

PMNorthAnna3COLPEmails Resource

From: Thomas Kevern
Sent: Wednesday, May 20, 2009 4:52 PM
To: Dominion.Naps3ColaRAI@DOM.COM
Cc: NorthAnna3COL Resource; Regina.Borsh@dom.com; john.hayden@dom.com; Wanda.K.Marshall@dom.com; Sharon Green; Janelle Jessie; Michael Eudy
Subject: North Anna SER/OI Chapters 1, 4, 6, 7, 15, 17,18, and 19
Attachments: NA Ch01 ML0909804063.pdf; NA Ch04 ML0910302060.pdf; NA Ch06 ML0913804800.pdf; NA Ch07ML0909804360.pdf; NA Ch15 ML0910302200.pdf; NA Ch17 ML0912403150.pdf; NA Ch18 ML0909804510.pdf; NA Ch19 ML0911306100.pdf

Gina:

In preparation for the ACRS subcommittee meeting on June 18th, the staff has forwarded the subject SER/OI chapters to the ACRS for review. As noted in the staff's memo to the ACRS, these SER/OI chapters are being provided to Dominion (cc Mr. Grecheck) for proprietary review. To expedite your review, I'm providing the e-files (attached) of these chapters and an excerpt of the staff's memo (below).

The staff has completed detailed reviews of FSAR chapters 1, 4, 6, 7, 15, 17, 18, and 19 and prepared the corresponding SERs with OIs. These SERs with OIs are being provided to support the upcoming meeting of the Advisory Committee on Reactor Safeguards (ACRS) ESBWR Design-Centered Subcommittee, scheduled to be held on June 18, 2009. The ACRS Full Committee meeting will be held at a future date.

The SERs with OIs are based on Revision 1 (December 2008) of the COL application which incorporates by reference Revision 5 of the ESBWR DCD. In addition, the COL application references the early site permit (ESP) for the North Anna ESP Site and incorporates, by reference, the North Anna ESP Application Site Safety Analysis Report, Revision 9.

The enclosed SERs with OIs have not been reviewed for proprietary information. Until the proprietary determination has been completed, the enclosures should not be released to the public. The staff has requested that Dominion complete the proprietary review before the June ACRS meeting, so that the enclosures can be made publicly available.

Thomas A. Kevern
Senior Project Manager
Office of New Reactors
USNRC
301.415.0224

Hearing Identifier: NorthAnna3_Public_EX
Email Number: 726

Mail Envelope Properties (CEEA97CC21430049B821E684512F6E5ECA3BBC361F)

Subject: North Anna SER/OI Chapters 1, 4, 6, 7, 15, 17,18, and 19
Sent Date: 5/20/2009 4:51:52 PM
Received Date: 5/20/2009 4:51:55 PM
From: Thomas Kevern

Created By: Thomas.Kevern@nrc.gov

Recipients:

"NorthAnna3COL Resource" <NorthAnna3COL.Resource@nrc.gov>
Tracking Status: None
"Regina.Borsh@dom.com" <Regina.Borsh@dom.com>
Tracking Status: None
"john.hayden@dom.com" <john.hayden@dom.com>
Tracking Status: None
"Wanda.K.Marshall@dom.com" <Wanda.K.Marshall@dom.com>
Tracking Status: None
"Sharon Green" <Sharon.Green@nrc.gov>
Tracking Status: None
"Janelle Jessie" <Janelle.Jessie@nrc.gov>
Tracking Status: None
"Michael Eudy" <Michael.Eudy@nrc.gov>
Tracking Status: None
"Dominion.Naps3ColaRAI@DOM.COM" <Dominion.Naps3ColaRAI@DOM.COM>
Tracking Status: None

Post Office: HQCLSTR01.nrc.gov

Files	Size	Date & Time
MESSAGE	1672	5/20/2009 4:51:55 PM
NA Ch01 ML0909804063.pdf		168422
NA Ch04 ML0910302060.pdf		77933
NA Ch06 ML0913804800.pdf		155360
NA Ch07ML0909804360.pdf		55655
NA Ch15 ML0910302200.pdf		110058
NA Ch17 ML0912403150.pdf		245288
NA Ch18 ML0909804510.pdf		80255
NA Ch19 ML0911306100.pdf		138964

Options

Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

1.0 INTRODUCTION AND INTERFACES

This Chapter of the safety evaluation report (SER) is organized as follows:

- Section 1.1 provides an overview of the entire combined license (COL) application;
- Section 1.2 provides the regulatory basis for the COL licensing process;
- Section 1.3 provides an overview of the COLA principal review matters and where the staff's review of the 10 parts of the COLA is documented.
- Section 1.4 documents the staff's review of Chapter 1 of the Final Safety Analysis Report (FSAR); and
- Section 1.5 documents regulatory findings that are in addition to those directly related to the staff's review of the FSAR.

1.1 Summary of Application

By a letter dated November 26, 2007 (Agencywide Documents Access and Management System [ADAMS] Accession No. [ML073320913](#)), pursuant to Sections 103 and 185b. of the Atomic Energy Act and 10 CFR 52, Subpart C, Virginia Electric and Power Company (doing business as Dominion Virginia Power [DVP or Dominion] and Old Dominion Electric Cooperative (ODEC) submitted to the U.S. Nuclear Regulatory Commission (NRC) an application for a COL to construct and operate an Economic Simplified Boiling-Water Reactor (ESBWR) plant at the North Anna Power Station (NAPS) site. Dominion and ODEC also applied for other licenses that would be required to possess and use source, special nuclear and byproduct materials related to the operation of the plant. Dominion has control of the NAPS site and existing facilities and has authority to act as ODEC's agent. The proposed plant is to be located on the existing NAPS site, in Louisa County, Virginia, adjacent to existing Units 1 and 2, and is designated as North Anna 3.

The North Anna 3 COL application incorporates by reference the ESBWR design certification (DC) application (Docket No. 05200010), which the NRC staff is currently reviewing. The ESBWR is a 4,500 MWt reactor that uses natural circulation for normal operations and has passive safety features. The COL application referenced Revision 4 of the ESBWR Design Control Document (DCD). In a letter dated December 12, 2008, Dominion submitted Revision 1 to the COL application, which referenced Revision 5 of the ESBWR DCD.

In addition to the ESBWR DCD, the COL application references the early site permit (ESP) for the North Anna ESP Site (ESP-003)—issued pursuant to 10 CFR 52.24—and incorporates by reference the North Anna Early Site Permit Application Site Safety Analysis Report, Revision 9.

The North Anna 3 COL application is organized as follows:

- **Part 1 General and Administrative Information**

Part 1 provides an introduction to the application and includes certain corporate information regarding Dominion and ODEC pursuant to 10 CFR 50.33(a)–(d).

- **Part 2 Final Safety Analysis Report**

Part 2 contains information pursuant to the requirements of 10 CFR 52.79 and, in general, adheres to the content and format guidance provided in Regulatory Guide (RG) 1.206.

- **Part 3 Environmental Report**

Part 3 contains environmental-related information pursuant to the requirements of 10 CFR 51.50(c). The environmental impacts of constructing and operating new nuclear units at NAPS were previously addressed by Dominion in the North Anna ESP Application.

- **Part 4 Technical Specifications**

Part 4 contains ESBWR Generic Technical Specifications and Bases and the North Anna Plant-Specific Technical Specifications and Bases.

- **Part 5 Emergency Plan**

Part 5 contains the North Anna Emergency Plan, supporting information such as Evacuation Time Estimates, and applicable offsite State and local emergency plans.

- **Part 6: [Not Used - reserved for Limited Work Authorization/site redress information]**

- **Part 7 Departures Report**

Part 7 contains information regarding “departures,” “variances,” “exemptions,” and “supplements’ or “supplemental information.” Dominion’s application contains no departures from the ESBWR standard design described in the DCD. The application contains 15 requests for variances related to the ESP. The application also includes supplemental information provided throughout the FSAR to conform with RG 1.206 guidance.

- **Part 8 Security Plan**

Part 8 contains the North Anna Unit 3 Security Plan and Safeguards Information that is withheld from public disclosure. Part 8 was submitted to the NRC in a separate transmission dated November 26, 2007 (Dominion Serial No. NA3-07-002).

- **Part 9 [Not Used]**

- **Part 10 Tier 1/ITAAC**

Part 10 contains ESBWR DCD Tier 1 information and the North Anna Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). The North Anna ITAAC are addressed in four parts: (1) Design Certification ITAAC, (2) Emergency Planning ITAAC, (3) Physical Security ITAAC, and (4) Site-Specific ITAAC.

1.2 Regulatory Basis

1.2.1 Applicable Regulations

10 CFR Part 52, Subpart C, “Combined Licenses,” sets out the requirements and procedures applicable to Commission issuance of a COL for nuclear power facilities. The following are of particular significance:

- 10 CFR 52.79 identifies the technical information for the FSAR.
 - 10 CFR 52.79 (b) provides additional requirements for a COL referencing an ESP.
 - 10 CFR 52.79 (d) provides additional requirements for a COL referencing a standard certified design.
- 10 CFR 52.80 provides additional technical information outside of the FSAR (ITAAC and the environmental report).
- 10 CFR 52.81 provides standards for reviewing the application.
- 10 CFR 52.83 provides for the finality of referenced NRC approvals (i.e., standard DC and ESPs).
- 10 CFR 52.85 provides requirements for administrative reviews and hearings.
- 10 CFR 52.87 provides for referrals to the Advisory Committee on Reactor Safeguards (ACRS).

The NRC staff reviewed the North Anna COL application according to the standards in 10 CFR Parts 20, 50, 51, 52, 55, 73, and 140. The staff evaluated the application against the acceptance criteria provided in the following standard review plans:

- NUREG-0800
- NUREG-1555

In addition, the staff considered the format and content guidance contained in RG 1.206.

1.2.2 Finality of Referenced NRC Approvals

In accordance with 10 CFR 52.83, “Finality of referenced NRC approvals; partial initial decision on site suitability,” if the application for a COL references a design certification rule (DCR) or an ESP, the scope and nature of matters resolved for the application and any combined license issued are governed by the relevant provisions addressing finality. For a DCR, finality is addressed by 10 CFR 52.63: “Finality of standard design certifications.”

Based on the finality afforded to referenced certified designs, the scope of this COL application review as it relates to the referenced certified design¹ is primarily limited to ensuring that the

¹ Note: While the ESBWR design is not yet certified, 10 CFR 52.55 (c) allows an applicant to assume the risk of incorporating by reference a design that is not certified. The NRC staff is currently reviewing the ESBWR

COL applicant adequately addresses the identified COL review items. Dominion may need to supplement this application, based on the outcome of the ESBWR DC rulemaking. This is being tracked as Open Item 1-1. The staff will supplement this SER as necessary to reflect the final disposition of the design certification application.

For an ESP, finality is governed by 10 CFR 52.39, "Finality of early site permit determinations." Similar to finality of a DC, the Commission may not change or impose new site characteristics, design parameters, or terms and conditions, including emergency planning requirements, on the ESP unless specified conditions are met.

The contents of the COL application are specified by 10 CFR 52.79(a), which requires the submission of information within the final safety analysis report that describes the facility, presents the design bases and the limits on its operation, and presents a safety analysis of the structures, systems, and components of the facility as a whole. For a COL application that references a DC, Section 52.79(d) requires the DCD to be included or incorporated by reference into the FSAR. A COL application that references a certified design must also contain the information and analysis required to be submitted within the scope of the COL application, but which is outside the scope of the DCD. This set of information addresses plant- and site-specific information and includes all COL action or information items; design information replacing conceptual design information; and programmatic information that was not reviewed and approved in connection with the design certification rulemaking.

The initial step in the staff evaluation of the COL application is to confirm that the complete set of information required to be addressed within the COL application was addressed within the DC, the DC as supplemented by the COL application or completely within the COL application. Following this confirmation, the staff review of the COL application is limited to the COL review items.

There are similar provisions in 10 CFR 52.79(b) pertaining to a COL application that references an ESP.

1.2.3 Overview of the Design-Centered Review Approach:

The design-centered review approach (DCRA) is described in Regulatory Issue Summary (RIS) 2006-06, "New Reactor Standardization Needed to Support the Design-Centered Licensing Review Approach." The DCRA is endorsed by the Commission in "Staff Requirements Secy-06-0187 – Semiannual Update of The Status of New Reactor Licensing Activities and Future Planning for New Reactors," dated November 16, 2006. The DCRA is Commission policy intended to promote standardization of COL applications beyond the scope of information included in the DC. Specifically, this policy allows for staff to perform one technical review for each standard reactor design issue outside the scope of the DC and use this decision to support decisions on multiple COL applications. In this context, "standard" refers to identical information.

The first COL application submitted for NRC staff review is designated in a design center as the reference COL application (R-COLA) and subsequent applications as subsequent COL applications (S-COLAs). North Anna Unit 3 has been designated as the R-COLA for the ESBWR design center.

design certification application (Docket No. 052-010), and the results of the NRC staff's technical evaluation will be documented in the staff safety evaluation report on the design certification application.

1.3 Principal Review Matters

The staff's evaluations related to the COL application review are addressed as follows:

- **Part 1 General and Administrative Information**

The staff's evaluation of the corporate information regarding DVP and ODEC pursuant to 10 CFR 50.33(a)–(d) is provided in Appendix A to this SER.

- **Part 2 Final Safety Analysis Report**

The staff's evaluation of information contained in the FSAR is provided in the corresponding sections of this SER.

- **Part 3 Environmental Report**

The staff's evaluation of environmental-related information pursuant to the requirements of 10 CFR 51.92(e) is provided in the Supplemental Environmental Impact Statement. It should be noted that the environmental impacts from constructing and operating new nuclear units at NAPS were previously evaluated by the NRC staff in NUREG-1811, Final Environmental Impact Statement for an ESP at the North Anna Site. In accordance with 10 CFR 51.50(c)(1), Part 3 of the COL application incorporates by reference the assessment of environmental issues that were resolved in the ESP proceeding and provides supplemental information, where appropriate.

- **Part 4 Technical Specifications**

Chapter 16 of this SER contains the staff's evaluation of the Technical Specifications includes both the ESBWR Generic Technical Specifications and Bases and the North Anna Plant Specific Technical Specifications and Bases.

- **Part 5 Emergency Plan**

Chapter 13 of this SER includes the staff's evaluation of the North Anna Emergency Plan, supporting information such as Evacuation Time Estimates, and the applicable offsite State and local emergency plans.

- **Part 7 Departures Report**

The staff's evaluation of the departures, variances, exemptions, and supplemental information contained in Part 7 is provided in the applicable chapter (i.e., Chapters 2 through 19) of this SER. In addition, any associated exemptions are granted separately from this SER.

- **Part 8 Security Plan**

The staff's evaluation of the Security Plan is documented separately from evaluations of other parts of the COL application and is identified as Safeguards Information.

- **Part 10 Tier 1/ITAAC**

Chapter 14 of this SER contains the staff's evaluation of ITAAC, with the exception of Physical Security ITAAC.

The staff's SER is structured as follows:

- The SER follows the basic premise of "finality" afforded to COL applicants that incorporates by reference a standard DC as well as an ESP. As such, this SER does not repeat any technical evaluation of material incorporated by reference; rather, it points to the corresponding review findings of the subject licensing action. However, the referenced DCD, the ESP, and the COL application FSAR are considered as part of the safety evaluation to ensure that the expected scope of information to be included within a COL application is adequate within the DCD, ESP, and COL FSAR.
- For sections that were complete incorporated by reference without any supplements or departures, the SER simply points to the DCD and related FSER and confirms that all relevant review items were addressed within the DCD and the staff's evaluation.
- For subject matter within the scope of the COL application, this SER utilized a six-subsection organization as follows:
 - "Introduction" section provides a brief overview of the specific subject matter.
 - "Summary of Application" section identifies whether portions of the review have received finality and clearly identifies the scope of review for the COL.
 - "Regulatory Basis" section identifies only the relevant criteria for the information addressed by the COL application.
 - "Technical Evaluation" section focuses on the information addressed in the COL application.
 - "Post-Combined License Activities" section identifies license conditions or other commitments.
 - "Conclusion" section summarizes how the technical evaluation resulted in a reasonable assurance determination by the staff that the relevant acceptance criteria have been met.

1.4 Staff Review of FSAR Chapter 1

1.4.1 Introduction

There are two types of information provided within Chapter 1 of the FSAR:

- General information that enables the reviewer or reader to obtain a basic understanding of the overall facility without having to refer to subsequent chapters. A review of the remainder of the application can then be completed with a better perspective and recognition of the relative safety significance of each item in the overall plant description.

- Specific information related to qualifications of the applicant, construction impacts, and regulatory considerations that apply throughout the balance of the application (e.g., conformance with the standard review plan (SRP) acceptance criteria).

The SER identifies the information incorporated by reference that summarizes new information and documents the staff's evaluation of the sections addressing regulatory considerations.

1.4.2 Summary of Application

Section 1.1, Introduction

Section 1.1 of the FSAR incorporates by reference Section 1.1 of the ESBWR DCD, Revision 5, and includes supplemental information to address the format and content of the COL application. The formatting of information in the FSAR and other parts of the COL application is summarized as follows:

- **Proprietary and Security-Related Sensitive and Classified Non-Safeguard Information (SUNSI).** Such information is to be withheld from public disclosure and therefore is not included in the public version of the COL application. SUNSI is included in the non-public version of the COL application and is appropriately indicated.
- **Numbering of Pages.** Text pages are numbered sequentially within each chapter (e.g., Page 1-4 is the fourth page of Chapter 1).
- **Tables and Figures.** Each table is identified by the section number followed by a number (for example, Table 1.9-204 would be an FSAR table in Section 1.9.) The use of the "200" series for FSAR table numbers distinguishes FSAR tables from DCD tables. If a table from the DCD is referenced in the FSAR text, it is denoted as such (e.g., DCD Table 4.1-1). Revising a table from the DCD or Early Site Permit for use in the FSAR, the original DCD or ESP table number would be appended with an "R." For example revising "DCD Table 4.2-1" would change it to "Table 4.2-1R." Drawings, pictures, sketches, curves, graphs, and engineering diagrams identified as figures are numbered using the section number followed by a number (Figure 2.1-201 would be an FSAR figure in Section 2.1). The use of the "200" series for FSAR figure numbers distinguishes FSAR figures from DCD or ESP figures. A figure from the DCD or ESP referenced in the FSAR text is denoted as such (DCD Figure 4.1-1). Revising a figure from the DCD or ESP for use in the FSAR would append the original DCD or ESP figure number with an "R; DCD Figure 4.2-1 would become Figure 4.2-1R.
- **Incorporation by Reference.** Consistent with provisions of 10 CFR 52.79, the COL application references the ESBWR DC application and the FSAR incorporates by reference the ESBWR DCD with departures and/or supplemental information as deemed appropriate by the applicant. In addition, the FSAR incorporates by reference the North Anna ESP Site Safety Analysis Report (SSAR), Revision 9, with variances and/or supplements. Analogous to a departure, a variance is a plant-specific deviation from one or more of the site characteristics, design parameters, or terms and conditions of an ESP or from the SSAR.
- **Supplements.** The following types of supplemental information are contained in the FSAR or other parts of the COL application:

- COL Items, consisting of both “applicant” (“A”) items, for which sufficient information is provided in the COL application to fully address and resolve the items, and “holder” (“H”) items, which are addressed in the COL application but require further action following issuance of the COL;
 - Conceptual Design Information;
 - ESP COL Action Items;
 - ESP Permit Conditions;
 - ESP SSAR Corrections; and
 - other supplemental information deemed appropriate by the applicant to demonstrate compliance with regulatory requirements, demonstrate conformance with staff guidance, and/or clarify the COL application content.
- **Left Margin Annotations.** FSAR sections are annotated in the left margin with information that identifies 1) the reason the information is being provided and, as applicable, 2) whether the information is standard (identical) for any ESBWR application or specific to the COL application for a particular plant. Table 1.1-201 identifies and defines the annotations.

Section 1.2 General Plant Description

Section 1.2 of the FSAR incorporates by reference Section 1.2 of the ESBWR DCD, Revision 5, and contains supplemental information to address the following systems and equipment outside the scope of the certified design: (1) main turbine; (2) main condenser; (3) hydrogen water chemistry system; (4) zinc injection system; (5) freeze protection; (6) other building structures; and (7) modular construction techniques and plans.

The ESBWR is a 4,500 MWt reactor that uses natural circulation for normal operation and has passive safety features. North Anna Unit 3, in addition to the buildings and structures within the scope of the ESBWR standard plant, includes an intake structure for plant makeup water, normal power heat sink and auxiliary heat sink cooling towers, a sewage treatment plant, water treatment facilities, storage tanks for water and fuel oil, a switchyard and other site support systems and structures necessary to support the operation and maintenance of the facility. Detailed descriptions of the plant-specific structures, systems, and components (SSCs) are contained in FSAR Chapters 3 through 19. Consistent with the guidance of RG 1.206, Chapter 2 of the FSAR contains information concerning the geological, seismological, hydrological, and meteorological characteristics of the site and vicinity, in conjunction with present and projected population distribution and land use and site activities and controls.

North Anna Unit 3 is intended to operate at an estimated gross electrical power output at rated power of approximately 1594 MWe. The estimated net electrical power output, which is dependent on site ambient conditions, the normal plant heat sink operation controls, and station electrical loads, is between approximately 1425 MWe and 1510 MWe.

Key milestones associated with the Unit 3 estimated schedule for completion of construction and the beginning of commercial operation are: (1) Potential Safety-Related Construction Start – 2012; and (2) Commercial Operation – 2017.

Section 1.3 Comparison with Other Facilities

Section 1.3 of the FSAR incorporates by reference Section 1.3 of the ESBWR DCD, Revision 5, and identifies that there are no updates to DCD Table 1.3-1 for North Anna Unit 3.

