chapter 18.

The staff found that this information is wholly incorporated in section 18 of the North Anna 3 COL FSAR, and is thus, the staff concludes that STD SUP 5.4-2 is acceptable.

- STD SUP 5.4-3

In FSAR Section 5.4.12, the applicant stated that operating procedures for the reactor vent system address considerations regarding when venting is needed and when it is not needed.

The NRC staff finds that supplement STD SUP 5.4-3 is acceptable because system venting is to be addressed in the plant operating procedures.

Conclusion:

The NRC staff reviewed the application and the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to Reactor Coolant System Component and Subsystem Design, and there is no outstanding information is expected to be addressed in the COL FSAR related to this section.

The staff is reviewing Section 5.4 of the ESBWR DCD on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to Reactor Coolant System Component and Subsystem Design, incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and being tracked as part of Open Item [1-1]. The staff will update Section 5.4 of this SER to reflect the final disposition of the DCA.