

## 3.0 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

### 3.1 Conformance with NRC General Design Criteria

Section 3.1 of the North Anna 3 combined license (COL) Final Safety Analysis Report (FSAR) incorporates by reference, with no departures or supplements, Section 3.1, "Conformance with NRC General Design Criteria," of Revision 5 of the Economic Simplified Boiling-Water Reactor (ESBWR) Design Control Document (DCD). The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 3.1 on Docket No. 52-010. The results of the staff's technical evaluation of the conformance to NRC general design criteria (GDC), 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. This SER on the ESBWR is not yet complete and is being tracked as **Open Item [1-1]**. The staff will update Section 3.1 of this SER to reflect the final disposition of the DCD.

### 3.2 Classification of Structures, Systems and Components

#### 3.2.1 Seismic Classification

##### 3.2.1.1 Introduction

Nuclear power plant structures, systems, and components (SSCs) important to safety should be designed to withstand the effects of earthquakes without losing the capability to perform their safety functions. SSCs include safety-related features necessary to ensure (1) the integrity of the reactor coolant pressure boundary (RCPB), (2) the capability to shut down the reactor and maintain it in a safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures. In passive plants, some non-safety-related SSCs are subject to additional regulatory oversight and are designated as regulatory treatment of non-safety systems (RTNSS).

The methodology in Regulatory Guide (RG) 1.29, "Seismic Design Classification," Revision 4 classifies certain SSCs that are important to safety as seismic Category I. Those portions of SSCs that need not be functional, but whose failure could damage seismic Category I SSCs, will be designed to preclude such failure. Also, the pertinent Quality Assurance (QA) requirements of 10 CFR Part 50 Appendix B will be applied to those SSCs, and RG 1.189 provides guidance for fire protection SSCs. Non-safety-related SSCs that are important to safety are evaluated under the RTNSS process described in FSAR Chapter 19 and reviewed in SER Chapter 22.

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<sup>1</sup> See SER 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 in a COL application that references a design certification.

### **3.2.1.2 Summary of Application**

Section 3.2 of the North Anna 3 COL FSAR Revision 1 incorporates by reference Section 3.2 of ESBWR DCD, Revision 5, with supplements. Section 3.2 of the DCD includes Section 3.2.1.

In FSAR Section 3.2, the applicant provided the following supplemental information:

#### Site Specific Information Replacing Conceptual Design Information

- STD CDI Classification Summary-Hydrogen Water Chemistry System

The applicant modified Table 3.2-1 to indicate that the plant design includes the hydrogen water chemistry system.

- STD CDI Classification Summary-Zinc Injection System

The applicant modified Table 3.2-1 to indicate that the plant design does not include the zinc injection system

- NA3 CDI Classification Summary-Cold Machine Shop

The applicant identified that the North Anna 3 site specific plant design does not include the cold machine shop.

Additional information related to standard review plan (SRP) and RG conformance for this section is provided in FSAR Chapter 1 Tables 1.9-201, 1.9-202 and 1.9-203.

### **3.2.1.3 Regulatory Basis**

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

In addition, the relevant requirements of the Commission regulations for seismic classification of SSCs and the associated acceptance criteria are described in Section 3.2.1 of NUREG-0800.

The applicable regulatory requirements for seismic classification of SSCs are as follows:

- 10 CFR Part 50 Appendix A, GDC 2

10 CFR Part 50 Appendix A GDC 2 requires (in part) that SSCs important to safety shall be designed to withstand the effects of natural phenomena, including earthquakes.

The related acceptance criteria are as follows:

- RG 1.29

RG 1.29 establishes an acceptable regulatory basis for acceptance of the seismic classification of SSCs. RG 1.29 describes the categorization of specific SSCs important to safety that are to be designed to withstand the effects of earthquakes.

- RG 1.206

The applicant should identify those fluid systems or portions thereof that are important to safety and are outside of the certified design scope, as well as the applicable industry codes and standards for each pressure-retaining component.

The applicant should also clearly identify all SSCs or portions thereof that are outside of the referenced certified design scope and are intended to be designed for an Operating Basis Earthquake (OBE).

#### **3.2.1.4 Technical Evaluation**

NRC staff reviewed Section 3.2.1 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff reviewed the conformance of Section 3.2.1 of the North Anna 3 COL FSAR to the guidance in SRP Section 3.2.1, RG 1.206, Section C.III.1, Chapter 3, C.I.3.2.1, “Seismic Classification,” and RG 1.29. The applicant is required to identify those SSCs important to safety that are outside of the referenced certified design scope and are designed to withstand the effects of earthquakes without losing the capability to perform their safety functions.

The staff’s review of Section 3.2.1 of the North Anna 3 COL FSAR Revision 1 found that the applicant had appropriately incorporated by reference Section 3.2.1 of ESBWR DCD, Revision 5. The staff’s review confirmed that the information in the application and the information incorporated by reference address the required information relating to the seismic classification of SSCs. The staff is reviewing Section 3.2.1 of the DCD on Docket No. 52-010. The staff’s technical evaluation of the information incorporated by reference and related to seismic classification will be documented in the staff SER on the DCA for the ESBWR.

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

#### Site Specific Information Replacing Conceptual Design Information

- STD CDI Classification Summary – Hydrogen Water Chemistry
- STD CDI Classification Summary – Zinc Injection System
- NA 3 CDI Classification Summary – Cold Machine Shop

NRC staff determined that the departures/supplements, including site specific information related to the hydrogen water chemistry, zinc injection systems, and cold machine shop do not affect the seismic classifications.

The staff reviewed the COL application information to determine whether the application contains sufficient information on the seismic classification of site specific SSCs that are outside of the DCD scope. The staff issued several requests for additional information (RAIs) to determine whether the scope of SSCs considered to be site specific is essentially complete, and whether sufficient information concerning the seismic classification of those SSCs is included in the application. The staff identified the following technical concerns:

### Seismic Classification of Site Specific RTNSS SSCs

GDC 2 identifies, in part, that SSCs important to safety shall be designed to withstand the effects of earthquakes. FSAR Section 3.2.1 identifies no departures or supplements relative to the seismic classification of SSCs, and the standardization matrix identifies no site specific information that applies to Section 3.2. However, certain potential RTNSS-important SSCs, such as the plant service water system (PSWS) and makeup water system, are identified as site specific and makeup sources for the ultimate heat sink. Also, it is not clear whether there are any non-safety-related SSCs outside of the DCD scope that may be important to safety.

The staff issued **RAI 03.02.01-6**, which requested the applicant to clarify whether there are any site specific, non-safety-related SSCs outside of the DCD scope that are important to safety and, if so, to identify the appropriate seismic classification of those SSCs. For example, certain site specific defense in depth RTNSS SSCs, such as the PSWS and the intake structure, may be considered non-safety-related but may be important to safety and should be categorized as designed to withstand the effects of earthquakes. This seismic concern for RTNSS SSCs was also identified during the concurrent ESBWR design certification review. If the applicant decides to resolve this issue in the DCD rather than in the COL for all plant SSCs, including those that are site specific, the staff has asked the applicant to so advise the NRC. The applicant's response to the RAI stated that there are no non-safety-related SSCs important to safety (RTNSS SSCs) that are outside of the DCD scope. This response also clarified that the seismic classification of RTNSS SSCs is within the DCD scope, and Appendix 19A of the DCD has undergone substantial changes in DCD Revision 5. The staff concurred that the seismic classification of site specific RTNSS SSCs can be evaluated in the DCD. Therefore, this COL concern is closed.

### Seismic Classification of Other Site Specific SSCs

Section 1 of the DCD identifies only limited site specific SSCs that are outside the scope of the DCD, and for which the COL applicant is expected to provide site specific information. COL application Table 1.9-203 indicates that there are no safety-related or RTNSS SSCs that are not included in the DCD. It is not clear, however, whether there are any other non-safety-related SSCs that are considered important to safety but are not included in the DCD that will be addressed in the COL application.

The staff issued **RAI 03.02.01-5** which requested the applicant to clarify whether there are any site specific SSCs outside of the DCD scope that are not included in DCD Table 3.2-1 and are to be seismically classified in the COL. For example, site specific structures such as the stack and miscellaneous items such as the reactor vessel insulation, which may or may not be site specific, are not included in the tables. If so, the RAI requested the applicant to identify the appropriate seismic classification of those SSCs or clarify when those SSCs will be classified. The applicant's response to the RAI stated that there are no non-safety-related SSCs important to safety (RTNSS SSCs) outside of the DCD scope, and there are no site specific SSCs not in the DCD that are to be seismically classified. In regard to the stack (changed to three stacks in DCD Revision 5) and reactor vessel insulation, the applicant clarified that these SSCs are not site specific. Because no site specific SSCs will be classified in the COL, the staff concurred that this COL concern is closed.

### Quality Assurance for seismic Category II SSCs

It is not clear in either the DCD or the FSAR how 10 CFR Part 50 Appendix B applies to seismic Category II SSCs, including those that may be site specific. FSAR Table 1.9-202 identifies conformance to RG 1.29. However, seismic Category II SSCs are not designated as QA Requirement B in either the DCD or the COL application. DCD Section 17.3 states that the COL applicant will address the QA Program, but it is not clear how the QA Program will include provisions for seismic Category II SSCs.

The staff issued **RAI 03.02.01-4**, which requested the applicant to clarify the extent to which pertinent QA requirements of Appendix B to 10 CFR Part 50 in Regulatory Position C.4 of RG 1.29 apply to the activities affecting safety-related functions of those portions of SSCs covered under Regulatory Positions 2 and 3 of RG 1.29, including any site specific SSCs. This concern was also cited in an RAI for the ESBWR design certification review, and a special class was designated for important non-safety-related SSCs. But SSCs that are designated as a special class are not specified for review at this time. If the applicant decides to resolve this issue in the DCD rather than in the COL for all plant SSCs, including those that are site specific, the staff has asked the applicant to so advise the NRC. The applicant's response to the RAI stated that this issue will be resolved in the DCD, and General Electric-Hitachi (GEH) has included this information in DCD Section 3.2 and in DCD Appendix 19A for all SSCs, including those that are site specific. The staff concurred that this COL can be reviewed in the design certification, and therefore this RAI is closed.

### Consistency with Regulatory Guidance

FSAR Table 1.9-201 points out that the seismic classification conforms to SRP Section 3.2.1, Revision 2, and that SRP Section 3.2.1 references RG 1.29 (currently Revision 4) for seismic classification. SRP Section 3.2.1 identifies that the applicant should provide a list of SSCs that are necessary for continued safe operation that must remain functional without undue risk to the health and safety of the public and within applicable stress, strain, and deformation limits during and following an OBE, if the applicant has set the OBE ground motion to the value of one-third of the safe shutdown earthquake (SSE) ground motion. The list of SSCs may be addressed either in this section or in the operational programs for pre-earthquake planning in COL FSAR Section 3.7.4. Other than the three CDIs noted above, Section 3.2 of FSAR Revision 0 does not identify any departures or supplements relative to the seismic classification in the DCD and the conformance to RG 1.29 Revision 3 in the DCD.

The staff issued **RAI 03.02.01-3**, which requested the applicant to clarify the extent to which site specific seismic classifications of SSCs are consistent with RG 1.29 Revision 4. The applicant's response to the RAI clarified that the FSAR is incorrect. The classification of site specific SSCs is consistent with the DCD that references RG 1.29 Revision 3, and COL FSAR Table 1.9-202 will be revised accordingly. In addition, the staff has indicated to the applicant that there are no site specific SSCs requiring classification in the COL application or changes to the methodology. Therefore, the staff finds that use of RG 1.29, Revision 3 is acceptable.

However, in order to be consistent with SRP Section 3.2.1 Revision 2, the staff has indicated to the applicant that a list of SSCs necessary for continued operation when subjected to an OBE should be available for review if the applicant has set the OBE ground motion equal to one-third of the SSE ground motion. Since the COL applicant has not deviated from the DCD, which sets the OBE ground motion equal to one-third of the SSE ground motion, the applicant should submit a list of SSCs necessary for continued operation either in this section or in the

operational programs for pre-earthquake planning in COL FSAR Section 3.7.4. Therefore, resolution of this issue is pending as **Open Item 03.02.01-3**.

#### List of RTNSS SSCs

DCD Revision 5, Section 3.2.1 refers to Table 19A-1 for a list of RTNSS SSCs. However, Table 19A-1 in Revision 5 of the DCD has been deleted. It is not clear whether this list includes site specific SSCs. The staff issued **RAI 03.02.01-2**, which requested the applicant to identify the appropriate reference for the list of site specific RTNSS SSCs. The applicant's response to the RAI agrees that there is an inconsistency and has notified GEH accordingly. The correct reference for risk-significant RTNSS SSCs is in Table 3 of NEDO-33411, which documents the list of risk-significant RTNSS SSCs. NRC staff concurred that this list of RTNSS SSCs can be reviewed in the design certification for site specific SSCs, so this RAI is closed.

#### RTNSS SSCs Classified as NonSeismic

DCD Revision 4 Table 3.2-1 identifies various non-safety-related potential RTNSS SSCs as either Seismic II or nonseismic (NS). It is not clear whether any of these potential RTNSS SSCs are considered site specific. DCD Section 19A.8.3 classifies RTNSS Criterion B-SSCs, as a minimum, seismic Category II, and are qualified to the Institute of Electrical and Electronics Engineers (IEEE)-344-1987. These SSCs must be available following a seismic event. Relative to any site specific RTNSS-important SSCs that are required to withstand the effects of earthquakes and are qualified to the IEEE-344, NRC staff issued **RAI 03.02.01-1**, which requested the applicant to clarify the basis for the Seismic II or NS classification or identify an appropriate departure. The applicant's response to the RAI stated that there are no site specific, RTNSS-important SSCs beyond those identified in the DCD. Because there are no site specific, RTNSS-important SSCs included in the COL, the staff concurred that this concern can be reviewed in the design certification. Therefore, this RAI is closed.

#### **3.2.1.5 Post Combined License Activities**

There are no post COL activities related to this section.

#### **3.2.1.6 Conclusion**

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to seismic classification of SSCs and, with the exception of **Open Item 03.02.01-3**, there is no outstanding information expected to be addressed in the COL FSAR related to this section. As a result of this open item, the staff is unable to finalize any conclusions for this section relating to seismic classification of SSCs in accordance with NRC requirements.

The staff is reviewing the information in DCD Section 3.2.1 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the seismic classification of SSCs, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.2.1 of this SER to reflect the final disposition of the DCA.

## **3.2.2 System Quality Group Classification**

### **3.2.2.1 Introduction**

Nuclear power plant systems and components important to safety should be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

The system quality group classification addresses the requirement that nuclear power plant systems and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed. This requirement is applicable to both pressure-retaining and non-pressure-retaining SSCs that are part of the RCPB, and other systems important to safety, when reliance is placed on these systems to (1) prevent or mitigate the consequences of accidents and malfunctions originating within the RCPB, (2) permit shutdown of the reactor and maintain it in a safe-shutdown condition, and (3) retain radioactive material. RG 1.26 Revision 4, "Quality Group Classification and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," provides the regulatory guidance for designing safety-related SSCs to quality standards. Non-safety-related SSCs that are important to safety are evaluated under the RTNSS process described in FSAR Chapter 19 and reviewed in SER Chapter 22.

### **3.2.2.2 Summary of Application**

Section 3.2 of the North Anna 3 COL FSAR Revision 1 incorporates by reference Section 3.2 of the ESBWR DCD Revision 5, with supplements. Section 3.2 of the DCD includes Section 3.2.2, "System Quality Group Classification."

In FSAR Section 3.2, the applicant provided the following supplemental information:

#### Site Specific Information Replacing Conceptual Design Information

- STD CDI Classification Summary

The applicant modified Table 3.2-1 to indicate that the plant design includes the hydrogen water chemistry system.

- STD CDI Classification Summary

The applicant modified Table 3.2-1 to indicate that the plant design does not include the zinc injection system.

- NA3 CDI Classification Summary

The applicant identified that the North Anna 3 site specific plant design does not include the cold machine shop.

Additional information related to SRP and RG conformance for this section is provided in FSAR Chapter 1, Tables 1.9-201, 1.9-202 and 1.9-203.

### **3.2.2.3 Regulatory Basis**

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

In addition, the relevant requirements of Commission regulations for quality group classification of SSCs and the associated acceptance criteria are described in Section 3.2.2 of NUREG-0800.

The applicable regulatory requirements for quality group classification of SSCs are as follows:

- 10 CFR Part 50 Appendix A, GDC 1

10 CFR Part 50 Appendix A GDC1 requires (in part) that SSCs important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function.

The related acceptance criteria are as follows:

- RG 1.26

RG 1.26 establishes an acceptable regulatory basis for meeting GDC 1 relative to quality group classification. RG 1.26 describes the classification of fluid systems and their supports that are important to safety, which are to be designed to quality standards commensurate with their safety function.

- RG 1.206

The applicant should identify those fluid systems or portions thereof that are important to safety and outside of the certified design scope, as well as the applicable industry codes and standards for each pressure-retaining component.