Section 1.4 Identification of Agents and Contractors

Section 1.4 of the FSAR incorporates by reference Section 1.4 of the ESBWR DCD, Revision 5, and contains supplemental information to identify the applicants, licensee, and contractors. Dominion and ODEC are the applicants for the COL, and Dominion will be the licensee authorized to construct and operate Unit 3. Dominion is responsible for making each of the key project decisions, including the ultimate decision on whether to build a new nuclear power plant and who would be the plant operator. Dominion selected GE-Hitachi Nuclear Energy Americas, (GEH) as primary contractor for the design of the unit and Bechtel Power Corporation (Bechtel) as the primary contractor for site engineering.

Contractor responsibilities and the relationship with Dominion are summarized as follows:

- GEH. GEH is responsible for developing the complete standard plant for the ESBWR necessary to obtain a DC from the NRC, supporting preparation of the COL application and activities to support deployment of the ESBWR on the North Anna site.
- Turbine Island and Nuclear Island. The contractors for the construction of the turbine island and the nuclear island have not yet been selected. The turbine island and the nuclear island together represent the power block. The contractor for the construction of the turbine island will be responsible for the erection and delivery of the turbine building, the electric building, and the contents of each building. The contractor for the construction of the nuclear island will be responsible for the erection and delivery of the reactor and fuel building, the control building, the hot machine shop, the radwaste building, and the contents of each building. Each contractor will be selected based on their historical work in the nuclear industry, ongoing nuclear business, ability to deliver integrated engineering and construction services, and available resources.
- Bechtel. Bechtel is responsible for the engineering and licensing support of the COL application, and for site engineering of facilities and utilities outside of the plant power block.
- Other contractors. Contractual relationships were established with several specialized consultants to assist in developing the COL application. Other subcontractors may be added as the need arises.

Section 1.5 Requirements for Further Technical Information

Section 1.5 of the FSAR incorporates by reference Section 1.5 of the ESBWR DCD, Revision 5, with no supplements or departures. The DCD section presents the background for the evolution of the ESBWR design, the methodology used to assess the need for further technical information, the computer code used for analysis and design, and the major Simplified Boiling-Water Reactor/ESBWR Test Programs.

Section 1.6 Material Referenced

Section 1.6 of the FSAR incorporates by reference Section 1.6 of the ESBWR DCD, Revision 5, and supplements the DCD by FSAR Table 1.6-201. The FSAR table lists topical reports not included in DCD Section 1.6 that are incorporated in whole or in part by reference in the FSAR.

Section 1.7 Drawings and Other Detailed Information

Section 1.7 of the FSAR incorporates by reference Section 1.7 of the ESBWR DCD, Revision 5, and supplements the DCD as follows: (1) FSAR Table 1.7-201 supplements DCD Table 1.7-2 for those portions of the electrical system configuration drawings outside the scope of the DCD; (2) FSAR Table 1.7-202 supplements DCD Table 1.7-3 for those portions of the mechanical system configuration drawings outside the scope of the DCD.

In STD COL 1.7-1-H the applicant commits to making available to the staff the final piping and instrumentation diagrams (P&IDs) used for construction upon completion of the final design configuration. In addition, design changes that result in revisions to the simplified diagrams will be incorporated in subsequent updates to the FSAR.

Section 1.8 Interfaces with Standard Design

Section 1.8 of the FSAR incorporates by reference Section 1.8 of the ESBWR DCD, Revision 5, and contains supplemental information as follows:

- **Balance of Plant Interfaces.** The significant interface requirements for those systems that are beyond the scope of the DCD are identified in DCD Tier 1.
- **Verification of Site Parameters.** FSAR Chapter 2 provides information demonstrating that the site characteristics fall within the ESBWR site parameters specified in the referenced certified design application. Chapter 2 also provides information demonstrating that the design of the facility falls within the site characteristics and bounding design parameters for the ESP.
- **COL Items and Permit Conditions.** FSAR Section 1.10 identifies specific FSAR sections that address the COL information items from the referenced certified design, and COL Action Items and Permit Conditions from the ESP.
- **Changes and Departures from the Referenced Certified Design.** FSAR Section 1.8 and Table 1.8-201 identify that there are no generic changes or departures from the referenced certified design.
- **Variances from the ESP and ESP SSAR.** The FSAR states that requests for variances from the ESP and SSAR comply with the requirements of 10 CFR 52.39 and 10 CFR 52.93. Variances are listed in Table 1.8-202 and the section of the FSAR in which each is discussed. The variances are described and evaluated in COL application Part 7.
- **Conceptual Design Information.** The referenced DCD includes conceptual design information (CDI) for certain systems, or portions of systems, that are outside the scope of the standard plant design. FSAR Table 1.8-203 identifies systems for which either the CDI in the DCD is adopted as the actual system design information, or the CDI in the DCD is replaced with site-specific design information, along with cross references to FSAR sections

- **Probabilistic Risk Assessment.** The FSAR states that the applicant reviewed site- and plant-specific information that included site meteorological data, site-specific population distribution, and plant-specific design information that replaced conceptual design information described in the DCD with respect to the DC PRA. FSAR Section 19.5 documents the conclusion that there is no significant change from the certified design PRA.
- **References.** The FSAR references are updated to include the Early Site Permit (ESP) for the North Anna ESP Site, No. ESP-003, November 2007.

Section 1.9 Conformance with Standard Review Plan and Applicability of Codes and Standards

Section 1.9 of the FSAR incorporates by reference Section 1.9 of the ESBWR DCD, Revision 5, and contains supplemental information as follows:

- **Conformance with Standard Review Plan.** Table 1.9-201 evaluates conformance with the SRP sections and Branch Technical Positions (BTPs) that were in effect six months prior to submitting the COL application. Table 1.9-201 does not re-address conformance with the SRP for those portions of the facility design included in the referenced certified design application. Similarly, Table 1.9-201 does not re-address SSAR conformance with the applicable Review Standard RS-002 sections. In the table, the term “Conforms” means that no exception is being taken to the guidance in the SRP section/acceptance criteria as they apply to site-specific design information, operational aspects of the facility, or siting information in the FSAR that supplements the SSAR. The term “Not applicable” in the table means that the SRP section/acceptance criteria do not apply to the ESBWR or to Unit 3. Any differences with the SRP acceptance criteria are identified and justified, with references to the applicable FSAR section(s) that address the difference, as necessary.
- **Applicability to Regulatory Criteria.** Table 1.9-202 evaluates conformance with Division 1, 4, 5, and 8 RGs that were in effect six months prior to submitting the COL application. All Division 1 RGs are evaluated in Division 4, 5, and 8 RGs that were identified in the SRP, in RG 1.206, or in DCD Table 1.9-21 as COL responsibility are also evaluated. (Conformance with Division 4 RGs is also addressed in COL application Part 3, Section 1.4.) Table 1.9-202 does not re-address conformance with RGs for those portions of the facility design included in the referenced certified design application. Similarly, Table 1.9-202 does not re-address SSAR conformance with the applicable RGs. In the table, the term “Conforms” means that no exception is being taken to the guidance in the regulatory positions as they apply to site-specific design information, operational aspects of the facility, or siting information in the FSAR that supplements the SSAR. The term “Not applicable” in the table means that the regulatory positions do not apply to the ESBWR or to Unit 3.
- **Regulatory Guide 1.206.** Table 1.9-203 evaluates conformance with the FSAR content guidance in RG 1.206. Where necessary, the table identifies the FSAR section where the required information is provided. In the table, the term “Conforms” means that the information called for in RG 1.206 is either 1) already addressed in the DCD or SSAR; or 2) addressed by adding new information beyond that contained in the DCD or SSAR. The term “Not applicable” in the table means that the information called for in RG 1.206 does not

- **Industrial Codes and Standards.** Table 1.9-204 identifies the Industrial Codes and Standards that are applicable to those portions of the Unit 3 design that are beyond the scope of the DCD or the SSAR, and to the operational aspects of the facility.
- **Applicability of Experience Information.** Table 1.9-205 addresses operational experience information, as described in applicable NUREG reports, for those portions of the Unit 3 design and operation that are beyond the scope of the ESBWR DCD. The comment column of Table 1.9-205 includes a reference to the applicable FSAR section that provides further discussion of the operational experience.

Section 1.10 Summary of COL Items

Section 1.10 of the FSAR incorporates by reference Section 1.10 of the ESBWR DCD, Revision 5, and contains supplemental information as follows: (1) Table 1.10-201 lists the FSAR location(s) where the individual COL items from the DCD are addressed, and (2) Table 1.10-202 lists the FSAR location(s) that address individual COL Action Items and Permit Conditions from the ESP.

Section 1.11 Technical Resolutions of Task Action Plan Items, New Generic Issues, New Generic Safety Issues and Chernobyl Issues

Section 1.11 of the FSAR incorporates by reference Section 1.11 of the ESBWR DCD, Revision 5, and contains supplemental information as follows:

- Table 1.11-201 supplements DCD Table 1.11-1, Resolutions To NUREG-0933 Table II Task Action Plan Items, New Generic Issues, Human Factors Issues and Chernobyl Issues, to address the site-specific aspects of (1) activities required by the action plan that the COL applicant is to complete and (2) environmental issues that are outside the scope of the DCD.
- Table 1.11-202 supplements DCD Table 1.11-1 to provide references to FSAR locations that provide additional information on specific issues.

Section 1.12 Impact of Construction Activities on Units 1 and 2

Section 1.12 of the FSAR contains a summary of the applicant's evaluation of the potential impact of the construction of Unit 3 on Units 1 and 2 SSCs important to safety, along with a description of the managerial and administrative controls used to provide assurance that Units 1 and 2 limiting conditions for operation (LCOs) are not exceeded as a result of Unit 3 construction activities. This evaluation involved the following sequential steps:

- Identification of potential construction activity hazards
- Identification of SSCs important to safety
- Identification of LCOs applicable to Units 1 and 2

- Identification of impacted SSCs and LCOs
- Identification of applicable managerial and administrative controls

1.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the DCD. In addition, the relevant requirements of the Commission regulations for the information contained in FSAR Chapter 1, and the associated acceptance criteria, are contained in Section 1.0 of NUREG-0800.

The applicable regulatory requirements are as follows:

- 10 CFR 52.77 and 10 CFR 52.79 as they relate to general introductory matters.
- 10 CFR 52.79(d)(2) requires that for a COL referencing a standard DC, the FSAR demonstrate that the interface requirements established for the design under 10 CFR 52.47 have been met.
- 10 CFR 52.79(a)(41) as they relate to an evaluation of the application against the applicable NRC review guidance in effect 6 months before the docket date of the application.
- 10 CFR 52.79(a)(20) as they relate to proposed technical resolutions of those Unresolved Safety Issues and medium- and high-priority generic safety issues which are identified in the version of NUREG-0933 current on the date up to 6 months before the docket date of the application and which are technically relevant to the design.
- 10 CFR 52.79(a)(17) as they relate to compliance with technically relevant positions of the Three Mile Island requirements.
- 10 CFR 52.79(a)(37) as they relate to the information necessary to demonstrate how operating experience insights have been incorporated into the plant design.
- 10 CFR 50.43(e) as it relates to requirements for approval of applications for a DC, combined license, manufacturing license, or operating license that propose nuclear reactor designs that differ significantly from light-water reactor designs that were licensed before 1997, or use simplified, inherent, passive, or other innovative means to accomplish their safety functions.
- 10 CFR 52.79(a)(31) regarding nuclear power plants to be operated on multi-unit sites as it relates to an evaluation of the potential hazards to the structures, systems, and components important to safety of operating units resulting from construction activities, as well as a description of the managerial and administrative controls to be used to provide assurance that the limiting conditions for operation are not exceeded as a result of construction activities at the multi-unit sites.

The related acceptance criteria are as follows.

- There are no specific SRP acceptance criteria associated with the general requirements.
- For regulatory considerations, acceptance is based on addressing the regulatory requirements as discussed within FSAR Chapter 1 or within the FSAR section referenced in

- For performance of new safety features, the FSAR information is to be sufficient to provide reasonable assurance that (1) the new safety features will perform as predicted in the applicant's FSAR, (2) the effects of system interactions are acceptable, and (3) the applicant provides sufficient data to validate analytical codes. The design qualification testing requirements may be met with either separate effects or integral system tests; prototype tests; or a combination of tests, analyses, and operating experience.
- For conformance with regulatory criteria, RG 1.206 states that an applicant should perform an evaluation for conformance with the Regulatory Guides that were in effect six months prior to the submittal of the COL application.

1.4.4 Technical Evaluation

The staff reviewed Chapter 1 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.² The NRC staff review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to this introduction chapter. Chapter 1 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff's consideration of the information incorporated by reference will be documented in the corresponding SER.

The staff's review of information contained in the COL FSAR is documented in the following paragraphs.

Sections 1.1, 1.2, 1.3, 1.4, 1.6, and 1.7

The information in these sections is related to the general information and provides the reader with a basic overview of the nuclear power plant and the structure of the FSAR itself. There are no specific SRP acceptance criteria for reviewing the information presented in these sections, therefore there are no specific regulatory findings.

Section 1.5

10 CFR 50.43(e) requires additional testing or analysis for applicants for a DC or combined license that propose nuclear reactor designs which differ significantly from light-water reactor designs that were licensed before 1997, or use simplified, inherent, passive, or other innovative means to accomplish their safety functions. This requirement is addressed in the DCD. The COL application does not contain any additional design features that require testing.

Section 1.8

The staff reviewed the information contained in FSAR Section 1.8 and evaluated the contents of Table 1.8-201 pertaining to departures, Table 1.8-202 pertaining to variances, Table 1.8-203 pertaining to CDI, and Table 1.10-201 pertaining to COL items. The technical evaluations and

² See Section 1.2.2, "Finality of Referenced NRC Approvals" for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

conclusions pertaining to the contents of these tables are presented in their respective chapters (Chapters 2 through 19) in this SER.

Section 1.9, 1.10, and 1.11

The staff reviewed Tables 1.9-201, 1.9-202, 1.9-203, 1.9-204, 1.9-205, 1.10-201, 1.10-202, 1.11-201, and 1.11-202 and evaluated the contents against the guidance provided in SRP Section 1.0, Introduction and Interfaces. The review concludes that the applicant provided sufficient information to address the regulatory considerations identified in RG 1.206 (C.I.1.9) and SRP Section 1.0 and, therefore, is acceptable. The staff's technical evaluation of information contained or referenced in Sections 1.9, 1.10 and 1.11 of the FSAR is addressed in Chapters 2 through 19 of this FSER as needed.

Section 1.12

The staff reviewed the information contained in Section 1.12 and determined that the applicant has performed an evaluation of the potential hazards to the SSCs important to the safety of Units 1 and 2 resulting from construction activities associated with Unit 3 and described the management and administrative controls to be used to provide assurance that the limiting conditions for operation of Units 1 and 2 are not exceeded as a result of construction activities. The staff's review is ongoing and is being tracked as an **Open Item 1-2**.

1.4.5 Post Combined License Activities

The applicant identified the following commitment:

- STD COL 1.7-1-H– Final Design Configuration Confirmation

The FSAR, Section 1.7.2, states that the final P&IDs used for construction will be available upon completion of the final design configuration and that design changes that result in revisions to the simplified diagrams will be incorporated in subsequent updates to the FSAR.

1.4.6 Conclusions

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to Chapter 1 and there is no outstanding information expected to be addressed in the COL FSAR related to this chapter.

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

In addition, the staff is unable to finalize its conclusions regarding FSAR Chapter 1 due to **Open Item 1-2**.

1.5 Other Regulatory Considerations

1.5.1 Applicant Technical Qualifications (10 CFR 52.97(iv))

DVP and ODEC currently own the North Anna Power Station, which includes two existing nuclear power plants (Units 1 and 2). DVP is the licensed operator of Units 1 and 2. In addition, DVP is the licensed operator of the two nuclear power plants (Units 1 and 2) at the Surry Power Station in southeastern Virginia. Based on the applicant's experience and demonstrated performance related to the construction and operation of these existing nuclear units, the staff concludes that the applicant is technically qualified to engage in the activities associated with a COL for North Anna Unit 3 in accordance with the provisions of 10 CFR 52.97(iv).

1.5.2 Applicant Financial Qualifications and Organization Considerations

The staff's evaluation of the applicant's financial qualifications, decommissioning funding assurance, antitrust, foreign ownership, and nuclear insurance and indemnity are provided in Appendix A to this SER.

1.5.3 Nuclear Waste Policy Act

Section 302(b) of the Nuclear Waste Policy Act of 1982, as amended, states, "The Commission, as it deems necessary or appropriate, may require as a precondition to the issuance or renewal of a license under section 103 or 104 of the Atomic Energy Act of 1954 [42 U.S.C. 2133, 2134] that the applicant for such license shall have entered into an agreement with the Secretary for the disposal of high-level radioactive waste and spent nuclear fuel that may result from the use of such license." In RAI 01-03, the staff requested that the applicant provide the Department of Energy (DOE) contract number for disposal of high-level radioactive waste and spent nuclear fuel or for the applicant to provide its plans, including the time frame, for entering into such a contract. **RAI 01-03** is being tracked as an **Open Item**.

1.5.4 Consultation with Department of Homeland Security

In accordance with Section 657 of the Energy Policy Act of 2005, the NRC consulted with the Department of Homeland Security (DHS).

1.5.5 Receipt, Possession, and Use of Source, Byproduct and Special Nuclear Material Authorized by 10 CFR Part 52 Combined Licenses

In the North Anna Unit 3 COL application transmittal letter, dated November 26, 2007, and in Part 1, General and Administrative Information, of the application, Dominion requested such other licenses as would be required for receipt, possession and use of source, byproduct and special nuclear material in connection with the operation of Unit 3. The staff notes that such licenses would be in accordance with Commission regulations in 10 CFR Parts 30, 40, and 70.

In a memorandum (ML083030065) dated December 9, 2008, the staff proposed standard license conditions and requirements regarding 10 CFR Parts 30, 40, and 70. The staff intends that holders of a COL under 10 CFR Part 52 will also be authorized to receive, possess, and use source, byproduct, and special nuclear material in accordance with the Commission's regulations in 10 CFR Parts, 30, 40, and 70. Standard license conditions will be incorporated in

the COL such that licensees will be required to comply with all applicable regulations of 10 CFR Parts 30, 40, and 70, as well as the regulations in 10 CFR Parts 20, 50, and 52.

Accordingly, in RAI 01-04 (ID 2829), the staff requested that the applicant supplement the COL application regarding the request to receive, possess, and use source, byproduct, and special nuclear material with sufficient information to support compliance with the applicable portions of 10 CFR Parts 30, 40, and 70. **RAI 01-04** is being tracked as an **Open Item**.

4.0 REACTOR

4.1 Introduction

This chapter describes the mechanical components of the Economic Simplified Boiling-Water Reactor (ESBWR) and the Reactor Core including the reactor internals, control rod drive, and core support structural materials, fuel system design (fuel rods and assemblies), the nuclear design, and the thermal-hydraulic design. It provides an evaluation and the supporting information necessary to establish the capability of the reactor to perform its safety functions throughout its design lifetime under all normal operational modes, including transient, steady-state, and accident conditions. This chapter also includes information to support the accident analyses.

4.2 Summary of Application

Chapter 4 of the North Anna 3 combined license (COL) Final Safety Analysis Report (FSAR), Revision 1 incorporates by reference, with no departures, Chapter 4, "Reactor," of the ESBWR Design Control Document (DCD), Revision 5. In addition, in the FSAR Chapter 4, the applicant provided the following information to address COL items.

COL Items

- STD COL 4.3-1-A Variances from Certified Design
- STD COL 4A-1-A Variances from Certified Design

For both items, the applicant stated that there are no changes from the referenced certified design.

4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in Chapter 4 of the Final Safety Evaluation Report (FSER) related to the ESBWR DCD.

4.4 Technical Evaluation

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed Chapter 4 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ Chapter 4 contains the following sections:

- 4.1 Summary Description
- 4.2 Fuel System Design
- 4.3 Nuclear Design
- 4.4 Thermal and Hydraulic Design
- 4.5 Reactor Materials
- 4.5.1 Control Rod Drive Structural Materials

¹ See Section 1.2.2, "Finality of Referenced NRC Approvals," for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

4.5.2 Reactor Internal and Core Support Structure Materials
4.6 Functional Design of Reactivity Control System

The staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to this Chapter.

Chapter 4 of the ESBWR DCD is being reviewed by the staff under Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to Chapter 4 will be documented in the safety evaluation report (SER) on the design certification application for the ESBWR design.

The staff reviewed the information contained in the COL FSAR and concluded that the applicant's resolutions to the COL items are within the scope of the design certification (DC), and are thus, acceptable.

4.5 Post Combined License Activities

There are no post COL activities related to this chapter.

4.6 Conclusion

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

The Staff is reviewing the information in DCD Chapter 4 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to "Reactor," 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 this is being tracked as part of **Open Item 1-1**. The staff will update Chapter 4 of this SER to reflect the final disposition of the design certification application.

6.0 ENGINEERED SAFETY FEATURES

The design and functional requirements of engineered safety features (ESF) of the plant are provided to mitigate the consequences of postulated accidents. The ESF consist of containment systems, core cooling systems, habitability systems, and fission product removal and control systems. The containment systems include the primary containment system, the passive containment cooling system, the containment isolation system, and the hydrogen control system. The passive core cooling system provides emergency core cooling following postulated design-basis events and is designed to operate without the use of active equipment such as pumps and ac power sources. Similarly, the passive containment cooling system removes heat from the containment without the use of active equipment or ac power sources. The control room habitability system is designed so that the main control room remains habitable following a postulated design basis event. Control of fission products following a postulated design basis event is provided by natural removal processes inside containment, the containment boundary, and the containment isolation system.

