

9.0 AUXILIARY SYSTEMS

9.1 Fuel Storage and Handling

9.1.1 New Fuel Storage

Section 9.1.1 of the North Anna 3 Combined License (COL) Final Safety Analysis Report (FSAR) incorporates by reference, with no departures or supplements, Section 9.1.1, “New Fuel Storage” of Revision 5 of the Economic Simplified Boiling-Water Reactor (ESBWR) Design Control Document (DCD). The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.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 9.1.1 on Docket No. 52-010. The results of the NRC staff’s technical evaluation of New Fuel Storage incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff safety evaluation report (SER) on the design certification application (DCA) for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.1.1 of this SER to reflect the final disposition of the DCA.

9.1.2 Spent Fuel Storage

Section 9.1.2 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.1.2, “Spent Fuel Storage” of Revision 5 of the ESBWR DCD. The 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 9.1.2 on Docket No. 52-010. The results of the NRC staff’s technical evaluation of Spent Fuel Storage 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 9.1.2 of this SER to reflect the final disposition of the DCA.

9.1.3 Spent Fuel Cooling and Cleanup System

Section 9.1.3 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.1.3, “Spent Fuel Cooling and Cleanup System” of Revision 5 of the ESBWR DCD. The 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 9.1.3 on Docket No. 52-010. The results of the NRC staff’s technical evaluation of the Spent Fuel Cooling and Cleanup System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being

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.

tracked as part of Open Item [1-1]. The staff will update Section 9.1.3 of this SER to reflect the final disposition of the DCA.

9.1.4 Light Load Handling System (Related to Refueling)

9.1.4.1 Introduction

This section of the North Anna 3 COL FSAR addresses the light load handling system which is used to handle the spent fuel assemblies underwater from the time they leave the reactor vessel until they are placed in a container for shipment from the site. Characteristics of the system are aimed at avoiding criticality accidents, radioactivity releases resulting from damage to irradiated fuel, and unacceptable personnel radiation exposure.

9.1.4.2 Summary of Application

Section 9.1.4 of the North Anna 3 COL FSAR incorporates by reference Section 9.1.4 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.1.4, the applicant provided the following:

COL Item

- STD COL 9.1.4-A Fuel Handling Operations

The applicant provided additional information in STD COL 9.1.4-A to address DCD COL Item 9.1.4-A. The applicant described the scope of the fuel handling procedures and procedures for equipment used to move fuel. The applicant states that these procedures will be developed six months before fuel receipt. The applicant states that the fuel handling equipment is inspected for operating conditions before each refueling and that a quality assurance (QA) program is applied to monitoring, implementing and assuring compliance with fuel handling procedures. The QA program is described in Section 17.5 of the COL FSAR.

9.1.4.3 Regulatory Basis

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

In addition, the relevant requirements of the Commission regulations for the fuel handling operations and the associated acceptance criteria are given in Section 9.1.4 of NUREG-0800.

The applicable regulatory requirements for fuel handling operations are as follows:

- GDC 61 of Appendix A to 10 CFR Part 50

9.1.4.4 Technical Evaluation

The NRC staff reviewed Section 9.1.4 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 The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the Light Load Handling System (Related to

Refueling).

Section 9.1.4 of the 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 the Light Load Handling System (Related to Refueling) will be documented in the staff SER on the DCA application for the ESBWR.

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

COL Items

• STD COL 9.1.4-A Fuel Handling Operations

The NRC staff reviewed STD COL 9.1.4-A related to the fuel handling operations included under Section 9.1.4 of the North Anna 3 COL FSAR. DCD COL Item 9.1.4-A in Section 9.1.6, "COL Information," of the ESBWR DCD, Revision 5, states that the applicant will provide a description of programs that address the following:

- Fuel handling procedures
- Maintenance manuals and procedures for equipment used to move fuel
- Equipment inspection and test plans for equipment used to move fuel
- Personnel qualifications, training, and control programs for fuel handling personnel
- [Quality Assurance] QA programs to monitor, implement, and assure compliance to fuel handling operations

In FSAR Section 9.1.4.13, "Refueling Operations," and FSAR Section 9.1.4.19, "Inspection and Testing Requirements," the applicant addressed DCD COL Item 9.1.4-A in STD COL 9.1.4-A. The applicant added a paragraph in FSAR Section 9.1.4.13 identifying the general subject matter of fuel handling procedures that will be developed. The program described by the applicant in FSAR Section 9.1.4.13 provide procedures for fuel handling, inspection and testing of fuel handling equipment in adequate time to support training and qualification of fuel handling personnel. These procedures will be completed six months prior to fuel load. In further response to DCD COL Item 9.1.4-A (STD COL 9.1.4-A), the applicant states that qualifications, training and the control programs for fuel handling personnel are addressed in FSAR Section 13.2, "Training." In request for additional information (RAI) 09.01.04-1, the staff asked the applicant to clarify how FSAR Section 13.2 addresses personnel qualification and training for fuel handlers. In their response dated August 4, 2008, the applicant stated that FSAR Section 13.2 refers to Appendix 13BB, "Training Program," which incorporates by reference Nuclear Energy Institute (NEI) 06-13A, "Template for an Industry Training Program Description." On December 5, 2008, the NRC endorsed NEI 06-13A, "Template for an Industry Training Program Description," Revision 1, as an acceptable template for describing reactor operator (RO) and non-licensed plant staff training programs for COL applications. The staff finds that the applicant has adequately addressed training and qualification of fuel handlers. Therefore, RAI 09.01.04-1 is resolved.

Also in response to DCD COL Item 9.1.4-A, the applicant revised Section 9.1.4.19 of the FSAR to identify that the QA program described in FSAR Section 17.5, "Quality Assurance Program

Description-Design Certification, Early Site Permits, and New License Applicants,” will monitor, implement and assure compliance with fuel handling procedures. The applicant also states that fuel handling equipment is inspected prior to each refueling. In RAI 09.01.04-2, the staff asked the applicant to clarify how testing and inspection before each refueling operation ensures that safety features and interlocks perform satisfactorily and prevent excessive personnel radiation exposure and fuel damage, in keeping with the requirements of General Design Criterion (GDC) 61, “Fuel storage and handling and radioactivity control.” In their response dated August 4, 2008, the applicant stated that the fuel handling procedures required by FSAR Section 9.1.4.13 include checking the status of interlocks. The interlocks for the refueling machine and the fuel handling machine are specified in ESBWR DCD Section 9.1.4.5, “Refueling Equipment.” Additionally, the applicant stated that the ESBWR DCD Technical Specifications (TS) includes TS 3.9.1, “Refueling Equipment Interlocks,” which prevent operation of the refueling equipment with fuel loaded over the core whenever any control rod is withdrawn, and prevent control rod withdrawal whenever fuel-loaded refueling equipment is over the core. The staff finds that the applicant’s response to RAI Standard Review Plan (SRP) Section 9.1.4-SBPB-02 is satisfactory and clarifies the applicant’s response in STD COL 9.1.4-A to DCD COL Item 9.1.4-A. Therefore, RAI 09.01.04-2 is resolved.

9.1.4.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.1.4.6 *Conclusions*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff’s review confirmed that the applicant addressed the relevant information relating to the Light Load Handling System (Related to Refueling) 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 the DCD Section 9.1.4 on Docket No. 52-010. The results of the NRC’s staff’s technical evaluation of the information related to the Light Load Handling System (Related to Refueling) 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 9.1.4 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR is acceptable and meets the requirements of GDC 61. The staff has evaluated STD COL 9.1.4-A provided by the applicant in the North Anna FSAR in response to the DCD COL Item 9.1.4-A from the ESBWR DCD. The staff evaluated STD COL 9.1.4-A to the relevant NRC regulations and acceptance criteria defined in NUREG-0800 Section 9.1.4 and finds that the applicant has satisfactorily addressed DCD COL Item 9.1.4-A.

9.1.5 *Overhead Heavy Load Handling System*

9.1.5.1 *Introduction*

This section of the North Anna 3 COL FSAR addresses the overhead heavy load handling systems which are used to lift loads whose weight is greater than the combined weight of a single spent fuel assembly and its handling device. The principal equipment is the fuel building (FB) crane and reactor building (RB) crane. The overhead heavy load handling system is

designed to ensure that inadvertent operations or equipment malfunctions, separately or in combination, will not cause a release of radioactivity, a criticality accident, inability to cool fuel within the reactor vessel or spent fuel pool (SFP), or prevent safe shutdown of the reactor.

9.1.5.2 Summary of Application

Section 9.1.5 of the North Anna 3 COL FSAR Revision 1 incorporates by reference Section 9.1.5 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.1.5, the applicant provided the following:

COL Items

- STD COL 9.1-5-A Handling of Heavy Loads

The applicant provided additional information in STD COL 9.1-5-A to address DCD COL Item 9.1-5-A. The applicant described the scope of the heavy load handling procedures. The applicant stated that they will be developed prior to fuel load. The applicant stated that the fuel handling equipment is inspected for operating conditions before each refueling. The applicant described the criteria for inspection of special lifting devices and the inspection and testing of cranes. The applicant described the training and qualification standard for crane operators and the application of specific quality program controls for heavy load handling. The QA program is described in Section 17.5 of the COL FSAR.

9.1.5.3 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 heavy load handling procedures and the associated acceptance criteria are given in Section 9.1.5 of NUREG-0800.

The applicable regulatory requirements for heavy load handling procedures are as follows:

- GDC 1 of Appendix A to 10 CFR Part 50

9.1.5.4 Technical Evaluation

The NRC staff reviewed Section 9.1.5 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 relevant information related to the Overhead Heavy Load Handling System.

Section 9.1.5 of the 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 the Overhead Heavy Load Handling System will be documented in the staff SER on the DCA for the ESBWR.

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

COL Items

- STD COL 9.1-5-A Handling of Heavy Loads

The NRC staff reviewed STD COL 9.1-5-A related to the handling of heavy loads included under Section 9.1.5 of the North Anna 3 COL FSAR. DCD COL Item 9.1-5-A in Section 9.1.6, "COL Information," of the ESBWR DCD Revision 5 states that the applicant will provide a description of the program governing heavy loads handling, and the schedule for implementation, that addresses the following:

- Heavy loads and heavy load handling equipment outside the scope of loads described in the referenced certified design and the associated heavy load attributes (load weight and typical load path)
- Requirements for heavy load handling safe load paths and routing plans including descriptions of automatic and manual interlocks not described in the referenced certified design and safety devices and procedures to assure safe load path compliance
- Summary description of requirements to develop heavy load handling equipment maintenance manuals and procedures
- Requirements for heavy load handling equipment inspection and test plans
- Requirements for heavy load personnel qualifications, training, and control programs
- QA program requirements to monitor, implement, and ensure compliance with the heavy load handling program

In FSAR Sections 9.1.5.6, "Other Overhead Load Handling Systems," 9.1.5.8, "Operational Responsibilities", and 9.1.5.9, "Safety Evaluations," the applicant addressed ESBWR DCD COL Item 9.1-5-A in STD COL 9.1-5-A. The portion of the DCD COL Item asking for inspection and test plans for heavy load handling equipment is addressed by the addition of two new paragraphs in Section 9.1.5.6, titled "Special Lifting Devices" and "Other Lifting Devices" and one new paragraph in Section 9.1.5.8, titled "Inspection and Testing." The "Special Lifting Devices" paragraph describes the inspection and test plans for special lifting devices. Special lifting devices are specifically designed lifting equipment for loads of greater than 4500 kg (10,000 lbs.) and are designed and constructed in accordance with American National Standards Institute (ANSI) N14.6, "Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More."

North Anna (applicant) took exception to the acceptance criteria in the standard and proposed visual criteria of no cracks in place of the nondestructive examination (NDE) requirements specified. Additionally, for the Dryer/Separator Strongback, the applicant took exception to the NDE of load bearing welds every five refuelings. Instead the applicant proposed visual and dimensional examinations prior to the initial lift each outage. In the "Other Lifting Devices" paragraph, the applicant identifies ANSI B30.9, "Slings," as the industry standard for testing and inspection requirements for slings used for heavy loads. In addition, the applicant also identified a change to the load rating criteria for slings used for heavy lifts, which are addressed by ANSI B30.9, and NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." Section 5.1.1(5) of NUREG-0612 discusses the use of both the static and maximum dynamic load to determine

the proper size and rating of slings. The applicant proposes to exclude dynamic loads for sizing of slings.