### **3.2.2.4 Technical Evaluation**

NRC staff reviewed Section 3.2.2 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff reviewed the conformance of Section 3.2.2 of the North Anna 3 COL FSAR to the guidance in SRP Section 3.2.2, RG 1.206, Section C.III.1, Chapter 3, C.I.3.2.2, "System Quality Group Classification," and RG 1.26. The applicant is required to identify those fluid systems or portions thereof that are important to safety and outside of the certified design scope, as well as the applicable industry codes and standards for each pressure-retaining component.

The staff's review of Section 3.2.2 of the North Anna 3 COL FSAR Revision 1 found that the applicant had appropriately incorporated by reference Section 3.2.2 of ESBWR DCD, Revision 5. The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to the quality group classification of SSCs. The staff is reviewing Section 3.2.2 of the DCD on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference related to seismic classification will be documented in the staff SER on the DCA for the ESBWR.

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

Site Specific Information Replacing Conceptual Design Information

- STD CDI Classification Summary- Hydrogen Water Chemistry
- STD CDI Classification Summary-Zinc Injection System
- NA3 CDI Classification Summary-Cold Machine Shop

NRC staff determined that the departures/supplements that include site specific information related to the hydrogen water chemistry, zinc injection systems and cold machine shop do not affect the quality group classifications. However, there are several open items in the staff's review of DCD Revision 4, Section 3.2.2 that are related to the treatment of typical site specific systems.

The staff reviewed the COL applicant information to determine whether the application contained sufficient information on the system quality group classification of site specific SSCs that are outside of the DCD scope. Several RAIs were prepared to determine whether the scope of the SSCs that are considered site specific is essentially complete, and whether sufficient information concerning the quality group classification of those SSCs is included in the application. The following technical concerns were identified:

Special Treatment for Risk-Significant SSCs

GDC 1 identifies (in part) that SSCs important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. Supplemental quality standards and the QA Program applicable to passive SSCs used in non-safety-related RTNSS systems that may be important to safety are not clearly defined in the COL application for site specific SSCs.

NRC staff issued **RAI 03.02.02-3**, which requested the applicant to clarify what supplemental quality standards are applied to non-safety-related, site specific SSCs that are important to safety to ensure that all SSCs important to safety are designed, fabricated, erected, and tested to quality standards commensurate with the safety function to be performed. This concern was also identified in an RAI for the review of the ESBWR design certification. The applicant's response stated that a new Special Class is applicable to those SSCs, but site specific Special Class SSCs are not identified in Section 3.2. The applicant was requested to advise the NRC whether this issue will be resolved in the DCD rather than in the COL for all plant SSCs, including those that are site specific. The applicant's response to the RAI stated that this issue will be resolved in the DCD. The applicant clarified that GEH has included this information in DCD Section 3.2 and Appendix 19A and that these are applicable to site specific SSCs. The staff concurred that this concern will be reviewed in the design certification. Therefore, this RAI is closed.

Codes and Standards

The NRC staff requirements memorandum (SRM) dated July 21, 1993, concerning SECY-93-087, stated that the staff will review passive plant design applications using the newest codes and standards endorsed by the NRC, and unapproved revisions to the codes will be reviewed on a case-by-case basis. Editions of various codes and standards referenced in

DCD Section 3.2.6 are not current, and newer codes and standards are not referenced in COL applicant Sections 3.2 or 1.8. The staff issued **RAI 03.02.02-2**, which requested the applicant to clarify the specific code editions the applicant has referenced that are currently endorsed by the NRC. The applicant was also asked to clarify whether current editions of codes and standards will be applied to the detailed design and procurement of ESBWR SSCs, so that these editions may be reviewed on a case-by-case basis. If the applicant decides to resolve this issue in the DCD rather than in the COL for all plant SSCs, including those that are site specific, the staff has asked the applicant to so advise the NRC.

The applicant's response to the RAI stated that DCD Table 1.8-22 identifies industrial codes and standards and adjustments that have been made to these codes and standards. The applicant also indicated that questions regarding versions of codes and standards should be addressed to GEH. COL applicants should supplement generic DCD information on compliance with RGs to address those that have been issued since the time the standard design was approved.

Although there are no site specific SSCs that are not classified in the DCD, effective regulatory guidance for site specific SSCs should be identified in the COL application rather than in the DCD, so that the effective RG revision is applied to site specific SSCs, including those added in the future. COL Table 1.9-204 identifies industrial codes and standards applicable to portions of the design that are beyond the scope of the DCD or SSAR, but the editions referenced in this list are different from the earlier editions referenced in Table 1.8-22 of the referenced DCD. In addition, the staff indicated that the applicant should more clearly identify which editions of industrial codes and standards are applicable to specific SSCs and whether those editions have been endorsed by the NRC. This is identified as **Open Item 03.02.02-2**.

#### Consistency with Regulatory Guidance

FSAR Table 1.9-201 shows that the seismic classification conforms to SRP Section 3.2.2, Revision 2 and that SRP Section 3.2.2 references RG 1.26 (currently Revision 4) for quality group classification. Section 3.2 of the FSAR Revision 0 does not identify any departures or supplements relative to the quality group classification identified in the DCD and compliance with RG 1.26 Revision 3 in the DCD. But FSAR Table 1.9-202 references conformance to Revision 4, dated March 2007. QA Program AR-NA-30 references Revision 4 to RG 1.26 with the DCD exception, but incorrectly references February 1976 rather than March 2007. NRC staff issued **RAI 03.02.02-1**, which requested the applicant to clarify whether classifications of site specific SSCs are consistent with RG 1.26 Revision 4.

The applicant's response to the RAI clarified that the FSAR is incorrect. The classification of site specific SSCs is consistent with the DCD that references RG 1.26 Revision 3. COL FSAR Table 1.9-202 and Appendix 17BB will be revised accordingly. COL applicants should supplement generic DCD information on conformance to RGs to address those that were issued since the time the standard design was approved. There are no site specific SSCs classified in the COL application, so the effective RGs are appropriately referenced in the DCD. Therefore, this is **Confirmatory Item 03.02.02-1**.

#### **3.2.2.5 Post Combined License Activities**

There are no post COL activities related to this section.

### **3.2.2.6 Conclusion**

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant had addressed the required information relating to quality group and seismic classification of SSCs. With the exceptions of **Confirmatory Item 03.02.02-1** and **Open Item 03.02.02-2** no outstanding information is expected to be addressed in the COL FSAR related to this section. As a result of these confirmatory and open items, the staff is unable to finalize the conclusions for this section relating to quality group classification of SSCs in accordance with NRC requirements.

The staff is reviewing the information in DCD Section 3.2.2 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the quality group classification of SSCs, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.2.2 of this SER to reflect the final disposition of the DCA.

### **3.3 Wind and Tornado Loadings**

Section 3.3 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 3.3, "Wind and Tornado Loadings," of Revision 5 of the ESBWR DCD. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 3.3 on Docket No. 52-010. The results of the staff's technical evaluation of the wind and tornado loadings, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.3 of this SER to reflect the final disposition of the DCA.

### **3.4 Water Level (Flood) Design**

Section 3.4 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 3.4, "Water Level (Flood) Design," of Revision 5 of the ESBWR DCD. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 3.4 on Docket No. 52-010. The results of the staff's technical evaluation of the water level (flood) 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.4 of this SER to reflect the final disposition of the DCA.

### **3.5 Missile Protection**

#### **3.5.1 Introduction**

SSCs important to safety are analyzed for and designed to be protected from a wide spectrum of internally generated missiles, such as missiles from rotating equipment, high energy fluid

systems, and gravitational missiles; externally generated missiles from tornado winds and extreme winds; and missiles from proximate site sources and aircraft hazards.

Methods of protection must be provided for all SSCs that are necessary to perform functions required to attain and maintain safe shutdown or to otherwise mitigate the consequences of an accident. These methods may consist of (1) locating the system or component in a missile-proof structure, (2) separating redundant systems or components in the missile's path or range, (3) providing local shields and barriers for systems and components, or (4) designing the equipment to withstand the impact of the most damaging missile.

The specific reactor site location determines the potential for missile hazards from nearby industrial sources and the hazards from aircraft operating in the region.

### **3.5.2 Summary of Application**

Section 3.5 of the North Anna 3 COL FSAR incorporates by reference Section 3.5 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 3.5, the applicant provided the following:

#### Supplemental Information

- STD SUP 3.5-1 Site Proximity Missiles

The applicant provided the following supplemental information. The applicant referred to Section 2.2 for information regarding the site specific missile sources.

- STD SUP 3.5-2 Aircraft Hazards

The applicant provided the following supplemental information. The applicant referred to Section 2.2 for information regarding the site specific aircraft hazard analyses and site specific critical areas.

### **3.5.3 Regulatory Basis**

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

In addition, the relevant requirements of the Commission regulations for turbine missiles and the associated acceptance criteria are described in Section 3.5.1.3 of NUREG-0800.

The applicable regulatory requirements for turbine missiles are as follows:

- GDC 4 of Appendix A to 10 CFR Part 50

In addition, the relevant requirements of Commission regulations for nearby site-generated missiles and the associated acceptance criteria are described in Section 3.5.1.5 of NUREG-0800.

The applicable regulatory requirements for protection against site proximity missiles are as follows:

- GDC 4 of Appendix A to 10 CFR Part 50

In addition, the relevant requirements of the Commission regulations for evaluating aircraft hazards and the associated acceptance criteria are described in Section 3.5.1.6 of NUREG-0800.

The applicable regulatory requirements related to aircraft hazards are as follows:

- GDC 4 of Appendix A to 10 CFR Part 50

### 3.5.4 Technical Evaluation

NRC staff reviewed Section 3.5 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to missile protection.

The staff is reviewing Section 3.5 of the DCD on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference related to missile protection 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 3.5-1 Site Proximity Missiles

NRC staff reviewed STD SUP 3.5-1, which states that the site specific missile sources are addressed in Section 2.2 of the North Anna 3 FSAR.

The staff's technical evaluation of this portion of the application is limited to reviewing the supplemental information pertaining to STD SUP 3.5-1.

The staff reviewed the conformance of Section 3.5 of the North Anna 3 COL FSAR to the guidance in RG 1.206, Section C.III.1, Chapter 3, C.I.3.5.1.3, "Turbine Missiles." The staff's review of the North Anna 3 COL FSAR Section 3.5 found that it appropriately incorporates by reference Section 3.5.1.1.1.2 of the ESBWR DCD, Revision 5.

Table 2.2-202 identifies two 10,000-gallon gasoline underground tanks. Those tanks and delivery tanker truck explosion potential were not provided by the applicant in FSAR Section 2.2.3. The staff issued **RAI 2.2.3-1**, which requested the applicant to address these potential explosions. The applicant responded adequately, and the staff reviewed the applicant's information demonstrating that the probability of a delivery accident is less than 10<sup>-6</sup>. The staff found the information reasonable and acceptable.

The staff issued **RAI 3.5.1.5-1**, which requested the applicant to provide an assessment of the potential for the turbine missile generation for existing Units 1 and 2 to affect the safe operation of the proposed Unit 3. The applicant's response stated that the planes-of-rotation of the turbine generators in Units 1 and 2 are oriented approximately 90 degrees relative to Unit 3 and are located approximately 1,640 feet from that unit. On the basis of the information the

applicant has provided, the potential for impact from turbine missiles generated as a result of that particular orientation is not considered a possible threat that could affect the safe operation of the proposed Unit 3. Therefore, RAI 3.5.1.5-1 is closed.

- STD SUP 3.5-2 Aircraft Hazards

NRC staff reviewed STD SUP 3.5-2 which states that the site specific aircraft analysis and site specific critical areas are addressed in Section 2.2 of the North Anna 3 FSAR.

The staff's technical evaluation of this portion of the application is limited to reviewing the supplemental information pertaining to STD SUP 3.5-2.

The applicant performed the aircraft hazards evaluation in the SSAR because the Early Site Permit (ESP) site lies within 5 miles of the edge of a military route and within 2 miles of the edge of a federal airway. The applicant addressed and evaluated potential aircraft hazards following the approach and methodology outlined in the NUREG-0800, SRP Section 3.5.1.6, "Aircraft Hazards." The applicant simulated an aircraft crash into the effective plant areas of the safety-related structures on the site. The applicant determined the probability of aircraft accidents resulting in radiological consequences greater than the 10 CFR Part 100 exposure guidelines based on the following:

- A third airport within 10 miles of Unit 3 opened in 2007. It is a private landing strip approximately 7.6 miles north-northwest of the site. The airport is not licensed for commercial use and has only three small aircraft based on the field. The expected volume of traffic is very light and would not exceed the limiting operations ( $500 \times 7.6^2 = 28,880$ ). Therefore, no additional evaluation was performed.
- One civil airway (V223) and four military training routes (IR714, IR760, VR1754, and VR1755) pass near the Unit 3 site. The U.S. Federal Aviation Administration (FAA) at Richmond International Airport characterized civil airway V223 as "not heavily used" and estimated the traffic to be no more than 200 aircrafts per day. The U.S. Department of the Navy identified a total of 341 flight operations in the year 2006 for the four routes, compared with the Site Safety Analysis Report (SSAR) assumption of 6,000 flights per year. As a result, the number of military training flights assumed in the SSAR remains bounding. To estimate the probability calculations, the applicant for the ESBWR design considered the ESBWR reactor building (RB) and fuel building (FB) and the control and radwaste buildings. The applicant estimated the total effective plant area at 0.024 square miles for civil airways and 0.032 square miles for the military routes and revised the probability calculations.

Utilizing the above revised data, the total probability of an aircraft crash into the plant was determined by the applicant to be  $1.02 \times 10^{-7}$  per year. Based on the recent FAA flight data obtained by the staff, the determination was made that the applicant had used conservatively higher values for flight operations to determine the total aircraft hazard probability. On the basis of FAA flight data and the review of the applicant's calculations of the probability of aircraft hazards, the staff considered the applicant's approach reasonable and the conclusion acceptable.

### **3.5.5 Post Combined License Activities**

There are no post COL activities related to this section.

### 3.5.6 Conclusion

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

The staff is reviewing the information in DCD Section 3.5 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to missile protection, incorporated by reference in the North Anna 3 COL FSAR, will be documented in the staff SER on the DC application for the ESBWR. The SER on the ESBWR is not yet complete and is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.5 of this SER to reflect the final disposition of the DCA.

In addition, the staff concluded that the relevant information presented in the COL FSAR is acceptable and meets the requirements of GDC 4 of Appendix A to 10 CFR Part 50. The staff based this conclusion on the following:

- STD SUP 3.5-1, "Site Proximity Missiles," is acceptable because the applicant has identified potential accidents related to the generation of site proximity missiles (except aircraft) in the site vicinity that could affect a nuclear power plant or plants of the specified type that might be constructed on the proposed site. The applicant has appropriately determined those potential accidents that should be considered as design-basis events and has demonstrated that the plant is adequately protected and can be operated with an acceptable degree of safety with regard to the design-basis accidents. The staff reviewed the information in the SSAR and FSAR. For the reasons given above, the staff concluded that the applicant has established that the construction and operation of Unit 3 of the specified type on the proposed site location is acceptable and meets the requirements of 10 CFR 52.79(a)(1)(iv) and 10 CFR 52.79(a)(1)(vi) for compliance with respect to determining the acceptability of the site.
- STD SUP 3.5-2, "Aircraft Hazards," is acceptable because the applicant has identified potential accidents related to the aircraft hazards in the site vicinity that could affect a nuclear power plant or plants of the specified type that might be constructed on the proposed site. The applicant has appropriately determined those potential accidents that should be considered as design-basis events and has demonstrated that the plant is adequately protected and can be operated with an acceptable degree of safety with regard to the design-basis accidents. The staff reviewed the information in the SSAR and FSAR. For the reasons given above, the staff concluded that the applicant has established that the construction and operation of Unit 3 of the specified type on the proposed site location is acceptable and meets the requirements of 10 CFR 52.79(a)(1)(iv) and 10 CFR 52.79(a)(1)(vi) for compliance with respect to determining the acceptability of the site.

### 3.6 Protection Against Dynamic Effects Associated with the Postulated Rupture of Piping

Section 3.6 of the North Anna 3 COL FSAR incorporates by reference with no departures or supplements Section 3.6, "Protection Against Dynamic Effects Associated with the Postulated Rupture of Piping," of Revision 5 of the ESBWR DCD. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 3.6 on Docket No. 52-010. The results of the staff's technical evaluation of the protection against dynamic effects associated with the postulated rupture of piping, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.6 of this SER to reflect the final disposition of the DCA.

### **3.7        Seismic Design**

Seismic Category I SSCs are designed to withstand the effects of the SSE event and to maintain the specified design functions. Seismic Category II and nonseismic structures are designed or physically arranged (or both) so that the SSE event would not cause an unacceptable structural interaction with or failure of seismic Category I SSCs.

The bases for the seismic design of safety-related SSCs and equipment include the following:

- Design ground motion response spectra (GMRS)
- Design ground motion time history
- Percentage of critical damping values
- Supporting media for seismic Category I structures

The seismic analyses of all seismic Category I SSCs use either a suitable dynamic analysis method or an equivalent static load method, if justified. Appropriate models are used for the soil, structures, and soil-structure interactions.