6.1 Design Basis Accident Engineered Safety Feature Materials

Section 6.1, "Design Basis Accident Engineered Safety Feature Materials" of the North Anna 3 combined license (COL) application incorporates by reference, with no departures or supplements, Economic Simplified Boiling-Water Reactor (ESBWR) design control document (DCD) Revision 5, Section 6.1, "Engineered Safety Feature Materials," which contains Section 6.1.1, "Metallic Materials," and Section 6.1.2, "Organic Materials." 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.¹ The NRC staff's review confirmed that there is no outstanding issue related to this subsection.

The staff is reviewing the information in DCD Section 6.1 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to engineered safety feature materials incorporated by reference in the North Anna 3 COL Final Safety Analysis Report (FSAR) will be documented in the staff's safety evaluation report (SER) on the design certification application for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item 1-1. The staff will update Section 6.1 of this SER to reflect the final disposition of the design certification application.

6.2 Containment Systems

6.2.1 Introduction

The containment and its associated systems provide the final barrier against the release of significant amounts of radioactive fission products in the event of an accident. The containment structure must be capable of withstanding, without loss of function, the pressure and temperature conditions resulting from postulated loss-of-coolant, steam line, or feed water line break accidents. The containment structure must also maintain functional integrity in the long term following a postulated accident (i.e., the structure must remain a low-leakage barrier against the release of fission products for as long as postulated accident conditions require).

¹ See Section 1.2.2, "Finality of Referenced NRC Approvals," for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

6.2.2 Summary of Application

Section 6.2 of the North Anna 3 COL FSAR incorporates by reference Section 6.2 of the ESBWR DCD Revision 5.

In addition, in FSAR Section 6.2, the applicant provided the following:

COL Item

- STD COL 6.2-1-H System Design

The applicant committed to provide an entry for the length of pipe from the containment to the inboard and outboard isolation valves in DCD Tables 6.2-16 through 6.2-45 at the completion of the piping design.

Supplemental Information

- STD SUP 6.2-1 Inspections to Limit Debris

The applicant provided the following supplemental information. The applicant provided a description of the plant procedures for conducting inspections to prevent debris inside the containment from affecting the emergency core cooling and long-term cooling safety functions.

6.2.3 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 design of the containment isolation valves and piping, and the associated acceptance criteria, are given in Section 6.2.4 of NUREG-0800 and are summarized below.

The applicable regulatory requirements for the design of the containment isolation valves and piping are General Design Criteria (GDC) 55, 56, and 57.

The related acceptance criteria are provided in Regulatory Guide (RG) 1.141, "Containment Isolation Provisions for Fluid Systems."

The relevant requirements of the Commission regulations for the controlling debris inside containment, and the associated acceptance criteria, are given in Section 6.2.2 of NUREG-0800 and are summarized below.

The applicable regulatory requirement for preventing debris from affecting the emergency core cooling and long-term cooling safety functions is 10 CFR 50.46(b)(5).

The related acceptance criteria are RG 1.82, Revision 3, "Water Sources for Long-Term Recirculation Cooling Following a Loss of Coolant Accident."

6.2.4 Technical Evaluation

NRC staff reviewed Section 6.2 of the North Anna 3 COL FSAR checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic. Section 6.2 contains the following subsections:

- 6.2.1 Containment Functional Design
- 6.2.2 Passive Containment Cooling System
- 6.2.3 Reactor Building Functional Design
- 6.2.4 Containment Isolation System
- 6.2.5 Combustible Gas Control in Containment
- 6.2.6 Containment Leakage Testing
- 6.2.7 Fracture Prevention of Containment Pressure Boundary

The staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to this Chapter.

Section 6.2 of the ESBWR DCD is being reviewed by the staff under Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to Section 6.2 will be documented in the safety evaluation report (SER) on the design certification application for the ESBWR design.

The staff reviewed the information contained in the COL FSAR:

COL Item

- STD COL 6.2-1-H System Design

NRC staff reviewed STD COL 6.2-1-H related to the location of the inboard and outboard isolation valves relative to the containment included under Section 6.2.4 of the FSAR.

In response to STD COL 6.2-1-H, the applicant stated that the pipe lengths will be determined as part of completion of the piping design ITAAC identified in DCD Tier 1, Table 3.1-1. The FSAR is to be revised to reflect the pipe length information in a subsequent update.

The staff issued RAI 6.02.04-1 stating that the applicant identified that the information on pipe lengths will be determined as part of the completion of the piping design ITAAC identified in DCD Tier 1, Table 3.1-1. The staff was unable to make its finding with respect to compliance with GDCs 55, 56, and 57 for this COL item without this information. The staff requested that the applicant propose an alternative approach to provide the pipe length information to demonstrate compliance with GDC 55, 56, and 57.

In a letter dated July 14, 2008, the applicant responded that the piping design is the responsibility of General Electric-Hitachi (GEH) and that GEH would comply with GDCs 55, 56, and 57 by implementing the ESBWR standard design for the North Anna 3 piping. In DCD Revision 5, Section 6.2.4.3 discusses how the containment isolation function meets the requirements in GDCs 55, 56, and 57.

The staff issued DCD RAI 6.2.157, Supplement 2, that relates to the ability of the ESBWR to meet GDC 55, 56, and 57 for locating the isolation valves as close to the containment as is practical.

In this context, “fully described” should be understood to mean that the program is clearly and sufficiently described in terms of the scope and level of detail to allow a reasonable assurance finding of acceptability. Required programs should always be described at a functional level and at an increased level of detail where implementation choices could materially and negatively affect the effectiveness and acceptability of the program.

Revised Content Guide for Generic Letter 2004-02: Supplemental Responses, dated November 2007 (ADAMS Accession No. ML073110278), provides guidance to pressurized water reactor licensees on programmatic controls that will ensure that potential sources of debris introduced into containment (e.g., insulations, signs, coatings, and foreign materials) will be assessed for potential adverse effects on the emergency core cooling system and containment spray system recirculation functions. While this document is strictly applicable to PWRs, the principles underlying the items quoted apply to BWRs attempting to address the guidance in RG 1.82, Revision 3. The applicant was requested to provide the following, as stated in the above guide, for the staff to review:

- A summary of the containment housekeeping programmatic controls that will be in place to control or reduce the latent debris burden. Specifically, to provide a description of programmatic controls that will be used to maintain the latent debris source term to ensure that assumptions used in designing debris strainers and conclusions remain valid.
- A summary of the foreign material exclusion programmatic controls that will be in place to control the introduction of foreign material into the containment.
- A description of how permanent plant changes inside containment are programmatically controlled so as to not change the analytical assumptions and numerical inputs of the analyses performed for designing debris strainers.
- A description of how maintenance activities, including associated temporary changes are assessed and managed.

In response, in a letter dated July 14, 2008, the applicant stated that the response to RAI 6.02.01-1 relates to and relies on the response to ESBWR DCD RAI 6.2-173 S01, which was being developed by GEH. The applicant agreed to respond to RAI 6.02.01-1 within 30 days after GEH submits the response to DCD RAI 6.2-173 S01.

In response to ESBWR DCD RAI 6.2-173 S01, in a letter dated December 1, 2008, GEH stated that the suppression pool water is not required for injection into the core or for long-term containment heat removal for 30 days following a loss-of-coolant accident (LOCA), and thus, RG 1.82 is not applicable to the ESBWR. GEH stated that hence, there is no requirement to develop a cleanliness program based on RG 1.82 and such a program does not need to be described in either the DCD or COL application.

GEH’s analysis has shown that the ESBWR can maintain the core covered for 30 days following a LOCA without crediting for an injection of water from the suppression pool. In the ESBWR, the Passive Containment Cooling System (PCCS) provides long-term decay heat removal from the containment. After 72 hours following a LOCA, the PCCS vent fans are available to increase the efficiency of the PCCS condensers. The PCCS along with the vent fans are capable of maintaining containment pressure below the design pressure for 30 days following a

LOCA. Therefore, the staff determined that RG 1.82 is not applicable to the ESBWR and there is no requirement to develop a cleanliness program based RG 1.82.

In a letter dated December 18, 2008, the applicant updated the response to RAI 6.02.01-1. The applicant proposed to change the FSAR to (1) state that RG 1.82 does not apply, (2) delete STD SUP 6.2-1, and (3) remove references to a cleanliness program. These changes are consistent with changes to the ESBWR DCD that GEH proposed in response to ESBWR DCD RAI 6.2-173 S01 and are acceptable. **RAI 6.02.01-1** is being tracked as a **Confirmatory Item**.

6.2.5 Post Combined License Activities

The following item was identified as a post COL activity:

- STD COL 6.2-1-H involving the distances of the inboard and outboard isolation valves relative to the containment. This information will become available after completion of the piping design.

Prior to finalizing the SER, the staff will determine the specific set of commitments to be included as conditions to the license related to Section 6.2.

6.2.6 Conclusion

NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to containment systems 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 6.2 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the containment systems incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff's SER on the design certification 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 6.2 of this SER to reflect the final disposition of the design certification application.

6.3 Emergency Core Cooling System

Section 6.3 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 6.3 "Emergency Core Cooling System," of Revision 5 of the ESBWR DCD. The NRC staff reviewed the application checked the referenced DCD to ensure that no issue relating to this section remained for review. The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 6.3 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the emergency core cooling system incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the design certification application for the ESBWR. This SER is not yet complete and is being tracked as part of Open Item 1-1. The staff will update Section 6.3 of this SER to reflect the final disposition of the design certification application.

6.4 Control Room Habitability Systems

6.4.1 Introduction

The control room habitability area provides protection for the plant operators and suitable environmental conditions for the necessary equipment to monitor and control the plant during normal operation and maintain the plant in a safe condition during accident conditions. The control room ventilation system and control building layout and structures ensure that plant operators are adequately protected against the effects of accidental releases of toxic and radioactive gases.

6.4.2 Summary of Application

Section 6.4 of the North Anna 3 COL FSAR incorporates by reference Section 6.4 of the ESBWR DCD Revision 5.

In addition, in FSAR Section 6.4, the applicant provided the following:

COL Item

- STD COL 6.4-1-A CRHA Procedures and Training

The applicant provided additional information in STD COL 6.4-1-A. The applicant stated that the operators are provided with training and procedures for control room habitability that address the applicable aspects of NRC Generic Letter 2003-01 and are consistent with the intent of Generic Issue 83.

- NAPS COL 6.4-2-A Toxic Gas Analysis

The applicant provided additional information in NAPS COL 6.4-2-A. The applicant stated that potential toxic gas sources are evaluated to confirm that an external release of hazardous chemicals does not impact control room habitability.

Supplemental Information

- NAPS SUP 6.4-1 System Safety Evaluation

The applicant provided the following supplemental information. The applicant described the evaluation performed of the impact of a postulated design basis accident in Units 1 or 2 on the Unit 3 control room.

6.4.3 Regulatory Basis

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

In addition, the relevant requirements of Commission regulations for procedures and training for control room habitability, and the associated acceptance criteria, are given in Section 6.4 and 13.2.1, 13.2.2 and 13.5.2.1 of NUREG-0800.

The related acceptance criteria are as follows: Generic Letter 2003-01 and Generic Issue 83.

In addition, the relevant requirements of the Commission regulations for control room toxic gas analyses and the associated acceptance criteria are given in Section 6.4 of NUREG 0800.

The applicable regulatory requirements for are as follows:

- GDC 4 and 19 of Appendix A to 10 CFR 50

The related acceptance criteria are RG 1.78, Revision 1 “Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release.”

In addition, the relevant requirements of Commission regulations for control room operator doses and the associated acceptance criteria are given in Section 6.4 of NUREG 0800.

The applicable regulatory requirements are as follows:

- GDC 19 of Appendix A to 10 CFR 50
- 10 CFR Part 50.34(f)(2)(xxviii)

6.4.4 Technical Evaluation

NRC staff reviewed Section 6.4 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.. The staff’s review confirmed that the information contained in the application and incorporated by reference addresses the required information related to control room habitability systems. Section 6.4 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The staff’s technical evaluation of the information incorporated by reference related to control room habitability systems will be documented in the staff SER on the design certification application for the ESBWR design.

The staff reviewed the information contained in the COL FSAR:

COL Item

- STD COL 6.4-1-A CRHA Procedures and Training

NRC staff reviewed NAPS COL 6.4-1-A related to the procedures and training included under Section 6.4 of the FSAR. The applicant provided additional information that states:

The COL applicant committed to develop and implement procedures and training for control room habitability that address the applicable aspects of NRC Generic Letter 2003-01 and are consistent with the intent of Generic Issue 83.

NRC staff evaluated STD COL 6.4-1-A related to providing operators with training and procedures for control room habitability that address the applicable aspects of NRC Generic Letter 2003-01 and are consistent with the intent of Generic Issue 83 included under Section 6.4 of the North Anna 3 COL Application.

The applicant stated, “Operators are provided with training and procedures for control room habitability that address the applicable aspects of NRC Generic Letter 2003-01 and are

consistent with the intent of Generic Issue 83. Training and procedures are developed and implemented in accordance with Sections 13.2 and 13.5, respectively.”

The staff determined that the applicant has provided adequate information regarding the development of operator training and procedures for control room habitability to address the applicable aspects of NRC Generic Letter 2003-01, as well as the intent of Generic Issue 83.

- NAPS COL 6.4-2-A Toxic Gas Analysis

NRC staff reviewed NAPS COL 6.4-2-A related to the toxic gas analysis included under Section 6.4 of the North Anna 3 COL FSAR. The applicant provided additional information that states:

The COL applicant will identify potential site-specific toxic or hazardous materials that may affect control room habitability in order to meet the requirements of TMI Action Plan III.D.3.4 and GDC 19.

NRC staff evaluated NAPS COL 6.4-2-A related to potential toxic gas sources to confirm that an external release of hazardous chemicals does not impact control room habitability included under Section 6.4 of the North Anna 3 COL Application.

The applicant provided additional information in NAPS COL 6.4-2-A under Section 6.4 of the North Anna 3 COL application to identify potential site-specific toxic or hazardous materials that may affect control room habitability. The potential sources of hazardous chemicals include offsite industrial facilities and transportation routes; and Units 1, 2, and 3. The applicant provided the evaluation of potentially hazardous off-site chemicals in Section 2.2, and concluded that there are no significant control room habitability impacts due to potential sources within 8 km (5 miles) of the plant. The applicant also performed a toxic gas analysis for potentially hazardous chemicals stored on site, in accordance with the guidelines of RG 1.78, and concluded that concentrations of toxic gas in the control room do not exceed the toxicity limits given in RG 1.78 and National Air Quality Standards. The applicant also analyzed the on-site hydrogen and oxygen storage facilities, and found their locations to be acceptable for toxic gas concerns per RG 1.78. This conclusion is based on hazards of a postulated instantaneous release followed by a vapor cloud explosion or intake of a flammable vapor concentration into a safety-related intake. The applicant concluded that Seismic Category I Class safety-related toxic gas monitoring instrumentation is not required.

The technical adequacy of the toxic gas hazards analysis provided by the applicant is being evaluated by the staff to confirm that a release of hazardous chemicals does not impact Unit 3 control room habitability, in accordance with the requirements of TMI Action Plan III.D.3.4 and GDC 19 and the regulatory positions in RG 1.78. The staff's evaluation is provided in Section 2.2.3 of this SER and is not yet complete due to two open items.

The staff performed analyses for the hazardous materials confirmed to be potential threats to the control room habitability. The staff performed confirmatory analyses using the HABIT computer code and found that the nitrogen and carbon dioxide concentrations inside the control room, following a postulated instantaneous release and subsequent vapor cloud intake into the control room, do not exceed the applicable toxicity/asphyxiation limit. Thus, the applicant's on-site storage locations of nitrogen and carbon dioxide are found to be acceptable per RG 1.78. If additional toxic gas threats are identified in response to one of the open items in Section 2.2.3, the staff will perform analyses on their impact to control room habitability prior to finalizing Section 6.4 of this SER. .

Supplemental Information

- NAPS SUP 6.4-1 System Safety Evaluation

The applicant provided additional information in NAPS SUP 6.4-1 to address the impact of a postulated design basis accident in Units 1 or 2 on the Unit 3 control room.

The applicant stated the following in NAPS SUP 6.4-1:

The Unit 2 LOCA as described in Section 15.4.1.8 of the Units 1 and 2 UFSAR was reviewed. The resultant dose at the Unit 3 MCR intake was determined by adjusting the LPZ dose consequences by the ratio of the χ/Q values and the ratio of the breathing rates (BR) for the LPZ versus the control room values. Detailed modeling of the Unit 3 control room was not performed because the doses are bounded by a postulated Unit 3 LOCA.

The staff finds that the supplemental information, NAPS SUP 6.4-1, provided by the applicant is adequately addressed and acceptable based on the staff's confirmatory analysis provided in Section 2.3.4.4 and chapter 15 of this SER.

The staff evaluation of the applicant's compliance with the control room habitability dose requirements of GDC 19 on the Unit 3 control room from a postulated Unit 3 DBA is documented in SER Section 15.

6.4.5 Post Combined License Activities

There are no post COL activities related to this section.

6.4.6 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 control room habitability and no outstanding information is expected to be addressed in the COL FSAR related to this subsection.

The staff is reviewing the information in DCD Section 6.4 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to control room habitability systems incorporated by reference in the North Anna 3 COL application will be documented in the staff's safety evaluation report on the design certification application for the ESBWR. This SER is not yet complete and is being tracked as part of Open Item 1-1. The staff will update Section 6.4 of this SER to reflect the final disposition of the design certification application.

In addition, the staff concludes that the information presented in the COL FSAR is acceptable and meets the requirements of GDC 4 and 19 of Appendix A to 10 CFR 50, 10 CFR Part 50.34(f)(2)(xxviii). This conclusion is based on the following:

- STD COL 6.4-1-A is acceptable because the applicant has provided adequate information regarding the development and implementation of operator training and procedures for control room habitability to address the applicable aspects of NRC Generic Letter 2003-01 as well as the intent of Generic Issue 83.

- The staff's review of NAPS COL 6.4-2-A regarding the technical adequacy of the applicant's toxic gas hazards analysis is not yet complete. SER Section 2.2.3 identifies two open items regarding the potential impact of the release of hazardous chemicals on the Unit 3 control room habitability. However, the staff does conclude that on-site storage locations of nitrogen and carbon dioxide are acceptable for toxic gas concerns about the control room habitability per RG 1.78.
- NAPS SUP 6.4-1 is acceptable because the staff finds that supplemental information NAPS SUP 6.4-1 provided by the applicant is adequately addressed. This conclusion is based on the staff's confirmatory analysis provided in Section 2.3.4.4 and chapter 15 of this SER. The staff evaluation of the applicant's compliance with the control room habitability dose requirements of GDC 19 on the Unit 3 control room from a postulated Unit 3 DBA is documented in SER Section 15.

6.5 Atmospheric Cleanup Systems

Section 6.5 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 6.5, "Atmosphere Cleanup Systems," of the ESBWR DCD, Revision 5. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.. The staff's review confirmed that there is no outstanding issue related to this subsection.

The staff is reviewing the information in DCD Section 6.5 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the fission product removal and control systems incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff's SER on the design certification application for the ESBWR. This SER is not yet complete and is being tracked as part of Open Item 1-1. The staff will update Section 6.5 of this SER to reflect the final disposition of the design certification application.

6.6 Preservice and Inservice Inspection and Testing of Class 2 and 3 Components and Piping

6.6.1 Introduction

Inservice inspection (ISI) programs are based on the requirements of 10 CFR 50.55a, "Codes and Standards," in that Code Class 2 and 3 components, as defined in Section III of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC), meet the applicable inspection requirements set forth in Section XI of the ASME Code, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components." ISI includes preservice examinations prior to initial plant startup as required by IWC-2200 and IWD-2200 of Section XI of the ASME Code.

6.6.2 Summary of Application

Section 6.6 of the North Anna 3 COL FSAR incorporates by reference Section 6.6 of the ESBWR DCD, Revision 5. Section 6 of the ESBWR DCD includes subsection 6.6, "Preservice and Inservice Inspection of Class 2 and 3 Components and Piping," that addresses the guidelines of Standard Review Plan (SRP) Section 6.6, "Inservice Inspection and Testing of Class 2 and 3 Components."

In addition, in FSAR Section 6.6, "Preservice and Inservice Inspection and Testing of Class 2 and 3 Components and Piping," the applicant provided the following supplements:

COL Items

- STD COL 5.2- 1-A Plant Specific Pressure Testing

In FSAR Section 6.6, the applicant provided additional information in STD COL 5.2-1-A to address pressure testing information for Class 2 and 3 components. The applicant states that system leakage and hydrostatic tests will meet all applicable requirements of ASME Code, Section XI , IWA-5000 , IWC-5000, and IWD-5000 for Class 2 and 3 components, including the limitations of 10 CFR 50.55a(b)(2)(xx) and 10 CFR 50.55a (b)(2)(xxvi).

- STD COL 6.6-1-A Plant Specific PSI/ISI Program Information

The applicant provided additional information in STD COL 6.6-1-A to address COL item 6.6-1-A. The applicant states: a) the Preservice inspection (PSI)/ISI program description for Class 2 and 3 components and piping is provided in DCD Section 6.6, b) no relief requests have been identified, c) the initial ISI program is to be based on the latest edition and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) on the date 12 months before fuel load, and d) the milestones for preservice and inservice program implementation are provided in FSAR section 13.4.

The applicant provided additional information in STD COL 6.6-1-A to address the Flow Acceleration Corrosion (FAC) Program. The applicant states that prior to startup, a comprehensive FAC susceptibility screening will be performed to identify any plant systems that may be susceptible to FAC degradation. Should any plant systems remain susceptible, a FAC program will be implemented with PSI baseline nondestructive examinations (NDE) and material constituency identified for each as-fabricated piping component in the susceptible systems.