The applicant did not provide any justification for these exceptions, so in RAI 09.01.05-1, the staff asked the applicant to provide their justification. In their response to RAI 09.01.05-1 dated August 4, 2008, the applicant changed "STD COL 9.1.6-5" to "STD COL 9.1-5-A." In STD 9.1-5-A, the applicant removed all exceptions to the guidelines specified in ANSI N14.6 for special lifting devices and revised their FSAR to state that, "Testing and inspection of special lifting devices follow the guidelines of ANSI N14.6." The applicant also removed their proposal to exclude dynamic loads for sizing of slings and revised their FSAR to state that, "Slings used for heavy load lifts meet the requirements specified for slings in ANSI B30.9 and the guidance specified in NUREG-0612, Section 5.1.1(5)." The staff finds these changes consistent with the guidelines of SRP Section 9.1.5, thus these changes are acceptable and RAI 09.01.05-1 is resolved.

Special lifting devices and slings used for critical load handling have specific guidelines in SRP Section 9.1.5.III.4.C.ii and NUREG-0612, Section 5.1.6. These guidance documents state the following:

- Special lifting devices used for critical load handling should satisfy the criteria of ANSI N 14.6, but should also have: a) dual, independent load paths, or b) a single load path with twice the design safety factor specified in ANSI N14.6.
- Slings used for critical load handling should satisfy the criteria of American Society of Mechanical Engineers (ASME) B30.9 and should be constructed of metallic material. The slings should be configured to either a) provide dual or redundant load paths or b) support a load twice the weight of the critical load.

This guideline is stated in SRP Section 9.1.5 based on NUREG-1774, "A Survey of Crane Operating Experience at U.S. Nuclear Power Plants from 1968 through 2002." NUREG-1774 documented several failures of lifting devices made of Kevlar due to fraying at load concentration areas. These handling guidelines are currently under review for incorporation into the ESBWR DCD and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.1.5 of this SER to reflect the final disposition of the DCA.

Additionally, in response to STD COL Item 9.1-5-A, the applicant replaced the information in ESBWR DCD section 9.1.5.8 with a revised FSAR Section 9.1.5.8, "Operational Responsibilities," that includes a new "Inspection and Testing" paragraph. In this paragraph, the applicant references ANSI B30.2, "Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)," B30.11, "Monorails and Underhung Cranes," and B30.16, "Performance Standards for Air Wire Rope Hoists" as the applicable standards for crane testing and inspection.

In accordance with DCD COL Item 9.1-5-A, the COL applicant will provide a description of the program that provides procedures for heavy load handling equipment and heavy load handling safe load paths and routing plans, and the schedule for implementation. The new "Procedures" paragraph in FSAR Section 9.1.5.8, Operational Responsibilities," describes the development of procedures for control of heavy loads and states that the procedures will be developed in sufficient time to allow for NRC review. FSAR Table 13.5-202, "Nominal Procedure Development Schedule," identifies a milestone of 6 months before fuel receipt for development of crane operation procedures. Section 9.1.5.8 also identifies the development of procedures

and processes for safe load paths and routing plans for heavy loads. This section specifies the identification of safe load paths and compensatory measures for loads that must be moved over the reactor vessel, SFP or safe shutdown equipment. Supervisory involvement is also required during heavy load movements to ensure procedural compliance.

Also in response to DCD COL Item 9.1-5-A, the applicant revised Section 9.1.5.8 of the FSAR to identify that the QA program described in Section 17.5, "Quality Assurance Program Description-Design Certification, Early Site Permits, and New License Applicants," is applicable to the heavy loads handling program.

The applicant stated that no heavy loads are identified that are outside the scope of the certified design. ESBWR DCD COL Item 9.1-5-A asks the COL applicant to provide a description of heavy load handling equipment outside the scope of the referenced certified design. DCD COL Item 9.1-5-A also asks the applicant to provide a description of automatic and manual interlocks not described in the reference certified design. The applicant's response in STD COL 9.1-5-A did not provide this information. In RAI 09.01.05-02, the staff requested that the applicant provide this information. In their response to RAI 09.01.05-02 dated August 4, 2008, the applicant stated that there are neither heavy load handling equipment nor interlocks associated with heavy load handling equipment that are outside the scope of the certified design. Therefore, RAI 09.01.05-02 is resolved.

The applicant stated that operators will be trained and qualified to meet the requirements of ANSI B30.2.

The staff believes that Tier 1 information for the overhead load handling system should include features and functions that could have a significant effect on the safety of a nuclear plant or are important in preventing or mitigating severe accidents. A drop of the reactor vessel head or a spent fuel cask could affect plant safety. Therefore, design features that reduce the risk and/or analyses that provide assurance of safety after a dropped load are important to safety. The staff considers "single failure proof" design criteria for the RB crane and the FB crane as Tier 1 safety significant design criteria and should be included in Tier 1 and Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). This design criteria and ITAAC are currently under review for incorporation into the ESBWR DCD and are being tracked as part of Open Item [1-1]. The staff will update Section 9.1.5 of this SER to reflect the final disposition of the DCA.

9.1.5.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.1.5.6 *Conclusions*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the Overhead Heavy Load Handling System 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 the DCD Section 9.1.5 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the Overhead Heavy Load Handling System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet

complete and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.1.5 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR is acceptable and meets the requirements of GDC 1. The staff based this conclusion on the above technical evaluations of the relevant information given in response to the COL Items, STD COL 9.1-5-A.

9.2 Water Systems

9.2.1 Plant Service Water System

9.2.1.1 *Introduction*

This section of the North Anna 3 COL FSAR describes the plant service water system (PSWS) for North Anna Unit 3. The system is designed to transfer heat from non-safety-related components in the Reactor and Turbine Buildings to the environment. The PSWS consists of two independent and fully redundant open trains that continuously recirculate raw water through the reactor component cooling water system (RCCWS) and turbine component cooling water system heat exchangers. The source of cooling water for the PSWS is the Auxiliary Heat Sink (AHS), and the heat removed is rejected back to the AHS. The AHS for North Anna 3 consists of mechanical draft plume abated cooling towers. The PSWS is a non-safety-related system that provides defense-in-depth decay heat removal during normal plant operating and transient conditions. Also, as discussed in ESBWR DCD Section 19A, "Regulatory Treatment of Non-Safety Systems," the PSWS is subject to regulatory treatment of non-safety systems (RTNSS) based on RTNSS Criterion C considerations.

9.2.1.2 *Summary of Application*

Section 9.2.1 of the North Anna 3 COL FSAR Revision 1 incorporates by reference Section 9.2.1 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.2.1 the applicant provided the following:

COL Item

- NAPS COL 9.2.1-1-A Material Selection

The applicant provided additional information in North Anna Power Station (NAPS) COL 9.2.1-1-A to address DCD COL Item 9.2.1-1-A. The applicant selected fiberglass reinforced polyester pipe (FRPP) for the buried portion of the PSWS to preclude long term corrosion. The applicant also stated that appropriate chemical treatment is added to the PSWS basin to preclude long term corrosion and fouling of the PSWS.

Site Specific Information Replacing Conceptual Design Information

- NAPS CDI System Description

The applicant provided additional information to replace conceptual design information (CDI) contained in the ESBWR DCD. The applicant eliminated the interconnection of the PSWS to the normal power heat sink. The North Anna PSWS rejects heat only through the AHS

mechanical draft cooling towers. The applicant provided Figure 9.2-201, "Plant Service Water System Simplified Diagram," depicting the PSWS.

- NAPS CDI PSWS Component Design Characteristics

The applicant provided additional information in Table 9.2-201 to replace CDI in the ESBWR DCD. The applicant provided site specific temperature parameters and the heat load for the cooling tower design.

Supplemental Information

- NAPS SUP 9.2.1-1 Basin Reserve Storage Capacity

The applicant provided the following supplemental information. The PSWS cooling tower basin reserve water storage capacity is 2.6 million gallons, which is needed to provide heat removal capability for seven days without active makeup.

Interface Requirement

Section 4.1, "Plant Service Water System," of the ESBWR DCD Tier 1 information specifies as an interface requirement that the PSWS plant-specific heat rejection facilities must be capable of supporting the post-72-hour cooling function of the PSWS.

9.2.1.3 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 PSWS and the associated acceptance criteria are given in Section 9.2.1, "Station Service Water System," of NUREG-0800.

The applicable regulatory requirements for the PSWS are as follows:

- GDC 2 of Appendix A to 10 CFR Part 50.
- GDC 4, 44, 45, and 46 of Appendix A to 10 CFR Part 50 used as guidance

9.2.1.4 Technical Evaluation

The NRC staff reviewed Section 9.2.1 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL 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 relevant information related to the PSWS.

Section 9.2.1 of the 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 the PSWS will be documented in the staff SER on the DCA for the ESBWR.

As discussed in the Introduction Section, the PSWS is a non-safety-related system that provides defense-in-depth decay heat removal capability and is subject to RTNSS based upon risk considerations (i.e., RTNSS Criterion C). The staff's evaluation of plant-specific PSWS considerations for the ESBWR design focuses primarily on confirming the capability of the PSWS to perform its defense-in-depth and RTNSS functions; confirming that the PSWS will not adversely impact safety-related structures, systems and components (SSCs); and confirming that ITAAC, test program specifications, and RTNSS availability controls for PSWS are appropriate.

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

COL Item

• NAPS COL 9.2.1-1-A Material Selection

The NRC staff reviewed NAPS COL 9.2.1-1-A related to the underground piping material selection under Section 9.2.1 of the North Anna 3 COL FSAR. In accordance with DCD Tier 2, Section 9.2.1.6, "COL Information," the COL applicant needs to determine PSWS material selections and provide provisions to preclude long-term corrosion and fouling based on site water quality analysis (DCD Tier 2, Subsection 9.2.1.2, "System Description"). The applicant addressed this COL information item by including the following plant-specific information in Section 9.2.1.2 of the North Anna 3 FSAR: "Fiberglass reinforced polyester pipe is used for buried PSWS piping to preclude long-term corrosion. Appropriate chemical treatment is added to the PSWS basin to preclude long-term corrosion and fouling of the PSWS based on site water quality analysis."

As discussed above in the Introduction section, the PSWS provides defense-in-depth decay heat removal capability and is designated as RTNSS Criterion. While defense-in-depth and RTNSS Criterion C SSCs do not require the same level of treatment as safety-related SSCs (e.g., wind, flood, and seismic capability), specifications and limitations for using FRPP should be described in the FSAR to properly document the plant design basis. The specifications and limitations should assure that FRPP is capable of withstanding operating conditions and dynamic effects that are expected to occur periodically (such as temperature extremes and water hammer). Additionally, consistent with the Commission's policy on RTNSS, the impact of using FRPP on reliability and availability assumptions need to be addressed especially with respect to common cause failure considerations. Finally, the effects of using FRPP on the consequences of pipe failure during seismic events (such as flood effects) need to be addressed in accordance with GDC 2 requirements. The staff asked the applicant in RAI 9.2.1-02 to provide additional information to address these considerations and to update the FSAR accordingly. The staff reviewed the applicant's response dated August 28, 2008, and determined the following:

1. With respect to criteria and limitations for using FRPP, the applicant indicated that this is addressed by incorporating DCD Chapter 3, Sections 9.2.1.1 and 19A.8.3, and Table 19A-4, "Capability of RTNSS Related Structures." The staff found that aside from general design considerations that apply to the PSWS and RTNSS Criterion C systems and components, the referenced information indicates that the ASME Power Piping Code B31.1, "Power Piping," applies for piping and valves, International Building Code (IBC)-2003 applies for seismic capability, and Institute of Electrical and Electronics Engineers, Inc., (IEEE) 344, "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," (1987) applies for demonstrating structural integrity. However, the

2. With respect to reliability and availability assumptions, the applicant indicated that the PSWS design information that is incorporated by reference (discussed in the above bullet) assures that the use of FRPP will not adversely affect reliability and availability assumptions for the PSWS. However, it is not clear that PSWS availability and reliability assumptions will be satisfied without establishing design specifications and limitations for using FRPP. Variations in manufacturing techniques and product formulations can lead to inferior components and if FRPP support requirements are not properly specified, water intrusion problems could lead to common cause and common mode PSWS failures. Furthermore, without establishing FRPP design specifications, it is not clear how the design reliability assurance program (D-RAP) can be properly implemented.