The seismic instrumentation program provides time history data on the seismic response of the free-field containment structure, and other seismic Category I structures, and is annunciated in the control room when triggered by a seismic event.

#### **3.7.1        Seismic Design Parameters**

##### **3.7.1.1     Introduction**

The ESBWR standard plant SSE design ground motion is addressed in Section 3.7, "Seismic Design," of ESBWR DCD, Revision 5. The horizontal and vertical SSE design ground motion spectra were developed by enveloping RG 1.60 response spectra anchored to 0.3 g acceleration level and North Anna 3 ESP site specific ground motion spectra. These spectra are shown in Figures 2.0-1 and 2.0-2 for horizontal and vertical directions, respectively, for a 5 percent damping level. ESBWR DCD Tier 2, Table 3.7-2 provides the spectral acceleration values of seismic design ground motion at 5 percent damping for different frequencies. The standard plant SSE design ground motion is subsequently termed the Certified Seismic Design Response Spectra (CSDRS) for the ESBWR design.

The CSDRS have also been used as the input ground motion at the building foundation level for the seismic design of the different buildings included in the certified design document. For the RB and FB and the control building, the input motion is the same as that shown in DCD Figures 2.0-1 and 2.0-2. The input motion for the Fire Water Service Complex (FWSC) is 1.35 times the values in Figures 2.0-1 and 2.0-2.

In all cases, the input motion is specified as outcrop motion in the free-field (i.e., the motion is not affected by the soil above the input elevation).

The response of the safety-related seismic Category I SSCs is affected by the following parameters:

- Design GMRS/time history
- Percentage of critical damping
- Characteristics of the supporting media

### **3.7.1.2 Summary of Application**

In North Anna 3 COL FSAR Section 3.7, the applicant incorporated by reference Section 3.7 of ESBWR DCD, Revision 5. Section 3.7 of the DCD includes Section 3.7.1, "Seismic Design Parameters."

In addition, in FSAR Section 3.7, the applicant provided the following:

#### Supplemental Information

- NAPS SUP 3.7-1 Site Specific Design Ground Motion Response Spectra

The applicant stated that the GMRS and the Foundation Input Response Spectra (FIRS) are described in Section 2.5.2 and the CSDRS at the foundation level are compared with the FIRS in Table 2.0-201. Specifically, the control building FIRS are in Figure 2.5-206, the RB and FB FIRS are in Figure 2.5-207, and the FWSC FIRS are in Figure 2.5-208. The comparisons of the DCD site parameters (CSDRS for the control building and the RB and FB) and Unit 3 site characteristic values (FIRS for the control building and RB and FB) are in Figure 2.0-201 for the horizontal spectra and in Figure 2.0-202 for the vertical spectra. The comparisons of the DCD site parameter (CSDRS for the FWSC) and Unit 3 site characteristic values (FIRS for the FWSC) are in Figure 2.0-203 for the horizontal spectra and in Figure 2.0-204 for the vertical spectra.

- NAPS SUP 3.7-2 Site Specific Design Ground Motion Time History

The applicant stated that the site specific earthquake ground motion time history is described in Section 2.5.4.

- NAPS SUP 3.7-3 Supporting Media for seismic Category I Structures

The applicant stated that the site specific properties of subsurface materials are in Section 2.5.4.

### **3.7.1.3 Regulatory Basis**

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

In addition, the relevant requirements of the Commission regulations for the site specific seismic design parameters and the associated acceptance criteria are described in Section 3.7.1 of NUREG-0800.

The applicable regulatory requirements for the site specific seismic design parameters are as follows:

- 10 CFR 52.79
- GDC 2 of Appendix A to 10 CFR Part 50
- Appendix S of 10 CFR Part 50

#### **3.7.1.4 Technical Evaluation**

NRC staff reviewed Section 3.7.1 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff's review confirmed that the information in the application and the information incorporated by reference address the relevant information related to the site specific seismic design parameters.

The staff is reviewing Section 3.7.1 of the DCD on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference related to the site specific seismic design parameters 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

- NAPS SUP 3.7-1 Site Specific Design Ground Motion Response Spectra

The staff reviewed NAPS SUP 3.7-1 related to the site specific design GMRS included under Section 3.7.1 of the North Anna 3 COL FSAR.

In Section 3.7.1.1.4, "Site Specific Design Ground Motion Response Spectra," supplemental Information Item NAPS SUP 3.7-1 provides additional information on the Design GMRS, including the FIRS for the RB and FB, control building, and FWSC at North Anna Unit 3.

The staff reviewed the site specific supplemental information in NAPS SUP 3.7-1 addressing site specific design GMRS included under Section 3.7.1.1.4 of the North Anna 3 COL. Comparisons of DCD CSDRS and FIRS for the RB and FB and control building are in Figures 2.0-201 and 2.0-202. Comparisons of DCD CSDRS and FIRS for the FWSC are in Figures 2.0-203 and 2.0-204. These comparisons demonstrate that Unit 3 site characteristic values FIRS are bounded by the DCD CSDRS. The comparison also demonstrates that the site specific FIRS for seismic Category I structures is an appropriate response spectrum with a peak ground acceleration level of at least 0.1 g, as required by Appendix S to 10 CFR Part 50.

Both 10 CFR 100.23 (d)(1) and 10 CFR Part 50 Appendix S specify that the SSE ground motion for the site is characterized by both horizontal and vertical free-field GMRS at the free-ground surface. For application to the engineering design, site specific GMRS that were determined at the foundation level of seismic Category I structures are bounded by CSDRS. However, a site specific SSE should be established as free-field GMRS that would be used to determine whether the plant shutdown would be required following a seismic event. The staff issued **RAI 3.07.01-2**, which requested the applicant to include in Section 3.7.1.1.4 both the site specific SSE and the corresponding OBE that would be required for operating the plant and setting up the seismic instrumentation, as required in FSAR Section 3.7.4. This RAI is **Open Item 3.07.01-2**.

It was noted that in response to **RAI 02.05.04-13 (Item 1.d)**, the applicant concluded that the backfill for the FWSC does not meet the DCD site parameter for minimum shear wave velocity.

As such per Note 16 of DCD Tier 2, Table 2.0-1, the applicant will re-perform the FIRS and perform a site specific SSI analysis for the FWSC to demonstrate its seismic adequacy. This analysis is not yet complete. This issue will be addressed by **Open Item 02.05.04-13 (1.d)**.

- NAPS SUP 3.7-2 Site Specific Design Ground Motion Time History

NRC staff reviewed NAPS SUP 3.7-2 related to the site specific design ground motion time history included under Section 3.7.1 of the North Anna 3 COL FSAR.

In Section 3.7.1.1.5, "Site Specific Design Ground Motion Time History," Supplemental Information Item NAPS SUP 3.7-2 refers to Section 2.5.4 for the site specific earthquake ground motion time history.

The staff reviewed the site specific supplemental information in NAPS SUP 3.7-2 and concluded that the applicant's reference to Section 2.5.4 did not provide sufficient information. The staff issued **RAI 03.07.01-1**, which requested the applicant to identify the appropriate FSAR sections and figures that address ground motion time histories.

In a response dated August 12, 2008, the applicant stated, "As indicated in FSAR Section 2.5.4.7.3, site specific ground motion time histories for the North Anna Unit 3 site are described in Section 2.5.4.7.3 of the SSAR for the North Anna ESP application, which is incorporated by reference into the COL application FSAR. Specifically, SSAR Section 2.5.4.7.3 states:

Two single horizontal-component acceleration time histories were developed to be spectrum-compatible for use in the rock column amplification analysis of [SSAR] Section 2.5.2.6.7 and the soil column amplification analysis described in [SSAR] Section 2.5.4.7.4. These time histories represent the high frequency and low frequency range of the horizontal hard rock SSE spectrum of [SSAR] Figure 2.5-48. These two time histories are described in [SSAR] Section 2.5.2.6.7.

The introductory paragraph in SSAR Section 2.5.2.6.7 states:

[SSAR] Figure 2.5-48 shows the hard rock (9,200 fps control point) horizontal and vertical SSE ground motion spectra selected for the North Anna ESP site. These spectra were established in consideration of two alternate approaches described in this section: a reference probability approach and a performance-based approach. The SSE spectra shown in Figure 2.5-48 have been conservatively selected to envelop both approaches.

The balance of SSAR Section 2.5.2.6.7 then proceeds to discuss the development of the subject SSE spectra.

The staff reviewed the applicant's response to **RAI 03.07.01-1**. The staff found the reference to Section 2.5.4 of the FSAR adequate based on further referencing from that section to sections addressing the issue in the SSAR for the North Anna 3 early site application. Accordingly, **RAI 03.07.01-1** is considered resolved.

- NAPS SUP 3.7-3

### Supporting Media for seismic Category I Structures

NRC staff reviewed NAPS SUP 3.7-3 related to the supporting media for seismic Category I structures included under Section 3.7.1 of the North Anna 3 COL FSAR.

In Section 3.7.1.3, “Supporting Media for seismic Category I Structures,” under Supplementary Information NAPS SUP 3.7-3, the applicant stated that the site specific properties of subsurface materials are in Section 2.5.4.

The staff reviewed the site specific supplemental information in NAPS SUP 3.7-3. The RB and FB and the control building are founded on sound bed rock. The FWSC is founded on weathered rock and structural fill. The staff noted that per Table 2.0-201, equivalent uniform shear wave velocity of the supporting media for seismic Category I structures meets the DCD minimum required site parameter value of 1,000 feet per second. ESBWR DCD Appendix 3A, Section 3A.3.2 also notes that North Anna ESP site specific soil conditions were considered for the ESBWR design. Figure 2.5-241 of the North Anna 3 COL FSAR shows median shear wave velocity versus depth for the North Anna Unit 3 site. Although North Anna Unit 3 site specific parameters for the RB and FB and the control building fall within the range of parameters considered for the seismic analysis of the standard plant design (ESBWR DCD), the applicant in response to **RAI 02.05.04-13 (Item 1.d)**, concluded that the backfill for the FWSC does not meet the DCD site parameter for minimum shear wave velocity. As such per Note 16 of DCD Tier 2, Table 2.0-1, the applicant will re-perform the FIRS and perform a site specific SSI analysis for the FWSC to demonstrate its seismic adequacy. This analysis is not yet complete. This issue will be addressed by **Open Item 02.05.04-13 (item 1.d)**.

#### **3.7.1.5 Post Combined License Activities**

There are no post COL activities related to this section.

#### **3.7.1.6 Conclusion**

NRC staff reviewed the application and checked the referenced DCD. The staff’s review confirmed that the applicant has addressed the relevant information relating to site specific seismic design parameters for the RB and FB and the control building. However, as a result of **Open Items 3.07.01-2 and 02.05.04-13 (item 1.d)**, the staff is unable to finalize the conclusions for this section relating to site specific seismic design parameters, in accordance with the requirements of NRC regulations.

The staff is reviewing the information in the DCD Section 3.7.1 on Docket No. 52-010. The results of the staff’s technical evaluation of the information related to site specific seismic design parameters, incorporated by reference in the North Anna 3 COL FSAR, will be documented in the staff SER on the DC application for the ESBWR. The SER on the ESBWR is not yet complete and is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.7.1 of this SER to reflect the final disposition of the DCA.

In addition, the staff concluded that the information pertaining to North Anna 3 COL FSAR Section 3.7.1 is within the scope of the design certification and adequately incorporates by reference Section 3.7.1 of the ESBWR DCD. The information is thus acceptable. The staff also compared the additional COL plant-specific supplemental information in the application to the relevant NRC regulations; to the acceptance criteria defined in NUREG-0800, Section 3.7.1;

and to other NRC RGs and concluded that the applicant is in compliance with the NRC regulations.

COL plant-specific supplemental information in NAPS SUP 3.7-1, NAPS SUP 3.7-2 and NAPS SUP 3.7-3 adequately addresses site specific design response spectra and time history for an SSE and demonstrates that it is bounded by the certified design response spectra of the ESBWR DCD. However, a site specific SSI analysis for the FWSC should be performed to adequately address the site characteristic value for shear wave velocity, and SSE should be established as free-field GMRS that would be used to determine whether the plant shutdown would be required following a seismic event. These issues are being tracked by **Open Items 3.07-01-2** and **02.05.04-13 (item 1.d)**.

### **3.7.2 Seismic System Analysis**

#### **3.7.2.1 Introduction**

Seismic analysis methods and acceptance criteria for all seismic Category I structures are described in Section 3.7.2, "Seismic Design," of the ESBWR DCD, Revision 5. It includes a review of basic assumptions, procedures for modeling, seismic analysis methods, development of in-structure response spectrum envelopes, consideration of torsional effects, evaluation of overturning and sliding of seismic Category I structures, and determination of composite damping. The review also covers design criteria and procedures for evaluating the interaction of nonseismic Category I structures with seismic Category I structures and the effects of parameter variations on floor response spectra (FRS).

Specifically, seismic system analyses of safety-related SSCs and equipment include the following:

- Seismic analysis methods
- Natural frequencies and responses
- Procedures used for analytical modeling
- Soil-structure interactions
- Development of in-structure response spectra
- Three components of earthquake motion
- Combination of modal responses
- Interactions of non-category I structures with seismic category I structures.
- Effects of parameter variations on FRS
- Use of equivalent vertical static factors
- Methods used to account for torsional effects
- Comparison of responses
- Analysis procedures for damping
- Determination of seismic Category I structure overturning moments

#### **3.7.2.2 Summary of Application**

Section 3.7 of the North Anna 3 COL FSAR incorporates by reference Section 3.7 of ESBWR DCD, Revision 5. Section 3.7 of the DCD includes Section 3.7.2, "Seismic System Analysis."

In addition, in FSAR Section 3.7, the applicant provided the following:



In Section 2.5.4, the applicant describes the site specific properties of subsurface materials.

The staff reviewed the site specific supplemental information in NAPS SUP 3.7-4 related to site specific subsurface material. The RB and FB and the control building are founded on sound bedrock. The FWSC is founded on weathered rock and structural fill. The staff noted that per Table 2.0-201, equivalent uniform shear wave velocity of the supporting media for seismic Category I structures meets the DCD minimum required site parameter value of 1,000 feet per second. ESBWR DCD Appendix 3A, "Seismic Soil-Structure Interaction Analysis," also notes that North Anna ESP site specific soil conditions were considered for the ESBWR seismic analysis. Figure 2.5-241 of the North Anna 3 COL FSAR shows median shear wave velocity versus depth for the North Anna Unit 3 site. Although North Anna Unit 3 site specific parameters for the RB and FB and the control building fall within the range of parameters considered for the seismic soil-structure analysis of standard plant design, as documented in the ESBWR DCD, the applicant in response to **RAI 02.05.04-13 (Item 1.d)**, concluded that the backfill for the FWSC does not meet the DCD site parameter for minimum shear wave velocity. As such per Note 16 of DCD Tier 2, Table 2.0-1, the applicant will re-perform the FIRS and perform a site specific SSI analysis for the FWSC to demonstrate its seismic adequacy. This analysis is not yet complete. This issue will be addressed by **Open Item 02.05.04-13 (item 1.d)**.

- NAPS SUP 3.7-5 Interaction of Non-Category I Structures with seismic Category I Structures

NRC staff reviewed NAPS SUP 3.7-5 related to interactions of non-Category I structures with seismic Category I structures included under Section 3.7 of the North Anna 3 COL FSAR.

As supplemental information to ESBWR DCD 3.7.2.8, the applicant refers to Figure 2.1-201 for the locations of site structures.

NRC staff reviewed Supplemental Information Item NAPS SUP 3.7-5 related to addressing the interactions of nonseismic Category I structures with seismic Category I structures, in conjunction with ESBWR DCD 3.7.2.8. NAPS SUP 3.7-5 referred to Figure 2.1-201 of the COL application for the locations of site structures. However, neither FSAR Section 3.7.2.8 nor the referenced Figure 2.1-201 includes all of the information required per C.I.3.7.2.8 of RG 1.206 to verify protection of seismic Category I structures from the failure of non-Category I structures as a result of seismic effects. ESBWR DCD 3.7.2.8 only includes the design criteria to be applied in plant design. Thus, in the absence of plant-specific information, such as distance between structures and the height of each structure, this item cannot be verified. The staff issued **RAI 03.07.02-1**, which requested the applicant to provide the identification and location of each Category I, II, and nonseismic structures, including the distance between structures and the height of each structure.

In the applicant's response dated October 8, 2008, the applicant stated that "FSAR Figure 2.1-201 and DCD Figure 1.1-1 include the names and locations of Category I, II, and nonseismic structures for North Anna Unit 3.

DCD Section 3.7.2.8 establishes design criteria that protect seismic Category I structures from the failure of non-Category I structures as a result of seismic effects. These criteria are applicable to structures that are within the scope of the ESBWR standard plant design and structures that are plant specific.

Information regarding the heights and actual distances between Categories I, II, and nonseismic structures that are within the scope of the ESBWR standard plant design is the responsibility of GEH.