- STD COL 6.6-2-A

The applicant provided additional information in STD COL 6.6-2-A to address accessibility and NDE of Class 1, 2, and 3 austenitic or dissimilar metal welds. The applicant stated that during the construction phase of the project, anomalies and construction issues are addressed using change control procedures. Procedures require that changes to approved design documents, including field changes and modifications, are subject to the same review and approval process as the original design. Accessibility and inspectability are key components of the design process. Control of accessibility for inspectability and testing during licensee design activities affecting Class 2 and 3 components is provided via procedures for design control and plant modifications. Ultrasonic techniques (UT) will be the preferred NDE method for all PSI and ISI volumetric examinations; radiographic techniques (RT) will be used only if UT cannot achieve the necessary coverage. The same NDE method used during PSI will be used for ISI to the extent practical to assure a baseline point of reference. If a different NDE method is used for ISI than was used for PSI, equivalent coverage will be achieved as required by the Code.

6.6.3 Regulatory Basis

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

In addition, the relevant requirements of the Commission regulations for PSI/ISI for Class 2 and 3 components and the associated acceptance criteria are given in Section 6.6 of NUREG 0800.

The applicable regulatory requirement for the PSI/ISI programs for Class 2 and 3 components is as follows:

- 10 CFR 50.55a

The related acceptance criteria are as follows:

ASME Boiler and Pressure Vessel Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components."

The basis for acceptance of the COL information item and supplementary information on ISI of Class 2 and 3 Components are established in 10 CFR 50.55a as it pertains to specification of the preservice and in service inspection and testing requirements of the ASME Code for Class 2 and 3 components.

6.6.4 Technical Evaluation

The NRC staff reviewed Section 6.6 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.. The staff's review confirmed that information contained in the application and incorporated by reference addresses the required information related to PSI/ISI and testing of Class 2 and 3 components. Section 6.6 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference related to PSI/ISI and testing of Class 2 and 3 components will be documented in the staff SER on the design certification application for the ESBWR design.

The staff reviewed conformance of Section 6.6 of the FSAR to the guidance in RG 1.206, Section C.III.1, Chapter 6, C.I.6.6, "Inservice Inspection of Class 2 and 3 Components." The NRC staff's review of the FSAR Section 6.6 finds that it incorporates by reference Section 6.6 of the ESBWR DCD. The staff's review of DCD Section 6.6 determined that the ESBWR ISI program for Code Class 2 and 3 components is acceptable and meets the requirements of 10 CFR 50.55a with regard to the preservice and inservice inspectability of these components. The specific version of the ASME Code, Section XI used as the baseline Code in the ESBWR certified design is the 2001 Edition up to and including the 2003 Addenda. It should also be noted that the staff did not identify any portions of the ESBWR ISI program for Class 1, 2 and 3 components that were excluded from the scope of the staff's review of the ESBWR design. The North Anna COL FSAR Section 6.6 states that the PSI/ISI program description for Class 2 and 3 components and piping is provided in ESBWR DCD Section 6.6. Therefore, the staff's conclusions regarding the acceptability of the ESBWR ISI program based on the 2001 Edition up to and including the 2003 Addenda of the ASME Code, Section XI with regard to preservice and inservice inspectability of Class 2 and 3 components remains unchanged. The staff's evaluation of the operational program aspects of the ASME Code Class 2 and 3 ISI program and Augmented Inspection Programs is addressed with Class 1 ISI in Section 5.2.4 of this FSER. The adequacy of the ISI program for metal containment (Class MC) components is addressed in Section 3.8.2 of this FSER. Accordingly, the staff's evaluation of this section focused on the acceptability of the COL applicant's supplemental information and responses to COL items as they relate to ISI of ASME Code Class 2 and 3 components.

The staff reviewed the following information contained in the North Anna 3 COL FSAR:

- STD COL 5.2- 1-A Plant Specific Pressure Testing

In FSAR section 6.6, the applicant provided additional information in STD COL 5.2-1-A to address pressure testing information for Class 2 and 3 components. This information also addresses the staff's RAI under Section 5.2.4 pertaining to the limitations under 10 CFR 50.55a. The applicant states that system leakage and hydrostatic tests will meet all applicable requirements of ASME Code, Section XI , IWA-5000 , IWC-5000, and IWD-5000 for Class 2 and 3 components, including the limitations of 10 CFR 50.55a(b)(2)(xx) and 10 CFR 50.55a (b)(2)(xxvi).

Revision 1 to the North Anna 3 COL FSAR agrees with the limitations for pressure testing of Class 1, 2, and 3 components in 10 CFR 50.55a, and is therefore acceptable to the staff.

- STD COL 6.6-1-A Plant Specific PSI/ISI Program Information

The COL applicant provided a full description of the PSI/ISI programs and augmented inspection programs for Class 2 and 3 components by supplementing the information in DCD Section 6.6. The COL applicant also provided milestones for program implementation (FSAR Section 13.4).

The COL item is addressed in the FSAR, in part, by replacing the last sentence and the parenthetical statement of the third paragraph of DCD Section 6.6 with the following:

The PSI/ISI program description for Class 2 and 3 components and piping is provided in DCD Section 6.6.

A PSI/ISI program encompasses Class 1, 2, and 3 components and is being evaluated under Section 5.2.4 of the staff SER of ESBWR DCD on Docket No. 52-010. Though Section 6.6 applies to Class 2 and 3 components, the augmented ISI programs, which protect against postulated piping failures and erosion/corrosion of piping, contain portions of the PSI/ISI program and include Class 1 components. This topic is discussed under Section 5.2.4 of this SER.

The applicant also provided Section 6.6.7.1, Flow Accelerated Corrosion Program Description, to describe the general attributes of the applicant's program for monitoring and managing degradation (i.e., thinning) of piping and components susceptible to flow accelerated corrosion. The staff's evaluation of FSAR Section 6.6.7.1 is addressed in Section 10.3 of this SER.

Since the PSI/ISI program for Class 1, 2, and 3 components and the implementation milestones are discussed under Section 5.2.4 of this SER, the staff concludes that STD COL 6.6-1-A is acceptable for Section 6.6 of this SER.

- STD COL 6.6-2-A

The applicant replaced the last sentence in the second paragraph of the ESBWR DCD, Revision 5, with the following:

During the construction phase of the project, anomalies and construction issues are addressed using change control procedures. Procedures require that

changes to approved design documents, including field changes and modifications, are subject to the same review and approval process as the original design. Accessibility and inspectability are key components of the design process. Control of accessibility for inspectability and testing during licensee design activities affecting Class 2 and 3 components is provided via procedures for design control and plant modifications. Ultrasonic techniques (UT) will be the preferred NDE method for all PSI and ISI volumetric examinations; radiographic techniques (RT) will be used as a last resort only if UT cannot achieve the necessary coverage. The same NDE method used during PSI will be used for ISI to the extent possible to assure a baseline point of reference. If a different NDE method is used for ISI than was used for PSI, equivalent coverage will be achieved as required by the Code.

Accessibility of Class 1, 2, and 3 components, and the use of alternative NDE methods are discussed under Section 5.2.4 of this FSER and was deemed acceptable to the staff. Based on the above discussion, STD COL 6.6-2-A is acceptable.

6.6.5 Post Combined Operating License Activities

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

6.6.6 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 PSI/ISI of Class 2 and 3 Components and Piping and no outstanding information is expected to be addressed in the COL FSAR related to this subsection.

The staff is reviewing the information in the DCD Section 6.6 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the PSI/ISI of Class 2 and 3 components incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the design certification application 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 6.6 of this SER to reflect the final disposition of the design certification application.

In addition, the staff concludes that COL items 5.2.1-A, 6.6-1-A and 6.6-2-A as provided in Section 6.6 of the North Anna COL FSAR meet the relevant guidelines in SRP Section 6.6 and are acceptable. Conformance with these guidelines provides an acceptable basis for satisfying in part, the requirements of GDC 32 and 10 CFR 50.55a.

7.0 INSTRUMENTATION AND CONTROL SYSTEMS

Instrumentation and Control (I&C) Systems are the systems that assure the integrity of the reactor coolant pressure boundary, the capability to shut down the reactor and maintain it in a safe shutdown condition, or the capability to prevent or mitigate the consequences of accidents.

Chapter 7 of the North Anna 3 Combined License (COL) application Final Safety Analysis Report (FSAR) incorporates by reference, with no departures or supplements, Chapter 7, "Instrumentation and Control Systems," of Revision 5 of the Economic Simplified Boiling Water Reactor (ESBWR) Design Control Document (DCD). Chapter 7 of the ESBWR DCD contains the Tier 2 information. The ESBWR DCD Tier 1 contains design acceptance criteria / inspections, tests, analyses, and acceptance criteria (ITAAC) information related to the Chapter 7 safety and non-safety systems. The North Anna 3 COL application Part 10: Tier 1/ITAAC incorporates the ESBWR DCD Tier 1 by reference with no departures or supplements. The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this chapter remained for review.¹ The NRC staff's review confirmed that there is no outstanding issue related to this chapter.

The staff is reviewing the information in DCD Tier 2, Chapter 7 and the Tier 1 information on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to the I&C Systems incorporated by reference in the North Anna 3 COL application FSAR will be documented in the staff safety evaluation report (SER) on the design certification application for the ESBWR. The SER on the ESBWR design certification application is not yet complete, and this is being tracked as Open Item 1-1. The staff will update Chapter 7 of this SER to reflect the final disposition of the design certification application.

¹ See Section 1.2.2, "Finality of Referenced NRC Approvals," for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

15.0 SAFETY ANALYSES

15.1 Introduction

This chapter provides analyses of the plant's responses to postulated disturbances in process variables and postulated equipment failures or malfunctions, determines their consequences, and evaluates the capability of the plant to control or accommodate these events. These analyses help determine the limiting conditions for operation, limiting safety system settings, and design specifications for safety-related components and systems.

This chapter includes a discussion of: (1) the classification of the transients and accidents and the analyses results in order to ensure that the applicant has considered a sufficiently broad spectrum of initiating events and postulated equipment failures, (2) the frequency of occurrence for initiating events for anticipated operational occurrences and highly unlikely accidents, (3) plant characteristics considered in the safety evaluation, (4) assumed protection system actions, (5) evaluation of individual initiating events and systems that operate to reduce the probability of occurrence of specific events, and (6) analysis of anticipated transients without scram. The safety analyses provide a significant contribution to the selection of limiting conditions for plant operation, limiting safety system settings, and design specifications for plant components and systems from the standpoint of public health and safety.

15.2 Summary of Application

Chapter 15 of the North Anna 3 combined license (COL) Final Safety Analysis Report (FSAR) incorporates by reference Chapter 15 of the Economic Simplified Boiling-Water Reactor (ESBWR) Design Control Document (DCD), Revision 5. In addition, in FSAR Chapter 15 the applicant provided the following additional information:

Supplemental Information:

- STD SUP 15.3-1 Radiological Consequences

The applicant added that procedures will detail the use of nuclear instrumentation to help in detecting a possible mislocated fuel bundle after fuel loading.

- NAPS SUP 15.3-2 Early Site Permit (ESP) Information

The applicant stated that Chapter 15 of the North Anna ESP Site Safety Analysis Report (SSAR) is incorporated by reference, except information related to the ESBWR is replaced by DCD Chapter 15. This supplemental information is identified as NAPS ESP variance (VAR) 2.0-6.

15.3 Regulatory Basis

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

Compliance with the non-seismic siting criteria of 10 CFR 100.21 and General Design Criterion (GDC) 19 requires that the applicant show that, for a plant located at the North Anna site, the radiological consequences of postulated accidents meet the criteria set forth in 10 CFR 52.79(a)(1) and for GDC 19 that the control room provides adequate radiation protection to

ensure that radiation exposures shall not exceed 0.05 Sv (5 rem) total effective dose equivalent (TEDE) to permit access and occupancy of the control room under accident conditions for the duration of the accident. Requirements for the technical information in the FSAR in the application for a combined license are given in 10 CFR 52.79. In particular, 10 CFR 52.79(a)(1)(vi) requires a description and safety assessment of the site on which the facility is to be located, including an evaluation of the offsite radiological consequences of postulated accidents to show that the site characteristics comply with 10 CFR Part 100.

Both 10 CFR 100.21, which references 10 CFR 50.34(a)(1)(ii)(D), and 10 CFR 52.79(a)(1)(iv) have the same following offsite radiological consequence evaluation factors:

- (A) *An individual located at any point on the boundary of the exclusion area for any 2-hour period following the onset of the postulated fission product release, would not receive a radiation dose in excess of [0.25 Sv] 25 rem total effective dose equivalent (TEDE).*
- (B) *An individual located at any point on the outer boundary of the low population zone, who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage) would not receive a radiation dose in excess of [0.25 Sv] 25 rem TEDE*

15.4 Technical Evaluation

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed Chapter 15 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ The NRC staff's review confirmed that the information contained in and incorporated by reference addresses the required information related to the Safety Analyses. Chapter 15 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The staff's technical evaluation of the information is incorporated by reference and all information related to accident analysis will be documented in the staff safety evaluation report (SER) on the design certification application for the ESBWR design.

In addition, the NRC staff checked the referenced North Anna ESP SSAR. The NRC staff's review confirmed that the information contained in the North Anna 3 COL application and incorporated by reference from the North Anna ESP SSAR, Revision 9, addresses the required information related to the radiological consequence analyses (RCA). The NRC staff's technical evaluation of the information incorporated by reference to the North Anna ESP SSAR related to the RCA is documented in the corresponding SER (i.e., NUREG-1835).

The staff reviewed the relevant information in the COL FSAR:

¹ See Section 1.2.2, "Finality of Referenced NRC Approvals," for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

Supplemental Information:

- STD SUP 15.3-1 Radiological Consequences
- NAPS SUP 15.3-2
(NAPS ESP VAR 2.0-6) ESP Information

North Anna COL FSAR, Revision 0, incorporated by reference the analysis of the radiological consequences from the ESBWR DCD, Revision 4, Section 15.4 and from Chapter 15 of North Anna ESP SSAR. The staff review of the incorporated by reference sections identified that the isotopic time-dependent fission product release rates to the environment for each design-basis accident (DBA) analyzed in the ESBWR DCD, Revision 4 were not bounded by those values specified in Appendix B, "Controlling Values of Parameters and Design-Basis Accident Source Term Plant Parameters," in ESP No. ESP-003 issued for the North Anna site.

Therefore, the staff requested, in request for additional information (RAI) 15.06.05-1, that if the isotopic activity releases per time period specified in the RCA for each DBA analyzed in the ESBWR DCD, Revision 5 and from Chapter 15 of North Anna ESP SSAR are not bounded by those specified in Appendix B to the North Anna ESP, provide the site-specific radiological consequence doses for exclusion area boundary (EAB), low population zone (LPZ), and control room for each DBA to demonstrate that North Anna site still meets the dose evaluation factors set forth in 10 CFR 50.34(a)(1)(ii)(D), 10 CFR 52.79(a)(1)(vi), and GDC 19.

In response to RAI 15.06.05-1, the applicant stated the following in its submittal dated October 17, 2008:

1. For the EAB and LPZ, the North Anna Unit 3 FSAR, Revision 0, Table 2.0-201, "Evaluation of Site/Design Parameters and Characteristics," shows that the site-specific χ/Q values for Unit 3 fall within those values in the DCD, Revision 5 and therefore, the North Anna Unit 3 meets the dose evaluation factors set forth in 10 CFR 50.34(a)(1)(ii)(D), and 10 CFR 52.79(a)(1)(vi).

The staff finds that this response is acceptable.

2. For the control room, the DCD, Revision 5 χ/Q s also remain bounding except for those associated with the DCD COL Item 2A.2-2-A, "Confirmation of Reactor Building χ/Q values." This COL item specifies administrative controls to be implemented if the χ/Q values for a release from certain reactor building or fuel building doors are not bounded by the DCD, Revision 5 χ/Q values. The North Anna FSAR, Revision 0 did not specify this condition in its administrative controls. In the North Anna FSAR, Revision 1, Chapter 2, "Site Characteristics," NAPS COL 2A.2-2-A, the applicant stated that the North Anna administrative controls will be such that the doors and personnel air locks on the east side of the Reactor Building or Fuel Building are promptly closed under conditions indicative of a fuel handling accident.

The staff finds that this response is acceptable.

3. The bounding values for isotopic activity release rates to the environment for the DBAs in ESP No. ESP-003, Appendix B, were not available for inclusion in North Anna FSAR Revision 0 because the ESP was issued on the same day that the Unit 3 COL application was submitted. A subsequent review of the COL application with respect to

The staff finds that this variance is acceptable because the calculated doses in the ESBWR, Revision 5 are within the regulatory limits and the site-specific χ/Q values are lower than those values specified in the ESBWR DCD, Revision 5.

4. The applicant stated that the North Anna 3 COL application Departure Report is being revised to clarify the criteria under which a variance is requested. In the North Anna COL Departure Report, Revision 1, the applicant revised the variance sections to clarify the criteria under which a variance is requested.

Therefore, RAI 15.06.05-1 is closed.

ESBWR DCD, Revision 5, Section 15.4 provided details and results of analyses of the offsite radiological consequences for the DBAs in several sections discussing the accidents. A list of the DBAs analyzed for radiological consequences and the sections where the RCA for those DBAs are discussed in the ESBWR DCD, Revision 5, is given below.

<u>DCD Section</u>	<u>Design-Basis Accident</u>
15.4.1	Fuel Handling Accident
15.4.5	Main Steam Line Break Outside Containment
15.4.6	Control Rod Drop Accident
15.4.7	Feedwater Line Break Accident
15.4.8	Failure of Small Line
15.4.9	RWCU/SDC System Line Failure
15.4.10	Spent fuel Cask Drop Accident

The NRC staff's technical evaluation of the information incorporated by reference related to the DBA RCA will be documented in the corresponding final SER.

The DBA RCA in the ESBWR DCD, Revision 5 used design reference values for the offsite atmospheric dispersion factors, in place of site-specific values. The χ/Q values are the only input to the DBA RCA that are impacted by the site characteristics. The applicant provided and discussed the North Anna site-specific offsite χ/Q values in resolution of COL Item 2.0-10-A, "Short-Term Dispersion Estimates for Accidental Atmospheric Releases," and COL Item 2.3-2, "Atmospheric Dispersion Factors for Control Room." The applicant also provided supplemental information in North Anna 3 COL FSAR Table 2.3-207, "Unit 3 Cross Unit χ/Q Result," for evaluating the impact of a postulated DBA in North Anna Units 1 and 2 on the North Anna Unit 3 control room. The North Anna site-specific EAB and LPZ χ/Q values are given in the North Anna COL FSAR Table 2.3.4-1.

In Section 2.3.4, "Short-Term diffusion Estimates," of this SER, the staff discusses its review and resolution of (1) COL item 2.0-10-A, (2) COL Item 2.3-2, and (3) the supplemental information, related to the North Anna site-specific χ/Q values as stated above, included under Section 2.3.4 of the North Anna COL FSAR, Revision 1.

The estimated offsite DBA dose calculated for a particular site is impacted by the site characteristics through the calculated χ/Q input to the analysis and the resulting dose would be different than that calculated generically for the ESBWR design. All other inputs and assumptions in the RCA remain the same as in the DCD. Smaller χ/Q values are associated with greater dilution capability, resulting in lower radiological doses. When comparing a DCD site parameter χ/Q value and a site characteristic χ/Q value, the site is acceptable for the design if the site characteristic χ/Q value is smaller than the site parameter χ/Q value. Such a comparison shows that the site has better dispersion characteristics than that required by the reactor design.

For each time averaging period, the North Anna site-specific offsite χ/Q values are less than the design reference offsite χ/Q values used by the ESBWR DCD, Revision 5 RCA for each of the DBAs. Since the result of the RCA for a DBA during any time period of radioactive material release from the plant is directly proportional to the χ/Q for that time period, and because the North Anna site-specific χ/Q values are less than the comparable ESBWR DCD, Revision 5, design reference χ/Q values for all time periods and all accidents, then the North Anna site-specific total dose for each DBA is therefore less than the ESBWR DCD, Revision 5, generic total dose for each DBA.

Since the ESBWR DCD, Revision 5, analyses show that the offsite and control room radiological consequences meet the regulatory dose requirements of 10 CFR 100.21, 10 CFR 50.34(a)(1), 10 CFR 52.79(a)(1), and GDC-19, and since, by the logic above, the North Anna site-specific DBA offsite and control room radiological consequences are less than those for the ESBWR DCD, Revision 5, then the applicant has sufficiently shown that the DBA offsite radiological consequences meet the requirements of 10 CFR 100.21, 10 CFR 50.34(a)(1), 10 CFR 52.79(a)(1), and GDC-19.

15.5 Post Combined License Activities

There are no post COL activities related to this Chapter.

15.6 Conclusion

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

In addition, the staff has compared the additional COL supplemental information within the application to the relevant NRC regulations, acceptance criteria defined in NUREG-0800, Chapter 15, and other NRC regulatory guides and concludes that the applicant is in compliance with NRC regulations.

The staff is reviewing the information in DCD Chapter 15 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information of the information related to "Safety Analyses" incorporated by reference in the North Anna 3 COL FSAR will be documented in the

staff's SER on the design certification (DC) application for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item 1-1. The staff will update Chapter 15 of this SER to reflect the final disposition of the DC application.

17.0 QUALITY ASSURANCE

This chapter of the application describes the quality assurance (QA) program for the design, fabrication, construction, testing, and operation of the nuclear plant. In addition, this chapter addresses the reliability assurance program (RAP) in the design phase and the Maintenance Rule program.