As a follow-up to the fiberglass issues, the staff issued **RAI 9.2.1-13 (Open Item 9.2.1-13)**. The staff requested the following information;

Describe the special treatment QA provisions applicable to supplemental quality class S/N (Special Quality Assurance/Non-Safety Related) for the FRPP used in PSWS for RTNSS systems. This special treatment should include the following considerations:

- a) Describe how operating experiences (OE), where as buried fiberglass materials have been utilized in a similar application such as water service with similar piping size, pressure and temperatures, will be addressed in the selection of the buried fiberglass materials.
- b) Describe if the ASME B31,1 "Nonmandatory Appendix III, Rules for Nonmetallic Piping and Piping Lines with Nonmetals," will be utilized for the fiberglass design and installation. In addition, describe any material classification, for example American Society for Testing and Materials or American Water Works Association that better defines the piping and fittings standards to be utilized.
- c) Provide details of the buried fiberglass application related to the special QA requirement associated with RTNSS.

With respect to the consequences of PSWS pipe failures during seismic events, the applicant referred to Tier 2 of the DCD, Section 9.2.1.3, "Safety Evaluation," which stipulates that a failure of all or any portion of the PSWS will not impact any plant safety function. Because the plant design-bases include flooding effects due to failure of all of the PSWS, failures that may occur due to the use of FRPP are encompassed by the plant design bases. Therefore, the staff finds that the use of FRPP relative to flooding considerations is acceptable.

In addressing COL 9.2.1-1-A , the staff noted that the applicant only addressed buried PSWS piping but did not address material selections for any other parts of the PSWS, including cooling towers and related components. Consequently, the staff asked the applicant in RAI 9.2.1-03 to

provide additional information to specify and explain the material selections that pertain to the rest of the PSWS. The applicant's response dated August 28, 2008, indicated that material selections for the PSWS (which include the AHS) will take into consideration PSWS water quality, water treatment options that are compatible with Lake Anna discharge limits, economic considerations, and DCD-related RTNSS criteria. However, no mention was made of using only materials (including materials in the AHS) that are both suitable and compatible for their assigned applications and for the conditions that exist. As a follow-up, the staff asked the applicant in supplemental **RAI 9.2.1-09** to address the specific composition or properties of those materials to be used in the PSWS. This is being tracked as **Open Item 9.2.1-09**.

SRP Section 9.2.1 and Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment" (as referred to by SRP Section 9.2.1), provide guidance for evaluating long-term corrosion and fouling considerations associated with service water systems. In particular, these considerations include:

- a. Establishing a program of surveillance and control techniques to prevent flow blockage problems due to biofouling;
- b. Establishing a routine inspection and maintenance program to assure that corrosion, erosion, protective coating failure, silting, biofouling and others that are applicable cannot degrade the PSWS defense-in-depth and RTNSS cooling functions; and
- c. Establishing a test program to verify (initially and periodically) the heat transfer capability of heat exchangers that are important to safety.

In order to prevent long-term corrosion and fouling of the PSWS, the applicant proposes to chemically treat the water in the PSWS cooling tower basin based on site water quality analysis. The FSAR does not explain what specific vulnerabilities are considered to be pertinent based upon siting considerations and industry OE that applies, and why chemical treatment alone is sufficient for addressing these vulnerabilities. While chemical treatment is a common practice and suitable for minimizing PSWS corrosion and fouling problems to some extent, it does not adequately address all of the potential PSWS vulnerabilities that have been identified over time as a result of industry OE as reflected in GL 89-13. The staff asked the applicant in RAI 9.2.1-04 to address the considerations referred to above and to fully address this COL information item.

The applicant responded to RAI 9.2.1-04 in a letter dated August 28, 2008, indicating that PSWS is a closed system with makeup water treated to preclude long-term corrosion and fouling based on the site water quality analysis. However, the applicant did not address the question that was asked in that anticipated site and system-specific vulnerabilities and degradation mechanisms, and programmatic controls to address these considerations, were not described. Because the PSWS for North Anna 3 is relied upon for defense-in-depth and RTNSS considerations, reliability is an important factor. Consequently, programmatic controls are necessary to periodically monitor the condition and performance of PSWS components over time to maintain the availability and reliability of the system. As a follow-up, the staff asked the applicant in supplemental **RAI 9.2.1-10** to address how the PSWS will be treated in accordance with 10 CFR 50.65, "Maintenance Rule," Regulatory Guide (RG) 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Plant Plants," and Nuclear Management and Resources Council (NUMARC) (now NEI) 93-01, Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plant." In addition, the staff asked the applicant to describe or provide drawings which indicate the design of the chemical control system,

chemical addition system, or water treatment system for the PSWS. This remains **Open Item 9.2.1-10**.

Conceptual Design Information and Supplemental Information

- NAPS CDI System Description
- NAPS CDI PSWS Component Design Characteristics
- NAPS SUP 9.2.1-1 Basin Reserve Storage Capacity

Tier 2 of the DCD, Section 9.2.1.2, states that the heat rejection facilities are dependent upon actual site conditions and are not part of the ESBWR standard plant. The conceptual design, for the standard plant, uses a normal power heat sink (NPHS) and an AHS as the heat rejection facilities. The NPHS is a natural draft cooling tower and the AHS consists of mechanical draft cooling towers. A cross-tie for the standard plant permits aligning PSWS to either of these heat sinks.

The applicant provided supplemental (NAPS CDI) information in Section 9.2.1.2 of the North Anna 3 COL FSAR to address this item. The NAPS CDI indicates that the AHS is the heat rejection facility for North Anna Unit 3, which consists of mechanical draft plume abated cooling towers. The FSAR provides Table 9.2-201, "PSWS Component Design Characteristics," and a revised Figure 9.2-201, "Plant Service Water System Simplified Diagram," that incorporate the AHS. Table 9.2-201 provides supplemental plant-specific information (NAPS SUP 9.2.1-1) that specifies the basin reserve storage capacity as $1.18 \times 10^4 \text{ m}^3$ (2.6 million gal). In addition to this, the staff noted that the FSAR also repeats the information that was included in Tier 2 of the DCD and there is no distinction between the plant-specific (NAPS CDI) and the standard plant design information. In order to avoid possible confusion in the future as to what is plant-specific vs. what is standard plant design and what change process is applicable, the staff asked the applicant in RAI 9.2.1-05 to provide appropriate clarification. The applicant's response dated August 28, 2008, indicated that the information in its entirety is supplemental to address the CDI provided in the DCD. However, only the heat rejection facility that is used for the PSWS is identified as CDI in the DCD. Consequently, most of the information that the applicant provided as supplemental is in fact part of the certified design and cannot be characterized as NAPS CDI. As a follow-up, the staff asked the applicant in supplemental **RAI 9.2.1-11** to clearly identify the plant specific information in the FSAR that addressed the CDI identified in the ESBWR DCD. This remains **Open Item 9.2.1-11**.

SRP Section 9.2.5, RG 1.27, and GL 89-13 provide guidance that is pertinent for evaluating heat rejection facilities. Important considerations include those discussed above under interface requirements, other plant-specific vulnerabilities and degradation mechanisms that are anticipated based on OE, and the potential impacts of postulated failures or other interactions on safety-related SSCs. The FSAR does not address these considerations. In addition, the FSAR does not address bounding conditions and limiting assumptions that pertain to the functional capability of the cooling towers that have not been explained and justified, and programmatic controls that assure that the functional capability of the cooling towers that will have to be maintained over the life of the plant have not been described. Consequently, the staff asked the applicant in RAI 9.2.1-06 to revise the NAPS CDI accordingly to include this information. The applicant's response dated August 28, 2008, indicated that the information requested by the staff is the type of information that is normally provided for a safety-related system. Because the PSWS is non-safety-related system, the applicant felt that the information

in the FSAR was adequate. Although the PSWS is a non-safety-related system, it is relied upon for providing defense-in-depth cooling for the reactor and SFP, and it is subject to RTNSS considerations. As such, PSWS reliability and availability are important factors. The PSWS design bases relative to these functions have not been described and consequently, the staff is unable to determine if the design of the PSWS is adequate. Additionally, programmatic controls to assure the reliability and availability of the PSWS over time have not been described. As a follow-up, the staff asked the applicant in supplemental **RAI 9.2.1-10** to address how the PSWS (including AHS cooling towers) will be treated in accordance with 10 CFR 50.65, "Maintenance Rule," RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Plant Plants," and NUMARC 93-01, Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plant." This remains **Open Item 9.2.1-10**.

Interface Requirement

Tier 1 of the ESBWR DCD, Section 4.1, specifies as an interface requirement that the PSWS plant-specific heat rejection facilities must be capable of supporting the post-72-hour RTNSS cooling function of the PSWS. In particular, the PSWS must be capable of removing at least 2.02×10^7 MJ (1.92×10^{10} BTU) over a period of seven days without active makeup. The COL applicant is required to develop plant-specific ITAAC that demonstrate that each train of the plant-specific cooling tower and basin satisfies this interface requirement.

The applicant provided plant-specific ITAAC item, "ITAAC for Plant Service Water Reserve Storage Capacity," for the PSWS in Section 2.4.2, "ITAAC for Plant Service Water System (Portion Outside the Scope of the Certified Design)," Table 2.4.2-1, "ITAAC for Plant Service Water Reserve Storage Capacity," of Part 10 of the COL application. The proposed Design Commitment is for the PSWS to contain an inventory of cooling water sufficient for removing heat from the RCCWS from time 0 (at shutdown) through day 7 without active makeup. The proposed Acceptance Criteria is to document that the minimum usable water volume in the cooling tower basins (Trains A and B) and associated pump forebay is 1.18×10^4 m³ (2.6 million gal).

SRP Section 9.2.5 and RG 1.27, "Ultimate Heat Sink for Nuclear Power Plants" (as referred to by SRP Section 9.2.5), provides guidance for evaluating the adequacy of cooling towers. Important factors that need to be considered when demonstrating that cooling towers are capable of dissipating the required heat load include (among other things) the capability to satisfy the PSWS pump minimum net positive suction head requirements for the most limiting cooling tower basin water level, temperature, and flow conditions; the maximum allowed PSWS water supply temperature; and the most limiting meteorological assumptions that pertain to the site for determining: (a) heat dissipation capability, and (b) water inventory requirements. Transient analyses that take these factors into consideration (including margin for expected degradation and operating flexibility) and confirmatory testing are usually necessary in order to demonstrate that cooling tower performance satisfies the specified heat removal capability.

The ITAAC proposed by the applicant specifies a cooling tower basin water inventory requirement as a way of demonstrating that the heat removal capability specified by the DCD has been satisfied, and no explanation or description was provided for how this water inventory requirement was established. While water inventory is an important consideration for assuring that the cooling towers are capable of performing their defense-in-depth and RTNSS functions, the review considerations discussed in the paragraph above were not addressed by the applicant and the proposed ITAAC do not adequately demonstrate that the cooling towers are capable of dissipating the specified heat load. Also, the basis for crediting the water volume in

the basins for both Trains A and B was not provided and justified. The staff asked the applicant in **RAI 9.2.1-01** to address the considerations referred to above and revise the ITAAC accordingly. The staff reviewed the applicant's response dated August 28, 2008, and found it only addressed the required volume of water in the cooling tower basin to support up to 7 days. The applicant did not address the specific question that was asked. As a follow-up, the staff asked the applicant in supplemental **RAI 9.2.1-08** to address additional acceptance criteria that confirms the PSWS can remove the required BTUs over a period of seven days without active makeup. This is being tracked as **Open Item 9.2.1-08**.

ITAAC Considerations

As specified in the COL application, Part 10, Section 1, "Tier 1/ITAAC," the ITAAC from Tier 1 of the DCD is incorporated by reference. However, Part 10, Section 2.4.2, "ITAAC for Plant Service Water System (Portion Outside the Scope of the Certified Design)," proposes ITAAC for the interface requirement that is specified in Section 4.1 of the DCD Tier 1. The adequacy of the plant-specific ITAAC that are proposed is evaluated above under "Interface Requirements." Also, the applicant's response to **RAI 9.2.1-13** may involve additional ITAAC considerations for staff evaluation.

Initial Plant Test Program

As indicated in the FSAR, Chapter 14.2, "Initial Plant Test Program for Final Safety Analysis Reports," the initial plant test program specified by Tier 2 of the DCD for the PSWS is incorporated by reference. The PSWS initial test program is discussed in the DCD Tier 2, Sections 14.2.8.1.51, "Plant Service Water System Preoperational Test," and 14.2.8.2.18, "Plant Service Water System Performance Test." However, these tests do not verify that performance of the CDI portions of the PSWS (including AHS) satisfies design specifications for the various modes of operation. The staff asked the applicant in **RAI 9.2.1-07** to establish and describe initial plant test program requirements for the PSWS accordingly. The applicant's response dated August 28, 2008, indicated that the preoperational and startup test programs that are incorporated by reference include testing for the CDI portions of the PSWS. The staff noted that the referenced test programs do not fully address CDI in that cooling tower performance, including fan functions and heat dissipation capability, are not evaluated. Also, the capability of the PSWS to properly function without initiating a water hammer following a loss of power is not addressed by the test program. As a follow-up, the staff asked the applicant in supplemental **RAI 9.2.1-12** to address how the design capability of the AHS will be verified by the initial plant test program and how design features which minimize an AHS/PSWS water hammer event are tested or verified that a water hammer event does not occur. This remains **Open Item 9.2.1-12**.