The heights of Unit 3 plant-specific structures, which are nonseismic, and the distances to the closest seismic Category I structure are in Table 1 (Attachment 1). The table shows that the height of each plant-specific structure is less than the distance to the nearest seismic Category I structure. The information contained in this table may change as the detailed design is completed. Any changes in the design, however, will continue to meet the DCD criteria to protect seismic Category I structures from the failure of non-Category I structures as a result of seismic effects.

The staff reviewed the applicant's response to **RAI 03.07.02-1** and found that all Unit 3 plant-specific structures, which are nonseismic, have heights that are less than the distance separating them from the nearest Category I structure. The applicant also indicated that the information regarding the heights of the plant-specific nonseismic structures and the distances separating them from the closest seismic Category I structures may change as the detailed design is completed. However, any changes in the design will continue to meet the DCD criteria in order to protect seismic Category I structures from the failure of non-Category I structures. Accordingly, **RAI 03.07.02-1** is considered resolved.

#### **3.7.2.5 Post Combined License Activities**

There are no post COL activities related to this section.

#### **3.7.2.6 Conclusion**

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the relevant information relating to the site specific seismic analysis for the RB and FB and the control building. However, as a result of **Open Item 02.05.04-13 (item 1.d)**, the staff is unable to finalize the conclusions for this section relating to seismic analysis of FWSC, in accordance with the requirements of NRC regulations.

The staff is reviewing the information in DCD Section 3.7.2 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the site specific seismic analysis, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.7.2 of this SER to reflect the final disposition of the DCA.

#### **3.7.3 Seismic Subsystem Analysis**

Section 3.7.3 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 3.7.3, "Seismic Subsystem Analysis," of Revision 5 of the ESBWR DCD. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 3.7.3 on Docket No. 52-010. The results of the staff's technical evaluation of the seismic subsystem analysis, incorporated by reference in the North Anna 3 COL FSAR, will be documented in the staff SER on the DCA for the





NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 3.8 on Docket No. 52-010. The results of the staff's technical evaluation of the seismic Category 1 structures, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.8 of this SER to reflect the final disposition of the DCA.

### **3.9 Mechanical Systems and Components**

This section describes the structural integrity and functional capability of various safety-related mechanical components. The design is not limited to the American Society of Mechanical Engineers (ASME) Code components and supports but is extended to other components, such as control rod drive mechanisms, certain reactor internals, and any safety-related piping designed to industry standards other than the ASME Code. The design includes issues such as load combinations, allowable stresses, methods of analysis, summary of results, and preoperational testing. The evaluation of this section focuses on determining whether there is adequate assurance that mechanical systems and components will perform their safety-related functions under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events.

#### **3.9.1 Special Topics for Mechanical Components**

Section 3.9.1 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 3.9.1, "Special Topics for Mechanical Components," of Revision 5 of the ESBWR DCD. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 3.9.1 on Docket No. 52-010. The results of the staff's technical evaluation of the special topics for mechanical components, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.9.1 of this SER to reflect the final disposition of the DCA.

#### **3.9.2 Dynamic Testing and Analysis of Systems Structures and Components**

##### **3.9.2.1 *Introduction***

The methodology, testing procedures, and dynamic analyses that GE used to ensure the structural integrity and functionality of piping systems, mechanical equipment, and their supports under vibratory loadings are described.

The criteria for the SSC design include the following considerations:

- Piping vibration, thermal expansion, and dynamic effects

- Seismic qualification testing of safety-related mechanical equipment
- Dynamic response analysis of reactor internals under operational flow transients and steady-state conditions
- Pre-operational flow-induced vibration (FIV) testing of reactor internals
- Dynamic system analysis of the reactor internals under faulted condition
- Correlation of reactor internals vibration tests with the analytical results

### **3.9.2.2 Summary of Application**

Section 3.9.2 of the North Anna 3 COL FSAR incorporates by reference Section 3.9.2 of the ESBWR DCD, Revision 5, with no departures. In addition, in FSAR Section 3.9.2.4, the applicant provided the following supplement:

#### COL Item

- NAPS COL 3.9.9-1-H Reactor Internals Vibration Analysis, Measurements and Inspection Program

The applicant provided additional information to address the vibration assessment program as specified in RG 1.20.

### **3.9.2.3 Regulatory Basis**

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

In addition, the relevant requirements of the Commission regulations for the reactor internal vibration analysis, measurements and inspection program, and associated acceptance criteria are described in Section 3.9.2 of NUREG-0800.

The applicable regulatory requirements for the reactor internals vibration analysis, measurements and inspection program are as follows:

- 10 CFR 52.79(a) (11)
- 10 CFR 50.55a
- GDC 1 and 4 of Appendix A to 10 CFR Part 50

The related acceptance criteria are as follows:

- RG 1.20

### **3.9.2.4 Technical Evaluation**

NRC staff reviewed Section 3.9.2 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff's review confirmed that

the information in the application and the information incorporated by reference address the relevant information related to the dynamic testing and analysis of SSCs.

The staff is reviewing Section 3.9.2 of the DCD on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference related to the dynamic testing and analysis of SSCs will be documented in the staff SER on the DCA for the ESBWR.

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

- NAPS COL 3.9.9-1-H                      Reactor Internals Vibration Analysis, Measurements and Inspection Program

NRC staff reviewed NAPS COL 3.9.9-1-H related to the vibration assessment program included under Section 3.9.2 of the North Anna 3 COL FSAR.

Nuclear power plant operating experience has revealed the potential for adverse flow effects from vibration caused by hydrodynamic loads and acoustic resonance within reactor coolant, steam, and feedwater systems, as well as reactor internal components such as steam dryers. The staff issued **RAI 03.09.02-1** (identified in the eRAI system as **RAI 747- 2436**), which requested Dominion to describe the planned implementation of the program to address potential adverse flow effects on safety-related valves and dynamic restraints within the Inservice Testing (IST) Program in the reactor coolant, steam, and feedwater systems at North Anna Unit 3 from hydraulic loading and acoustic resonance during plant operation.

Dominion responded to this RAI in a letter dated September 11, 2008, that presented a plan to use the overall Initial Test Program, which includes preoperational and startup testing, to address potential adverse flow effects on safety-related valves and dynamic restraints. The program will confirm attributes of the component design described in the ESBWR DCD, with implementation described in FSAR Section 14.2 and Table 13.4-201. As part of ESBWR DCD Tier 2, Section 3.9.2, Dominion referred to ESBWR DCD Tier 2, Section 3.9.2.1, "Piping Vibration, Thermal Expansion and Dynamic Effects," which states that the overall test program is divided into the preoperational test phase and the initial startup test phase with piping vibration, thermal expansion, and dynamic effects testing performed during both phases and described in ESBWR DCD Tier 2, Chapter 14. Dominion also referred to ESBWR DCD Tier 2, Section 3.9.2.1.1, "Vibration and Dynamic Effects Testing," which states that the purpose of these tests is to confirm that the piping, components, restraints, and supports of specified high- and moderate-energy systems have been designed to withstand the dynamic effects of steady-state, FIV and anticipated operational transient conditions.

Dominion referenced ESBWR DCD Tier 2, Section 3.9.3.5, which requires valve specifications to incorporate lessons learned from nuclear power plant operations and research programs, including applicable load combinations. Dominion also referred to ESBWR DCD Tier 2, Sections 3.9.3.7 and 3.9.3.8, which require analyses or tests for component supports to assure their structural capability to withstand seismic and other dynamic excitations. With respect to reactor internals, ESBWR DCD Section 3.9.2.3 states that the major reactor internal components within the vessel are subjected to extensive testing, coupled with dynamic system analyses, to properly evaluate the resulting FIV phenomena during normal reactor operation and from anticipated operational transients. The preoperational and startup tests are described in DCD Section 14.2.8.1.42, "Expansion, Vibration and Dynamic Effects Preoperational Test," and in DCD Section 14.2.8.2.10, "System Vibration Test," which describe the applicable preoperational and startup tests. Based on this information, the staff found Dominion's

description of plans to implement the provisions in the ESBWR DCD to address potential adverse flow effects for safety-related valves and dynamic restraints at North Anna 3 to reflect nuclear power plant operating experience. In particular, Dominion plans to address the effects of steady-state FIV and operational transients, including lessons learned from operating experience and research programs as part of equipment qualification. Further, Dominion plans to address potential adverse flow effects by monitoring piping vibration during the Initial Test Program for North Anna 3. The staff will review the qualification provisions for potential adverse flow effects as part of the review of design and procurement specifications stated in SER Section 3.9.6. The implementation of the provisions in ESBWR DCD Tier 2, Chapter 14 will be reviewed as part of future NRC inspections at North Anna 3. The staff found Dominion's plans acceptable because they recognize the safety significance of potential adverse flow effects with future regulatory activities to monitor the details of those plans. Therefore, RAI 03.09.02-1 is closed.

The staff issued **RAI 03.09.02-2**, which requested Dominion to indicate when it proposed to submit to the staff an implementation schedule to review the comprehensive FIV assessment program for reactor internals, in accordance with RG 1.20 Revision 3 and SRP Sections 3.9.2 and 3.9.5. Dominion responded to this RAI in a letter dated September 11, 2008, and stated that the comprehensive FIV assessment program for reactor internals has been submitted by GEH to the staff as part of the ongoing ESBWR DCD review.

RG 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing," Revision 3, Section C.2.5, "Schedule," specifies the following five items to be addressed for an acceptable schedule:

- NRC staff requested classification of the reactor internals as a prototype or a specific non-prototype category. In response, Dominion stated that per DCD Appendix 3L.1, the ESBWR reactor internals are non-prototype Category II.
- During the staff's review of the COL application, a commitment should be established regarding the scope of the comprehensive vibration assessment program. In response, Dominion stated that a description of the program scope is in DCD Appendix 3L. The North Anna 3 FSAR incorporates DCD Appendix 3L by reference, thus Dominion has committed to the comprehensive vibration assessment program scope described in DCD Section 3L.
- The staff requested a description of the vibration measurement and inspection phases of the comprehensive vibration assessment program, which should be submitted to the NRC with sufficient time to permit utilization of the staff's related recommendations. In response, Dominion stated that a description of the program's vibration measurement and inspection phases is in DCD Appendix 3L.
- The staff requested a summary of the vibration analysis program to be submitted to the NRC at least 60 days before submission of the description of the vibration measurement and inspection programs. Dominion responded that a summary of the vibration analysis program is in DCD Appendix 3L. (For details on the vibration analysis program see DCD Section 3L.5, "Startup Test Program.") The comprehensive vibration assessment program impact (hammer) tests, described in DCD Section 3L.4.6, will be developed and available for the staff to review no later than 60 days before the intended use of the tests. FIV testing is described in DCD Section 14.2.8.2.11, "Reactor Internals Vibration Test (Initial startup Flow-Induced Vibration Testing)." The testing will be developed and available to the staff not less than 60 days before scheduled fuel load.

- The staff requested that the preliminary and final reports, which together summarize the results of the vibration analysis, measurement, and inspection programs, should be submitted to the NRC within 60 days and 180 days, respectively, following the completion of the vibration testing. Dominion responded with a commitment to submit preliminary and final reports within 60 days and 180 days, respectively, following the completion of the vibration testing.

In response to DCD COL Item 3.9.9-1-H, COL FSAR Section 3.9.2.4, "Initial Startup Flow-Induced Vibration Testing of Reactor Internals," states that "[a] vibration assessment program as specified in RG 1.20 will be completed no later than one year after the time of application." As Dominion stated in this RAI response, DCD Section 3L and the referenced GEH reports satisfy the vibration assessment program description requirement. FSAR Section 3.9.2.4 has been revised to provide the schedule information in accordance with the applicable scheduling portions of C.3 of RG 1.20 for non-prototype internals. FSAR Section 3.9.2.4 and Table 1.9-202, "Conformance with Regulatory Guides," have been revised as shown in the September 11, 2008, letter that comprises Dominion's response to **RAI 03.09.02-2**. The staff's review considered this information reasonable and acceptable based on the ongoing ESBWR DCD review. Therefore, RAI 03.09.02-2 is closed.

### **3.9.2.5 Post Combined License Activities**

The applicant identified the following commitment:

- NAPS COL 3.9.9-1-H Reactor Internals Vibration Analysis, Measurements and Inspection Program.

In the final SER, the staff will determine the specific commitments to be included as conditions to the license.

### **3.9.2.6 Conclusion**

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the relevant information relating to the dynamic testing and analysis of SSCs, and no outstanding information is expected to be addressed in the COL FSAR related to this section.

The staff is reviewing the information in DCD Section 3.9.2 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the dynamic testing and analysis of SSCs, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.9.2 of this SER to reflect the final disposition of the DCA.

In addition, based on the staff's review discussed in this SER section, the staff concluded that the North Anna 3 COL application, together with incorporation by reference of the ESBWR DCD, provides an acceptable description of the Dynamic and Analysis and Testing Program to be used at North Anna 3. The staff has determined that this program will provide reasonable assurance that SSCs to be used at North Anna 3 will be capable of performing their safety functions if the program is developed and implemented consistent with the descriptions in the North Anna 3 FSAR and the ESBWR DCD. Therefore, the staff concluded that Dominion has

provided sufficient information to satisfy the requirements of 10 CFR Parts 50 and 52 for the dynamic testing and analysis of SSCs, pending resolution of the identified open items in this SER section and approval of the ESBWR DCA.

### **3.9.3 ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures**

#### **3.9.3.1 Introduction**

The structural integrity and functional capability of pressure-retaining components, their supports, and core support structures are ensured by designing them in accordance with ASME Code Section III, or other industrial standards. The loading combinations and their respective stress limits; the design and installation of pressure-relief devices; and the design and structural integrity of ASME Code Class 1, 2, and 3 components and component supports are included.

The criteria for the SSC design include the following considerations:

- Loading combinations, design transients, and stress limits
- Pump and valve operability assurance
- Design and installation criteria of Class 1, 2, and 3 pressure-relieving devices
- Component and piping supports

#### **3.9.3.2 Summary of Application**

Section 3.9.3 of the North Anna 3 COL FSAR incorporates by reference Section 3.9.3 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 3.9.3, the applicant provided the following:

##### COL Items

- STD COL 3.9.9-2-H ASME Class 2 or 3 or Quality Group D Components with 60 Year Design Life

The applicant provided additional information in STD COL 3.9.9-2-H to address COL Information Item 3.9.9-2-H. The applicant stated that the piping stress reports identified in this DCD section will be completed within 6 months of completing ITAAC Table 3.1-1. The FSAR will be revised as necessary to address the results of this analysis.

- STD COL 3.9.9-4-A Snubber Inspection and Test Program

The applicant provided additional information in STD COL 3.9.9-4-A to address DCD COL Item 3.9.9-4-A. The applicant stated that a plant-specific table will be prepared in conjunction with closure of ITAAC Table 3.1-1, with specific snubber information listed in this section of the DCD. This information will be included as part of a subsequent FSAR update. The applicant also stated that the Inservice Testing Program for snubbers will be completed in accordance with milestones described in Section 13.4.

### 3.9.3.3 *Regulatory Basis*

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

The relevant requirements of the Commission regulations for ASME components and supports, including inservice testing and the associated acceptance criteria, are described in Sections 3.9.3 and 3.9.6 of NUREG-0800. In addition, the relevant requirements of Commission regulations for Sections 3.9.3 and 3.9.6 are contained in 10 CFR 50.55a and Appendix A GDC 1, 2, 4, 14, and 15.

### 3.9.3.4 *Technical Evaluation*

NRC staff reviewed Section 3.9.3 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff's review confirmed that the information in the application and the information incorporated by reference address the relevant information related to the ASME Code Class 1, 2, and 3 Components; Component Supports; and Core Support Structures.

The staff is reviewing Section 3.9.3 of the DCD on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference related to the piping stress reports and the ASME Code Class 1, 2, and 3 Components; Component Supports; and Core Support Structures will be documented in the staff SER on the DCA for the ESBWR.

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

- STD COL 3.9.9-2-H ASME Class 2 or 3 or Quality Group D Components with 60 Year Design Life

The staff reviewed STD COL 3.9.9-2-H, related to the schedule for completion of piping stress reports included under Section 3.9 of the North Anna 3 COL FSAR, which states:

“The piping stress reports identified in this DCD section will be completed within six months of the completion of ITTAC Table 3.1-1. The FSAR will be revised as necessary in a subsequent update to address the results of this analysis.”

However, this COL information item is being modified as part of the review of the ESBWR DCD, Revision 5. Until changes to STD COL 3.9.9-2-H are completed in the DCD, the staff is unable to evaluate the adequacy of the North Anna response to the COL item, and this will be addressed as part of **Open Item [1-1]**.

- STD COL 3.9.9-4-A Snubber Inspection and Test Program

NRC staff reviewed STD COL 3.9.9-4-A, related to milestones for completion of the IST Program for snubbers included under Section 3.9 of the North Anna 3 COL FSAR.