This chapter has the following sections related to QA:

- Section 17.1, “Quality Assurance During Design,”
- Section 17.2, “Quality Assurance During Construction and Operations,”
- Section 17.3, “Quality Assurance Program Description,” and
- Section 17.5, “Quality Assurance Program Description – Design Certification Early Site Permits, and New License Applicants.”

This organization is consistent with the Economic Simplified Boiling-Water Reactor (ESBWR) design certification (DC), with the new Section 17.5 introduced within the COL application. Section 17.5 follows the guidance in Regulatory Guide (RG) 1.206 and the corresponding Section 17.5 in NUREG-0800. Specifically in RG 1.206 and the March 2007 revision to NUREG-0800, staff consolidated all QA program related guidance in support of new reactor licensing into Section 17.5. The combined license (COL) final safety analysis report (FSAR) maintains the general organization of the sections on QA, but in NAP-SUP 17.0-1, the applicant stated, that the detailed QA program description related to the COL is contained in Section 17.5.

In addition, since the North Anna FSAR incorporates by reference both the ESBWR DC and the North Anna ESP, there are essentially three QA programs being discussed.

- Early Site Permit (ESP) Application Development QA Manual – incorporated by reference;
- QA Program used by GE Hitachi Nuclear Energy (GEH) for the ESBWR – incorporated by reference and applicable to design, construction, and operation; and
- DOM-QA-1, Dominion Nuclear Facility QA Program Description which is based on Nuclear Energy Institute (NEI) 06-14, “Quality Assurance Program Description.”

17.1 Quality Assurance During Design

17.1.1 Introduction

This section of the FSAR addresses the QA program that was applied during the design phase of the plant and the QA program that was implemented during the ESP and combined license application (COLA) development.

17.1.2 Summary of Application

Section 17.1 of the North Anna 3 COL FSAR incorporates by reference Section 17.1 of the ESBWR design control document (DCD), Revision 5. In addition, in FSAR Section 17.1, the applicant provided the following:

Supplemental Information

The applicant provided the following supplemental information.

- NAPS SUP 17.1-1

NAPS SUP 17.1-1 describes the QA program that was applied during the preparation of the ESP application. Chapter 17 of the North Anna 3 site safety analysis review (SSAR), incorporated by reference, includes the QA program that was applied during the preparation of the ESP application.

- NAPS SUP 17.1-2

NAPS SUP 17.1-2 provides a reference to Section 17.5 of the North Anna 3 COL FSAR for the description of the QA program that was applied during the preparation of site-specific design activities.

17.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the final safety evaluation report (FSER) relating to the ESBWR DCD. For additional information on the regulatory basis see Section 17.5 of this safety evaluation report (SER).

17.1.4 Technical Evaluation

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed Section 17.1 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ The staff review confirmed that the information contained in the application and incorporated by reference addresses the required information related to QA during design activities. The staff is reviewing Section 17.1 of the ESBWR DCD on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference from the ESBWR DCD relating to the QA program implementation during design activities will be documented in the staff SER on the design certification application for the ESBWR design.

The staff reviewed the information contained in the COL FSAR.

Supplemental Information

- NAPS SUP 17.1-1

The NRC staff reviewed the reference to the SSAR included under Section 17.1 of the North Anna 3 COL FSAR. This reference is identified as NAPS SUP 17.1-1. The staff has concluded that the SSAR, incorporated by reference, includes the QA program that was applied during the preparation of the ESP application.

¹ See Section 1.2.2, "Finality of Referenced NRC Approvals," for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

- NAPS SUP 17.1-2

The NRC staff reviewed the reference to Section 17.5 of the North Anna 3 COL FSAR. The staff has concluded that the referenced section contains the description of the QA program that will be applied during the preparation of site-specific design activities (see Section 17.5 of this SER).

17.1.5 Post Combined License Activities

There are no post COL activities related to this section.

17.1.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The staff review confirmed that the applicant addressed the required information relating to QA during activities and there is no outstanding information expected to be addressed in the COL FSAR related to this subsection.

The NRC staff is reviewing the information in DCD Section 17.1 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the QA program during design activities 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 17.1 of this SER to reflect the final disposition of the DC application.

In addition, the staff concludes that the relevant information presented in the COL FSAR is acceptable and meets the NRC regulatory requirements. This conclusion is based on the following:

- NAPS SUP 17.1-1 is acceptable because it describes the QA program that was applied during the preparation of the ESP application. Chapter 17 of the North Anna 3 SSAR, incorporated by reference, includes the QA program that was applied during the preparation of the ESP application.
- NAPS SUP 17.1-2 is acceptable because it adequately provides a reference to Section 17.5 of the North Anna 3 COL FSAR for a description of the QA program that was applied during the preparation of site-specific design activities (see Section 17.5 in this SER).

17.2 Quality Assurance During Construction and Operations

17.2.1 Introduction

This section of the FSAR addresses the QA program during construction and operations phases of the plant, including adapting the design to specific plant implementation.

17.2.2 Summary of Application

Section 17.2 of the North Anna 3 COL FSAR incorporates by reference Section 17.2 of the ESBWR DCD, Revision 5.

In addition, in FSAR 17.2, the applicant provided the following:

COL Items

- STD COL 17.2-1-A QA Program for the Construction and Operations Phases
- STD COL 17.2-2-A QA Program for Design Activities

The applicant provided additional information to address DCD COL Items 17.2-1-A and 17.2-2-A. The applicant indicated that the QA program in place during the construction and operations phases, including adapting the design to specific plant implementation, is described in Section 17.5 of the North Anna 3 COL FSAR.

17.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD. For additional information on the regulatory basis see Section 17.5 in this SER.

17.2.4 Technical Evaluation

The NRC staff reviewed Section 17.2 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic. The review confirmed that the information contained in the application and incorporated by reference addresses the required information related to QA programs during construction and operations. Section 17.2 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference from the ESBWR DCD related to the QA program implemented during construction and operations will be documented in the staff SER on the design certification application for the ESBWR design.

The NRC staff reviewed the QA program that will be implemented during the construction and operations phases. The review includes adapting the design to specific plant implementation and is described in Section 17.5 in this SER.

17.2.5 Post Combined License Activities

There are no post COL activities related to this section.

17.2.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The staff review confirmed that the applicant addressed the required information relating to QA programs during construction and operations and there is no outstanding information expected to be addressed in the COL FSAR related to this subsection.

The NRC staff is reviewing the information in DCD Section 17.2 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to QA during construction and operations 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 Open Item 1-1. The staff will update Section 17.2 in this SER to reflect the final disposition of the DC application.

In addition, the staff concludes that the relevant information presented in the COL FSAR is acceptable and meets the NRC regulatory requirements. This conclusion is based on the following:

- The substitute paragraph indicated in COL FSAR Section 17.2 is acceptable because it adequately incorporates by reference Section 17.5 of the ESBWR DCD.
- STD COL 17.2-1-A: COL Section 17.2 is acceptable because it adequately incorporates by reference Section 17.5 of the North Anna 3 COL FSAR.
- STD COL 17.2-2-A: COL Section 17.2 is acceptable because it adequately incorporates by reference Section 17.5 of the North Anna 3 COL FSAR.

17.3 QUALITY ASSURANCE PROGRAM DESCRIPTION

17.3.1 Introduction

This section of the FSAR addresses the overall project QA program.

17.3.2 Summary of Application

Section 17.3 of the North Anna 3 COL FSAR incorporates by reference Section 17.3 of the ESBWR DCD, Revision 5.

In addition, in FSAR 17.3, the applicant provided the following:

COL Item

- STD COL 17.3-1-A Quality Assurance Program Description

The applicant provided additional information to resolve ESBWR DCD COL Item 17.3-1-A. COL information Item 17.3-1-A states:

“The COL Applicant shall provide a Quality Assurance Program Description (QAPD) describing the overall project QA program (Section 17.3).”

The applicant indicated that the QAPD applicable to the licensee is described in Section 17.5 of the North Anna 3 COL FSAR.

17.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD. For additional information on the regulatory basis see Section 17.5 in this SER.

17.3.4 Technical Evaluation

The NRC staff reviewed Section 17.3 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic. The review confirmed that the information contained in the application and incorporated by reference addresses the

required information related to the QA program description. The staff is reviewing Section 17.3 of the ESBWR DCD on Docket No. 52-010. The staff's technical evaluation of the information incorporated by reference related to the QA program description will be documented in the staff SER on the design certification application for the ESBWR design.

The staff reviewed the information contained in the COL FSAR:

COL Item

- STD COL 17.3-1-A Quality Assurance Program Document

The applicant indicated that the QAPD applicable to the licensee is described in Section 17.5 of the North Anna 3 COL FSAR. The NRC staff reviewed the QAPD applicable to the licensee. The review is described in Section 17.5 in this SER.

17.3.5 Post Combined License Activities

There are no post COL activities related to this section.

17.3.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The staff review confirmed that the applicant addressed the required information relating to the QA program description and there is no outstanding information expected to be addressed in the COL FSAR related to this subsection.

The NRC staff is reviewing the information in DCD Section 17.3 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the QA program description 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 17.3 of this SER to reflect the final disposition of the DC application.

In addition, the staff concludes that the relevant information presented in the COL FSAR is acceptable and meets the NRC regulatory requirements. This conclusion is based on the following:

- STD COL 17.3-3-A: COL Section 17.3 is acceptable because it adequately incorporates by reference Section 17.5 of the North Anna 3 COL FSAR.

17.4 Reliability Assurance Program During Design Phase

17.4.1 Introduction

This section of the FSAR addresses the Commission's policy for the RAP that is presented in Item E of SECY-95-132. The RAP applies to the various structures, systems, and components (SSCs) in the plants that are identified as risk-significant (or significant contributors to plant safety). This designation is determined by using a combination of probabilistic, deterministic, or other methods of analysis, including information obtained from sources such as plant- and site-specific probabilistic risk assessment (PRA), nuclear plant operating experience, relevant component failure databases, and expert panels.

The RAP is implemented in two stages. The first stage applies to reliability assurance activities that occur before the initial fuel load. The goal of the RAP during this stage is to ensure that the reactor design meets the considerations identified earlier through the reactor design, procurement, fabrication, construction, and preoperational testing activities and programs. The second stage applies to reliability assurance activities for the operations phase of the plant life cycle. The objective during this stage is to ensure that the reliability for the SSCs within the scope of the RAP is maintained during plant operations.

17.4.2 Summary of Application

Section 17.4 of the North Anna 3 COL FSAR incorporates by reference Section 17.4 of the ESBWR DCD Revision 5.

In addition, in FSAR Section 17.4, the applicant provided the following:

COL Item

- STD COL 17.4-1-H Operation Reliability Assurance Activities

The applicant provided additional information in STD COL 17.4-1-H. The COL information item requires the applicant to address the operation reliability assurance activities. The applicant provided supplemental information in Section 17.4.1 of the COL FSAR to describe the operational reliability assurance activities.

This item also contains information related to ITAAC:

The applicant will confirm that a report containing the list of risk-significant SSCs has been generated. The reliability of each as-built risk-significant SSC is verified to be consistent with the reliability assumed in the ESBWR design PRA. This ITAAC requirement is described in Section 3.6 of Tier 1 DCD.

17.4.3 Regulatory Basis

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

In addition, the relevant requirements of the Commission regulations for the RAP and associated acceptance criteria are given in Section 17.4 of NUREG-0800.

17.4.4 Technical Evaluation

NRC staff reviewed Section 17.4 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic. The review confirmed that the information contained in the application and incorporated by reference addressed the required information related to the RAP. Section 17.4 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The technical evaluation of the information incorporated by reference and related to the RAP will be documented in the staff SER on the design certification application for the ESBWR design.

The staff reviewed the relevant information in the COL FSAR:

COL Item

- STD COL 17.4-1-H Operation Reliability Assurance Activities

NRC staff reviewed STD COL 17.4-1-H related to the RAP and included in Section 17.4 of the North Anna 3 COL FSAR.

In FSAR Subsection 17.4.1, the applicant states that the objectives of reliability assurance during the operations phase are integrated into the QAP, the Maintenance Rule program, and other operational programs.

The staff finds that the applicant has addressed the following RAP information in accordance with the provisions in Standard Review Plan (SRP) Section 17.4:

- Description of the RAP that includes scope, purpose, and objectives
- Probabilistic/PRA methods and results for evaluating, identifying, and prioritizing SSCs according to their degree of risk significance
- Description of the quality controls for developing and implementing the RAP (organization, design control, procedures and instructions, records, corrective action, and audit plans)
- Implementation of the QA requirements during the design procurement, fabrication, construction, and testing of SSCs within the scope of the RAP
- Integration of the RAP activities for the operations phase into the applicant's existing operational programs (i.e., Maintenance Rule, surveillance testing, inservice testing (IST), inservice inspection (ISI), maintenance, and QA)
- The process for providing corrective action for design and operational errors that degrade non-safety-related SSCs within the scope of the RAP
- Expert panel qualification requirements.

The staff has asked the applicant to clarify the qualification requirements of the expert panel and the corrective action process through the request for additional information (RAI) process. The applicant responded that the expert panel qualification requirement would be incorporated in accordance with Nuclear Management and Resources council (now NEI) NUMARC 93-01 (Ref. 17.4.-1). NUMARC 93-01, Revision 2, page 17 states that, "[I]f a utility selects a method based on PRA to establish risk significance, it should begin the process by assembling a panel of individuals experienced with the plant PRA and with operations and maintenance." The staff finds the response acceptable. The applicant also responded that the corrective action process for design and operational errors that degrade non-safety-related SSCs within the scope of the RAP are described in FSAR Sections 17.5, "Quality Assurance Program Description," and 17.6, "Maintenance Rule Program." FSAR Section 17.6.1.2, which incorporates by reference NEI 07-02A (Ref. 17.4-2), states that corrective actions will be implemented in accordance with the site Corrective Action Program. The staff finds that the response is acceptable.

ITAAC

In Subsection 17.4.6, the applicant states that the list of risk-significant SSCs will be confirmed through ITAAC. This ITAAC requirement is described in Section 3.6 in Tier 1 DCD and the staff's evaluation of it is included in the FSER related to the DCD.

17.4.5 Post Combined License Activities

The applicant has committed to implement a process for integrating reliability assurance activities for risk-significant SSCs into operational programs (e.g., Maintenance Rule, surveillance testing, maintenance programs and QA) to meet the objectives of the RAP during plant operation. Consistent with this commitment, the following item was identified as the responsibility of the COL holder:

- STD COL 17.4-1-H Operation Reliability Assurance Activities

17.4.6 Conclusion

NRC staff reviewed Section 17.4 of the North Anna COL application and checked the referenced DCD. The review confirmed that the applicant has addressed the required information relating to the RAP and no outstanding information is expected to be addressed in the COL FSAR related to this subsection.

The staff is reviewing the information in DCD Section 17.4 on Docket No. 52-010. The results of the staff technical evaluation of the information related to the RAP incorporated by reference in the North Anna 3 COL FSAR will be documented in the SER on the DC application for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item 1-1. The staff will update Section 17.4 of this SER to reflect the final disposition of the DC application.

In addition, the staff concludes that the relevant information presented in the COL FSAR is acceptable and meets NRC regulatory requirements. This conclusion is based on the following:

- STD COL 17.4-1-H is acceptable because it is in conformance with the regulatory requirements as described in SRP Section 17.4.

17.5 Quality Assurance Program Description – Design Certification, Early Site Permits, and New License Applicants

17.5.1 Introduction

This section addresses the establishment and implementation of a QA program applicable during the design, fabrication, construction, testing, and operation of the nuclear power plant. There are two phases: the first phase applies to activities performed before the start of construction (e.g., site investigations, design and safety analyses, early procurements); and the second phase applies to QA activities performed during design implementation, construction, and operations.

17.5.2 Summary of Application

Section 17.5 of the North Anna 3 COL FSAR provides the following supplements that relate to the QA program applied to activities described in Sections 17.1 through 17.3 of the ESBWR DCD, Revision 5, and activities during the ESP application described in SSAR Chapter 17.

In FSAR Section 17.5, the applicant provided the following:

Supplemental information

- NAPS SUP 17.5-1

The applicant provided supplemental information to address the QA controls applied to DC activities and made reference to Section 17.1 of the North Anna 3 COL FSAR. This supplemental information addresses the QA program that was applied during the preparation of the ESP.

- NAPS SUP 17.5-2

The applicant provided supplemental information to address the QA controls that will be applied to activities performed before the start of construction (e.g., site investigations, design and safety analyses, and early procurements).

- NAPS SUP 17.5-3

The applicant provided supplemental information to address the QA controls that will be applied to QA activities during design implementation, construction, and operations.

17.5.3 Regulatory Basis

The relevant requirements of Commission regulations for the applicant's QA program description and associated acceptance criteria are given in Section 17.5 of NUREG-0800.

The applicable regulatory requirements are those related to QA programs that are set forth in 10 CFR 52.79(a)(25) and Appendix B to 10 CFR Part 50.

10 CFR 52.79(a)(25) requires that an application for a COL contain a description of the QA program, applied to the design and to be applied to the fabrication, construction, and testing of the SSCs of the facility. In addition, the description of the QA program must include a discussion of how the applicable requirements of Appendix B have been and will be satisfied, including a discussion of how the QA program will be implemented.

Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," sets forth NRC regulatory requirements related to QA programs. Appendix B establishes QA requirements for the design, fabrication, construction, and testing of the SSCs of the facility. The pertinent requirements of Appendix B apply to all activities affecting the safety-related functions of those SSCs and include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, operating, maintaining, repairing, refueling, and modifying.

17.5.4 Technical Evaluation

The NRC staff reviewed NAPS SUP 17.5-1, NAPS SUP 17.5-2, and NAPS SUP 17.5-3 included in Section 17.5 of the North Anna 3 COL FSAR. NAPS SUP 17.5-1 and NAPS SUP 17.5-2 address the QA program applied to design activities by including a reference to the Dominion Nuclear Facility (DOM) QAPD (Ref. 17.5-201 of the North Anna 3 COL FSAR) topical report (TR) for the Dominion operating nuclear power plants. North Anna 3 will apply this TR to QA activities performed before the start of construction (e.g., site investigations, design and safety analyses, early procurements). NAPS SUP 17.5-3 addresses the QA program applied to the construction and operations phases.

The staff reviewed the relevant information in the COL FSAR:

Supplemental information

- NAPS SUP 17.5-1
- NAPS SUP 17.5-2

NAPS SUP 17.5-1 and NAPS SUP 17.5-2 address the QA program that was applied to safety-related activities performed before the start of construction (e.g., site investigations, design and safety analyses, early procurements). The applicant stated that the QA controls applied during this time period are described in the DOM QAPD TR for the Dominion operating nuclear plants supplemented by COL project procedures. The existing DOM QAPD had not been compared to the acceptance criteria in the NUREG-0800 SRP Section 17.5, "Quality Assurance Program Description – Design Certification, Early Site Permit and New License Applicants," (Ref. 17.5-1). This plan was in effect when the NAPS Unit 3 COL application was submitted. To meet the expectations of RG 1.206, Section C.III.1, Chapter 17, Section C.III.17.5, NRC staff therefore issued a RAI, **RAI 17.5-1**. The staff requested the applicant to provide an evaluation of the existing DOM QAPD (DOM-QA-1) against the acceptance criteria in SRP Section 17.5, which demonstrates its acceptability for controlling QA activities before the start of construction.

In the August 4, 2008, response to **RAI 17.5-1**, the applicant evaluated DOM-QA-1 with respect to SRP Section 17.5 acceptance criteria. The applicant provided a table that illustrates each acceptance criterion in SRP Section 17.5 and evaluates whether DOM-QA-1 meets a criterion or whether a criterion is not applicable. The table was included in the COL FSAR as Table 1.9-201. As a result of the evaluation, the applicant found that, with the exception of some criteria that are not applicable, the QAPD conforms to the acceptance criteria in SRP Section 17.5. The staff reviewed the table and found it to be acceptable.

- NAPS SUP 17.5-3

NAPS SUP 17.5-3 addresses and resolves ESBWR DCD COL Items 17.2-1-A, 17.2-2-A, and 17.3-1-A. This supplemental information describes the QA program that will be applied to the construction and operations phases. Appendices 17AA and 17BB of the North Anna 3 COL FSAR include the QAPD and the NAPS Unit 3 QAPD, respectively, that will be applied during construction and operations.

The staff issued **RAI 17.5-2** and requested the applicant to clarify the expected scope of work for each QAPD, as it relates to design and procurement activities, by identifying when and where these design and procurement activities will take place and specifying under which QAPD the activities will be conducted.

In the August 4, 2008, response to **RAI 17.5-2**, the applicant provided the current scope of work for each QAPD as it relates to design and procurement activities. The applicant clarified that General Electric-Hitachi, Wilmington, NC) will be responsible for design activities associated with the COL review, and Bechtel (Frederick, MD) will be responsible for construction site preparation. In addition, Bechtel will oversee procurement for items and services such as design work, and GEH will oversee activities for manufacturing and fabricating the reactor pressure vessel. These activities will be conducted under the NAPS Unit 3 QAPD described in FSAR Appendix 17BB. The NAPS Unit 3 QAPD will be ready for implementation by June 2009. The staff found that the applicant had satisfactorily clarified the scope of each QAPD. Therefore, the staff found that the applicant's response to **RAI 17.5-2** is acceptable.

The NRC staff reviewed and evaluated NAPS Unit 3 QAPD supplemental information included in 17.5-3 to determine whether it met NRC regulations by adhering to the guidance in SRP Section 17.5. SRP Section 17.5 provides an outline for a QA program that is acceptable to NRC staff for DC, ESP, COL, and operating license applicants.