9.2.1.5 Post Combined License Activities

There are no post COL activities related to this section.

9.2.1.6 Conclusions

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the PSWS and there is no outstanding information expected to be addressed in the COL FSAR related to this subsection. However, as a result of Open Items 9.2.1-8, 9.2.1-9, 9.2.1-10, 9.2.1-11, 9.2.1-12, and 9.2.1-13, the staff is unable to finalize its conclusions on this subsection relating to the PSWS in accordance with the guidance of GDC 44, 45 and 46.

9.2.2 Reactor Component Cooling Water System

The staff is reviewing the information in DCD Section 9.2.2 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the RCCWS 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 9.2.2 of this SER to reflect the final disposition of the DCA.

9.2.3 Makeup Water System

9.2.3.1 Introduction

9.2.3.2 Summary of Application

- NAPS CDI

System Description

9-17

9.2.3.3 **Regulatory Basis**

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

There is no associated SRP section in NUREG-0800 for the MWS. The applicable regulatory requirement for the site specific aspects of the MWS is:

- GDC 2, "Design Bases for Protection Against Natural Phenomena," in that failure of the non-safety-related system or component due to natural phenomena such as earthquakes, tornadoes, hurricanes, and floods should not adversely affect the safety-related SSCs.

9.2.3.4 **Technical Evaluation**

The NRC staff reviewed Section 9.2.3 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.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the RCCWS.

Section 9.2.3 of the 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 the RCCWS will be documented in the staff SER on the DCA for the ESBWR.

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

Site Specific Information Replacing Conceptual Design Information

- | | |
|------------|--------------------|
| • NAPS CDI | System Description |
|------------|--------------------|

In FSAR Section 9.2.3.2, the applicant replaced the introductory text and demineralization subsystem portions of the ESBWR DCD Section 9.2.3.2. In FSAR Section 9.2.3.2, the applicant provided site-specific system description of the MWS. The MWS consists of two subsystems: (1) the demineralization subsystem, and (2) the storage and transfer subsystem. The makeup water transfer pumps and the demineralization subsystem are sized to meet the demineralized water needs of all operational conditions except for shutdown/refueling/startup. During the shutdown/refueling/startup mode, the increases in plant water consumption require use of a temporary demineralization subsystem and temporary makeup water transfer pumps to be used as a supplemental water source.

The MWS major components are housed entirely in the water treatment building except for the demineralized water storage tank (which is outdoors and adjacent to this building) and the distribution piping to the interface systems. The site specific design includes freeze protection for the demineralized water storage tank and piping exposed to freezing conditions.

The staff reviewed the site-specific MWS and its components and finds that the applicant's proposed system design is similar to the MWS described in Section 9.2.3.2 of the ESBWR DCD, Revision 5. The NAPS MWS components and associated piping in contact with demineralized water are fabricated from corrosion resistant materials such as stainless steel to prevent contamination of the makeup water.

Water for the demineralization subsystem is provided by the station water system (SWS). Production of demineralized water by the demineralization subsystem can be initiated and shut down either automatically (based on the demineralized water storage tank level) or manually. The applicant described the process and sequence of chemical treatment of the station water to produce demineralized water. The applicant's water treatment process is similar to that described in the DCD Section 9.2.3.2. After the chemical treatment process, the treated water is then transferred to the MWS demineralized storage tank.

The NRC staff reviewed the design information provided in the FSAR Section 9.2.3 for NAPS MWS and finds that the applicant did not identify any further supplements and/or departures, except the above discussed site-specific information. The site-specific portion of the MWS is non-safety-related and its failure does not compromise any safety-related system or component nor does it prevent a safe-shutdown. Also, the site-specific design will not change the conclusion of ESBWR DCD for MWS, as it relates to GDC 2.

Also, the site-specific portion of the MWS does not interface with any potentially radioactive system. Therefore, no interface requirements needed to be satisfied.

9.2.3.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.2.3.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the RCCWS 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 the DCD Section 9.2.3 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the RCCWS 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 9.2.3 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the site-specific portion of the MWS presented within the NAPS COL application is acceptable and does not change the conclusions of ESBWR DCD, as it relates to GDC 2.

9.2.4 *Potable and Sanitary Water Systems*

9.2.4.1 *Introduction*

This section of the North Anna 3 COL FSAR describes the potable water system (PWS) which supplies clean water for domestic use and human consumption. The sanitary waste system collects and treats sanitary wastes from plant restrooms and locker room facilities. The system design ensures that there is no possibility for radioactive contamination of the potable water or the sanitary waste drainage system.

9.2.4.2 Summary of Application

Section 9.2.4, "Potable and Sanitary Water Systems," of the North Anna 3 COL FSAR Revision 1, incorporates by reference Section 9.2.4, "Potable and Sanitary Water Systems," of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.2.4, the applicant provided the following

Site Specific Information Replacing Conceptual Design Information

- NAPS CDI Potable and Sanitary Water Systems

The applicant provided additional information to replace CDI contained in the ESBWR DCD. The applicant described the site specific potable and sanitary water system. The PWS consists of ground wells at various locations on site. For each well house there is a submersible well pump, compressor, hydro-pneumatic tank and interconnecting piping and valves. The Unit 3 potable water header is connected to the Units 1 and 2 domestic water system with a normally closed valve. The sanitary wastes are collected in underground tanks located throughout the yard and pumped to an on site sewage treatment plant. Neither the PWS nor the sanitary waste system interconnects with any system that contains radioactive fluids. The sanitary waste discharge system (SWDS) is monitored for radioactivity. The applicant provided Figure 9.2-202, "Potable Water System Simplified Diagram," depicting the PWS and Figure 9.2-203, "Sanitary Waste Discharge System Simplified Diagram," depicting the SWDS.

9.2.4.3 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 potable and sanitary water system and the associated acceptance criteria are given in Section 9.2.4 of NUREG-0800.

The applicable regulatory requirements for the potable and sanitary water system are as follows:

- GDC 60, "Control of Releases of Radioactive Materials to the Environment" of Appendix A to 10 CFR Part 50.

9.2.4.4 Technical Evaluation

The NRC staff reviewed Section 9.2.4 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the Potable and Sanitary Water Systems.

Section 9.2.4 of the DCD is being reviewed by the staff on under Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to the Potable and Sanitary Water Systems will be documented in the staff SER on the DCA for the ESBWR.

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

Site-Specific Information Replacing Conceptual Design Information

• NAPS CDI Potable and Sanitary Water Systems

The staff reviewed NAPS CDI related to the site specific design of the potable and sanitary water system included under Section 9.2.4 of the North Anna 3 COL FSAR, Revision 1. Meeting the requirements of GDC 60 for this system ensures that design provisions are in place to prevent liquid effluents containing radioactive materials from contaminating the PWS and SWDS and potentially being released to the environment.

The PWS and SWDS do not perform any safety related function and are not connected to any safety-related systems. Failure of these systems does not affect any safety-related components or prevent a safe shutdown of the plant.

The proposed source of potable water for the PWS is water from ground wells, at a supply capacity of 12.6 liters per second (200 gallons per minute). It is stated in the application that the water quality will meet the standards of the authorities having jurisdiction. The PWS does not handle radioactive fluids, and it is not connected to and does not interface with any system potentially containing radioactive fluids. However, potable water is supplied to areas where potential backflow could cause radiological contamination. In the unlikely event of radiological intrusion into the PWS in these areas, the applicant has proposed use of backflow preventers to prevent the spread of contamination into the PWS. The staff concludes that because the PWS is not connected to or does not interface with systems that contain radioactivity, and backflow preventers are installed in areas of potential contamination, acceptable design provisions have been made to prevent the inadvertent contamination of the PWS with radioactive material.

The proposed SWDS consists of an onsite sewage treatment plant with a normal capacity of 94,500 liters per day (25,000 gallons per day) or a maximum capacity of 189,000 liters per day (50,000 gallons per day) of sanitary sewage. The effluent is routed to the cooling tower blow down sump. The effluent meets standards established by Federal, state, and local regulations and permits. The SWDS does not handle radioactive fluids. It is not connected to and does not interface with any system potentially containing radioactive fluids.

The staff requested information related to process and effluent monitoring and sampling provisions for the SWDS in RAI 11.05-2. In the June 30, 2008 response, the applicant removed composite samplers from the SWDS design and proposed a per batch sewage treatment plant sludge tank grab sampling program. Revision 1 of the North Anna FSAR has been updated to reflect these changes. The grab sampling program is adequate in detecting potential radiological contamination and preventing uncontrolled radioactive releases to the environment from this system. The staff concludes that because the SWDS is not connected to or does not interface with systems that contain radioactivity, and sewage treatment plant sludge tank sampling will be performed, acceptable design provisions have been made to prevent the inadvertent contamination of the SWDS with radioactive material and inadvertent radioactive releases to the environment.

Based on the staff's review of the applicant's design criteria and design bases for the potable and sanitary water systems, the staff finds that acceptable design provisions have been made to prevent the inadvertent contamination of the systems with radioactive material, and therefore

find the proposed design of the potable and sanitary water system meets the requirements of GDC 60 and therefore is acceptable.

No departures or COL information items are identified in this section; TS, ITAAC, and initial plant test program are not applicable for these systems. There is no ESBWR DCD Tier 1 interface associated with these systems.

9.2.4.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.2.4.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the Potable and Sanitary Water Systems 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 the DCD Section 9.2.4 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the Potable and Sanitary Water Systems 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 9.2.4 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR is acceptable and meets the requirements of GDC 60. The staff based its conclusion on the fact that the potable and sanitary water systems have no safety-related function and failure of the system does not compromise any safety-related system or component, nor does it prevent a safe shutdown of the plant. The NAPS PWS and SWDS have no interface with any safety-related equipment, and no interconnections exist between the PWS and SWDS and any potentially radioactive system.

9.2.5 *Ultimate Heat Sink*

9.2.5.1 *Introduction*

This section of the North Anna 3 COL FSAR describes the ultimate heat sink (UHS). The UHS consists of the IC and the Passive Containment Cooling (PCC) pools, the Dryer/Separator pool and Reactor Well, Fire Protection System (FPS) makeup water for the IC/PCC pools, and SFP from the primary (seismic Category I) firewater storage tanks via the safety-related Fuel and Auxiliary Pools Cooling System (FAPCS) piping, and other water sources that are credited for providing makeup water for the IC/PCC pools, and SFP after water from the firewater storage tanks has been depleted. The Dryer/Separator pool and Reactor Well provide sufficient makeup water for the IC/PCC expansion pools to support operation of the IC System and PCC System during the initial 72 hours following an accident. A source of makeup water for the SFP is not credited during this period. After the initial 72 hours, the FPS is relied upon for supplying the necessary makeup water for the IC/PCC pools and the SFP for up to 7 days. The parts of the UHS that are relied upon for the first 72 hours following an accident are safety-related and are evaluated in Section 5.4.6, "Isolation Condenser System (ICS)," and Section 6.2.2, "Passive Containment Cooling System." The parts of the UHS that are relied upon for providing makeup

water during the period from 72 hours through seven days post-accident are not required to be safety-related, but must be readily available on-site and are subject to RTNSS as discussed in Chapter 19A of the ESBWR DCD, Revision 5. This section evaluates the adequacy of the capability that is credited for providing makeup water to the IC/PCC pools, and SFP after the initial seven days have elapsed following an accident.

9.2.5.2 Summary of Application

Section 9.2.5 of the North Anna COL FSAR incorporates by reference Section 9.2.5 of the ESBWR DCD Revision 5.

In addition, in FSAR Section 9.2.5, the applicant provided the following:

COL Item

- STD COL 9.2.5-1-H Post 7 Day Makeup to UHS

The applicant provided additional information in STD COL 9.2.5-1-H to address DCD COL Item 9.2.5-1-H. The applicant committed to providing procedures to identify and prioritize available makeup water seven days after an accident and provide instructions for establishing the necessary connections. The procedures will be developed in accordance with the procedure development milestone in Section 13.5.

9.2.5.3 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 UHS and the associated acceptance criteria are given in Section 9.2.5 of NUREG-0800.