In ESBWR DCD Tier 2 COL Information Item 3.9.9-4-A, “A Snubber Inspection and Test Program,” GEH states that the “COL applicant shall provide a full description of the snubber preservice and inservice inspection and testing programs and a milestone for program implementation, including the development of a data table identified in Section 3.9.3.7.1(3)f.” In

FSAR Section 3.9.9, Dominion states that this COL Information Item, STD COL 3.9.9-4-A, is addressed in Section 3.9.3.7.1(3)e and Section 3.9.3.7.1(3)f of the FSAR.

In North Anna FSAR Section 3.9.3.7.1(3)e, Dominion states that the last two sentences at the end of DCD Section 3.9.3.7.1(3)e will be replaced with STD COL 3.9.9-4-A, which states, “The inservice testing program for snubbers will be completed in accordance with milestones described in Section 13.4.” In Table 13.4-201 of the FSAR, the Inservice Testing Program is identified as the program to be implemented according to 10 CFR 50.55a(f) and the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code). However, snubbers are not specifically identified in the table. The staff issued **RAI 3.9.03-01**, which requested Dominion to explain how Table 13.4-201 would assure that the snubber inservice program is included in the generic IST program listed in the table. Dominion responded in a letter dated September 3, 2008, and stated that Table 13.4-201 lists each operational program, the regulatory source for the program, the associated implementation milestones, and the section of the FSAR where the operational program is fully described. Dominion stated that Table 13.4-201, Item 1, the Inservice Inspection Program, and Item 2, the Inservice Testing Program, both include a reference to Section 3.9.3.7.1(3)e, “Snubber Preservice and Inservice Examination and Testing.” The staff addresses the IST Program for dynamic restraints at North Anna 3 in Section 3.9.6 of this SER.

The staff reviewed FSAR Section 13.4 and verified that Table 13.4-201 references to DCD Tier 2, Revision 5, Section 3.9.3.7.1(3)e indicate that the snubber inservice examination and testing program is included in the operational programs required by NRC regulations. This information is acceptable to the staff, and RAI 3.9.03-01 is closed.

In North Anna 3 FSAR Section 3.9.3.7.1(3)f, Dominion replaced the first sentence of this section with STD COL 3.9.9-4-A, which states that “A plant-specific table will be prepared in conjunction with closure of ITAAC Table 3.1-1 and include the following specific snubber information.” Because ESBWR DCD Tier 1, ITAAC Table 3.1-1 no longer contains piping and component ITAAC, the staff issued **RAI 3.9.03-02**, which requested Dominion to correct the reference of the above ITAAC table when preparing the requested plant-specific snubber information. Dominion responded to the RAI in a letter dated September 3, 2008, stating that DCD Revision 5 relocated the ITAAC related to the design of piping and components for specific systems from DCD Tier 1, Table 3.1-1 to the Tier 1 sections that contain the applicable systems. These ASME Code Class 1, 2, and 3 systems and associated ITAAC are listed in DCD Tier 1, Section 3.1, “Design of Piping Systems and Components.” Dominion stated that FSAR Section 3.9.3.7.1(3)f will be revised to state the following:

For the ASME Class 1, 2, and 3 systems listed in DCD Tier 1, Section 3.1 that contain snubbers, a plant-specific table will be prepared in conjunction with the closure of the system-specific ITAAC for piping and component design.

The staff found Dominion’s action in correcting the DCD Tier 1 reference regarding closure of component ITAAC to be adequate. Pending confirmation that the future DCD revision properly incorporates the changes as required, **RAI 3.9.03-02** will be **Confirmatory Item 3.9.3-02**.

### **3.9.3.5 Post Combined License Activities**

The staff considered the response to STD COL 3.9.9-2-H related to the schedule for the completion of piping stress reports and included under Section 3.9 of the North Anna 3 COL FSAR. Although it may change after **Open Item [1-1]** is resolved, Dominion committed to

completing the piping stress reports within 6 months of completing ITAAC Table 3.1-1. Also, the FSAR will be revised as necessary in a subsequent update to address the results of this analysis. Before finalizing the SER, the staff will determine the specific set of commitments to be included as conditions to the license.

#### **3.9.3.6 Conclusion**

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the relevant information relating to ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures, and no outstanding information is expected to be addressed in the COL FSAR related to this section. However, because of the **Confirmatory Item 3.9.3-2**, the staff is unable to finalize the conclusion for STD COL 3.9.9-4-A, related to milestones for completion of the inservice testing program for snubbers, in accordance with the requirements of 10 CFR 50.55a and GDC 1, 2, 4, 14, and 15.

The staff is reviewing the information in DCD Section 3.9.3 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.9.3 of this SER to reflect the final disposition of the DCA.

#### **3.9.4 Control Rod Drive System**

Section 3.9.4 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 3.9.4, "Control Rod Drive System," of Revision 5 of the ESBWR DCD. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 3.9.4 on Docket No. 52-010. The results of the staff's technical evaluation of the control rod drive system, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.9.4 of this SER to reflect the final disposition of the DCA.

#### **3.9.5 Reactor Pressure Vessel Internals**

Section 3.9.5 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements Section 3.9.5, "Reactor Pressure Vessel Internals," of Revision 5 of the ESBWR DCD. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 3.9.5 on Docket No. 52-010. The results of the staff's technical evaluation of the reactor pressure vessel internals, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.9.5 of this SER to reflect the final disposition of the DCA.

### **3.9.6 Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints**

#### **3.9.6.1 Introduction**

In this SER section, the NRC staff describes its review of the functional design, qualification, and IST Programs for pumps, valves, and dynamic restraints as required by the NRC regulations in 10 CFR Part 52 and Section 50.55a for North Anna 3. RG 1.206 discusses the Commission's position in SECY-05-197, "Review of Operational Programs in a Combined License Application and General Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," that operational programs should be fully described in COL applications to avoid the need for ITAAC related to those programs. Dominion relies on the ESBWR DCD and supplemental information in the FSAR for North Anna 3 to fully describe the IST Program, and other related operational programs, in support of the COL application.

#### **3.9.6.2 Summary of Application**

Section 3.9.6 of the North Anna 3 COL FSAR, Revision 1, incorporates by reference Section 3.9.6 of the ESBWR DCD, Revision 5. In addition, in FSAR Section 3.9.6, the applicant provided the following:

##### COL Item

- STD COL 3.9.9-3-A                      Inservice Testing Programs

The applicant provided additional information in STD COL 3.9.9-3-A to address COL Information Item 3.9.9-3-A. The applicant stated that the milestones for implementing the ASME OM Code preservice and IST Programs and the Motor-Operated Valve Testing Program are defined in Section 13.4.

##### Supplemental Information

- STD SUP 3.9-1                              10 CFR 50.55a Relief Requests and Code Cases

The applicant provided the following supplemental information. The applicant stated that no relief from or alternate to the ASME OM Code is being requested beyond what is identified in the DCD.

ESBWR DCD Section 3.9.3.5, "Valve Operability Assurance," describes the process for the functional design and qualification of valves to be used in the ESBWR. ESBWR DCD Tier 2, Section 3.9.3.5 specifies that valve designs not previously qualified will meet the requirements of the ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." For valve designs that were previously qualified to standards other than ASME QME-1-2007, ESBWR DCD Tier 2, Section 3.9.3.5 specifies an approach for valve qualification that follows the key principles of ASME QME-1-2007. The North Anna 3 FSAR incorporates by reference this section of the ESBWR DCD without supplemental information.

ESBWR DCD Tier 2, Section 3.9.3.6, "Design and Installation of Pressure Relief Devices," discusses main steam safety relief valves, other safety relief valves and vacuum breaker valves, and depressurization valves. The North Anna 3 FSAR incorporates by reference this section of the ESBWR DCD without supplemental information.

ESBWR DCD Tier 2, Section 3.9.3.7, "Component Supports," discusses piping supports, spring hangers, struts, and snubbers (dynamic restraints). In Revision 1 (dated December 2008) to the North Anna 3 FSAR, Dominion provided supplemental information on the snubber operational program for North Anna 3. This supplemental information describes the snubber Inservice Examination and Testing Program, including specifying that the program will satisfy ASME OM Code Section ISTD, and providing specific examples of the program content to supplement the ESBWR DCD.

ESBWR DCD Tier 2, Section 3.9.6, "Inservice Testing of Pumps and Valves," provides a general description of the IST Operational Program to be developed for an ESBWR plant. As a design change, the ESBWR does not include safety-related, motor-operated valves (MOVs). In Revision 1 (dated December 2008) to the North Anna 3 FSAR, Dominion provided supplemental information on the IST Program for North Anna 3. For example, the North Anna Unit 3 FSAR describes the overall IST Program, preoperational testing, power-operated valve testing, and check valve testing.

North Anna FSAR Section 13.4, "Operational Program Implementation," indicates that FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations," lists each operational program; the regulatory source for the program; the FSAR section that describes the operational program; and the associated implementation milestones. FSAR Table 13.4-201 specifies the implementation milestone for the IST Program as "after generator online on nuclear heat"; and the implementation milestone for the Preservice Testing Program and the MOV Testing Program as "prior to fuel load."

### **3.9.6.3 Regulatory Basis**

The regulatory basis for the NRC staff review of the North Anna 3 FSAR is provided by 10 CFR Parts 50 and 52. Specifically, the NRC regulations in 10 CFR 52.79(a)(11) require that a COL application provide a description of the programs and their implementation necessary to ensure that the systems and components meet the requirements of the ASME *Boiler and Pressure Vessel Code* (BPV Code) and the ASME OM Code, in accordance with 10 CFR 50.55a. As discussed in the SER on the ESBWR DCA, GDC 1, 2, 4, 14, 15, 37, 40, 43, 46, and 54 in Appendix A to 10 CFR Part 50 establish the necessary design, fabrication, construction, testing, and performance requirements for SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. The QA criteria in 10 CFR Part 50, Appendix B provide assurance that the design, tests, and documentation related to functional design, qualification, and IST programs for pumps, valves, and dynamic restraints will comply with established standards and criteria, thereby ensuring that such equipment will be capable of performing the intended functions.

RG 1.206 provides guidance for a COL applicant in preparing and submitting the COL application in accordance with NRC regulations. For example, Section C.IV.4 in RG 1.206 discusses the requirement in 10 CFR 52.79(a) for descriptions of operational programs that need to be included in the FSAR for a COL application to allow the reasonable assurance for a finding of acceptability. In particular, a COL applicant should fully describe the IST, MOV Testing, and other Operational Programs defined in Commission Paper SECY-05-197 to avoid the need for ITAAC for those programs. The term "fully described" for an operational program should be understood to mean that the program is clearly and sufficiently described in terms of scope and level of detail to allow a reasonable assurance finding. Further, operational programs should be described at a functional level and with an increasing level of detail where implementation choices could materially and negatively affect the program's effectiveness and

acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR, as discussed in the SRM for SECY-05-0197, dated February 22, 2006.

NRC staff followed SRP Section 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints," in the staff's review of the North Anna 3 COL application. North Anna 3 FSAR Table 1.9-201, "Conformance with Standard Review Plan," specifies that the COL application conform to SRP Section 3.9.6, with the indication that there are no safety-related pumps in the ESBWR design. The staff also compared the North Anna 3 FSAR information with the guidance in RG 1.206. North Anna 3 FSAR Table 1.9-203, "Conformance with the FSAR Content Guidance in RG 1.206," specifies that the COL application conform to Section C.III.1 3.9.6 of RG 1.206, where applicable, with the exception that a specific snubber table will be prepared in conjunction with ITAAC Table 3.1-1.

References 10 through 13 in SRP Section 3.9.6 provide information on lessons learned from valve performance experience at operating nuclear power plants.

#### **3.9.6.4 Technical Evaluation**

The staff reviewed the North Anna 3 COL application and the applicable sections in the ESBWR DCD incorporated by reference in the North Anna 3 FSAR for the functional design, qualification, and IST Programs for safety-related pumps, valves, and dynamic restraints to determine whether the North Anna 3 COL application meets the regulatory requirements to provide reasonable assurance that the applicable safety-related components at North Anna 3 will be capable of performing their safety functions. In response to several RAIs, GEH and Dominion revised the ESBWR DCD and North Anna FSAR, respectively, to provide a full description of the IST and MOV Operational Programs in support of the North Anna 3 COL application.

The staff is reviewing Section 3.9.6 of the DCD on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference related to the functional design, qualification, and IST Programs for safety-related pumps, valves, and dynamic restraints. The evaluation will be documented in the staff SER on the DCA for the ESBWR.

ESBWR DCD Tier 2, Section 3.9.6, "Inservice Testing of Pumps and Valves," provides a general description of the IST Operational Program to be developed for an ESBWR plant. ESBWR DCD Tier 2, Section 3.9.9 specifies COL Information Item STD COL 3.9.9-3-A, which states that the COL applicant shall provide a full description of the IST Program and a milestone for full program implementation, as identified in Section 3.9.6.1.

In Revision 1 to the North Anna 3 FSAR, the applicant incorporates by reference the ESBWR DCD, including Tier 2 Table 3.9-8, "Inservice Testing," to assist in describing the IST Program to be developed for North Anna 3. ESBWR DCD Tier 2, Section 3.9.6.1.4, "Valve Testing," references NUREG-1482 (Revision 1), "Guidelines for Inservice Testing at Nuclear Power Plants." Following the issuance of the North Anna 3 COL, the guidance in NUREG-1482 can be used to develop the IST Program for North Anna 3, including the specific information to be included in IST Program documentation and tables for NRC inspection. The North Anna 3 FSAR also provides supplemental information on the IST Program for North Anna 3, in addition to the information in the ESBWR DCD. For example, the North Anna 3 FSAR describes the overall IST Program, preoperational testing, power-operated valve testing, check valve testing, and the snubber examination and testing program. The staff reviewed the combined

information in both the North Anna 3 FSAR and the ESBWR DCD to evaluate the full description of the IST Operational Program to be developed for North Anna 3.

ESBWR DCD Tier 2, Section 3.9.6 specifies that IST of the applicable ASME BPV Code, Section III, Class 1, 2, and 3 pumps and valves will be performed in accordance with the ASME OM Code required by 10 CFR 50.55a(f), including limitations and modifications set forth in 10 CFR 50.55a. ESBWR DCD Tier 2, Section 3.9.10, "References," specifies the 2001 Edition, with the 2003 Addenda of the ASME OM Code for use in the ESBWR design. The North Anna 3 FSAR incorporates by reference these provisions in the ESBWR DCD. As Supplemental Information STD COL 3.9-1, North Anna 3 FSAR Section 3.9.6.6, "10 CFR 50.55a Relief Requests and Code Cases," states that no relief from or alternative to the ASME OM Code is being requested beyond what is identified in the DCD. The ASME OM Code 2001 through 2003 Addenda is incorporated by reference in 10 CFR 50.55a of the NRC regulations, with certain limitations and modifications. Therefore, the staff considers the application of the ASME OM Code 2001 Edition through 2003 Addenda, as specified in the NRC regulations with applicable limitations and modifications, to be acceptable for the North Anna Unit 3 IST Program description. As specified in 10 CFR 50.55a, a COL licensee is required to incorporate in the IST Program the latest edition and addenda of the ASME OM Code approved in 10 CFR 50.55a(f), on the date 12 months before initial fuel load.

The ESBWR DCD specifies that the ESBWR reactor design does not require the use of pumps to mitigate the consequences of design-basis accidents or to achieve or maintain the safe shutdown condition. Therefore, the IST Program for the ESBWR design does not include any pumps. As indicated in a GEH response to **RAI 3.9-152** (MFN 06-489) dated November 30, 2006; post-accident long-term decay heat removal for the ESBWR is performed by non-safety-related systems as accepted in Commission paper SECY-94-084, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems in Passive Plant Designs." The availability of systems relied on after 72 hours, addressed under the RTNSS Program, is discussed in Section 22 of this SER.

Section 3.9, "Mechanical Systems and Components," of Chapter 3, "Design of Structures, Components, Equipment, and Systems," in Revision 1 (dated December 2008) to the North Anna Unit 3 FSAR, incorporates by reference Revision 5 of the ESBWR DCD with supplemental information. Section 3.9.3.5, "Valve Operability Assurance," in ESBWR DCD Tier 2 specifies that valve designs that were not previously qualified will meet the requirements of the ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." For valve designs that were previously qualified to standards other than ASME QME-1-2007, ESBWR DCD Tier 2, Section 3.9.3.5 specifies an approach for valve qualification that follows the key principals of ASME QME-1-2007. Based on the lessons learned from valve performance experience at operating nuclear power plants, the staff found the provisions in Revision 5 to the ESBWR DCD for the functional design and qualification of safety-related valves to be acceptable.

The staff issued **RAI 03.09.06-1**, which requested Dominion to discuss the process, such as by component examples, for implementing the provisions specified in ESBWR DCD Tier 2, Section 3.9.3.5 for the functional design and qualification of valves and dynamic restraints. Dominion's response in a letter dated September 11, 2008, stated that GEH is responsible for the design and qualification of mechanical equipment, including valves and dynamic restraints. Dominion noted that GEH is currently developing the procurement specifications and processes that will be made available for NRC review. With respect to solenoid-operated valves, Dominion stated that GEH will supply the power supply parameters to the valve supplier, and that the

supplier will be responsible for qualifying the valves to those requirements. NRC staff will conduct an on-site review of the GEH design and procurement specifications for the ESBWR components to resolve this RAI, which is **Open Item OI 3.9.6-01**.