The QAPD for NAPS Unit 3 is the top-level document that establishes the QA measures to be applied for activities related to the design, construction, and operation of an ESBWR at the NAPS Unit 3 site. Part I Section 1.1 of the NAPS Unit 3 QAPD lists the quality activities to which the QAPD applies. Although this list is not all-inclusive, the staff noted that siting is on the list. The staff issued **RAI 17.5-3** and requested the applicant to clarify how siting activities would be subject to this QAPD since the NAPS ESP has been approved.

In the August 4, 2008, response to **RAI 17.5-3**, the applicant states that siting activities subject to this QAPD are associated with any additional design work or measurements required to support construction. Additional subsurface measurement activities would be performed consistent with Nuclear Quality Assurance (NQA)-1-1994 Basic Requirement 3 Supplement 3S-1, Basic Requirement 11 Supplement 11S-1, and subsurface investigation requirements in Subpart 2.20. The staff endorsed NQA-1-1994 as an acceptable approach to meet Appendix B to 10 CFR Part 50 requirements. Therefore, the staff finds that the applicant's response to **RAI 7.5-3** is acceptable.

The staff's review of the NAPS QAPD is provided below:

17.5.4.1 Organization

The QAPD for the NAPS Unit 3 follows the guidance in SRP Section 17.5, paragraph II.A related to organization. The NAPS Unit 3 QAPD includes a commitment from the applicant to comply with the quality standards for QA organizations described in NQA-1-1994, Basic Requirement 1, and Supplement 1S-1. The QAPD describes and defines the responsibility and authority for planning, establishing, and implementing an effective overall QA program. The QAPD provides a description of an organizational structure; functional responsibilities; levels of authority; and interfaces for establishing, executing, and verifying QAPD implementation. The QAPD establishes independence between the organization responsible for checking a function and the organization that performs the function. In addition, the QAPD allows NAPS Unit 3 management to size the QA organization commensurate with assigned duties and responsibilities.

The staff issued **RAI 17.5-4** and requested the applicant to provide a flowchart to delineate the organizational interfaces and interrelationships between the North Anna corporate and onsite QA organizations.

In the August 4, 2008, response and a supplemental letter dated September 11, 2008, responding to **RAI 17.5-4**, the applicant included Figures II.1-1 and II.1-2 to identify organizations for the construction and operations phases, respectively. The NRC staff is currently reviewing NEI 06-14 that the applicant used to develop the QAPD and is evaluating the extent of information that the organizational section of the QAPD needs to include. (Ref. 17.5-14) This revision to NEI 06-14 will result in changes to the organizational description contained in the QAPD. **RAI 17.5-4 is being tracked as an Open Item.**

In addition, the staff noted that the NAPS Unit 3 QAPD provides a reference to the NAPS Unit 3 COL FSAR Chapter 13 for a more detailed description of the operating organization. The staff issued **RAI 17.5-7** and requested the applicant to clarify the regulation (i.e. 50.54(a) or 50.59) that will be applied to changes in the operating organizational description included in FSAR Chapter 13.

The applicant chose to describe the detailed organizational responsibilities for operating the facility in Chapter 13 of the FSAR to minimize duplication of information between Chapters 13 and 17. This detailed description is incorporated by reference in Chapter 17. Because the organization is implementing the QA program described in Chapter 17, the applicant will manage any changes to the organization in accordance with 10 CFR 50.54(a) to ensure the appropriate review and approval process. In the August 4, 2008, response to **RAI 17.5-7**, a revised response from the applicant which included a statement in Section 13.1.1 committing that changes to the organization will be reviewed under the provisions of 10 CFR 50.54(a). This review will ensure that any reduction in commitments under the QAPD will be submitted to and approved by NRC staff before implementation. On this basis, the staff finds the response to **RAI 17.5-7** acceptable.

17.5.4.2 Quality Assurance Program

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.B for the QA program. The QAPD establishes measures to implement a QA program to ensure that the design, construction, and operation of a nuclear power plant are in accordance with governing regulations and license requirements. The QA program comprises those planned and systematic actions that are necessary to provide confidence that SSCs will perform their intended safety function, including certain non-safety-related SSCs and activities that are significant contributors to plant safety, as described in North Anna 3 COL FSAR. The QA program requires that a list or system be maintained identifying SSCs and activities to which the QAPD applies.

10 CFR 52.79 identifies the technical information required to be included in the applicant's FSAR. NRC staff noted that the NAPS Unit 3 QAPD provides a reference to 10 CFR 50.34(b)(6)(ii). The staff issued **RAI 17.5-5** and requested the applicant to revise the cited regulation.

In the August 4, 2008, response to **RAI 17.5-5**, the applicant chose to correctly cite 10 CFR 52.79(a)(27) rather than 10 CFR 50.34(b)(6)(ii). The change was shown on the attached FSAR markup. In Revision 1 to the FSAR submitted in December 2008, NRC staff noted that the applicant did not incorporate the reference to the regulation. Instead, the applicant decided to change it to "regulations." In a conference call on February 25, 2009, the applicant mentioned that the change was based on the latest revision to the NEI 06-14 that includes the word "regulation." The staff is currently reviewing the NEI 06-14 that the applicant used to develop

the QAPD and is evaluating the reference to the regulation. **RAI 17.5-5 is being tracked as an Open Item.**

The QAPD provides measures to assess the adequacy of the QAPD at least once each year or at least once during the existence of the activity, whichever is shorter, to ensure that it is effectively implemented. The program allows the period for assessing the QAPD during the operations phase to be extended to once every 2 years. In addition, consistent with SRP Section 17.5 paragraph II.B.8, the QAPD applies a grace period of 90 days to activities that must be performed on a periodic basis. The next due date for the performance of an activity that invokes the 90-day grace period remains unchanged. The next due date for an activity performed before the scheduled due date is moved forward so that the interval prescribed for the performance of the activity is not exceeded.

The QAPD also adheres to the guidance in SRP Section 17.5 paragraphs II.S and II.T for training. The QAPD describes measures that establish and maintain formal indoctrination and training programs for personnel performing, verifying, or maintaining activities within the scope of the QAPD to ensure that they achieve and maintain an appropriate level of proficiency. The technical specifications for NAPS Unit 3 delineate the minimum qualifications for plant and support staff involved in quality activities. Personnel are required to complete the training for positions identified in 10 CFR 50.120, "Training and Qualification of Nuclear Power Plant Personnel," in accordance with programs accredited by the National Nuclear Accrediting Board of the National Academy for Nuclear Training. The QAPD also establishes minimum training requirements for managers responsible for QAPD implementation, in addition to minimum training requirements for individuals responsible for planning, implementing, and maintaining the QAPD.

The QAPD also adheres to SRP Section 17.5 paragraph II.W for independent program reviews. The QAPD provides measures for establishing an independent review program for activities occurring during the operational phase. The QAPD includes a commitment from the applicant to comply with the quality standards for independent reviews described in NQA-1-1994 (Ref. 17.5-2), Basic Requirement 2, and Supplements 2S-1 through 2S-4 with the following alternatives:

- NQA-1-1994 Supplement 2S-1, includes NQA-1-1994 Appendix 2A-1. The QAPD proposes the following alternatives to the implementation of Supplement 2S-1 and Appendix 2A-1:
 - NQA-1-1994 Supplement 2S-1 identifies the responsibility of the organization to designate those activities that require qualified inspectors and test personnel and establish written procedures for the qualifications of those personnel. As an alternative to this requirement, the QAPD proposes that a qualified engineer may plan inspections, evaluate the capabilities of an inspector, or evaluate the training program for inspectors. For purposes of these functions, a qualified engineer is one who has a baccalaureate degree in engineering in a discipline related to the inspection or test activity (i.e., electrical, mechanical, or civil engineering); has at least 5 years of engineering work experience with at least 2 of those years in nuclear facilities.

NRC staff evaluated this proposed alternative and determined that the designation of a qualified engineer to plan inspections, evaluate inspectors, or evaluate the inspector qualification programs is consistent with the training and qualification criteria in Appendix B to 10 CFR Part 50, Criterion II, "Quality Assurance Program," and NQA-1-

1994 Supplement 2S-1. Therefore, the staff concluded that this alternative is acceptable.

- NQA-1-1994 Appendix 2A-1 provides guidance for qualifying inspection and test personnel as Level I, II, or III. As an alternative to this guidance, the QAPD proposes that personnel performing independent quality verification inspections, examinations, measurements, or tests will be required to possess qualifications equal to or better than those required for performing the task being verified. In addition, the verification performed must be within the skills of these personnel and addressed by procedures. These personnel will not be responsible for planning quality verification inspections or tests (i.e., establishing hold points and acceptance criteria in procedures and determining responsibility for performing the inspection), evaluating inspection training programs, or certifying inspection personnel.

NRC staff evaluated this proposed alternative and determined that it is consistent with initial qualification requirements for inspection and test personnel that are specified in SRP Section 17.5 paragraph II.T.5. Therefore, the staff concluded that this alternative is acceptable.

- NQA-1-1994 Supplement 2S-2 states that nondestructive examination personnel must be qualified. As an alternative to this requirement, the QAPD proposes to follow the applicable standard cited in Sections III and XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. The 10 CFR 50.55a, "Codes and Standards," also requires the use of the latest edition and addenda in Sections III and XI of the ASME Code. NRC staff evaluated this proposed alternative and determined that it is consistent with the regulation in 10 CFR 50 Appendix B Criterion II, "Quality Assurance Program." Therefore, the staff concluded that this alternative is acceptable.
- NQA-1-1994 Supplement 2S-3 states that the prospective lead auditors must have participated in a minimum of five audits in the previous 3 years. As an alternative to this requirement, the QAPD proposes to follow the guidance in SRP Section 17.5 paragraph II.S.4.c, which states that prospective lead auditors shall demonstrate their ability to properly conduct the audit process as implemented by the company, to effectively lead an audit team, and to effectively organize and report results (including participation in at least one nuclear audit within the year preceding the date of qualification). NRC staff evaluated this proposed alternative and determined that it is consistent with the regulation in Appendix B to 10 CFR Part 50, Criterion II. Therefore, the staff concluded that this alternative is acceptable.

17.5.4.3 Design Control

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.C for design control. The QAPD establishes the necessary measures to control the design, design changes, and temporary modifications of items that are subject to the provisions of the QAPD (e.g., temporary bypass lines, electrical jumpers and lifted wires, and temporary setpoints). The QAPD design process includes provisions to control design inputs, outputs, changes, interfaces, records, and organizational interfaces with the applicant and its suppliers. These provisions ensure that the design inputs (i.e., design bases and the performance, regulatory, quality, and quality verification requirements) are correctly translated into design outputs (i.e., analyses, specifications, drawings, procedures, and instructions). The QAPD provisions also call for

individuals who are knowledgeable about QA principles to review design documents and ensure that they contain the necessary QA requirements.

In the QAPD, the applicant commits to comply with the QA standards described in NQA-1-1994, Basic Requirement 3, and Supplement 3S-1 to establish the program for design control and verification; in Subpart 2.20 for the subsurface investigation requirements; and in Subpart 2.7 standards for computer software QA controls.

17.5.4.4 Procurement Document Control

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.D for procurement document control. The QAPD establishes the necessary administrative controls and processes to ensure that procurement documents include or reference applicable regulatory, technical, and QA program requirements. As noted in SRP Section 17.5 paragraph II.D.1, applicable technical, regulatory, administrative, quality, and reporting requirements (such as specifications, codes, standards, tests, inspections, special processes, and the regulation in 10 CFR Part 21, "Reporting of Defects and Noncompliance") must be included in procurement documents and invoked on the supplier of basic components. In the QAPD, the applicant commits to comply with the quality standards described in NQA-1-1994 Basic Requirement 4 and Supplement 4S-1, with the following alternatives and commitment:

- NQA-1-1994 Supplement 4S-1 Section 2.3 states that procurement documents must require suppliers to have a documented QA program that implements NQA-1-1994, Part I.
 - As an alternative to this requirement, the QAPD proposes that suppliers have a documented QA program that meets Appendix B to 10 CFR Part 50, as applicable to the circumstances of the procurement. NRC staff evaluated this proposed alternative and determined that it is consistent with Appendix B Criterion IV, "Procurement Document Control." Therefore, the staff concluded that this alternative is acceptable.
 - As an alternative to this requirement, the QAPD proposes that procurement documents could allow suppliers to work under the applicant's QAPD, including implementing procedures, if suppliers do not have their own QA program. NRC staff evaluated this proposed alternative and determined that the applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.G, "Control of Purchased Material, Equipment, and Services." Specifically, the QAPD provides measures to evaluate prospective suppliers so that only qualified suppliers are selected, acceptance actions are performed for procured products and services, and suppliers are periodically audited and evaluated to ensure that qualified suppliers continue to provide acceptable products and services. Therefore, the NRC staff concluded that this alternative is acceptable.
- NQA-1-1994 Supplement 4S-1 Section 3 states that procurement documents are to be reviewed before awarding a contract. As an alternative to this requirement, the QAPD proposes to conduct the QA review of procurement documents through a review of the applicable procurement specifications, including the technical and quality procurement requirements, before awarding a contract. In addition, procurement document changes (e.g., scope, technical, or quality requirements) will also receive QA review. NRC staff evaluated this proposed alternative and determined that it provides adequate QA review of procurement documents before awarding a contract and after any changes. Therefore, the staff concluded that this alternative is acceptable.

- The QAPD includes a commitment from the applicant that procurement documents prepared for commercial-grade items and procured as safety-related items shall contain technical and QA requirements to which the procured item can be appropriately dedicated. NRC staff evaluated this proposed commitment and determined that it is consistent with staff guidance in Generic Letter (GL) 89-02 dated March 21, 1989, (Ref. 17.5-3), "Actions to Improve the Detection of Counterfeit and Fraudulently Marked Products," and GL 91-05 dated April 9, 1991, (Ref. 17.5-4), "Licensee Commercial-Grade Procurement and Dedication Programs," as delineated in SRP Section 17.5 paragraphs II.U.1.d and II.U.1.e. Therefore, the staff concluded that this commitment is acceptable.

17.5.4.5 Instructions, Procedures, and Drawings

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.E for instructions, procedures, and drawings. The QAPD establishes the necessary measures and governing procedures to ensure that activities affecting quality are prescribed by and performed in accordance with documented instructions, procedures, and drawings.

In the QAPD, the applicant commits to comply with the quality standards for instructions, procedures, and drawings described in NQA-1-1994 Basic Requirement 5 to establish procedural controls.

17.5.4.6 Document Control

The applicant's QAPD follows the guidance of SRP Section 17.5 paragraph II.F for document control. The QAPD establishes the necessary measures and governing procedures to control the preparation, review, approval, and issuance of as well as changes in documents that specify QA requirements or prescribe measures for controlling activities affecting quality, including organizational interfaces. The QAPD provides measures to ensure that the same organization that performed the original review and approval also review and approve revisions or changes to documents, unless other organizations are specifically designated.

A listing of all controlled documents identifying the current approved revision or date is maintained so personnel can readily determine the appropriate document for use. To ensure effective and accurate procedures during the operational phase, applicable procedures are reviewed and updated as necessary, consistent with NRC staff guidance provided in SRP Section 17.5, paragraph II.F.8.

In the QAPD, the applicant commits to comply with the QA standards for document control described in NQA-1-1994, Basic Requirement 6, and Supplement 6S-1 to establish provisions for document control.

17.5.4.7 Control of Purchased Material, Equipment, and Services

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.G for control of purchased materials, equipment, and services. The QAPD establishes the necessary measures and governing procedures to control the procurement of items and services to ensure conformance with specified requirements. The program provides measures to evaluate prospective suppliers so that only qualified suppliers are selected. In addition, the program requires that suppliers be periodically audited and evaluated to ensure that qualified suppliers continue to provide acceptable products and services.

The program provides for acceptance actions such as source verification, receipt inspection, pre- and post-installation tests, and the review of documentation such as certificates of conformance to ensure that procurement, inspection, and test requirements have been satisfied before relying on the item to perform its intended safety function. Purchased items (such as components, spares, and replacement parts necessary for plant operation, refueling, maintenance, and modifications) and services are subject to QA and technical requirements at least equivalent to those specified for original equipment, or by properly reviewed and approved revisions to ensure that the items are suitable for the intended service and are of an acceptable quality that is consistent with the intended effect on safety.

In the QAPD, the applicant commits to comply with the quality standards for the control of purchased material, equipment, and services described in NQA-1-1994, Basic Requirement 7, and Supplement 7S-1 to establish procurement verification control with the following exceptions and alternatives:

- NQA-1-1994, Basic Requirement 7, and Supplement 7S-1 state that procurement sources and suppliers' performance are to be evaluated. As an exception to these requirements, the QAPD proposes that other 10 CFR Part 50 licensees (other than North Anna 3), authorized nuclear inspection agencies, the National Institute of Standards and Technology (NIST), and other State and Federal agencies that may provide items or services to North Anna 3 are not required to be evaluated or audited.
- NRC staff acknowledges that 10 CFR Part 50 licensees, authorized nuclear inspection agencies, the National Voluntary Laboratory Accreditation Program (NVLAP) administered by NIST, and other State and Federal agencies perform work under quality programs acceptable to the NRC, and that no additional audits or evaluations are required. However, the applicant remains responsible for ensuring that procured items or services conform to the Appendix B to 10 CFR Part 50 program, applicable ASME Boiler and Pressure Vessel Code requirements, and other regulatory requirements and commitments. As discussed in the QAPD, the applicant also remains responsible for ensuring that the items or services are suitable for the intended application and for documenting the evaluation that supports this conclusion. The proposed exception provides an appropriate level of quality and safety. The staff determined that this exception is acceptable as documented in a previous safety evaluation (SE) (Ref. 17.5-5).
- SRP Section 17.5 paragraph II.L.8 establishes provisions for the procurement of commercial-grade calibration services for safety-related applications. As an exception to these provisions, the QAPD proposes that procurement source evaluations and selection measures not be required, provided that all of the following conditions are met:
 - Purchase documents impose additional technical and administrative requirements to satisfy any licensee-specific QAPD and technical requirements
 - Purchase documents require reporting as-found calibration data when calibrated items are found to be out of tolerance.
 - A documented review of the supplier's accreditation will be performed and will include a verification of the following:

- The calibration laboratory holds a domestic accreditation by any one of the following accrediting bodies, which are recognized by the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA):
 - NVLAP administered by NIST
 - American Association for Laboratory Accreditation (A2LA),
 - ACLASS Accreditation Services (ACLASS),
 - International Accreditation Service (IAS),
 - Laboratory Accreditation Bureau (L-A-B).
- The accreditation encompasses ANS/ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories."
- The published scope of accreditation for the calibration laboratory covers the necessary measurement parameters, ranges, and uncertainties.

NRC staff evaluated and found to be acceptable the NVLAP and A2LA accreditation programs (Ref. 17.5-6). The staff subsequently determined that the accreditation programs of ACLASS, L-A-B, and IAS are also recognized by the ILAC MRA and are therefore acceptable (Ref. 7, 8, and 9).

- NQA-1-1994 Supplement 7S-1 Section 8.1 states that documented evidence must conform to procurement documents and be available at the nuclear facility site before installation or use. As an alternative to the requirement that documented procurement evidence be available at the nuclear facility site during construction, the QAPD proposes that documented evidence may be stored in physical form or in electronic media, under the control of the applicant or its supplier(s), and at a location(s) other than the nuclear facility site as long as the documents can be accessed at the nuclear facility site during construction. After the completion of construction, sufficient documented evidence will be available to the licensee to support operations. The NRC staff determined that implementation of this alternative would allow access to and review of the necessary procurement documented evidence at the nuclear facility site, both before installation and use. Therefore, the staff concluded that this alternative is acceptable.
- As an alternative to the requirements that control commercial-grade items and services in NQA-1-1994 Supplement 7S-1 Section 10, the applicant commits in the QAPD to follow NRC guidance discussed in GLs 89-02 and 91-05. In addition, the applicant commits to establish and describe special QA verification requirements in applicable documents to assure that the commercially procured items will perform satisfactorily. In addition, the documents should determine critical characteristics, technical evaluations, receipt requirements, and QA evaluations of the items to ensure that they are suitable for their intended use. NRC staff determined that this alternative
 - is consistent with the guidance in SRP Section 17.5 paragraphs II.U.1.d and II.U.1.e,
 - will improve the likelihood of detecting counterfeit and fraudulently marked products, and

- will improve the commercial-grade dedication programs.

Therefore, the staff concluded that this alternative is acceptable.

17.5.4.8 Identification and Control of Materials, Parts, and Components

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.H for identification and control of materials, parts, and components. The QAPD establishes the necessary measures for the identification and control of items such as materials (including consumables and items with limited shelf life), parts, components, and partially fabricated subassemblies. The identification of items is maintained throughout fabrication, erection, installation, and use so that the item can be traced to its documentation consistent with the item's effect on safety.

In the QAPD, the applicant commits to comply with the QA standards for controlling materials, parts, and components described in NQA-1-1994, Basic Requirement 8, and Supplement 8S-1 to establish provisions for the identification and control of items.

17.5.4.9 Control of Special Processes

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.I for the control of special processes. The QAPD establishes programs, procedures, and processes to ensure that special processes requiring interim controls to maintain quality—such as welding, heat treating, chemical cleaning, and nondestructive examinations—are implemented and controlled in accordance with applicable codes, specifications, and standards.

In the QAPD, the applicant commits to comply with the QA standards controlling special processes described in NQA-1-1994, Basic Requirement 9, and Supplement 9S-1 to establish measures for the control of special processes.

17.5.4.10 Inspection

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.J for inspections. The QAPD establishes the necessary measures for implementing inspections to ensure that items, services, and activities affecting safety meet established requirements and conform to applicable documented specifications, instructions, procedures, and design documents. The inspection program establishes requirements for planning inspections, determining applicable acceptance criteria, setting the frequency of inspections, and identifying special tools needed to perform the inspection. Properly qualified personnel independent of those who performed or directly supervised the work are required to perform the inspections.