The applicable regulatory requirements for the makeup sources of water to the UHS are as follows:

- GDC 2, 4, 5, 44, 45 and 46 of Appendix A to 10 CFR Part 50

9.2.5.4 Technical Evaluation

The NRC staff reviewed Section 9.2.5 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the UHS.

Section 9.2.5 of the 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 the UHS will be documented in the staff SER on the DCA for the ESBWR.

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

COL Item

- STD COL 9.2.5-1-H Post 7 Day Makeup to UHS

The NRC staff reviewed STD COL 9.2.5-1-H related to the makeup water to the UHS included under Section 9.2.5 of the North Anna 3 COL FSAR. As discussed above in the Introduction Section, the UHS consists of both safety-related and non-safety-related SSCs. The staff's evaluation of the UHS for the ESBWR design focuses primarily on assuring that sufficient makeup water is available and can be supplied to the IC/PCC pools, and SPF for long-term cooling after the initial seven days have elapsed following an accident. Acceptability is judged based upon conformance with the regulatory basis referred to above, as applied to the standard plant design and reflected in Tier 2 of the ESBWR DCD, Revision 5, Section 9.2.5.

This COL information item is listed in Tier 2 of the ESBWR DCD, Section 9.2.5.1, "COL Information," and specifies that COL applicants need to develop procedures for supplying makeup water to the IC/PCC pools and SFP for 7 days after an accident. During the period from 72 hours up to 7 days following an accident, the FPS is credited for providing post-accident makeup water to the UHS through safety-related FAPCS piping. After 7 days, the applicant can either use offsite makeup sources to replenish the UHS water supply via safety-related FAPCS connections that are located outside the reactor and fuel buildings, or the applicant can use on-site water sources if they are available. The minimum required flow rate that is specified for post-72 hour makeup is 46 m³/hr (200 gpm), and makeup water quality is normally required to meet demineralized water chemistry specifications. However, during accident conditions, makeup water quality that satisfies FPS or SWS chemistry specifications can be used. The post 7-day makeup water source is not required to be safety-related or subject to RTNSS, but should be from sources that are diverse or highly reliable. These considerations are discussed in Tier 2 of the ESBWR DCD, Section 9.2.5, which specifically states: "The COL applicant will develop procedures to supply makeup water 7 days after an accident (9.2.5-1-H)."

The applicant provided the following response for this COL Item:

"Procedures that identify and prioritize available makeup sources seven days after an accident, and provide instructions for establishing necessary connections, will be developed in accordance with the procedure development milestones in Section 13.5."

Except for the development milestones that are referred to by the proposed response, it is not clear to what extent the other provisions of Section 13.5, "Plant Procedures," will be implemented, what makeup considerations will be addressed, what criteria will be satisfied, and how soon after an accident the makeup capability will be assessed. Therefore, the staff asked the applicant in **RAI 9.2.5-01** to provide additional information to address these considerations. In a response dated August 4, 2008, the applicant described likely details associated with UHS makeup procedure development. For "STD COL 9.2.5-1-H", the applicant has committed to develop procedures to identify and prioritize available makeup sources for 7 days after an accident. In addition, the applicant made reference to Section 13.5.2.1.4, "Emergency Operating Procedures," and identified that this procedure, "STD COL 9.2.5-1-H", will be developed through the implementation of these processes. The staff determined that this approach is acceptable since the applicant committed to develop this procedure and develop the details to address available means of makeup delivery which includes permanent plant systems, portable equipment and temporary delivery/processing systems in NAPS FSAR

Section 9.2.5. Based on the RAI response, the statement in FSAR Section 9.2.5, and the schedule defined in FSAR Section 13.5, the staff determined this issue can be closed.

9.2.5.5 *Post Combined License Activities*

- The following item was identified as the responsibility of the COL holder: STD COL 9.2.5-1-H Post 7 Day Makeup to UHS

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

9.2.5.6 *Conclusions*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the UHS 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 the DCD Section 9.2.5 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the UHS 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 9.2.5 of this SER to reflect the final disposition of the DCA.

9.2.6 *Condensate Storage and Transfer System*

9.2.6.1 *Introduction*

This section of the North Anna 3 COL FSAR describes the condensate storage and transfer system (CS&TS) which supplies condensate-quality water for makeup to selected plant systems. It consist of two independent and 100 percent redundant transfer pumps, that takes suction from a single condensate storage tank (CST), and provide water to interface systems as required. The CST serves as a reservoir for the CS&TS water inventory and is the normal source of water for makeup to selected plant systems. It also provides storage capacity for condensate rejected from the condensate and feedwater system, for condensate quality liquid waste management system effluent during normal operation, and for condensate and feedwater system and hotwell inventory during system maintenance outages. The CS&TS is not a safety-related system, and does not perform any safety-related function.

9.2.6.2 *Summary of Application*

Section 9.2.6 of the North Anna 3 COL FSAR, Revision 1, incorporates by reference Section 9.2.6 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.2.6, the applicant provided the following:

Supplemental Information

- STD SUP 9.2.6-1 System Description

The applicant provided the following supplemental information. The applicant stated that freeze protection is provided for the CS&TS.

9.2.6.3 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 the CST and piping freeze protection and the associated acceptance criteria are given in Section 9.2.6 of NUREG-0800. In NUREG-0800, Section 9.2.6 stated that “The safety-related portions of the CFS are protected from the effects of natural phenomena – including cold weather, tornados, and flooding – such that event will not adversely affect the safety function of the system.”

Since the CS&TS is not a safety-related system, and does not perform any safety-related functions, there is no applicable regulatory requirement for the freeze protection for the CS& TS.

9.2.6.4 Technical Evaluation

The NRC staff reviewed Section 9.2.6 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.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the Condensate Storage and Transfer System.

Section 9.2.6 of the 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 the Condensate Storage and Transfer System will be documented in the staff SER on the DCA for the ESBWR.

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

Supplemental Information

- STD SUP 9.2.6-1 System Description

The NRC staff reviewed STD SUP 9.2.6-1 related to the freeze protection for the CS&TS included under Section 9.2.6 of the North Anna 3 COL FSAR. The staff reviewed conformance of Section 9.2.6 of the North Anna COL FSAR to the relevant NRC regulations and acceptance criteria defined in NUREG-0800, Section 9.2.6, “Condensate Storage Facilities.” The staff's review finds that the applicant appropriately incorporated by reference Section 9.2 of the ESBWR DCD, Revision 5, with the following Tier 2 supplemental information added:

The applicant provided supplemental information as part of the FSAR with regards to CS&TS freeze protection. In FSAR Section 9.2.6, the applicant added the following text to the end of the first paragraph of Section 9.2.6.2 of the ESBWR DCD, Revision 5: “Freeze protection is provided for the CS&TS.”

The NRC staff reviewed the standard supplemental information provided in STD SUP 9.2.6-1. Freeze protection for the CS&TS is addressed in Tier 2, Section 1.2.2.12.2, "Condensate Storage and Transfer System," of the ESBWR DCD, Revision 5. Although the CS&TS does not perform or ensure any safety-related function, and is not required to achieve or maintain safe shutdown, DCD Tier 2, Section 1.2.2.12.2 specifies that if required, the CS&TS will be provided with freeze protection. A general discussion on freeze protection is provided in FSAR Section 1.2.2.12.16, "Freeze Protection." The incorporation of freeze protection in the CS&TS design is a system enhancement that has no impact on the system's regulatory compliance, but could result in increase system reliability and availability; therefore the staff finds the proposed standard supplement acceptable.

9.2.6.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.2.6.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the Condensate Storage and Transfer System 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 the DCD Section 9.2.6 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the Condensate Storage and Transfer System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.2.6 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR is acceptable. The staff based its conclusion on the fact that freeze protection in the CS&TS design is a system enhancement that has no impact on the system's regulatory compliance.

9.2.7 *Chilled Water System*

Section 9.2.7 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.2.7, "Chilled Water System" of Revision 5 of the ESBWR DCD. The 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 9.2.7 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Chilled Water System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.2.7 of this SER to reflect the final disposition of the DCA.

9.2.8 Turbine Component Cooling Water System

Section 9.2.8 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.2.8, "Turbine Component Cooling Water System" of Revision 5 of the ESBWR DCD. The 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 9.2.8 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Turbine Component Cooling Water System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.2.8 of this SER to reflect the final disposition of the DCA.

9.2.9 Hot Water System

Section 9.2.9 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.2.9, "Hot Water System" of Revision 5 of the ESBWR DCD. The 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 9.2.9 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Hot Water System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.2.9 of this SER to reflect the final disposition of the DCA.

9.2.10 Station Water System

9.2.10.1 Introduction

This section of the North Anna 3 COL FSAR describes the SWS which provides filtered and treated water as makeup to the circulating water system cooling tower basin, the PSWS cooling tower basin, feed to the MWS for further treatment for use as demineralized water and to fill the primary firewater tanks.

9.2.10.2 Summary of Application

Section 9.2.10 of the North Anna 3 COL FSAR, incorporates by reference Section 9.2.10 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.2.10, the applicant provided the following:

Site Specific Information Replacing Conceptual Design Information

- NAPS CDI Detailed System Description

The applicant provided additional site specific information to replace CDI contained in the ESBWR DCD. The applicant described the SWS. The SWS is comprised of two subsystems.

The plant cooling tower makeup subsystem provides makeup to the plant service water cooling towers and the main circulating water system cooling tower. The pretreated water supply subsystem chemically conditions and filters the water for further treatment for use as demineralized makeup water. The applicant provided Tables 9.2-203 and 9.2-204 listing the design parameters of the SWS equipment. The applicant provided Figures 9.2-204 and 9.2-205 depicting the SWS.

9.2.10.3 Regulatory Basis

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

There is no associated SRP section in NUREG-0800 for the SWS. The applicable regulatory requirement for the SWS is as follows:

- GDC 2, "Design Bases for Protection Against Natural Phenomena," in that failure of the non-safety-related system or component due to natural phenomena such as earthquakes, tornadoes, hurricanes, and floods should not adversely affect the safety-related SSCs.

9.2.10.4 Technical Evaluation

The NRC staff reviewed Section 9.2.10 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL 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 relevant information related to the SWS.

Section 9.2.10 of the 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 the SWS will be documented in the staff SER on the DCA for the ESBWR.

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

Site Specific Information Replacing Conceptual Design Information

- NAPS CDI Detailed System Description

The NRC staff reviewed NAPS CDI related to the ESBWR conceptual design of the SWS and the design parameters for the SWS components included under Section 9.2.10 of the North Anna 3 COL FSAR.

In FSAR Section 9.2.10.2, "System Description," the applicant replaced the "Detailed System Description," portion of this section in the reference ESBWR DCD, Revision 5. In FSAR Section 9.2.10.2, the applicant provided the site specific detailed description of SWS design proposed for NAPS. The SWS consists of two subsystems: (1) plant cooling tower makeup system (PCTMS), and (2) pretreated water supply system (PWSS).

The PCTMS provides makeup water to the cooling tower basins for both, PSWS and circulation water system (CWS). The supply of water makes up for losses resulting from evaporation, drift and blowdown from the cooling towers. In addition, the PCTMS provides makeup water to replace water used for strainer backwashes. The PCTMS consists of a water source, pumps,

strainers, connecting piping, valves and instrumentation. The applicant provided a simplified system diagram in FSAR Figure 9.2-204, "Station Water System – Plant Cooling Tower Makeup System (PCTMS)," and component design parameters for the PCTMS in FSAR Table 9.2-203, "Station Water System – Plant Cooling Tower Makeup System Component Design Parameters."

The PWSS chemically conditions and filters the water supplied to the MWS for further treatment for use as demineralized water. The PWSS also supplies water to the FPS for filling the primary firewater tanks. In addition, the PWSS provides cooling tower makeup to the PSWS as an alternate to the PCTMS. The PWSS also provides water for the strainers and filter backwashes. The PWSS consists of a water source, pumps, strainers, filters, chemical injection equipment, station water storage tank (SWST), connecting piping, valves and instrumentation. Further, the applicant provided a simplified system diagram in FSAR Figure 9.2-205, "Station Water System – Pretreated Water Supply System (PCTMS)," and component design parameters for the PCTMS in Table 9.2-204, "Station Water System – Pretreated Water Supply System Component Design Parameters."