Section 3.9.6, "Inservice Testing of Pumps and Valves," of the North Anna 3 COL FSAR incorporates by reference Section 3.9.6 of the ESBWR DCD Tier 2, with supplemental information, to fully describe the IST Program for North Anna 3. ESBWR DCD Tier 2, Section 3.9.10, "References," lists the ASME OM Code, 2001 Edition, with the 2003 Addenda. The staff issued **RAI 03.09.06-2**, which requested Dominion to clarify the ASME OM Code edition and addenda that are the basis for the North Anna 3 IST Program described in the COL application. Dominion's response to this RAI in a letter dated September 11, 2008, confirmed the reference to the ASME OM Code, 2001 Edition, with the 2003 Addenda. The staff found that Dominion's response clarified the specific ASME OM Code edition and addenda to be used in describing the IST Program for the North Anna 3 COL application. Therefore, this RAI is closed.

North Anna 3 FSAR Section 3.9.6 describes the incorporation of lessons learned from valve experience at operating nuclear power plants into the air-operated valve (AOV) IST Program for North Anna 3. The staff issued **RAI 03.09.06-3**, which requested the applicant to discuss (1) the provisions in the FSAR for the periodic verification of AOV capability, (2) the application of lessons learned from valve performance to power-operated valves (POVs) other than AOVs, and (3) the basis for the statement in Section 3.9.6 of the proposed revision to the North Anna 3 FSAR that post-maintenance procedures are applied where high-risk valve performance could be affected. Dominion's response to this RAI in a letter dated September 11, 2008, discussed the IST Program for AOVs and other POVs (with the exception of MOVs). In Revision 1 (dated December 2008) to the North Anna 3 FSAR, the applicant supplemented the ESBWR DCD with a description of the testing program for POVs to be used at North Anna 3. For example, the AOV program will include the key elements of the Joint Owners Group AOV program discussed in Regulatory Issue Summary (RIS) 2000-03, "Resolution of Generic Safety Issue 158: Performance of Safety-Related Power-Operated Valves Under Design-Basis Conditions," which also references NRC staff comments on the program. Among the key lessons learned in the AOV program, the North Anna 3 FSAR specifies that periodic dynamic testing of AOVs will be performed to re-verify the capability of the valve to perform its required functions, if necessary, based on valve qualification or operating experience. The North Anna 3 FSAR states that the attributes of the AOV Testing Program are applied to other POVs to the extent that they apply to and can be implemented on those valves. The North Anna 3 FSAR also clarifies that post-maintenance procedures ensure that baseline testing is re-performed as necessary, when maintenance on the valve (valve repair or replacement) has the potential to affect valve functional performance. The provisions included in the North Anna 3 FSAR to supplement the ESBWR DCD are sufficient to apply the lessons learned from valve testing to the POV Testing Program at North Anna 3. Therefore, this RAI is closed.

ESBWR DCD Tier 2, Section 3.9.3.7.1, "Piping Supports," specifies provisions for snubber design, testing, installation, and preservice examination and testing. ESBWR DCD Tier 2, Section 3.9.3.7.1 states in paragraph E, "Snubber Pre-service and In-service Examination and Testing," that the COL applicant will provide a full description of the snubber inspection and test program. ESBWR DCD Tier, 2 Section 3.9.9 specifies COL Information Item STD COL 3.9.9-4-A, which states that the COL applicant shall provide a full description of the snubber Preservice and Inservice Inspection and Testing Programs and a milestone for program implementation, including development of a data table identified in

Section 3.9.3.7.1(3)f. North Anna FSAR Section 3.9.9 states that COL Information Item STD COL 3.9.9-4-A is addressed in Sections 3.9.3.7.1(3)e and f.

Table 1.9-203, "Conformance with the FSAR Content Guidance in RG 1.206," in the North Anna 3 FSAR states that the COL application conforms to Paragraph C.III.1.3.9.6.4 of RG 1.206, with the exception that a plant-specific snubber table will be prepared in conjunction with closure of ITAAC Table 3.1-1. Section 3.9 in Revision 1 (dated December 2008) to the North Anna 3 FSAR describes the snubber Inservice Examination and Testing Program, including specifying that the program will satisfy ASME OM Code Section ISTD and will provide specific examples of the program content to supplement the ESBWR DCD. The staff reviewed the description of the IST Program for dynamic restraints in comparison to the ASME OM Code, Section ISTD. The staff found that the North Anna 3 FSAR and the ESBWR DCD (Revision 5) provide a reasonable description of the Operational Program for dynamic restraints at North Anna 3. The specific requirements of the ASME OM Code, Section ISTD, incorporated by reference in 10 CFR 50.55a, take precedence over the summary description in the North Anna 3 FSAR and the ESBWR DCD. The staff issued **RAI 03.09.06-4**, which requested Dominion to clarify the reference to the ASME BPV Code Section XI, with respect to snubbers at North Anna 3 that are described in paragraph 3(b) of ESBWR DCD Tier 2, Section 3.9.3.7.1. Dominion's response to this RAI in a letter dated September 11, 2008, referred to an RAI response from GEH indicating that the reference to the ASME BPV Code Section XI would be deleted from this section in the ESBWR DCD Tier 2. The staff found that the planned action by GEH, as referenced by Dominion, resolves this RAI. This is **Confirmatory Item OI 3.9.6-01**.

North Anna 3 FSAR Section 13.4, "Operational Program Implementation," indicates that FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations," lists each operational program, the regulatory source for the program, the associated implementation milestones, and the FSAR section where the operational program is fully described (as discussed in RG 1.206). FSAR Table 13.4-201 specifies the implementation milestone for the IST Program as "after generator online on nuclear heat." The implementation milestone for the Preservice Testing Program is specified as "prior to fuel load." A note in FSAR Table 13.4-201 specifies that the "snubber inservice examination is initially performed not less than two months after attaining 5% reactor power operation and will be completed within 12 calendar months after attaining 5% reactor power."

**RAI 03.09.06-5** requested Dominion to discuss the commencement of the Preservice Testing Program. Dominion's response to this RAI in a letter dated September 11, 2008, stated that as described in RG 1.206 Section C.IV.4.3, the COL will contain a license condition that requires Dominion to submit to the NRC a schedule that supports planning for and conducting NRC inspections of Operational Programs (including preservice testing). The schedule will be submitted 12 months after the COL has been issued and will be updated every 6 months until 12 months before the scheduled fuel loading, and every month thereafter, until either the operational programs in FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial service, whichever comes first. Dominion stated that commencement of preservice testing will be concurrent with the operational status of the equipment and its readiness to support preservice testing, with completion of the preservice testing before fuel load, as indicated in FSAR Table 13.4-201. Dominion indicated that this provision means, for example, that the installation of the valves in the piping system must be complete, along with most of the piping system itself, when the valve power and controls are in place to support valve stroking. Any post-installation construction testing and valve setup activities (such as setting torque or limit switches, lubricating the valve, packing installation or adjustment) must be complete. Dominion stated that accomplishing these activities will depend

on the plant construction and turnover schedules. Because the staff found that Dominion's response clarified, in an acceptable manner, the commencement of the Preservice Testing Program, this RAI is closed.

North Anna 3 FSAR incorporates by reference ESBWR DCD Tier 2, Section 3.9.2, "Dynamic Testing and Analysis of Systems, Components, and Equipment," which addresses criteria, testing procedures, and dynamic analyses employed to ensure the structural and functional integrity of piping systems, mechanical equipment, reactor internals, and their supports under vibratory loadings. ESBWR DCD Tier 2, Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," addresses methods of testing and analyses employed to ensure the operability of mechanical and electrical equipment, under the full range of normal and accident loadings, to ensure conformance with the NRC regulations. ESBWR DCD Tier 2, Section 14.2.8.1.42, "Expansion, Vibration and Dynamic Effects Preoperational Test," states that its objective is to verify that critical components and piping runs are properly installed and supported, so that expected steady-state and transient vibration and movement due to thermal expansion do not result in excessive stress or fatigue to safety-related plant systems and equipment.

Nuclear power plant operating experience has revealed the potential for adverse flow effects from vibration caused by hydrodynamic loads and acoustic resonance within reactor coolant, steam, and feedwater systems. The staff issued **RAI 03.09.06-6**, which requested Dominion to describe the planned implementation of the program to address potential adverse flow effects on safety-related valves and dynamic restraints, within the IST Program, in the reactor coolant, steam, and feedwater systems at North Anna 3 from hydraulic loading and acoustic resonance during plant operation. Dominion's response to this RAI in a letter dated September 11, 2008, stated the intention to use the overall Initial Test Program (including preoperational and startup testing) to address potential adverse flow effects on safety-related valves and dynamic restraints. The objective of the program is to confirm attributes of the component design as described in the ESBWR DCD, with implementation described in FSAR Section 14.2 and Table 13.4-201. As part of ESBWR DCD Tier 2, Section 3.9.2, Dominion referred to ESBWR DCD Tier 2, Section 3.9.2.1, "Piping Vibration, Thermal Expansion and Dynamic Effects," which states that the overall testing program is divided into the preoperational test phase and the initial startup test phase with piping vibration, thermal expansion, and dynamic effects testing performed during both phases, as described in ESBWR DCD Tier 2, Chapter 14. Dominion also referred to ESBWR DCD Tier 2, Section 3.9.2.1.1, "Vibration and Dynamic Effects Testing," which states that the purpose of these tests is to confirm that the piping, components, restraints, and supports of specified high- and moderate-energy systems have been designed to withstand the dynamic effects of steady-state FIV and anticipated operational transient conditions. Dominion referenced ESBWR DCD Tier 2, Section 3.9.3.5, which requires valve specifications to incorporate lessons learned from nuclear power plant operations and research programs, including applicable load combinations. Dominion also referred to ESBWR DCD Tier 2, Sections 3.9.3.7 and 3.9.3.8, which require analyses or tests for component supports to assure their structural capability to withstand seismic and other dynamic excitations. Dominion indicated that ESBWR DCD Tier 2, Sections 14.2.8.1.42 and 14.2.8.2.10, "System Vibration Test," describe the applicable preoperational and startup tests. Based on this information, the staff found that Dominion's description of plans to implement provisions in the ESBWR DCD to address potential adverse flow effects for safety-related valves and dynamic restraints at North Anna 3 reflect nuclear power plant operating experience. In particular, Dominion plans to address the effects of steady-state FIV and operational transients, including lessons learned from operating experience and research programs as part of equipment qualification. Furthermore, Dominion plans to address potential adverse flow effects by monitoring piping

vibration during the Initial Test Program for North Anna 3. The staff will review the qualification provisions for potential adverse flow effects as part of the review of design and procurement specifications addressed in **Open Item OI 3.9.6-01** and discussed above in this SER section. The implementation of the provisions in ESBWR DCD Tier 2, Chapter 14 will be reviewed as part of future NRC inspections at North Anna 3. The staff found that Dominion's plans recognize the safety significance of potential adverse flow effects with future regulatory activities to monitor the details of those plans. Therefore, this RAI is closed.

In addition to the RAIs to Dominion described above, the staff is reviewing the ESBWR DCD regarding the functional design, qualification, and IST Programs for safety-related valves and dynamic restraints. Completion of the NRC review of the ESBWR DCD is necessary to finalize the evaluation of the COL application for North Anna 3. For example, the staff's evaluation of the North Anna 3 FSAR Section 3.9.6 is dependent on the outcome of the staff's review of ESBWR DCD Tier 2, Section 3.9.6.

### COL Information Items

Section 3.9.9 in the ESBWR DCD Tier 2 specifies the following COL information items related to functional design, qualification, and IST Programs for safety-related valves and dynamic restraints:

- STD COL 3.9.9-3-A                      Inservice Testing Programs

The COL applicant shall provide a full description of the IST Program and a milestone for full program implementation as identified in Section 3.9.6.1.

In STD COL 3.9.9-3-A in North Anna Unit 3 FSAR Section 3.9.9, "COL Information," Dominion states that COL Information Item 3.9.9-3-A is addressed in Section 3.9.6.

In addition, as noted in Section 3.9.3, the following information item will also be addressed in more detail in Section 3.9.6.

- STD COL 3.9.9-4-A                      Snubber Inspection and Test Program

The applicant shall provide a full description of the Snubber Preservice and Inservice Inspection and Testing Programs and a milestone for program implementation, including the development of a data table identified in Section 3.9.3.7.1(3)f.

In STD COL 3.9.9-4-A, Dominion states that COL Information Item 3.9.9-4-A is addressed in Sections 3.9.3.7.1(3)e and f.

As discussed in this SER section, NRC staff reviewed Dominion's response to ESBWR COL Items 3.9.9-3-A and 3.9.9-4-A in STD COL 3.9.9-3-A and 3.9.9-4-A in the North Anna 3 FSAR.

### Supplemental Information

- STD SUP 3.9-1                              10 CFR 50.55a Relief Requests and Code Cases

Supplemental Information STD COL 3.9-1 in North Anna 3 FSAR, Section 3.9.6.6, states that no relief from or alternative to the ASME OM Code is being requested beyond what is identified in the DCD.

As discussed in this SER section, NRC staff reviewed North Anna Supplemental Information Item STD SUP 3.9-1.

In addition to the review of the North Anna 3 COL application, the staff is reviewing the ESBWR DCA. The provisions in the ESBWR DCD are needed to support the North Anna 3 COL application in fully describing the IST operational program for North Anna 3. Therefore, the staff's evaluation of the North Anna 3 FSAR Section 3.9.6 depends on the outcome of the review and approval of ESBWR DCD Tier 2, Section 3.9.6.

### Interfaces for Standard Design

ESBWR DCD Tier 2, Section 1.8, "Interfaces with Standard Design," identifies site specific interfaces with the standard ESBWR design. DCD Table 1.8-1, "Matrix of NSSS Interfaces," references Section 3.9 for the supporting interface areas of mechanical systems and components. NRC staff reviewed the North Anna 3 COL application for interface requirements with the ESBWR standard design regarding the functional design, qualification, and IST programs for safety-related valves and dynamic restraints using the review procedures described in SRP Section 3.9.6. The staff found that Dominion's consideration of design interface items is acceptable based on compliance with NRC regulations discussed in this SER section.

### License Conditions

FSAR Section 13.4 indicates that FSAR Table 13.4-201 lists each operational program, the regulatory source for the program, the associated implementation milestones, and the FSAR section where the operational program is fully described, as discussed in RG 1.206. RG 1.206 Section C.IV.4.3 states that the COL will contain a license condition that requires the licensee to submit to the NRC a schedule that supports planning and conducting NRC inspections of Operational Programs. The schedule must be submitted 12 months after the NRC issues the COL. The schedule will be updated every 6 months, until 12 months before scheduled fuel loading, and every month thereafter until either the operational programs in FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial service, whichever comes first. In the final SER, the staff will determine the specific commitments to be included as conditions to the license.

#### **3.9.6.5 Post Combined License Activities**

NRC regulations in 10 CFR 50.55a(f)(4)(i) state that inservice tests conducted during the initial 120-month interval to verify operational readiness of pumps and valves, whose function is required for safety, must comply with the requirements in the latest edition and addenda of the ASME Code, incorporated by reference in 10 CFR 50.55a(b) on the date 12 months before the date scheduled for initial fuel loading, under a COL issued per 10 CFR Part 52 (or the optional ASME Code cases listed in RG 1.192) subject to the limitations and modifications listed in 10 CFR 50.55a. In the final SER, the staff will determine the specific commitments to be included as conditions to the license.

#### **3.9.6.6 Conclusion**

The staff reviewed the North Anna 3 COL FSAR, with the incorporation by reference of the ESBWR DCD, to determine whether it contains an acceptable description of the functional design, qualification, and IST Programs for North Anna 3 that provides reasonable assurance

that the safety-related components within the scope of the North Anna 3 IST Program will be capable of performing their safety functions in accordance with the NRC regulations and the ASME Code requirements. However, as a result of **Open Item 3.9.6-01 and Confirmatory Item 3.9.6-01**, the staff is unable to finalize the conclusions.

The staff is reviewing the information in DCD Section 3.9.6 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the functional design, qualification, and IST Programs for safety-related pumps, valves, and dynamic restraints, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.9.6 of this SER to reflect the final disposition of the DCA.

### **3.9.7 Risk Informed Inservice Testing**

Section 3.9.7 of the ESBWR DCD provides information regarding risk-informed IST and states that risk-informed IST initiatives, if any, included in the implementation plans for the IST program, which is an operational program addressed in Section 13.4. In Section 3.9.7 of the North Anna 3 COL FSAR, the applicant stated in STD SUP 3.9-2 that a risk-informed IST will not be utilized. NRC staff's review confirmed that the applicant has addressed the relevant information, and no outstanding information is expected to be addressed in the COL FSAR related to this section.

The staff is reviewing the information in DCD Section 3.9.7 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to risk-informed IST, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.9.7 of this SER to reflect the final disposition of the DCA.