In the QAPD, the applicant commits to comply with QA standards for inspections described in NQA-1-1994, Basic Requirement 10, Supplement 10S-1, and Subparts 2.4, 2.5, and 2.8 to establish inspection requirements with the following commitment and alternative:

- NQA-1-1994 Subpart 2.4 requires the use of the Institute of Electrical and Electronic Engineers (IEEE) Standard 336-1985, "IEEE Standard Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities" (Ref. 17.5-10). IEEE Standard 336-1985 refers to IEEE 498-1985, "IEEE Standard Requirements for the Calibration and Control of Measuring and Test Equipment Used in Nuclear Facilities" (Ref. 17.5-11). Each of these standards uses the definition of safety systems equipment from IEEE Standard 603-1980, "IEEE Standard Criteria for Safety

Those systems (the reactor trip system, an engineered safety feature, or both, including all their auxiliary supporting features and other auxiliary feature) which provide a safety function. A safety system is comprised of more than one safety group of which any one safety group can provide the safety function.

The QAPD must commit to the IEEE Standard 603-1980 definition of safety systems equipment to appropriately implement NQA-1-1994 Subpart 2.4. In the QAPD, the applicant commits to the definition of safety systems equipment from IEEE Standard 603-1980, but does not commit to the balance of IEEE Standard 603-1980. This definition applies only to equipment in the context of NQA-1-1994 Subpart 2.4. The NRC staff determined that the use of the definition of safety systems equipment is acceptable because it is consistent with the requirements in NQA-1-1994 Subpart 2.4.

- NQA-1-1994 Supplement 10S-1 Section 3.1 states that inspection personnel will not report to the immediate supervisor responsible for performing the work being inspected. As an alternative to this requirement, the QAPD proposes that QA inspectors will report to quality control management while performing these inspections. The NRC staff determined that the use of this alternative is consistent with SRP Section 17.5 paragraph II.J.1. Therefore, the staff concluded that this alternative is acceptable.

17.5.4.11 Test Control

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.K for test control. The QAPD establishes the necessary measures and governing provisions to demonstrate that items subject to the provisions of the QAPD will perform satisfactorily in service, that the plant can be operated safely as designed, and that the operation of the plant as a whole is satisfactory.

In the QAPD, the applicant commits to comply with the QA standards for test control described in NQA-1-1994, Basic Requirement 11, and Supplement 11S-1, to establish provisions for testing.

The applicant also commits in the QAPD to comply with the QA standards for software test control described in NQA-1-1994 Supplements 11S-2 and Subpart 2.7 to establish provisions to ensure that computer software used in applications affecting safety be prepared, documented, verified, tested, and used in a manner that obtains the expected outputs and maintains configuration control.

17.5.4.12 Control of Measuring and Test Equipment

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.L for the control of measuring and test equipment (M&TE). The QAPD establishes the necessary measures to control the calibration, maintenance, and use of M&TE that provide information important to safe plant operations.

In the QAPD, the applicant commits to comply with the quality standards for M&TE described in NQA-1-1994 Basic Requirement 12 and Supplement 12S-1 to establish provisions that control M&TE with the following clarification and exception:

- The QAPD clarifies that the out-of-calibration conditions described in paragraph 3.2 of Supplement 12S-1 of NQA-1-1994 refer to cases where the M&TE are found to be out of the required accuracy limits (i.e., out of tolerance) during calibration. NRC staff determined that the clarification for the out-of-calibration conditions is consistent with Supplement 12S-1. Therefore, the staff concluded that this clarification is acceptable.
- As an alternative to the NQA-1-1994 Subpart 2.4 Section 7.2.1 calibration labeling requirements, the QAPD proposes that when it is impossible or impractical to mark equipment with required calibration information because of equipment size or configuration, the required calibration information will be documented and traceable to the equipment. NRC staff determined that this alternative is consistent with NRC staff guidance provided in SRP 17.5 paragraph II.L.3. Therefore, the staff concluded that this alternative is acceptable.

17.5.4.13 Handling, Storage, and Shipping

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.M for handling, storage, and shipping of procured items. The QAPD establishes the necessary measures to control the handling, storage, packaging, shipping, cleaning, and preservation of items to prevent inadvertent damage or loss and to minimize deterioration.

In the QAPD, the applicant commits to comply with the QA standards for handling, storage, and shipping in NQA-1-1994 Basic Requirement 13 and Supplement 13S-1 and to establish provisions for handling, storage, and shipping. In the QAPD, the applicant also commits to comply with the quality standards described in NQA-1-1994 Subparts 2.1, 2.2, and 2.15 during the construction and pre-operations phases of the plant, as applicable, with the following alternatives:

- NQA-1-1994 Subpart 2.2 Section 6.6 states that the preparation of records must include information on personnel access to QA records. The QAPD establishes the necessary measures to document personnel authorized to access storage areas and record personnel access. However, the QAPD proposes not to consider these documents as QA records. As an alternative, the applicant will retain these documents in accordance with plant administrative controls. The NRC staff determined that these records do not meet the classification of a QA record as defined in NQA-1-1994 Supplement 17S-1 Section 2.7. Therefore, the staff concluded that this alternative is acceptable.
- NQA-1-1994 Subpart 2.2 Section 7.1 refers to Subpart 2.15 for requirements related to handling items. The QAPD clarifies that the scope of Subpart 2.15 includes hoisting, rigging, and transporting items for nuclear power plants during construction. The NRC staff has determined that this clarification is acceptable because it distinguishes between the requirements for construction and operation.

17.5.4.14 Inspection, Test, and Operating Status

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.N on the inspection, testing, and operating status of items subject to QA oversight. The QAPD establishes the necessary measures to identify the inspection, testing, and operating status of items and components subject to the provisions of the QAPD to maintain personnel and reactor safety, and to avoid the inadvertent operation of equipment.

In the QAPD, the applicant commits to comply with the QA standards in this area described in NQA-1-1994 Basic Requirement 14 to establish procurement verification controls.

17.5.4.15 *Nonconforming Materials, Parts, or Components*

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.O for nonconforming materials, parts, or components. The QAPD establishes the necessary measures to control items, including services that do not conform to specified requirements, to prevent inadvertent installation or use. Instances of nonconformance are evaluated for their impact on the operability of quality SSCs to ensure that the final condition does not adversely affect safety, operation, or maintenance of the item or service. The results of evaluations of conditions adverse to quality are analyzed to identify quality trends to be documented and reported to upper management in accordance with applicable procedures.

In addition, the QAPD provides for establishing the necessary measures to implement the requirements of Subparts A and C of 10 CFR Part 52, 10 CFR 50.55(e), and 10 CFR Part 21, where applicable.

In the QAPD, the applicant commits to comply with the QA standards for nonconforming materials, parts, or components described in NQA-1-1994, Basic Requirement 15, and Supplement 15S-1 to establish measures for nonconforming materials.

17.5.4.16 *Corrective Action*

The applicant's QAPD follows the guidance in SRP Section 17.5, paragraph II.P for corrective action programs. The QAPD establishes the necessary measures to promptly identify, control, document, classify, and correct conditions adverse to quality. The QAPD requires personnel to identify known conditions adverse to quality. Reports of these conditions adverse to quality are analyzed to identify trends. Significant conditions adverse to quality are documented and reported to responsible management. In the case of suppliers working on safety-related activities or similar situations, the applicant may delegate specific responsibility for the corrective action program, but the applicant maintains responsibility for the program's effectiveness.

In addition, the QAPD establishes the measures necessary for implementing a reporting program in accordance with the requirements in 10 CFR Part 21.

In the QAPD, the applicant commits to comply with the QA standards for corrective action programs described in NQA-1-1994 Basic Requirement 16, to establish a corrective action program.

17.5.4.17 *Quality Assurance Records*

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.Q on QA records. The QAPD establishes the necessary measures to ensure that sufficient records of items and activities affecting quality are generated, identified, retained, maintained, and can be retrieved.

Concerning the use of electronic records storage and retrieval systems, the QAPD complies with the NRC guidance in GL 88-18, "Proposed Final NRC," GL 88-18, Supplement 1, "Guidance on Managing Quality Assurance Records in Electronic Media," dated September 13, 1999; Regulatory Issue Summary 2000-18, "Guidance on Managing Quality Assurance

Records in Electronic Media,” dated October 23, 2000, and associated Nuclear Information and Records Management Association (NIRMA) Technical Guides (TG) 11-1998, TG 15-1998, TG 16-1998, and TG 21-1998.

In the QAPD, the applicant commits to comply with the quality standards for QA records described in NQA-1-1994, Basic Requirement 17, and Supplement 17S-1 establishing provisions for records, with the following alternative:

- NQA-1-1994 Supplement 17S-1 Section 4.2(b) states that records must be firmly attached in binders or placed in folders or envelopes for storage in steel file cabinets or on shelving in containers. As an alternative to this requirement, the QAPD proposes that hard-copy records be stored in steel cabinets or on shelving in containers, except that methods other than binders, folders, or envelopes may be used to organize records for storage. The NRC staff determined that this alternative is acceptable as documented in a previous SE (Ref. 17.5-13).

17.5.4.18 Quality Assurance Audits

The applicant’s QAPD follows the guidance in SRP Section 17.5 paragraph II.R on QA audits. The QAPD establishes the necessary measures to implement audits for verifying that activities covered by the QAPD are performed in conformance with documented requirements. The audit program is reviewed for effectiveness as part of the overall audit process.

The QAPD provides for the COL applicant or holder to conduct periodic internal and external audits. Internal audits are conducted to determine that the program and procedures being audited comply with the QAPD. Internal audits are performed with a frequency commensurate with the safety significance of the program or activity and in such a manner as to ensure that an audit of all applicable QA program elements is completed for each functional area within a period of 2 years after determining that the program is well established. External audits determine the adequacy of a supplier’s or contractor’s QA program.

The applicant ensures that audits are documented and audit results are reviewed. In accordance with the QAPD, the COL applicant or holder will respond to all audit findings and initiate appropriate corrective actions. In addition, where corrective actions are indicated, the applicant will document the follow-up of applicable areas through inspections, review, repeat audits, or other appropriate means to verify the implementation of assigned corrective actions.

In the QAPD, the applicant commits to comply with the standards for QA audits described in NQA-1-1994, Basic Requirement 18, and Supplement 18S-1 to establish an independent audit program.

17.5.4.19 Non-Safety-Related SSC Quality Assurance Control

17.5.4.19.1 Non-Safety-Related SSCs – Significant Contributors to Plant Safety

The applicant’s QAPD follows the guidance in SRP Section 17.5 paragraph II.V.1 for controls related to non-safety-related SSCs. The QAPD establishes program controls applied to non-safety-related SSCs that are significant contributors to plant safety and to which Appendix B does not apply. The QAPD applies specific controls to these items in a selected manner,

targeting the characteristics or critical attributes that render the SSCs significant contributors to plant safety that are consistent with applicable sections in the QAPD.

17.5.4.19.2 Non-Safety-Related SSCs Credited for Regulatory Events

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.V.2 to establish the QA requirements for non-safety-related SSCs credited for regulatory events. In the QAPD, the applicant commits to comply with the following regulatory guidance:

- The applicant shall implement quality provisions for the fire protection system in accordance with Regulatory Position 1.7, "Quality Assurance," in RG 1.189, "Fire Protection for Operating Nuclear Power Plants," issued April 2001.
- The applicant shall implement QA provisions for anticipated transient without scram (ATWS) equipment in accordance with GL 85-06, "Quality Assurance Guidance for ATWS Equipment That Is Not Safety Related," issued January 1985.
- The applicant shall implement quality provisions for station blackout (SBO) equipment in accordance with Regulatory Position 3.5, "Quality Assurance and Specific Guidance for SBO Equipment That Is Not Safety Related," and Appendix A, "Quality Assurance Guidance for Non-Safety Systems and Equipment," in RG 1.155, "Station Blackout," issued August 1988.

17.5.4.20 Regulatory Commitments

The applicant's QAPD follows the guidance in SRP Section 17.5 paragraph II.U for describing its regulatory commitments. The QAPD establishes QA program commitments. In the QAPD, the applicant commits to comply with the following NRC RGs and other QA standards to supplement and support the QAPD:

- RG 1.26, Revision 3, "Quality Group Classification and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," issued February 1976. In the QAPD, the applicant commits to comply with the regulatory positions of this guidance, with the exception of Criteria C.1, C.1.a, C.1.b, and C.3 (these four criteria are only applicable to the AP1000 Design).
- RG 1.29 Revision 3, "Seismic Design Classification," issued September 1978. In the QAPD, the applicant commits to comply with the regulatory positions of this guidance with the exception of Criteria C.1.d, C.1.g, and C.1.n (these three criteria are only applicable to the AP1000 Design).
- ASME NQA-1-1994, "Quality Assurance Requirements for Nuclear Facility Applications," Parts I and II, as described in Sections 17.5.4.1 through 17.5.4.18 of this SER.
- NIRMA technical guides as described in Section 17.5.4.17 of this SER.

The staff issued **RAI 17.5-6** and requested the applicant to clarify its intent regarding its commitment to the guidance of RG 1.37 in the QAPD, noting that although Section 13.2 of the applicant's QAPD references the commitment to RG 1.37, Revision 1, "Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled

Nuclear Power Plants,” issued March 2007, but Part IV, “Regulatory Commitments,” of the QAPD does not identify RG 1.37 as a commitment.

In an August 4, 2008, response to **RAI 17.5-6**, the applicant stated that the omission of the commitment to RG 1.37 in Part IV of the QAPD was inadvertent. The applicant has revised the FSAR to include the commitment to the guidance of RG 1.37. The staff finds the response to this **RAI 17.5-6** acceptable.

17.5.5 Post Combined License Activities

There are no post COL activities related to this section.

17.5.6 Conclusion

The staff confirmed that the application addressed the required information relating to the QA Program.

The NRC staff used the requirements of Appendix B to 10 CFR Part 50 and the guidance in SRP Section 17.5 as the underlying premises for evaluating the acceptability of North Anna 3 COL FSAR supplemental information Items 17.5-1, 17.5-2, and 17.5-3 in Section 17.5 of the COL FSAR. Furthermore, the staff evaluated the QAPD guidance that will be applied to activities during design implementation, construction, and operations and arrived at the following conclusions:

- The QAPD provides adequate guidance for the applicant to apply a QAPD to activities and items that are important to safety.
- The QAPD provides adequate guidance for the applicant to establish controls that, when properly implemented, comply with Appendix B to 10 CFR Parts 21, 50, 52, and 10 CFR CFR 50.55(e). The controls also comply with the acceptance criteria in SRP Section 17.5 and with the commitments to applicable regulatory guidance.

However, as a result of Open Items 17.5-4 and 17.5-5, the staff is unable to finalize its conclusions related to the QA Program.

17.6 Maintenance Rule Program

17.6.1 Introduction

This section addresses the program for Maintenance Rule implementation based on the requirements of 10 CFR 50.65 and the guidance in NUMARC 93-01, “Industry Guidance for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” as endorsed by RG 1.160. For 50.65(a) (4), the guidance contained in the February 22, 2000, revision to Section 11 of NUMARC 93-01, as endorsed by RG 1.182, is effective for NUMAC 93-01 Revision 2.

17.6.2 Summary of Application

Section 17.6 of the North Anna 3 COL FSAR incorporates by reference NEI 07-02A, “Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed Under 10 CFR Part 52.”

In addition, in FSAR Section 17.6, the applicant provided the following:

COL Items

- STD COL 17.4-1-H Operation Reliability Assurance Activities

The applicant provided an additional section in the COL FSAR, Revision 1, addressing compliance with the “Maintenance Rule,” which states that the NEI 07-02A guidance for the Maintenance Rule program is incorporated by reference into Section 17.6 of the North Anna 3 COL FSAR.

Supplemental Information

- STD SUP 17.6-1

The applicant stated that the text of the template provided in NEI 07-02A is generically numbered as “17.X.” When the template is incorporated by reference into this section, the numbering will change from “17.X” to “17.6.”

- STD SUP 17.6-2

The applicant addressed the COL information by describing the Maintenance Rule Program relationship with reliability assurance activities in FSAR Section 17.6.3.

- STD SUP 17.6-3

The applicant stated that the correct reference to design reliability assurance program (DRAP) in the NEI 07-02A, paragraph 17.6.1.1.b, will then be “(DRAP, See FSAR Section 17.4)”.

17.6.3 Regulatory Basis

The regulatory basis for the information incorporated by reference is addressed in the FSER for TR NEI. The regulatory basis for acceptance of the Maintenance Rule program is established in 10 CFR 50.65, “Requirements for monitoring the effectiveness of maintenance at nuclear power plants” and 10 CFR 52.79(a) (15), which requires that a COL FSAR contain a description of the program and its implementation for monitoring the effectiveness of maintenance necessary to meet the requirements of 10 CFR 50.65.

17.6.4 Technical Evaluation

NRC staff reviewed Section 17.6 of the North Anna 3 COL FSAR and checked the referenced TR NEI 07-02A, “Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed Under 10 CFR Part 52,” Revision 0, to ensure that the combination of TR NEI 07-02A and the information in the COL represent the complete scope of information relating to this review topic.. The review confirmed that the applicant has addressed required information relating to theand no outstanding information is expected to be addressed in the COL FSAR related to the Maintenance Rule program.

The staff issued the SER on TR NEI 07-02A and approved the template for the Maintenance Rule program (Ref. 17.4-2).

The staff reviewed the relevant information in the COL FSAR:

COL Items

- STD COL 17.4-1-H Operation Reliability Assurance Activities

The Maintenance Rule program supports the operation RAP. The applicant incorporated by reference NEI 07-02A, as an acceptable method for satisfying the acceptance criteria in SRP Section 17.6. The staff finds that this approach is acceptable.

Supplemental Information

- STD SUP 17.6-1

The applicant stated that the text of the template provided in NEI 07-02A is generically numbered as “17.X.” When the template is incorporated by reference into this section, numbering will change from “17.X,” to “17.6.”

- STD SUP 17.6-2

The applicant described the Maintenance Rule program relationship with the reliability assurance activities in FSAR Section 17.6.3. The applicant states that the reliability of SSCs during the operations phase is assured through the implementation of operational programs, including, the Maintenance Rule program, the QAP, the ISI program, the IST program, technical specifications surveillance requirements, and maintenance programs.

- STD SUP 17.6-3

The applicant action in changing the phrase in paragraph 17.6.1.1.b in NEI 07-02A template from “(DRAP –See FSAR Section 17.Y)” to “(See Section 17.4),” is of editorial in nature, (see also the evaluation under STD SUP 17.6.1).

17.6.5 Post Combined License Activities

The applicant has committed to implement a process for integrating reliability assurance activities for risk-significant SSCs into operational programs (e.g., Maintenance Rule, surveillance testing, maintenance programs and QA) to meet the objectives of the RAP during plant operation. Consistent with this commitment, the following item was identified as the responsibility of the COL holder:

- STD COL 17.4-1-H Operation Reliability Assurance Activities

17.6.6 Conclusion

The staff concludes that the topical report incorporated by reference and supplemental provided in the FSAR are acceptable and meets the requirements of 10 CFR 50.65 with respect to a Maintenance Rule program. This conclusion is based on the following:

- The staff issued the SER on TR NEI 07-02A and approved the template for the Maintenance Rule program (Ref. 17.4-2)

- STD COL 17.4-1-H is acceptable because it appropriately references NEI 07-02A as the template used by the applicant for developing its Maintenance Rule program.
- STD SUP 17.6-1 is acceptable because it appropriately conforms the section numbering of NEI 07-02 when incorporated by reference.
- STD SUP 17.6-2 is acceptable because the reliability of SSCs during the operations phase is assured through the implementation of operational programs, including, the Maintenance Rule program, the QAP, the ISI program, the IST program, technical specifications surveillance requirements, and maintenance programs.
- STD SUP 17.6-3 is acceptable because it incorporates an appropriate reference change.

17.7 References

- 17.4.-1 NUMARC 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, Nuclear Energy Institute, April, 1996.
- 17.4-2 Nuclear Energy Institute, "Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed Under 10 CFR Part 52", NEI 07-02A, March 2008.
- 17.5-1. U.S. Nuclear Regulatory Commission, "Quality Assurance Program Description - Design Certification, Early Site Permit and New License Applicants," NUREG-0800, March 2007.
- 17.5-2. American Society of Mechanical Engineers. "Quality Assurance Requirements for Nuclear Facility Applications" ANSI/ASME Standard NQA-1-1994, Washington DC.
- 17.5-3. Generic Letter 89-02, "Actions to Improve the Detection of Counterfeit and Fraudulently Marked Products," dated March 21, 1989
- 17.5-4. Generic Letter 91-05, "Licensee Commercial-Grade Procurement and Dedication Programs," dated April 9, 1991.
- 17.5-5. U.S. NRC, Office of Nuclear Reactor Regulation, "Approval of Nuclear Management Company Quality Assurance Topical Report (TAC Nos. MC1309, MC1310, MC1311, MC1312, MC1313, MC1314, MC1315, MC1316)," (ADAMS Accession No. ML050700416), March 24, 2005.
- 17.5-6. U.S. NRC, Office of Nuclear Reactor Regulation, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – Approval of Change To Quality Assurance Program (Commercial-Grade Calibration Services) (TAC Nos. MA4402, MC4403, and MA4404)," (ADAMS Accession No. ML052710224), September 28, 2005.
- 17.5-7. U.S. NRC, Office of Nuclear Reactor Regulation, Letter of Recognition of ACLASS Accreditation Services, "Reply to Your Letter Dated September 26, 2007, Seeking Agency Assistance in Accepting ACLASS Accreditation Services," (ADAMS Accession No. ML ML073440472), December 19, 2007.