The NRC staff reviewed the site specific design information provided in NAPS FSAR Section 9.2.10.2, and finds that the applicant replaced the detailed system description from the reference ESBWR DCD Section 9.2.10.2, "System Description," as the site specific NAPS CDI. The SWS design in the application is identical to that in the DCD. Also, the staff finds that the applicant did not identify any departures and/or supplements, except that the applicant included additional information by providing the SWS-PCTMS flow diagram in FSAR Figure 9.2-205 and component design parameters in FSAR Table 9.2-204. Additionally, the staff referred to Section 9.2.10.3, "Safety Evaluation," in the ESBWR DCD and finds that the SWS has no safety-related function. The DCD further states that failure of the SWS does not compromise any safety-related system or component, nor does it prevent a safe shutdown of the plant. Further, the NAPS SWS has no interface with any safety-related equipment, and no interconnections exist between the SWS and any potentially radioactive system. The design information provided in the NAPS COL application does not impact the conclusions in the ESBWR staff SER, and therefore the staff finds the NAPS SWS design acceptable.

Based on the above discussion, the staff finds that the NAPS SWS meets the requirements of GDC 2, since, it is a non-safety-related system, and failure of the system or its components due to natural phenomena will have no adverse affects on safety-related SSCs.

Site Specific Pre-Operational Tests

In STD SUP 14.2-1 the applicant provided information in Section 14.2.9.1.1, "Station Water System Pre-Operation Test" to address SWS pre-operational testing. The preoperational testing review is performed under Section 14.2 of this SER.

9.2.10.5 Post Combined License Activities

There are no post COL activities related to this section.

9.2.10.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the SWS 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 the DCD Section 9.2.10 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the SWS 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 9.2.10 of this SER to reflect the final disposition of the DCA.

The staff concludes that the site specific design portion of the SWS presented within the NAPS COL application is acceptable and does not change the conclusions of ESBWR DCD, as they relate to GDC 2.

9.3 Process Auxiliaries

9.3.1 Compressed Air

Section 9.3.1 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.3.1, "Compressed Air" of Revision 5 of the ESBWR DCD. The 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 9.3.1 on Docket No. 52-010. The results of the NRC staff's technical evaluation of Compressed Air 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 9.3.1 of this SER to reflect the final disposition of the DCA.

9.3.2 Process Sampling System

9.3.2.1 *Introduction*

This section of the North Anna 3 COL FSAR addresses information related to the ESBWR process sampling system (PSS). The PSS is designed to collect representative water and gaseous samples for analysis contained in the reactor coolant system (RCS) and associated auxiliary system process streams during all normal modes of operation and following an accident. The proposed design includes permanently installed sample lines, sampling panels with analyzers and associated sampling equipment, provisions for local grab sampling, and permanent shielding. Provisions are made to ensure that representative samples are obtained from turbulent flow zones to ensure adequate mixing. Continuous sample flows are routed from selected locations to the sampling stations where pressure, temperature, and flow adjustments are made as necessary. Effluents from sample stations are returned to an appropriate process stream or to the radwaste drain headers through a common return line.

9.3.2.2 *Summary of Application*

Section 9.3.2 of the North Anna 3 COL FSAR incorporates by reference Section 9.3.2 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.3.2, the applicant provided the following:

COL Item

- STD COL 9.3.2-1-A Post Accident Sampling Program

The applicant provided additional information in STD COL 9.3.2-1-A to address DCD COL Item 9.3.2-1-A. The applicant described the post accident sampling program. The post accident sampling program consists of emergency operating procedures that rely on installed post accident radiation monitoring instrumentation, plant procedures for obtaining highly radioactive grab samples, a containment monitoring system capable of operation in post loss-of-coolant accident (LOCA) mode, and effluent radiation monitoring. The post accident sampling program functions in lieu of a dedicated PASS.

9.3.2.3 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 PSS and the associated acceptance criteria are given in Section 9.3.2 of NUREG-0800.

The applicable regulatory requirements for the post accident sampling program are as follows:

- GDC 64 of Appendix A to 10 CFR Part 50
- 10 CFR 20.1101(b)
- Section IV.B of Appendix E to 10 CFR Part 50

9.3.2.4 Technical Evaluation

The NRC staff reviewed Section 9.3.2 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the Process Sampling System.

Section 9.3.2 of the 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 the Process Sampling System will be documented in the staff SER on the DCA for the ESBWR.

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

COL Item

- STD COL 9.3.2-1-A Post Accident Sampling Program

The NRC staff reviewed STD COL 9.3.2-1-A related to the post accident sampling program included under Section 9.3.2 of the North Anna 3 COL FSAR. The staff reviewed conformance of Section 9.3.2 of the North Anna 3 COL FSAR to the guidance in RG 1.206, Section C.III.1, Chapter 9, C.I.9.3.2, "Process and Post-Accident Sampling Systems." The staff's review of the North Anna 3 COL FSAR, Section 9.3.2 finds that it appropriately incorporates by reference

Section 9.3.2 of the ESBWR DCD, Revision 5. In addition the applicant provided information on the North Anna 3 post-accident sampling program as required by STD COL 9.3.2-1-A of the ESBWR DCD. The post-accident sampling program meets the guidance provided in SRP Section 9.3.2.1.6 for actions required in lieu of a Post Accident Sampling System (PASS) as follows:

- Emergency Operating Procedures that rely on Emergency Action Levels, defined in the Emergency Plan (EP), are used to classify fuel damage events. These procedures rely on installed post-accident radiation monitoring instrumentation described in DCD Section 7.5 and do not require the capability to obtain and analyze highly radioactive coolant samples although sample analyses may be used for classification as well.
- Plant procedures contain instructions for obtaining highly radioactive grab samples from the following:
 - Reactor Coolant – from the reactor water cleanup/shutdown cooling sample line using the RB Sample Station. These samples can be analyzed for the parameters indicated in DCD Table 9.3-1. If coolant activity is greater than 1.0 Ci/ml, handling of the samples is delayed to avoid overexposure of personnel.
 - Suppression Pool – from FAPCS sample line at the RB Sample Station. These samples can be analyzed for the parameters indicated in DCD Table 9.3-1. If coolant activity is greater than 1.0 Ci/ml, handling of the samples is delayed to avoid overexposure of personnel.
 - Containment Atmosphere - may be taken as described in DCD Section 11.5.3.2.12 and analyzed for fission products.
- DCD Section 7.5.2.2 describes Containment Monitoring System operation in post-LOCA mode for gaseous sampling for O₂ and H₂.
- Effluent radiation monitoring is described in DCD Section 7.5. Field sampling and monitoring capability is maintained in accordance with the EP.
- Post accident monitoring is adequate to implement the EP without reliance on post accident sampling capability; therefore, the absence of a dedicated Post-Accident Sampling System does not reduce the effectiveness of the EP.

As part of the review of FSAR, Revision, 0, Section 11.5, the staff noted that FSAR Subsection 9.3.2.2 (System Description) refers incorrectly to Section 11.5.3.2.12 of the ESBWR DCD (Tier 2) regarding available provisions for sampling the containment atmosphere. This subsection of the ESBWR DCD addresses the radiation monitoring system for the technical support center (TSC) air intake and not the containment. Accordingly, the applicant was requested, under RAI 9.03.02-1, to update the reference citation in FSAR Section 9.3.2.2 with the proper DCD Tier 2, Chapter 11.5 subsection addressing provisions for the sampling of containment atmosphere. In response to RAI 09.03.02-1, the applicant proposed a revision to the section of the FSAR by correcting the improper reference. The staff finds that the applicant has revised their FSAR accordingly and RAI 09.03.02-1 is resolved.

The staff finds that the North Anna 3 COL FSAR has adequately addressed STD COL 9.3.2-1-A by providing information that adequately describes the North Anna Unit 3 post-accident sampling program capability.

9.3.2.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.3.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the Process Sampling System 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 the DCD Section 9.3.2 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the Process Sampling System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.3.2 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR is acceptable and meets the requirements of GDC 64, 10 CFR 20.1101(b), and Section IV.B of Appendix E to 10 CFR Part 50.

9.3.3 *Equipment and Floor Drain System*

Section 9.3.3 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.3.3, "Equipment and Floor Drain System" of Revision 5 of the ESBWR DCD. The 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 9.3.3 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the "Equipment and Floor Drain System" incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.3.3 of this SER to reflect the final disposition of the DCA.

9.3.4 *Chemical and Volume Control System*

Section 9.3.4 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.3.4, "Chemical and Volume Control System" of Revision 5 of the ESBWR DCD. The 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 9.3.4 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Chemical and Volume Control System

incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.3.4 of this SER to reflect the final disposition of the DCA.

9.3.5 Standby Liquid Control System

9.3.5.1 Introduction

This section of the North Anna 3 COL FSAR addresses the Standby Liquid Control System (SLCS) which is an independent reactivity control system designed to provide both manual and automatically initiated capability for bringing the reactor from full power and minimum control rod inventory to a subcritical condition with the reactor in the most reactive state without taking credit for control rod movement. The SLCS performs safety-related functions; therefore, it is classified as safety-related and is designed as a seismic Category I system. The SLCS meets the following safety design bases by providing: (1) a diverse backup capability, independent of normal reactor shutdown methods, to shutdown the reactor when the control rods fail to insert during AOOs and Anticipated Transients without Scram (ATWS), and (2) makeup water to the Reactor Pressure Vessel (RPV) to mitigate the consequences of a LOCA.

The SLCS is a passive system which consists of two identical and separate trains. Each SLCS train includes a nitrogen pressurized accumulator containing sodium pentaborate solution and is connected by piping through two parallel injection squib valves to the RPV. Each train provides 50 percent of the required SLCS injection capacity required for an ATWS.

9.3.5.2 Summary of Application

Section 9.3.5 of the North Anna 3 COL FSAR incorporates by reference Section 9.3.5 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.3.5, the applicant provided the following:

Supplemental Information

- STD SUP 9.3.5-1 System Description

The applicant provided the following supplemental information:

STD SUP 9.3.5-1 added the following to the end of the fifth paragraph under “Detailed System Description” of DCD Section 9.3.5.2, “System Description”: “The above provisions adequately prevent loss of solubility of borated solutions (sodium pentaborate).”

9.3.5.3 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 SLCS thermal environmental conditions and the associated acceptance criteria are given in Section 9.3.5 of NUREG-0800.

The applicable regulatory requirements for the SLCS thermal environmental conditions are as follows:

- GDC 2
- GDC 4 of Appendix A to 10 CFR Part 50
- GDC 5
- GDC 26
- GDC 27
- 10 CFR 50.62(c)(4)
- 10 CFR 52.80(a)

9.3.5.4 Technical Evaluation

The NRC staff reviewed Section 9.3.5 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL 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 relevant information related to the SLCS.

Section 9.3.5 of the 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 the SLCS will be documented in the staff SER on the DCA for the ESBWR.

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

Supplemental Information

- STD SUP 9.3.5-1 System Description

The NRC staff reviewed STD SUP 9.3.5-1-A related to the SLCS included under Section 9.3.5 of the North Anna 3 COL FSAR. The NRC staff reviewed conformance of Section 9.3.5 of the COL FSAR to the guidance in RG 1.206, Section C.III.1, Chapter 9, C.I.9.3.5, "Standby Liquid Control System (BWRs)." The staff's review of Section 9.3.5 of the COL FSAR finds that it appropriately incorporates by reference Section 9.3.5 of the ESBWR DCD, Revision 5.

The staff review of this application is limited to the following item: STD SUP 9.3.5-1 in which the applicant summarized that the provisions adequately prevent loss of solubility of borated solutions (sodium pentaborate).

The NRC staff reviewed the resolution to the supplementary item related to the provisions to prevent loss of solubility of borated solutions (sodium pentaborate) included under Section 9.3.5.2 of the North Anna 3 COL FSAR. STD SUP 9.3.5-1, supplemental information item, is an editorial change which enlightens and summarizes the technical information of the previous paragraphs in the DCD with respect to preventing the loss of solubility of borated

solutions of the SLCS. The statement does not alter the technical information related to preventing loss of solubility of borated solutions and hence is acceptable.

9.3.5.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.3.5.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the SLCS 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 the DCD Section 9.3.5 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the SLCS 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 9.3.5 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR is acceptable and meets NRC requirements.

9.3.6 *Instrument Air System*

Section 9.3.6 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.3.6, "Instrument Air System" of Revision 5 of the ESBWR DCD. The 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 9.3.6 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Instrument Air System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the SER 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 9.3.6 of this SER to reflect the final disposition of the DCA.

9.3.7 *Service Air System*

Section 9.3.7 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.3.7, "Service Air System" of Revision 5 of the ESBWR DCD. The 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 9.3.7 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Service Air System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open

Item [1-1]. The staff will update Section 9.3.7 of this SER to reflect the final disposition of the DCA.