### **3.9.8 Risk Informed Inservice Inspection of Piping**

Section 3.9.8 of the ESBWR DCD provides information regarding risk-informed inservice inspection of piping and states that risk-informed inservice inspection of piping initiatives, if any, included in the implementation plans for the inservice inspection of piping program, which is an operational program addressed in Section 13.4. In Section 3.9.8 of the North Anna 3 COL FSAR, the applicant stated in STD SUP 3.9-3 that a risk-informed inservice inspection will not be utilized. NRC staff's review confirmed that the applicant has addressed the relevant information, and no outstanding information is expected to be addressed in the COL FSAR related to this section.

The staff is reviewing the information in DCD Section 3.9.8 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to risk-informed inservice inspection of piping, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.9.8 of this SER to reflect the final disposition of the DCA.

### **3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment**

#### **3.10.1 Introduction**

Seismic and dynamic qualifications of this equipment, other than the piping, include the following types:

- Safety-related instrumentation and electrical equipment and certain monitoring equipment.
- Safety-related active mechanical equipment that performs a mechanical motion while accomplishing a system safety-related function. These devices include the control rod drive mechanisms; HVAC, and fluid system valves.
- Safety-related, non-active mechanical equipment whose mechanical motion is not required while accomplishing a system safety-related function, but whose structural integrity must be maintained in order to fulfill the design safety-related function.

Mechanical equipment, electrical equipment, instrumentation, and, where applicable, their supports classified as seismic Category I have demonstrated that they are capable of performing their designated safety-related functions under the full range of normal and accident (including seismic and hydrodynamic) loadings. This equipment includes devices associated with systems essential to safe shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or are otherwise essential in preventing the significant release of radioactive material into the environment or in mitigating the consequences of accidents.

The criteria for these seismic and dynamic qualifications include the following considerations:

- Seismic and dynamic qualification criteria
- Methods and procedures for qualifying electrical equipment, instrumentation, and mechanical components
- Methods and procedures for qualifying supports of electrical equipment, instrumentation, and mechanical components
- Documentation

#### **3.10.2 Summary of Application**

In North Anna COL FSAR Section 3.10, the applicant incorporated by reference Section 3.10 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 3.10, the applicant provided the following:

##### COL Item

- STD COL 3.10.4-1-A                      Dynamic Qualification Report

The applicant provided additional information in STD COL 3.10.4-1-A to address COL Information Item 3.10.4-1-A. The applicant stated that the Dynamic Qualification Report will be

completed before fuel load. FSAR information will be revised, as necessary, as part of a subsequent FSAR update.

### Supplemental Information

- STD SUP 3.10-1                      QA Program Applied to Equipment Qualification Files

The applicant provided the following supplemental information. The applicant states that “Section 17.5 defines the QA Program requirements that are applied to equipment qualification files, including requirements for handling safety-related quality records, control of purchased material, equipment and services, test control, and other quality-related processes.”

### **3.10.3      Regulatory Basis**

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

In addition, the relevant requirements of the Commission regulations for the dynamic qualification report for the seismic and dynamic qualification of mechanical and electrical equipment, and the associated acceptance criteria, are in Section 3.10 of NUREG-0800.

The applicable regulatory requirements for the Dynamic Qualification Report for the seismic and dynamic qualification of mechanical and electrical equipment are as follows:

- GDC 1, 2, and 4 of Appendix A to 10 CFR Part 50; Appendix S to 10 CFR Part 50; and Appendix A to 10 CFR Part 100
- Criteria XVII of Appendix B to 10 CFR Part 50

### **3.10.4      Technical Evaluation**

NRC staff reviewed Section 3.10 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff’s review confirmed that the information in the application and the information incorporated by reference address the relevant information related to the seismic and dynamic qualification of mechanical and electrical equipment.

The staff is reviewing Section 3.10 of the DCD on Docket No. 52-010. The staff’s technical evaluation of the information, incorporated by reference and related to the seismic and dynamic qualification of mechanical and electrical equipment, will be documented in the staff SER on the DCA for the ESBWR.

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

- STD COL 3.10.4-1-A                      Dynamic Qualification Report
- STD SUP 3.10-1                      QA Program Applied to Equipment Qualification Files

The staff reviewed the conformance of Section 3.10 of the North Anna COL FSAR to the guidance in RG 1.206, Chapter 3, Sections C.I.3.10 and C.III.1.3.10, “Seismic and Dynamic

Qualification of Mechanical and Electrical Equipment.” The staff’s review of Section 3.10 of the North Anna COL FSAR found that the applicant has appropriately incorporated by reference Section 3.10 of the ESBWR DCD, Revision 5 except that the standard COL item described above is not acceptable in accordance with the guidance in Section C.I.3.10.4 of RG 1.206. RG 1.206 Sections C.I.3.10.4 and C.III.3.10.4 state that the applicant should provide the results of tests and analyses to demonstrate adequate seismic qualification of equipment. However, RG 1.206 acknowledges that this level of detail may not be available and provides an alternative provision for an implementation plan that includes milestones and completion dates.

The staff reviewed the North Anna COL FSAR and found that it does not provide either the results of qualification or an implementation plan. This information is necessary for the staff to make a reasonable assurance safety finding for licensing (i.e., to find that the design is in accordance with the regulations). The information included with this plan should address those planning details not addressed in the DCD. Those details include, for example, a listing of the equipment to be qualified, the method of qualification, who will be performing the qualification, the timing, etc. The expectation is that all information for the phases would be completed before procurement would be available for review prior to licensing. For example, the list of equipment and qualification method can be provided now with wording for a license condition which will require provision of the name of the organization qualifying the equipment and details on timing post procurement six months before the qualification process is expected to be completed. It is expected that this information would be available to be audited by the NRC Staff prior to equipment installation. In **RAI 3.10-1**, the NRC requested the applicant to provide an implementation plan that includes the level of detail that will be completed prior to procurement and the plan for completing equipment qualification as called for in RG 1.206 and the example described above. This is being tracked as **Open Item 3.10-1**.

### **3.10.5 Post Combined License Activities**

There are no post COL activities related to this section.

### **3.10.6 Conclusion**

NRC staff reviewed the application and checked the referenced DCD. The staff’s review confirmed that the applicant has addressed the relevant information relating to the seismic and dynamic qualification of mechanical and electrical equipment, and additional information is expected to resolve **Open Item 3.10-1**. Because of **Open Item 3.10-1**, the staff is unable to finalize its conclusions for this section in accordance with the requirements of NRC regulations.

The staff is reviewing the information in the DCD Section 3.10 on Docket No. 52-010. The results of the staff’s technical evaluation of the information related to the seismic and dynamic qualification of mechanical and electrical equipment 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.10 of this SER to reflect the final disposition of the DCA.

## **3.11 Environmental Qualification of Mechanical and Electrical Equipment**

### **3.11.1 Introduction**

This section of the FSAR describes the Environmental Qualification (EQ) Program to be used at North Anna 3 for the electrical and mechanical equipment important to safety. The objective of

the EQ Program is to reduce the potential for common failure due to specified environmental events and to demonstrate that the equipment within the scope of the EQ Program is capable of performing its intended design function under all conditions, including environmental stresses resulting from design-basis events. During plant operation, the COL licensee implements the EQ Program, which specifies the replacement frequencies of affected safety-related equipment in harsh environments and non-safety-related equipment whose failure under the postulated environmental conditions could prevent satisfactory performance of the safety functions of the safety-related equipment, and certain post-accident monitoring equipment.

This equipment must perform its safety functions under all normal environmental conditions, abnormal operational occurrences, design-basis events, post-design-basis events, and containment test conditions. This capability is demonstrated through qualification testing and analysis of similar equipment under the temperature, pressure, humidity, chemical effects, radiation, and submergence conditions under which the equipment will be expected to operate. The qualification information shall include identification of the equipment required to be environmentally qualified. Each component shall have, onsite in auditable form, the designated functional requirements; the definition of the applicable environmental parameters; the periodic maintenance to support the qualified life; the accident that the component is required to mitigate; the required operation time; and the documentation of the qualification process employed to demonstrate the required environmental capability. This information shall be maintained current.

### **3.11.2 Summary of Application**

Section 3.11 of the North Anna 3 COL FSAR, incorporates by reference Section 3.11 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 3.11, the applicant provided the following:

#### COL Item

- STD COL 3.11-1-A Environmental Qualification Document

The applicant provided additional information in STD COL 3.11-1-A to address COL Information Item 3.11-1-A. The applicant stated that the EQ program, including development of the Environmental Qualification Document (EQD), will be implemented in accordance with the milestone schedule provided in Section 13.4.

### **3.11.3 Regulatory Basis**

The regulatory basis for NRC staff review of the ESBWR DCA is documented in the NRC SER on the ESBWR standard.

The relevant requirements of the Commission regulations for the equipment qualification operational program and equipment qualification document and the associated acceptance criteria are described in Section 3.11 of NUREG-0800.

The applicable regulatory requirements for the equipment qualification document are as follows:

- 10 CFR 50.49, "Environmental qualification of electrical equipment important to safety for nuclear plants," requires an applicant for a license for a nuclear power plant to establish a program for qualifying electrical equipment for environmental effects.

#### Appendix A to 10 CFR Part 50

- GDC 1, "Quality Standards and Records," requires that components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.
- GDC 2, "Design Bases for Protection Against Natural Phenomena," requires that components important to safety be designed to withstand the effects of natural phenomena without loss of capability to perform their safety function.
- GDC 4, "Environmental and Dynamic Effects Design Bases," requires that components important to safety be designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss of coolant accidents.
- GDC 23, "Protection System Failure Modes," requires that protection systems be designed to fail in a safe state, or in a state demonstrated to be acceptable on some other defined basis, if conditions such as postulated adverse environments (e.g., extreme heat or cold, pressure, steam, water, or radiation) are experienced.

#### Appendix B to 10 CFR Part 50

- Criterion III, "Design Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 requires establishing measures to ensure that applicable regulatory requirements and the associated design bases are correctly translated into specifications, drawings, procedures, and instructions. These measures should include provisions to ensure that appropriate quality standards are included in design documents and that deviations from established standards are controlled. A process should also be established to determine the suitability of equipment that is essential to safety-related functions and to identify, control, and coordinate design interfaces between participating design organizations. Where a testing program is used to verify the adequacy of a specific design feature, the test shall include suitable qualification testing of a prototype unit under the most adverse design conditions.
- Criterion XI, "Test Control," requires that a test control plan be established to ensure that all tests needed to demonstrate a component's performance capability be identified in accordance with required procedures and acceptance limits in applicable design documents.
- Criterion XVII, "Quality Assurance Records," requires maintaining sufficient records to furnish evidence of activities affecting quality. The records must include inspections, tests, audits, monitoring of work performance, and materials analysis. Records must be identifiable and retrievable.

The related acceptance criteria are as follows:

- In accordance with SECY-05-0197, Equipment Qualification is part of the expanded list of Operational Programs that will be reviewed in the COL application. NRC staff will review

- Further, Operational Programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR as discussed in the SRM for SECY-05-0197, dated February 22, 2006.

#### 3.11.4 Technical Evaluation

NRC staff reviewed Section 3.11 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff's review confirmed that the information in the application and incorporated by reference addresses the relevant information related to the EQ of mechanical and electrical equipment.

The staff is reviewing Section 3.11 of the DCD on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference related to the EQ of mechanical and electrical equipment 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 3.11-1-A                      Environmental Qualification Document

COL Item 3.11-1-A states that the COL applicant will provide a full description and a milestone for program implementation of the EQ Program that includes completion of the plant-specific EQD per ESBWR DCD Tier 2, Section 3.11.4.4. In STD COL 3.11-1-A, Dominion stated that COL Information Item 3.11-1-A for North Anna 3 is addressed in North Anna 3 FSAR Section 3.11.4.4. NRC staff reviewed Dominion's response to the ESBWR COL Information Item 3.11-1-A as provided in STD COL 3.11-1-A in the North Anna 3 FSAR. In addition to the review of the North Anna 3 COL application, the staff is reviewing the ESBWR DCA. The provisions in the ESBWR DCD are needed to support the North Anna 3 COL application in fully describing the EQ Operational Program for North Anna 3. Therefore, the staff's evaluation of the North Anna 3 FSAR Section 3.11 is dependent on the outcome of the review and approval of ESBWR DCD Tier, 2 Section 3.11.

The North Anna 3 FSAR Section 3.11 incorporates by reference ESBWR DCD Tier 2, Section 3.11 with supplemental information. The staff issued **RAI 03.11-1**, which requested Dominion to provide or reference certain information or indicate the status of and schedule for its availability, related to the EQ Program for safety-related mechanical equipment for North Anna 3. Dominion's response to this RAI in a letter dated September 11, 2008, noted that Revision 5 to the ESBWR DCD Tier 2, Section 3.11 provides substantial additional information. For example, ESBWR DCD Tier 2, Table 3.11-1, "Electrical and Mechanical Equipment for

Environmental Qualification,” identifies the environment in which a component within the scope of the EQ Program will be located. Dominion indicated in the RAI response that there is no site specific, safety-related equipment to be used for North Anna 3 beyond that described in the ESBWR DCD. Section 3.11.4.1, “Harsh Environment Qualification,” in ESBWR DCD Tier 2, Section 3.11.4, “Qualification Program, Methods and Documentation,” indicates that qualification of mechanical equipment includes materials that are sensitive to environmental effects (e.g., seals, gaskets, lubricants, and fluids for hydraulic systems). Dominion stated that completion of the plant-specific EQD will be accomplished as specified in North Anna 3 FSAR Section 3.11.4.4. Furthermore, Dominion indicated that completion of the EQ Program for plant equipment will be confirmed by close-out of the ITAAC, which is specified in ESBWR DCD Tier 1, Table 3.8-1, “ITAAC for Environmental Qualification of Mechanical and Electrical Equipment.” The staff will conduct an onsite review of the design and procurement specifications for the ESBWR components to resolve **RAI 3.11-1**. This is **Open Item 3.11-01**.

ESBWR DCD Tier 2, Section 3.11.2.2, “Qualification Program, Methods and Documentation,” states that safety-related mechanical equipment that is located in a harsh environment is qualified by analyses of materials data, which are generally based on test and operating experience. ESBWR DCD Tier 2, Section 3.11.2.2 specifies that safety-related equipment located in a mild environment will be qualified per IEEE 323. The staff issued **RAI 03.11-2**, which requested Dominion to discuss the implementation of the EQ approach for North Anna 3. Dominion’s response to this RAI in a letter dated September 11, 2008, referred to Revision 5 to ESBWR DCD Tier 2, Section 3.11 for more detailed provisions for the EQ Program. Dominion also noted that the qualification of safety-related mechanical equipment will be performed by Dominion’s vendor (GEH), and that the qualification processes used by GEH will be available for audit by the NRC. As discussed above, the NRC staff will conduct an onsite review of the design and procurement specifications for the ESBWR components. Therefore, **RAI 03.11-2** is unresolved and this issue will be tracked under **Open Item 3.11-02**.

Revision 0 to North Anna 3 FSAR Section 3.11.2.2 stated that following implementation of the EQ Program, ESBWR DCD Table 3.11-1 would be supplemented, as necessary, in a subsequent FSAR update to include additional equipment covered by the program but not identified in the table. The staff issued **RAI 03.11-3**, which requested Dominion to clarify the statement in North Anna 3 FSAR Section 3.11.2.2 that the FSAR would be updated to include additional equipment not identified in the ESBWR DCD Tier 2, Table 3.11-1. Dominion’s response to this RAI in a letter dated September 11, 2008, stated that there is no safety-related equipment or safe shutdown equipment outside the scope of the ESBWR design for North Anna 3, as indicated in North Anna 3 FSAR Table 1.9-203. As a result, there is no additional equipment covered by the EQ Program for North Anna 3 not identified in DCD Table 3.11-1. Revision 1 (dated December 2008) to the North Anna 3 FSAR removed the statement in question. Therefore, RAI 3.11-3 is closed.

Revision 4 to ESBWR DCD Tier 2, Section 3.11.2.2 stated that the qualification program and methodology were described in the NRC-approved proprietary licensing Topical Report NEDE-24326-1-P, “General Electric Environmental Qualification Program.” In a letter dated November 19, 2007 (MFN 07-174, Supplement 2), GEH stated that the NRC staff review of NEDE-24326-1-P was addressed in NUREG-1503, “Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design.” On page 3-90 of NUREG-1503, NRC staff found that the topical report conforms to 10 CFR 50.49 and its associated standards, except for the position on the time margin. The staff issued **RAI 03.11-4**, which requested Dominion to describe the implementation of NEDE-24326-1-P for the EQ of safety-related mechanical equipment at North Anna 3, including the exception to its acceptance

indicated in NUREG-1503. Dominion's response to this RAI in a letter dated September 11, 2008, stated that Revision 5 to the ESBWR DCD incorporated the provisions of NEDE-24326-1-P and also addressed the time margin issue. Therefore, RAI 3.11-4 is closed.