- 17.5-8. U.S. NRC, Office of Nuclear Reactor Regulation, Letter of Recognition of Laboratory Accreditation Bureau (L-A-B), "Reply to Your Letter Dated February 29, 2008, Seeking Assistance in Accepting Laboratory Accreditation Bureau," (ADAMS Accession No ML081140564), April 22, 2008.
- 17.5-9. U.S. NRC, Office of Nuclear Reactor Regulation, Letter of Recognition of International Accreditation Services, "Reply to Your Letter Dated March 3, 2008, Seeking Assistance in Accepting International Accreditation Services, INC," (ADAMS Accession No ML081330253), May 14, 2008.
- 17.5-10. Institute of Electrical and Electronic Engineers (IEEE) Standard 336-1985, "IEEE Standard Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities."
- 17.5-11. Institute of Electrical and Electronic Engineers (IEEE) Standard 498-1985, "IEEE Standard Requirements for the Calibration and Control of Measuring and Test Equipment Used in Nuclear Facilities."
- 17.5-12. Institute of Electrical and Electronic Engineers (IEEE) Standard 603-1980, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations."
- 17.5-13. U.S. NRC, Office of Nuclear Reactor Regulation, Safety Evaluation of the Proposed Change to the Quality Assurance Program, "Approval of Nuclear Management Company Quality Assurance Topical Report," (ADAMS Accession No. ML052360625), August 26, 2005.
- 17.5-14. Nuclear Energy Institute, "Template for Quality Assurance Program Description", NEI 06-14, April 2007.

Chapter 17-Call Outs

QA	RAI
FASR	NQA
ESP	NEI
COLA	ASME
ESBWR	NIST
DCD	NVLAP
NAPS	ILAC
SUP	ALLA
SSAR	ACLACS
FSER	IAS
SER	L-A-B
NRC	MRA
STD	IEEE
QAPD	M&TE
SSCs	NIRMA
DOM	ATWS
SRP	SBO
RG	

18.0 HUMAN FACTORS ENGINEERING

18.1 Introduction

Human Factors Engineering (HFE) describes the human system interface (HSI) design development, the HSI design goals and bases, the standard HSI design features and the detailed HSI design and implementation process, with embedded design acceptance criteria, for the Economic Simplified Boiling-Water Reactor (ESBWR). The incorporation of HFE principles into all phases of the design of these interfaces is also discussed.

18.2 Summary of Application

Chapter 18 of the North Anna 3 Combined License (COL) Final Safety Analysis Report (FSAR) Revision 1 incorporates by reference, with no departures and one supplement, Chapter 18, "Human Factors Engineering" of Revision 5 of the ESBWR Design Control Document (DCD).

In addition, in FSAR Section 18.13, "Human Performance Monitoring," the applicant provided the following supplement information:

COL Item

- STD COL 18.13-1-H Milestone for Human Performance Monitoring (HPM) Implementation.

The COL Holder is responsible to provide a milestone for the implementation of the HPM program. The applicant indicated that an HPM program will be implemented prior to the beginning of the first licensed operator training class.

18.3 Regulatory Basis

The regulatory basis of the information incorporated by reference and the supplemental information presented in this application is addressed in Chapter 18 of the Final Safety Evaluation Report (FSER) related to the ESBWR DCD.

18.4 Technical Evaluation

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed Chapter 18 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information related to HFE.

Chapter 18 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to general HFE program and scope will be documented in the staff safety evaluation report (SER) on the design certification application for the ESBWR design.

¹ See Section 1.2.2, "Finality of Referenced NRC Approvals," for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

The staff reviewed the information contained in the COL FSAR:

COL Item

- COL STD 18.13-1-H Milestone for HPM Implementation.

The applicant stated that an HPM program will be implemented prior to the beginning of the first licensed operator training class.

The ESBWR DCD Revision 5, Section 18.13.3 states the strategy for this COL Holder Item is implemented through the use of a representative training simulator during periodic training exercises.

By implementing the monitoring program at the beginning of the first licensing class, the COL applicant has selected the earliest opportunity subsequent to the completion of the HFE design verification and validation to begin collecting performance information. Senior reactor operator/reactor operator licensing requires the use of a full scope simulator to develop and demonstrate operating competencies. This implements the DCD methodology and ensures simulated design conditions are used to evaluate human performance. Timely initiation of the HPM program using a plant reference simulator provides reasonable assurance that any degradation in performance will be detected and corrected before plant safety is compromised.

18.5 Post Combined License Activities

There are no post COL activities related to this chapter.

18.6 Conclusions

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

The staff is reviewing the information in ESBWR DCD Chapter 18 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to the HFE incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the design certification application for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as Open Item 1-1. The staff will update Chapter 18 of this SER to reflect the final disposition of the DC application.

The NRC staff concludes that the information pertaining to the COL Holder Item has been addressed satisfactorily. The applicant provided an acceptable schedule for implementation of the HPM program, starting with the first license class. The NRC finds that there is a reasonable assurance that any performance degradation will be detected and corrected before plant safety is compromised.

19.0 PROBABILISTIC RISK ASSESSMENT AND SEVERE ACCIDENTS

This chapter describes the plant specific probabilistic risk assessment (PRA) and severe accident evaluations and corresponding regulatory requirements.

19.1 Probabilistic Risk Assessment

This section of the safety evaluation report (SER) provides an integrated review of Sections 19.1, 19.2, 19.4, 19.5 and Appendix 19.AA of the North Anna 3 Combined License (COL) Final Safety Analysis Report (FSAR). These FSAR sections describe the objectives of the design-specific PRA, an overview of the Economic Simplified Boiling-Water Reactor (ESBWR) PRA and a summary of PRA maintenance, and PRA results and insights.

19.1.1 Introduction

In accordance with Title 10 *Code of Federal Regulations* (CFR) 52.79(d)(1), a COL application is required to contain a description of the plant-specific PRA and its results. In addition, if the COL application references a design certification (DC), then the plant-specific PRA information should use the PRA information for the DC and be updated to account for site-specific design information and any design changes or departures.

19.1.2 Summary of Application

Sections 19.1 and 19.4 of the North Anna 3 COL FSAR, incorporate by reference Sections 19.1 and 19.4, of the ESBWR design control document (DCD), Revision 5, with no departures or supplements. The applicant added Appendix 19AA providing a summary of plant specific PRA review. Sections 19.2 and 19.5 of the COL FSAR incorporate by reference Section 19.2 and 19.5 of the ESBWR DCD, Revision 5, with no departures and the following supplemental information:

- COL Item STD COL 19.2.6-1-H Seismic High Confidence Low Probability of Failure Margins

In FSAR Section 19.2.3.2.4, the applicant provided supplementary information to address DCD COL Item 19.2.6-1-H. The applicant stated that an analysis of as-built structure, system, and component (SSC) high confidence low probability of failure (HCLPF) will be performed prior to fuel load and will be compared to those assumed in the ESBWR seismic margin analysis to determine if any new vulnerabilities have been introduced.

Supplemental Information

- NAPS SUP 19.5-1

In FSAR Section 19.5 and Appendix 19AA, the applicant provided supplementary information (NAPS SUP 19.5-1) which describes the results of its evaluation of site-specific information, plant-specific information, design changes or departures from the certified design, to determine if any changes from the certified design PRA are warranted.

19.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the final safety evaluation report (FSER) related to the DCD [9-4].

The regulatory basis for acceptance of the supplementary information on consideration of site-specific and plant-specific information and design features is established in 10 CFR 52.79(d)(1), which requires: (1) a COL applicant referencing a certified design to include, in the FSAR, information sufficient to demonstrate that the site characteristics fall within the site parameters specified in the design certification, and (2) that plant-specific PRA information in a COL application that references a standard design certification must use the PRA information from the design certification and must be updated to account for site-specific design information and any design changes or departures.

Consistent with 10 CFR 50.71(h), each COL holder shall maintain and upgrade the PRA. The upgraded PRA must cover initiating events and modes of operation contained in NRC-endorsed consensus standards on PRA in effect one year prior to each required upgrade.

19.1.4 Technical Evaluation

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed Sections 19.1, 19.2, 19.4, and 19.5 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information related to PRA. Sections 19.1, 19.2, 19.4, and 19.5 of ESBWR DCD are being reviewed by the staff on Docket No. 52-010. The NRC staff's evaluation of the information incorporated by reference related to these sections will be documented in the staff SER on the design certification application for the ESBWR design.

In addition, the NRC staff reviewed Parts 4 and 7 of the North Anna 3 COL FSAR which includes the Technical Specifications and Departures Report, respectively. The NRC staff has determined from this review that the applicant has not taken any departures from the Certified ESBWR design and that the ESBWR Generic Technical Specifications (GTS) and Bases of the referenced certified design are incorporated by reference into the Unit 3 plant specific technical specifications with only minor modifications that would not impact the ESBWR design specific PRA.

The staff reviewed the information contained in the COL FSAR:

COL Item

- STD COL 19.2.6-1-H Seismic High Confidence Low Probability of Failure Margins

The applicant provided the following supplementary information to address DCD COL Item 19.2.6-1-H:

¹ See Section 1.2.2, "Finality of Referenced NRC Approvals," for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

“As-built SSC HCLPF will be compared to those assumed in the ESBWR seismic margin analysis shown in DCD Table 19.2-4. Deviations from the HCLPF values or other assumptions in the seismic margins evaluation will be analyzed to determine if any new vulnerabilities have been introduced. A minimum HCLPF value of 1.67*SSE will be met for the SSCs identified in DCD Table 19.2-4. This comparison and analysis will be completed prior to fuel load.”

This Holder item is described in ESBWR DCD Tier 2, Section 19.2.6, Revision 5. In the response to the request for additional information (RAI) 19.2-92 for Chapter 19 of ESBWR DCD Tier 2, General Electric-Hitachi (GEH) revised DCD Table 19.2-4 to clarify that the safe shutdown earthquake for HCLPF values is the ESBWR certified seismic design response spectrum (CSDRS). Therefore, the staff considers that the COL Holder will confirm the HCLPFs for SSCs in DCD Table 19.2-4 with respect to ESBWR CSDRS.

Supplemental Information

- NAPS SUP 19.5-1

In Section 19.5 of the FSAR, the applicant stated the following in support of the assertion that the requirement of 10 CFR 52.79(a)(46) for a description of the plant-specific PRA and its results has been met: “The review of site-specific information and plant-specific design information determined that: 1) the DCD PRA bounds site-specific, and plant-specific design parameters and design features and 2) these parameters and features have no significant impact on the DCD PRA results and insights.” In order to confirm the validity of the applicant’s assertion, the staff issued RAI Questions 19-1 and 19-2 requesting the applicant provide additional information regarding the site-specific and plant-specific design parameters and design features, and explain how the site-specific and plant-specific design parameters and design features were bounded by the DCD PRA. The applicant responded to these questions in their letter dated July 14, 2008 and numbered 005. In their response to the staff, the applicant described the key site-specific parameters and features considered in their evaluation and provided a summary of the evaluation for each specific parameter or feature.

The parameters and features evaluated by the applicant include:

- Loss of service water frequency
- Loss of preferred power frequency
- Loss of service water frequency
- Plant-specific flooding zones of the yard and service water building
- Seismic fragilities
- Site-specific terrain and meteorological data
- Sharing of systems with other facilities on the site (i.e., nuclear units 1 & 2)
- Plant-specific procedures for outage planning and control

The staff finds this list of parameters and features to be complete given that the applicant has not taken any departures from the Certified ESBWR design and that the ESBWR GTS and Bases of the referenced certified design are incorporated by reference into the Unit 3 plant specific technical specifications with only minor modifications that would not impact the ESBWR design specific PRA.

The applicant incorporated a summary of the evaluation into Chapter 19, Appendix AA of the FSAR. In their evaluation the applicant considers the extent to which the treatment in the DCD

of each parameter or feature is at variance with the corresponding parameter or feature. The staff finds that the information in the evaluation is sufficient to support the conclusion that differences between site specific parameters and features and assumptions in the DCD are small and do not invalidate the applicant's reference of the DCD PRA results and insights provided in Chapter 19 of the ESBWR DCD. The staff finds the applicant's evaluation as summarized in Appendix AA of Chapter 19 of the FSAR to be acceptable.

19.1.5 Post Combined License Activities

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

- 19.2.6-1-H Seismic High Confidence Low Probability of Failure Margins

19.1.6 Conclusion

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

The staff is reviewing the information in ESBWR DCD Sections 19.1, 19.2, 19.4, and 19.5 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to the PRA incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the design certification application (DCA) for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as Open Item 1-1. The staff will update Section 19.1 of this SER to reflect the final disposition of the DCA.

In addition, the staff has compared the additional COL information within the application to the relevant NRC regulations. The regulatory basis for acceptance of the supplementary information on consideration of site-specific and plant-specific information and design features is established in 10 CFR 52.79(d)(1). The staff cannot make a conclusion on this section until the resolution of Open Item 1-1.

19.2 Severe Accident Evaluation

The regulations do not require that a COL application include a SAMA evaluation. It is, however, required to be in the Environmental Report. 10 CFR 52.79(a)(17) states that a COL application for a LWR must contain a FSAR that provides the information with respect to compliance with technically relevant positions of the relevant TMI requirements in 10 CFR 50.34(f). This material is included in Appendix 1A and Chapter 19 of the ESBWR DC D Tier 2, which has been incorporated by reference in the North Anna COL application.

This section of SER provides the staff's review of Section 19.3 of the North Anna 3 COL FSAR.

19.2.1 Introduction

This section provides the NRC staff's evaluation of the following topics related to severe accident evaluation in the North Anna 3 COL FSAR and Environmental Report [19-5]:

- a. Severe accident prevention,
- b. Severe accident mitigation,

- c. Containment performance capability,
- d. Accident management, and
- e. Consideration of potential design improvements under 10 CFR 50.34(f) [19-6].

19.2.2 Summary of Application

Sections 19.3 of the North Anna 3 COL FSAR, incorporates by reference Sections 19.3, of the ESBWR DCD, Revision 5 with no departures or supplements.

In the COL FSAR Chapter 18, Human Factors Engineering, the applicant incorporated by reference Section 18.1 of the ESBWR DCD with no departures or supplements. This section of the ESBWR DCD addresses accident management.

The applicant addresses consideration of potential design improvements under 10 CFR 50.34(f) in Section 7.3 (“Severe Accident Mitigation Alternatives”) of the North Anna, Unit 3 COL Environmental Report [19-5]. Section 7.3 addresses severe accident mitigation alternatives (SAMA) based on the ESBWR's severe accident mitigation design alternatives (SAMDA) [19-7] and North Anna's site and regional data.

19.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the DCD [19-4].

The regulatory basis also includes the requirements of 10 CFR 52.79(a)(17) for a COL application [19-8]. This regulation invokes 10 CFR 50.34(f)(1)(i) which requires applicants to “perform a plant/site-specific probabilistic risk assessment (PRA), the aim of which is to seek such improvements in the reliability of core and containment heat removal systems as are significant and practical and do not impact excessively on the plant.”

19.2.4 Technical Evaluation

19.2.4.1 *Severe Accident Prevention, Severe Accident Mitigation, and Containment Performance Capability*

Sections 19.3, 19B, and 19C of the North Anna, Unit 3 COL FSAR incorporate by reference, without any departures, Sections 19.3, 19B, and 19C, respectively, of the ESBWR DCD [19-3]. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. The NRC staff's review confirmed there is no outstanding issues related to these sections.

The staff is reviewing the information in ESBWR DCD Sections 19.3, 19B, and 19C on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to severe accident prevention, severe accident mitigation, and containment performance capability 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 this is being tracked as part of Open Item 1-1. The staff will update Section 19.2 of this SER to reflect the final disposition of the DCA.

19.2.4.2 Accident Management

The staff is reviewing the information in the ESBWR DCD related to accident management on Docket No. 52-010. In particular, the staff's ongoing safety evaluation of the ESBWR DCD has an open item related to providing the technical basis for accident management. Resolution of this open item may lead to a revision to the North Anna, Unit 3 COL application, to ensure that the present applicant will develop procedures according to the ESBWR Human Factors Engineering Procedures Development Implementation Plan (NEDO-33274, Revision 2) that include the technical basis. In addition, the present applicant must ensure that accident management training will be implemented according to the ESBWR Human Factors Engineering Training Implementation Plan (NEDO-33275, Revision 1). These documents are being evaluated by the NRC staff as part of the Chapter 18 review. ITAACs 7 and 8 in Table 3.3-1 of the ESBWR DCD Tier 1, will ensure that the severe accident management technical basis will be incorporated into the severe accident management guideline procedures prior to operation of North Anna, Unit 3.

The results of the NRC staff's technical evaluation of the information related to accident management incorporated by reference in the North Anna, Unit 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 this is being tracked as part of Open Item 1-1. The staff will update Section 19.2 of this SER to reflect the final disposition of the DCA.

19.2.4.3 Consideration of Potential Design Improvements Required by 10 CFR 50.34(f)

The applicant has submitted a Level 1 and Level 2 PRA, most of which has been incorporated by reference to Chapter 19 of the ESBWR DCD, which in turn references the ESBWR PRA. This PRA has estimated significant reductions in risk relative to the currently operating BWRs, reflecting improvements in the reliability of core and containment heat removal systems.

Candidate design improvements were evaluated in the ESBWR SAMDA analysis in the ER.

The ESBWR SAMDA analysis [19-7] is being reviewed by the NRC staff as part of the ESBWR design certification review (Docket No. 52-010). The results of the NRC staff's technical evaluation of the information related to ESBWR SAMDA analysis will be documented in the staff SER safety evaluation report on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 19.2 of this SER to reflect the final disposition of the ESBWR SAMDA analysis, and this is being tracked as part of Open Item 1-1.

19.2.5 Post Combined License Activities

There are no post COL activities related to this section.

19.2.6 Conclusions

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information and there is no outstanding information expected to be addressed in the COL FSAR related to severe accident prevention, severe accident mitigation, containment performance capability, accident management and consideration of potential design improvements under 10 CFR 50.34(f).

The staff is reviewing the information in ESBWR DCD related to severe accident evaluation on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to severe accident evaluation incorporated by reference in the North Anna 3 COL FSAR and Environmental Report will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item 1-1. The staff will update Section 19.2 of this SER to reflect the final disposition of the DCA.

19A Regulatory Treatment of Non-Safety Systems

This section provides the selection criteria and processes used to develop the regulatory treatment of non-safety systems (RTNSS).

Section 19A of the North Anna 3 COL FSAR incorporates by reference Section 19A of the ESBWR DCD, Revision 5 without any departures or supplements. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. The NRC staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 19A on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to RTNSS 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 this is being tracked as part of Open Item 1-1. The staff will update Section 19A of this SER to reflect the final disposition of the DCA.

19B Deterministic Analysis for Containment Pressure Capability

This section provides the selection criteria and processes used to develop the evaluation of external seismic event. This section includes the deterministic analysis for containment pressure capability.

Section 19B of the North Anna 3 COL FSAR, incorporates by reference Section 19B of the ESBWR DCD, Revision 5 without any departures or supplements. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. The NRC staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 19B on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to RTNSS 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 this is being tracked as part of Open Item 1-1. The staff will update Section 19B of this SER to reflect the final disposition of the DCA.

19C Probabilistic Analysis for Containment Pressure Fragility

This section provides the selection criteria and processes used to develop the evaluation of external seismic event. This section includes the probabilistic analysis for containment pressure fragility.

Section 19C of the North Anna 3 COL FSAR, incorporates by reference Section 19C of the ESBWR DCD, Revision 5 without any departures or supplements. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. The NRC staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in DCD Section 19C on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to RTNSS 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 this is being tracked as part of Open Item 1-1. The staff will update Section 19C of this SER to reflect the final disposition of the DCA.

REFERENCES

- 19-1. SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," U.S. Nuclear Regulatory Commission, April 2, 1993 (SRM dated July 21, 1993).
- 19-2. Dominion, "North Anna 3 Combined License Application, Part 2: Final Safety Analysis Report," Revision 1, December 2008.
- 19-3. GE-Hitachi Nuclear Energy, "ESBWR Design Control Document," Revision 5, May 2008.
- 19-4. Dominion, "North Anna 3 Combined License Application, Part 3: Applicants' Environmental Report - Combined License Stage," Revision 1, December 2008.
- 19-5. Title 10, Part 50, "Domestic Licensing of Production and Utilization Facilities," of the Code of Federal Regulations, Section 34, "Contents of Construction Permit and Operating License Applications; Technical Information," U.S. Nuclear Regulatory Commission.
- 19-6. NEDO-33306, "Licensing Topical Report ESBWR Severe Accident Mitigation Design Alternatives," Revision 1, GE-Hitachi Nuclear Energy, August 2007.
- 19-7. Title 10, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," of the *Code of Federal Regulations*, Section 79, "Contents of Applications; Technical Information in Final Safety Analysis Report," U.S. Nuclear Regulatory Commission.
- 19-8. NEI 91-04, "Severe Accident Issue Closure Guidelines," Revision 1, Nuclear Energy Institute, Report NEI 91-04, 1994.
- 19-9. Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," U.S. Nuclear Regulatory Commission, June 2007.
- 19-10. NEDE-33217P, Class III (Proprietary) and NEDO-33217, Class I (non-proprietary), "ESBWR Man-Machine Interface System and Human Factors Engineering Implementation Plan," Revision 3, GE Energy, March 2007.

19-11. "Response to Portion of NRC Request for Additional Information Letter No. 121 Related to ESBWR Design Certification Application - PRA & Severe Accidents - RAI Number 19.2.4-1 Supplement 2," GE Hitachi Nuclear Energy, MFN 05-169, Supplement 3, April 3, 2008, Docket No. 52-010.