9.3.8 High Pressure Nitrogen Supply System

Section 9.3.8 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.3.8, "High Pressure Nitrogen System" of Revision 5 of the ESBWR DCD. The 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 9.3.8 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the High Pressure Nitrogen System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.3.8 of this SER to reflect the final disposition of the DCA.

9.3.9 Hydrogen Water Chemistry System

9.3.9.1 Introduction

This section of the North Anna 3 COL FSAR describes the hydrogen water chemistry (HWC) system which injects hydrogen into the feedwater system at the suction of the feedwater pumps to reduce oxidizing species in the RCS. The addition of hydrogen reduces the likelihood of corrosion failures that would adversely affect plant availability. Oxygen is injected into the offgas system to ensure a proper mixture of hydrogen and oxygen.

ESBWR DCD Section 9.3.9 addresses information related to the ESBWR hydrogen water chemistry system (HWCS). The HWCS is not within the certified scope of the ESBWR. The ESBWR Standard Plant Design includes the capability to incorporate a HWCS, but the system itself is not part of the ESBWR Standard Plant Design.

9.3.9.2 Summary of Application

Section 9.3.9 of the North Anna 3 COL FSAR incorporates by reference Section 3.9 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.3.9, the applicant provided the following:

COL Items

- STD COL 9.3.9-1-A Implementation of Hydrogen Water Chemistry

The applicant provided additional information in STD COL 9.3.9-1-A to address DCD COL Item 9.3.9-1-A. The applicant stated that the HWC option is included in the plant's design.

- NAPS COL 9.3.9-2-A Hydrogen and Oxygen Storage and Supply

The applicant provided additional information in NAPS COL 9.3.9-2-A to address DCD COL item 9.3.9-2-A. The applicant stated that the hydrogen supply system for the HWCS is

integrated with the generator hydrogen supply system and is described in DCD Section 10.2.2.2.8..

Site Specific Information Replacing Conceptual Design Information

- NAPS CDI System Description

The applicant provided additional information to replace CDI in the ESBWR DCD. The applicant described the HWC injection points and states that a monitoring system is provided to track the effectiveness of the HWCS.

- NAPS CDI Hydrogen Storage Facility

The applicant provided additional information to replace CDI in the ESBWR DCD. The applicant provided a description of the hydrogen storage facility. The hydrogen is stored in an 18,000 gallon ASME Section VIII, Division 1 cryogenic tank located outside the plant protected area.

- STD CDI Power Generation Design Basis

The applicant provided additional information to replace CDI in the ESBWR DCD. The applicant stated that hydrogen is injected into the feedwater at the suction of the feedwater pumps and oxygen is injected into the off-gas system.

- STD CDI Inspection and Testing Requirements

The applicant provided additional information to replace CDI in the ESBWR DCD. The applicant stated that the connections for the HWCS are tested and inspected with the feedwater and off-gas piping. Major components of the HWCS are inspected and tested as separate components prior to installation.

- STD CDI Instrumentation and Controls

The applicant provided additional information to replace CDI in the ESBWR DCD. The applicant stated that instrumentation is provided to control the injection of hydrogen and augment the injection of oxygen.

9.3.9.3 Regulatory Basis

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

There is no associated SRP section in NUREG-0800 for the HWCS.

The applicable industry requirements for the HWCS, which have been endorsed by the NRC, are as follows:

- Electric Power Research Institute “BWR Hydrogen Water Chemistry Guidelines”, EPRI Report NP-4947-SR
- Electric Power Research Institute “Guidelines for Permanent BWR Hydrogen Water Chemistry Installations”, EPRI Report NP-5283-SR-A

9.3.9.4 *Technical Evaluation*

The NRC staff reviewed Section 9.3.9 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 relevant information related to the HWCS.

Section 9.3.9 of the 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 the HWCS will be documented in the staff SER on the DCA for the ESBWR.

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

COL Items

- STD COL 9.3.9-1-A Implementation of Hydrogen Water Chemistry

The HWCS is composed of hydrogen and oxygen supply systems to inject hydrogen in the feedwater and oxygen in the off-gas while several monitoring systems track the effectiveness of the HWCS. Provisions are made in the design to allow for installation of a system adding hydrogen to the feedwater at the suction of the feedwater pumps. The ESBWR DCD requires that the HWCS utilizes the guidance included in the Electric Power Research Institute (EPRI) Report NP-4947-SR, "BWR Hydrogen Water Chemistry Guidelines," 1987 Revision. The report provides guidelines on how to operate the HWCS. The NRC staff has endorsed the report in its SER of the EPRI Utility Requirements Document and on that basis the staff finds Report NP-4947-SR, 1987 Revision acceptable. In addition, the staff finds that the North Anna COL FSAR has adequately addressed STD COL 9.3.2-1-A by providing information that adequately describes the North Anna Unit 3 HWCS and incorporates the EPRI guidance.

- NAPS COL 9.3.9-2-A Hydrogen and Oxygen Storage and Supply

The HWCS is non-safety-related; however, given the potential for hydrogen combustion or detonation, the handling of hydrogen at nuclear power plant facilities needs to be safe, reliable, and consistent with the requirements for using hydrogen gas. The ESBWR DCD requires that any HWCS installations including the means for storing and handling hydrogen meet the EPRI Report NP-5283-SR-A, "Guidelines for Permanent BWR Hydrogen Water Chemistry Installations." The report provides guidance to store and handle hydrogen at nuclear power facilities. The staff has approved EPRI Report NP-5283-SR-A in its letter J.E. Richardson to G.H. Niels dated July 13, 1987. Therefore, the staff finds that the North Anna COL FSAR specifies an acceptable method to handle and store hydrogen for the HWCS and incorporates the EPRI guidance.

Site Specific Information Replacing Conceptual Design Information

- NAPS CDI System Description

The Staff finds the CDI acceptable because it provides a monitoring system to track the effectiveness of the HWCS.

- NAPS CDI Hydrogen Storage Facility

The Staff finds that the North Anna COL FSAR specifies an acceptable method to store hydrogen.

- STD CDI Power Generation Design Basis

The Staff finds the CDI acceptable because it provides the location where each gas is injected

- STD CDI Inspection and Testing Requirements

The Staff finds the CDI acceptable because it ensures the HWCS will work as designed.

- STD CDI Instrumentation and Controls

The Staff finds the CDI acceptable because it provides information on the proper functionality of the HWCS.

9.3.9.5 Post Combined License Activities

There are no post COL activities related to this section.

9.3.9.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the HWCS 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 the DCD Section 9.3.9 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the HWCS 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 9.3.9 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR is acceptable and meets the requirements of NRC endorsed EPRI guidelines.

9.3.10 Oxygen Injection System

9.3.10.1 Introduction

This section of the North Anna 3 COL FSAR addresses information related to the ESBWR oxygen injection system (OIS). The OIS does not perform any safety-related function. The OIS is designed to add oxygen to the Condensate and Feedwater System in order to reduce corrosion and suppress corrosion product release. Industry experience has shown that the most beneficial oxygen concentration is between 30 to 200 ppb. The OIS is also designed to inject oxygen into the off-gas system when the HWC is implemented, to ensure that excess hydrogen in the off-gas stream is recombined.

9.3.10.2 Summary of Application

Section 9.3.10 of the North Anna 3 COL FSAR incorporates by reference Section 9.3.10 of the ESBWR DCD, Revision 4.

In addition, in FSAR Section 9.3.10, the applicant provided the following;

COL Item

- NAPS COL 9.3.10-1-A Oxygen Storage Facility

The applicant provided additional information in NAPS COL 9.3.10-1-A to address DCD COL Item 9.3.10-1-A. The applicant described the bulk oxygen storage facility which consists of a 9,000 gallon ASME Section VIII, Division 1 cryogenic tank located outside the plant fenced area. The tank is equipped with an atmospheric vaporizer, a pressure regulating valve, an excess flow check valve and relief valves.

9.3.10.3 Regulatory Basis

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

There is no associated SRP section in NUREG-0800 for the oxygen storage facility.

The applicable industry requirements for oxygen storage facility, which have been endorsed by the NRC, are as follows:

- Electric Power Research Institute "Guidelines for Permanent BWR Hydrogen Water Chemistry Installations", EPRI Report NP-5283-SR-A

9.3.10.4 Technical Evaluation

The NRC staff reviewed Section 9.3.10 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL 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 relevant information related to the OIS.

Section 9.3.10 of the 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 the OIS will be documented in the staff SER on the DCA for the ESBWR.

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

COL Item

- NAPS COL 9.3.10-1-A Oxygen Storage Facility

The NRC staff reviewed NAPS COL 9.3.10-1-A related to the oxygen storage facility included under Section 9.3.10 of the North Anna 3 COL FSAR. The OIS is designed to add sufficient oxygen (30 to 200 ppb) to reduce corrosion, general corrosion, and the release of corrosion

products in the condensate and feedwater systems. The requirements for design, operation, maintenance, surveillance, and testing of the oxygen storage facility are specified in EPRI Report NP-5283-SR-A, "Guidelines for Permanent BWR Hydrogen Water Chemistry Installations." The ESBWR DCD specifies that any HWCS installations meet the EPRI Report NP-5283-SR-A. In addition, the oxygen storage facility is located in an area where the amount of combustible material is limited through design and administrative controls. North Anna 3 COL FSAR uses the guidance of EPRI Report NP-5283-SR-A to store and handle oxygen. The staff has approved EPRI Report NP-5283-SR-A in its letter J.E. Richardson to G.H. Niels dated July 13, 1987. Therefore, the staff finds that the North Anna COL FSAR specifies an acceptable method to handle and store oxygen.

In addition, the staff finds that the North Anna 3 COL FSAR has adequately addressed NAPS COL 9.3.2-1-A by providing information that adequately describes the North Anna Unit 3 oxygen injection module of the HWCS and by providing an acceptable description of the oxygen storage facility.

9.3.10.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.3.10.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the OIS 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 the DCD Section 9.3.10 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the OIS 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 9.3.10 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR is acceptable and meets the requirements of NRC endorsed EPRI guidelines. The staff based its conclusion on the design information provided in STD COL 9.3.10-1A.

9.3.11 *Zinc Injection System*

This section of the North Anna 3 COL FSAR incorporates by reference Section 9.3.11 of the ESBWR DCD, Revision 5. Section 9.3.11 of the ESBWR DCD, states that the ESBWR Standard Plant design includes provisions for connecting an optional Zinc Injection System (ZIS). This section also provides two COL Items, stating that the COL applicant shall determine if a ZIS is required to be implemented at startup based on plant configuration and material selection, and if a ZIS were to be installed the applicant shall include necessary information on system description, test and inspection. In Section 9.3.11 of the North Anna 3 COL FSAR the applicant has stated for both COL Items, STD COL 9.3.11-1-A and STD COL 9.3.11-2-A, that a ZIS will not be utilized. The NRC staff review confirmed that the applicant has addressed the relevant information and no outstanding information is expected to be addressed in the COL FSAR related to this subsection.

The staff is reviewing the information in the DCD Section 9.3.11 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the ZIS 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 9.3.11 of this SER to reflect the final disposition of the DCA.

9.3.12 Auxiliary Boiler System

Section 9.3.12 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.3.12, "Auxiliary Boiler System" of Revision 5 of the ESBWR DCD. The 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 9.3.12 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Auxiliary Boiler System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.3.12 of this SER to reflect the final disposition of the DCA.

9.4 Heating, Ventilation, and Air Conditioning

Section 9.4 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.4, "Heating, Ventilation, and Air Conditioning" of Revision 5 of the ESBWR DCD. The 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 9.4 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Heating, Ventilation, and Air Conditioning 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 9.4 of this SER to reflect the final disposition of the DCA.

9.5 Other Auxiliary Systems

9.5.1 Fire Protection System

9.5.1.1 *Introduction*

This section of the North Anna 3 COL FSAR describes the FPS which provides assurance, through a defense-in-depth philosophy, that the Commission's fire protection objectives are satisfied. These objectives are: (1) to prevent fires from starting; (2) to detect rapidly, control, and extinguish promptly those fires that do occur; and (3) to provide protection for SSCs important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant. In addition, FPS must be designed such that their failure or inadvertent operation does not adversely impact the ability of the SSCs

important to safety to perform their safety functions. The FPS has a RTNSS function to provide post 72 hour makeup to the IC/PCC pools and the SFP.