ESBWR DCD Tier 2, Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," addresses methods of test and analysis employed to ensure the operability of mechanical and electrical equipment under the full range of normal and accidental loadings to ensure conformance to the NRC regulations. Operating experience from nuclear power plants has revealed the potential for adverse flow effects during normal plant operation that can impact safety-related components (such as safety relief valves). As a result, equipment qualification programs need to address these adverse flow effects to provide confidence that safety-related equipment will be capable of performing their safety functions. The staff issued **RAI 03.11-5**, which requested Dominion to describe the consideration of FIV in the qualification of safety-related mechanical equipment, including acoustic resonance and hydraulic loading, at North Anna 3. Dominion's response to this RAI in a letter dated September 11, 2008, stated that ESBWR DCD Tier 2, Section 3.9.3.5 requires that the ESBWR general valve requirement specification include requirements related to the design and functional qualification of safety-related valves that incorporate lessons learned from nuclear power plant operations and research programs. ESBWR DCD Tier 2, Section 3.10 addresses methods of test and analysis employed to ensure the operability of mechanical and electrical equipment under the full range of normal and accident loadings. Dominion stated that it will perform testing, as described in ESBWR DCD Tier 2, Section 3.9.2 and North Anna 3 FSAR Section 14.2, to provide confidence in the capability of safety-related equipment to perform its safety functions. For example, ESBWR DCD Tier 2, Section 3.9.2.1.1 discusses vibration and dynamic effects testing that will be performed during the Initial Test Program, as described in DCD Sections 14.2.8.1.42 and 14.2.8.2.10. The objective of these tests will be to confirm that the piping, components, restraints, and supports of specified high and moderate-energy systems have been designed to withstand the dynamic effects of steady-stated FIV and anticipated operational transient conditions. The staff considers that the actions planned by Dominion to address potential adverse flow effects on safety-related valves and dynamic restraints will incorporate lessons learned from nuclear power plant operating experience. Therefore, RAI 3.11-5 is closed.

North Anna 3 FSAR Section 3.11.2.2 states that the implementation of the EQ Program, including development of the plant-specific EQD, will be in accordance with the milestone defined in Section 13.4, "Operational Program Implementation." North Anna 3 FSAR Section 13.4 includes FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations," that lists each Operational Program, the regulatory source for the program, the FSAR section where the operational program is described, and the associated implementation milestones. FSAR Table 13.4-201 specifies the implementation milestone for the EQ Program as "prior to fuel load." The staff issued **RAI 03.11-6**, which requested Dominion to clarify the commencement of the EQ Program and its transition into an operating reactor program for North Anna 3. Dominion's response to this RAI in a letter dated September 11, 2008, stated that the COL will contain a license condition that will require Dominion to submit a schedule to the NRC 12 months after issuance of the COL, which will support planning and conducting NRC inspections of Operational Programs, including the EQ Program, with periodic updating of the schedule. Dominion stated that this schedule will address additional program implementation details, such as commencement of the EQ Program. Dominion indicated that the transition of the EQ Program into an Operating Program will occur as part of the plant turnover process to Dominion. The staff found that Dominion's response has clarified the plans for implementation and turnover of the EQ Program during plant construction and startup for North Anna 3.

Therefore, RAI 3.11-6 is closed and there will be a license condition for the EQ program, which is discussed below.

ESBWR DCD Tier 1, Section 3.8, "Environmental Qualification of Mechanical and Electrical Equipment," specifies the EQ ITAAC for safety-related mechanical and electrical equipment in Table 3.8-1, "ITAAC for Environmental Qualification of Mechanical and Electrical Equipment." The inspections, tests, and analyses for safety-related mechanical equipment located in a harsh environment state that (i) analyses will be performed to identify the environmental design bases, including the definition of anticipated operational occurrences and normal, accident, and post-accident environments; (ii) type tests and/or analyses of material data will be performed on safety-related mechanical equipment identified as located in a harsh environment; and (iii) inspections will be performed to verify proper non-metallic materials of the as-installed, safety-related mechanical equipment located in a harsh environment. The staff issued **RAI 03.11-7**, which requested Dominion to describe the plan for the implementation of the ITAAC for safety-related mechanical equipment located in a harsh environment, as specified in the ESBWR DCD Tier 1. Dominion's response to this RAI in a letter dated September 11, 2008, stated that ESBWR Tier 1, Section 1.1.2.2 provides a general plan description of ITAAC implementation. Part 10 of the North Anna 3 COL application incorporates the DCD ITAAC by reference. With respect to specific ITAAC implementation, Dominion references the NRC regulations in 10 CFR 52.99 that require the licensee to submit, no later than 1 year after COL issuance or the start of construction as defined in 10 CFR 50.10(b), whichever is later, a schedule for completing the inspections, tests, or analyses in the ITAAC, with subsequent updates to the ITAAC schedule. Dominion stated that plans and schedules for implementing ITAAC will be provided in accordance with 10 CFR 52.99. NRC staff considers Dominion's plans for addressing the EQ ITAAC to be consistent with the regulations and is thus acceptable. Therefore, RAI 3.11-7 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. DCD Table 1.8-1, "Matrix of NSSS Interfaces," references Section 3.11 for the supporting interface area of environmental design of mechanical and electrical equipment. The staff reviewed the North Anna 3 COL application for interfacing requirements with the ESBWR standard design regarding the EQ of mechanical and electrical equipment using the review procedures described in SRP Section 3.11. The staff found Dominion's consideration of design interface items to be acceptable based on compliance with the NRC regulations, as discussed in this SER section.

#### License Conditions

North Anna 3 FSAR Section 13.4 indicates that FSAR Table 13.4-201 lists each operational program, the regulatory source for the program, the associated implementation milestones, and the FSAR section in which the Operational Program is fully described, as discussed in RG 1.206. Listed in North Anna 3 COL Table 13.4-201, Operational Program #3 is identified as the EQ Program and it reflects a committed implementation milestone for this Operational Program as prior to fuel loading. RG 1.206 Section C.IV.4.3 states that the COL will contain a license condition that requires the licensee to submit a schedule to the NRC 12 months after issuance of the COL, which supports planning and conducting NRC inspections of Operational Programs. The schedule will be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the operational programs in FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial

service, whichever comes first. The staff will prepare this license condition as part of the completion of the staff review of the North Anna 3 COL application.

### **3.11.5 Post Combined License Activities**

FSAR Table 13.4-201 identifies the EQ Program as an Operational Program 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, including Operational Programs related to EQ that are consistent with SECY-05-0197. The COL licensee is responsible for defining the process and procedures for the equipment qualification files and how these files will be retained and maintained in an auditable format, for the period that the equipment is installed and/or stored for future use in the nuclear power plant. The COL licensee is also responsible for implementing an administrative program to control revisions of EQ files when adding, modifying, or deleting components in the EQ program. Plant modifications and design-basis changes are subject to change process reviews (for example, reviews in accordance with 10 CFR 50.59 or 10 CFR Part 52) in accordance with appropriate plant procedures. Dominion will be responsible for satisfying the NRC regulatory requirements and COL license conditions to enable NRC staff to perform inspections related to the EQ Program for North Anna 3, in a timely manner prior to plant operation.

### **3.11.6 Conclusion**

NRC staff reviewed the North Anna 3 COL application and the referenced ESBWR DCD. The staff's review confirmed that the applicant has addressed the relevant information, and additional information is expected to resolve **Open Items 3.11-01 and 3.11-02**. Because of **Open Items 3.11-01 and 3.11-02**, the staff is unable to finalize its conclusions on this section relating to the EQ of mechanical and electrical equipment, in accordance with the requirements of NRC regulations.

The staff is reviewing the information in the DCD Section 3.11 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the EQ of mechanical and electrical equipment, 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 complete and is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.11 of this SER to reflect the final disposition of the DCA.

Furthermore, the staff is unable to finalize the conclusions regarding an onsite review of the design and procurement specifications, conformance to these guidelines provides an acceptable basis for satisfying (in part) the requirements of CFR 50.49 and 10 CFR Part 50, Appendix B, Criteria III, XI and XVII. In addition, the staff is unable to finalize the conclusions that the applicant's resolution to COL Information Item STD COL 3.11-1- A meets the relevant guidelines of SRP Section 3.11; RG 1.206 Section C.III.1, Chapter 3, C.I.3.11; RG 1.206 Section C.III.4.3; and SECY-05-0197.

In addition, the staff will prepare a license condition that requires the licensee to submit a schedule to the NRC 12 months after issuance of the COL, which supports planning and conducting NRC inspections of Operational Programs. The schedule will be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter, until either the operational programs in FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial service, whichever comes first.

### **3.12 Piping Design Review**

#### **3.12.1 Introduction**

The ESBWR DCD does not contain Section 3.12; however, SRP and RG 1.206 do have Section 3.12, "ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and their Associated Supports" and "Piping Design Review," respectively. Therefore, the applicant has submitted this section as supplemental information.

This section covers the design of the piping system and piping support for seismic Category I, Category II, and non-safety systems. This section also discusses the adequacy of the structural integrity, as well as the functional capability, of the safety-related piping system, piping components, and their associated supports. The design of piping systems should ensure that they perform their safety-related functions under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events. This includes pressure-retaining piping components and their supports, buried piping, instrumentation lines, and the interaction of nonseismic Category I piping and associated supports with seismic Category I piping and associated supports. This section covers the design transients and resulting loads and load combinations with appropriate specified designs and service limits for seismic Category I piping and piping support, including those designated as ASME Code Class 1, 2, and 3, and those not covered by the ASME Code.

#### **3.12.2 Summary of Application**

North Anna 3 COL FSAR Section 3.12 provided the following supplemental information:

##### Supplemental Information

- STD SUP 3.12-1 Piping Design Review

The applicant states that information on seismic Category I and II and non seismic piping analyses and their associated supports is in DCD Sections 3.7, 3.9, 3D, 3K, 5.2, and 5.4

- STD SUP 3.12-2 Completion of ITAAC

The applicant states that the location of and distance between piping systems will be established as part of the completion of ITAAC Table 3.1-1. The FSAR will be revised, as necessary, in a subsequent update to include this information.

#### **3.12.3 Regulatory Basis**

The regulatory basis of the supplemental information is addressed in the appropriate FSER sections related to the DCD.

In addition, the relevant requirements of the Commission regulations for the analysis of ASME Code Class 1, 2, and 3 piping system, components, and associated supports and acceptance criteria are described in Section 3.12 of NUREG-0800.

The applicable regulatory requirements for the piping design review are as follows:

- GDC 1, 2, 4, 14, and 15 of Appendix A to 10 CFR Part 50

- 10 CFR 50.55a
- Appendix S to 10 CFR Part 50
- 10 CFR 52.47(b)(1), and 52.80(a)

### 3.12.4 Technical Evaluation

NRC staff reviewed Section 3.12 and the sections referenced in Section 3.12 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to the piping design review.

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

- STD SUP 3.12-1 Piping Design Review

The staff reviewed the supplemental information STD SUP 3.12-1 ("Piping Design Review"). The ESBWR DCD does not have Section 3.12. Therefore, this supplemental information is being considered as an editorial change to provide a map for the piping design information. The staff finds this change acceptable.

- STD SUP 3.12-2 Completion of ITAAC

NRC staff reviewed the supplemental information STD SUP 3.12-2 ("Completion of ITAAC"). This supplemental information clarifies the ITAAC completion of as-built piping analysis. ESBWR DCD, Revision 5 revised ITAAC Table 3.1-1 by moving the piping design ITAAC from Table 3.1-1 to the ITAAC Tables of systems identified in Chapter 2 of Tier 1. However, the supplemental information states that the FSAR will be revised, as necessary, in a subsequent update to include this information. On the basis that this information will be updated later, the staff may confirm the update and close this issue later. This issue will be reviewed as part of the review for **Open Item [1-1]** discussed in the conclusion to this section.

The COL applicant's piping design acceptance criteria (DAC) closure schedule is evaluated and documented in Section 14.3.3 of this report.

### 3.12.5 Post Combined License Activities

The following will be implemented following issuance of the COL: As-designed piping ITAAC ASME design report and as-built piping ITAAC ASME certified design report.

In the final SER, the staff will determine the specific commitments to be included as conditions to the license.

### 3.12.6 Conclusion

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the relevant information relating to the piping design review, and no outstanding information is expected to be addressed in the COL FSAR related to this section.

The staff concluded that the information pertaining to North Anna COL FSAR Sections 3.7, 3.9, and 3.12 is within the scope of the design certification and adequately incorporates by reference Sections 3.7 and 3.9 of the ESBWR. The information is thus acceptable. In addition, the staff compared the additional COL information in the application to the relevant NRC regulations; acceptance criteria defined in NUREG-0800, Section 3.12; and other NRC RGs and concluded that the applicant is in compliance with the NRC regulations. The COL information item involving design specifications and as-designed reports is adequately addressed by the applicant's ITAAC and will be closed after final acceptance of ESBWR DCD. In conclusion, the applicant has provided sufficient information to satisfy the requirements of 10 CFR Part 52 by providing reasonable assurance that the piping system will be designed and built in accordance with the certified design.

The staff is reviewing the information in the DCD on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the piping design review, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.12 of this SER to reflect the final disposition of the DCA.

### **3.13      Threaded Fasteners (ASME Code Class 1, 2, and 3)**

#### **3.13.1      Introduction**

The ESBWR DCD does not contain Section 3.13. However, RG 1.206 does have Section 3.13, "Threaded Fasteners (ASME Code Class 1, 2, and 3)." Therefore, the applicant has submitted this section as supplemental information.

Per RG 1.206, this section provides the criteria used to select materials to fabricate threaded fasteners (e.g., threaded bolts, studs) in ASME Code Class 1, 2, or 3 systems; as well as the criteria to fabricate, design, test, and inspect the threaded fasteners in these systems both before initial service and during service.

#### **3.13.2      Summary of Application**

North Anna 3 COL FSAR Section 3.13 provided the following supplemental information:

##### Supplemental Information

- STD SUP 3.13-1                      Threaded Fasteners-ASME Code Class 1, 2, and 3

The applicant states that information on criteria for the selection of materials, design, inspection, and testing of threaded fasteners are in DCD Sections 3.9.3.9, with supporting information in DCD Sections 4.5.1, 5.2.3, and 6.1.1.

#### **3.13.3      Regulatory Basis**

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

In addition, the relevant requirements of the Commission regulations for threaded fasteners for ASME Code Class 1, 2, and 3 and the associated acceptance criteria are described in Section 3.13 of NUREG-0800.

The applicable regulatory requirements for threaded fasteners for ASME Code Class 1, 2, and 3 are as follows:

- GDC 1, 4, 14, 30, and 31 of Appendix A to 10 CFR Part 50
- Appendix B to 10 CFR Part 50
- Appendix G to 10 CFR Part 50
- 10 CFR 50.55a

#### **3.13.4 Technical Evaluation**

NRC staff reviewed Section 3.13 and the sections referenced in Section 3.13 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 represents the complete scope of information relating to this review topic.<sup>1</sup> The staff's review confirmed that the information in the application and the information incorporated by reference address the relevant information related to threaded fasteners for ASME Code Class 1, 2, and 3.

The staff reviewed the supplemental information as follows:

##### Supplemental Information

- STD SUP 3.13-1 Threaded Fasteners-ASME Code Class 1, 2, and 3

NRC staff reviewed STD SUP 3.13-1 related to the criteria for the selection of materials, design, inspection, and testing of threaded fasteners included under Section 3.13 of the North Anna 3 COL FSAR. STD SUP 3.13-1 points to ESBWR DCD Tier 2, Sections 4.5.1, 5.2.3, and 6.1.1. Those sections provide additional and specific requirements concerning treaded fasteners used in reactor internals, the reactor coolant system, and other engineered safety features. The staff found that STD SUP 3.13-1 appropriately points out the DCD sections that identify the specific use of threaded fasteners in reactor internals, the reactor coolant system, and other engineered safety features.

The staff reviewed the conformance of Section 3.13 of the North Anna 3 COL FSAR to the guidance of RG 1.206, Section C.III.1, Chapter 3, C.I.3.13, "Threaded Fasteners." The staff's review of Section 3.13 of the North Anna 3 COL FSAR found that the applicant has appropriately incorporated by reference Section 3.9.3.9 of ESBWR DCD, Revision 5.

#### **3.13.5 Post Combined License Activities**

There are no post COL activities related to this section.

#### **3.13.6 Conclusion**

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the relevant information relating to threaded fasteners for ASME Code Class 1, 2, and 3; and no outstanding information is expected to be addressed in the COL FSAR related to this section.

In addition, the staff concluded that the information pertaining to North Anna 3 COL FSAR Section 3.13 is within the scope of the design certification and adequately incorporates by reference Section 3.9.3.9 of the ESBWR DCD, which addresses SRP Section 3.13, “Threaded Fasteners – ASME Code Class 1, 2, and 3.” The information is thus acceptable.

The staff is reviewing the information in the DCD on Docket No. 52-010. The results of the staff’s technical evaluation of the information related to threaded fasteners for ASME Code Class 1, 2, and 3, 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 is being tracked as part of **Open Item [1-1]**. The staff will update Section 3.13 of this SER to reflect the final disposition of the DCA.