9.5.1.2 Summary of Application

Section 9.5.1, Appendix 9A, and Appendix 9B of the North Anna 3 COL FSAR Revision 1 incorporates by reference Section 9.5.1, Appendix 9A, and Appendix 9B of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.5.1, the applicant provided the following:

COL Items:

- NAPS COL 9.5.1-1-A Secondary Firewater Storage Source

The applicant provided additional information in NAPS COL 9.5.1-1-A to address DCD COL Item 9.5.1-1-A. The applicant identified Lake Anna as the secondary source of water. The lake has a capacity well in excess of 550,000 gallons as specified in ESBWR DCD, Revision 5, and as per guidance given in RG 1.189 Regulatory Position 3.2.1.

- NAPS COL 9.5.1-2-A Secondary Firewater Capacity

The applicant provided additional information in NAPS COL 9.5.1-2-A to address DCD COL Item 9.5.1-2-A. The applicant stated that tests will be performed to demonstrate that the secondary fire protection pump circuit supplies the required flow and pressure at the Turbine Building /yard interface boundary. DCD Section 14.2.8.1.39 which is incorporated by reference states that FPS tests are in accordance with the criteria in codes and standards listed in Table 9.5-1. Therefore, secondary pump curve tests and flow test will be in accordance with National Fire Protection Association (NFPA) 20.

- NAPS COL 9.5.1-4-A Piping and Instrumentation Diagrams

The applicant provided additional information in NAPS COL 9.5.1-4-A to address DCD COL Item 9.5.1-4-A. The applicant provided Figures 9.5-201, 9.5-202 and 9.5-203 depicting the site-specific firewater supply piping.

- NAPS COL 9.5.1-10-H Fire Brigade

The applicant provided additional information in NAPS COL 9.5.1-10-H to address DCD COL Item 9.5.1-10-H. The applicant stated that the fire brigade will be implemented in accordance with the milestones in FSAR Section 13.4 for the Fire Protection Program.

- STD COL 9.5.1-5-A Fire Barriers

The applicant provided additional information in STD COL 9.5.1-5-A to address DCD COL Item 9.5.1-5-A. The applicant stated that the mechanical and electrical penetration seals are qualified to RG 1.189 through testing by an independent laboratory. Certification test results will be available for review at least 6 months before receipt of fuel.

- STD COL 9.5.1-6-H Smoke Control

The applicant provided additional information in STD COL 9.5.1-6-H to address DCD COL Item 9.5.1-6-H. The applicant stated that the procedures for manual smoke control will be developed as part of the Fire Protection Program implementation. The program will be operational for areas storing new fuel prior to receipt of the fuel. Other elements of the Fire Protection Program will be operational before initial fuel load.

- STD COL 9.5.1-7-H FHA Compliance Review

The applicant provided additional information in STD COL 9.5.1-7-H to address DCD COL Item 9.5.1-7-H. The applicant stated that the compliance review of the as-built design against the assumptions and requirements stated in the fire hazards analysis (FHA) will be completed in accordance with the milestone schedule in FSAR Section 13.4. ESBWR DCD, Revision 5 added the specific items to be reviewed.

- STD COL 9.5.1-8-A Fire Protection Program Description

The applicant provided additional information in STD COL 9.5.1-8-A to address DCD COL Item 9.5.1-8-A. The applicant stated that the Fire Protection Program will be operational for areas storing new fuel before receipt of the fuel. Other elements of the Fire Protection Program will be operational prior to initial fuel load per FSAR Section 13.4.

- STD COL 9.5.1-11-A Quality Assurance

The applicant provided additional information in STD COL 9.5.1-11-A to address DCD COL item 9.5.1-11-A. The applicant stated the following:

“Quality assurance controls are applied to the activities involved in the design, procurement, installation, and testing and the administrative controls of FPS, in accordance with the measures outlined in Chapter 17.

For the operational fire protection program, the Quality Assurance Program implements the requirements of RG 1.189 through site-specific administrative controls procedures. The procedures will be developed six months before fuel receipt and will be fully implemented prior to fuel receipt.”

- STD COL 9A.7-1-A Fire Zone Drawings

The applicant provided additional information in STD COL 9A.7-1-A to address DCD COL Item 9A.7-1-A. STD COL 9A.7-1-A provides fire zone drawings for the site-specific portions of the Yard.

- NAPS COL 9A.7-2-A Detailed Fire Hazards Analysis of the Yard

The applicant provided additional information in STD COL 9A.7-2-A to address DCD COL Item 9A.7-2-A. NAPS COL 9A.7-2-A commits to performing a detailed FHA of the Yard area that is outside the scope of the certified design.

Supplemental Information

- NAPS SUP 9.5.1-1 and NAPS SUP 9A-01 Codes, Standards and Regulatory Guidance

The applicant provided Table 9.5-201 to supplement DCD Table 9.5-1 for those portions of the Fire Protection Program that are not addressed in the ESBWR DCD and for operational aspects of the fire detection and suppression systems.

- STP SUP 9.5.1-3 Combustible and Ignition Source Controls

The applicant revised FSAR Section 9.5.1.15.6 to add combustible and ignition source controls for areas adjacent to the main control room (MCR) and in computer rooms that are not part of the control room complex and prohibit storage of transient combustibles below the raised floor in the MCR complex and prohibit the storage of hazardous chemicals in areas that contain or expose equipment important to safety.

9.5.1.3 Regulatory Basis

The regulatory basis for 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 Fire Protection Program and the associated acceptance criteria are given in Section 9.5.1 of NUREG-0800.

The applicable regulatory requirements for the Fire Protection Program are as follows:

- 10 CFR 50.48,
- 10 CFR 50.48(f),
- 10 CFR Part 50 Appendix A, GDC 3, 5, 19, and 23,
- 10 CFR Part 50 Appendix R,
- 10 CFR Part 52,
- 10 CFR 52.47(b)(1),
- 10 CFR 52.80(a),
- 10 CFR Part 72
- SECY-90-016,
- SECY-93-087
- SECY-94-084

9.5.1.4 Technical Evaluation

The NRC staff reviewed Section 9.5.1 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 NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the FPS.

Section 9.5.1 of the 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 the FPS will be documented in the staff SER on the DCA for the ESBWR.

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

The NRC staff reviewed the relevant information in the COL FSAR and the applicant's responses to RAI letters accordingly and concludes that the relevant information in the COL and Supplemental Information Items, and responses to RAIs is acceptable and meets the requirements of GDC 3, 5, 19 and 23 of Appendix A to 10 CFR Part 50, 10 CFR 50.48, SECY-90-016, SECY-93-087 and SECY-94-084 as shown below:

North Anna 3 conforms to the SRP Section 9.5.1 acceptance criteria with the following exceptions:

- SRP Acceptance Criterion 1 (RG 1.174, Revision 1 – PRA Insights) does not apply to North Anna 3. PRA has not been applied to the design of the plant-specific Fire Protection Program.
- SRP Acceptance Criterion 2 (RG 1.188, Revision 1 – License Renewal) and 4 (RG 1.191 – Decommissioning) are not applicable to the North Anna 3 COL application.
- SRP Acceptance Criterion 3 (RG 1.189, Revision 1 – Fire Protection): North Anna 3 conforms except that the site executive in charge of construction (Vice President – Nuclear Development) is in charge of fire protection during construction as described in North Anna 3 COL FSAR, Revision 1, Table 1.9-202 and Section 13.1. North Anna Unit 3 shares Unit 1 and 2 existing warehouse buildings but this does not adversely affect the Fire Protection Program at North Anna Unit 3.
- SRP Acceptance Criterion 5 (RG 1.206, Regulatory Position C.III.1, Section C.I.9.5.1 – Fire Protection Program): North Anna 3 conforms to the nine requirements listed in Section C.I.9.5.1 except as listed below:
 - C.I.9.5.1.1(1): See North Anna 3 COL FSAR Revision 1 and response to RAIs 09.05.01-5, 09.05.01-7, 09.05.01-18, and 13.01.02-13.01.03-1. Significant RAI technical evaluations are shown below.
- SRP Acceptance Criterion 6 (SECY-90-016, SECY-93-087, and SECY-94-084): North Anna 3 conforms as per North Anna 3 COL FSAR Revision 1, Table 1.9-201 and below technical evaluation for RAI 09.05.01-16.
- SRP Acceptance Criterion 7 implementation milestones: North Anna 3 does not conform to the requirement for the Fire Protection Program to be fully implemented prior to fuel receipt at the plant site. North Anna 3 will use a two tier approach such that the elements of the Fire Protection Program necessary to support receipt and storage of fuel onsite for buildings storing new fuel and adjacent fire areas that could affect the fuel storage area are fully

The staff reviewed the relevant information in the COL FSAR:

COL Item

- NAPS COL 9.5.1-1-A Secondary Firewater Storage Source

The NRC staff reviewed NAPS COL 9.5.1-1-A related to secondary firewater sources included under Section 9.5.1.4 of the North Anna 3 COL FSAR Revision 1. The staff determined that the secondary firewater source is Lake Anna is well in excess of the 550,000 gallons as specified in ESBWR DCD, Revision 5, and as per guidance given in RG 1.189 Regulatory Position 3.2.1. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- NAPS COL 9.5.1-2-A Secondary Firewater Capacity

The NRC staff reviewed NAPS COL 9.5.1-2-A related to secondary firewater capacity included under Section 9.5.1.4 of the North Anna 3 COL FSAR Revision 1. The staff determined that each secondary fire pump will be tested to show that each pump can supply a minimum of 2130 gpm with sufficient discharge pressure to develop a minimum of 107 psig at the Turbine Building/Yard interface boundary which is the same as the DCD requirement. This test cannot be performed until the system is built. This activity will be completed prior to fuel receipt. DCD Section 14.2.8.1.39 which is incorporated by reference states that FPS tests are in accordance with the criteria in codes and standards listed in Table 9.5-1. Therefore, secondary pump curve tests and flow test will be in accordance with NFPA 20. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- NAPS COL 9.5.1-4-A Piping and Instrumentation Diagrams

The NRC staff reviewed NAPS COL 9.5.1-4-A related to the site specific simplified piping and instrumentation diagrams included under Section 9.5.1 of the North Anna 3 COL FSAR Revision 1. The staff reviewed Figures 9.5.201, 9.5.202, 9.5.203 of the North Anna 3 COL application, and DCD Figure 9.5.1 and determined that these figures do provide simplified diagrams of the site-specific firewater piping as requested by the DCD. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- NAPS COL 9.5.1-10-H Fire Brigade

The NRC staff reviewed NAPS COL 9.5.10-1-H related to implementation of the fire brigade included under Section 9.5.1.15.4 of the North Anna 3 COL FSAR Revision 1. The staff determined that implementation of the fire brigade will be in accordance with the milestones in Section 13.4 for the Fire Protection Program. The staff accepts North Anna 3's fire brigade implementation milestones as given in Section 13.4 since they will provide appropriate protection consistent with the plant's completion schedule. Additionally, the fire brigade requirements are incorporated by reference to the DCD. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- STD COL 9.5.1-5-A Fire Barriers

The NRC staff reviewed NAPS COL 9.5.1-5-A related to the qualification of fire barriers included under Section 9.5.1.10 of the North Anna 3 COL FSAR Revision 1. The staff determined that mechanical and electrical penetration seals and electrical raceway fire barrier systems will be qualified to the requirements delineated in RG 1.189 by a recognized testing laboratory in accordance with the applicable guidance of NFPA 251 and/or American Society for Testing and Materials E-119. Detailed design in this area is not complete. Specific design and certification test results for penetration seal designs and electrical raceway fire barrier systems will be available for review at least six months prior to fuel receipt. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- STD COL 9.5.1-6-H Smoke Control

The NRC staff reviewed STD COL 9.5.1-6-H related to manual smoke control included under Section 9.5.1.11 of the North Anna 3 COL FSAR Revision 1. The staff determined that procedures for manual smoke control will be developed as part of the Fire Protection Program implementation in accordance with milestones in FSAR Section 13.4. Smoke removal provisions are in accordance with NFPA 804 except Sections 8.4.3 (3) and 8.4.3.2 as per the DCD. NFPA 804 has not been endorsed by the NRC but is considered acceptable where it does not conflict with regulatory requirements and guidance. The applicant's response to RAI 09.05.01-3 states that should a conflict exist between RG 1.189 and NFPA 804 the COL application conforms to RG 1.189. Automatic sprinkler protection is provided where applicable to limit heat and smoke generation as per the DCD.

RAI 09.05.01-16 addresses issues related to smoke control as follows:

Summary:

Describe how the FHA will evaluate the potential for the migration of smoke, hot gases or fire suppressant to prevent safe shutdown and verify that fire dampers that do not close on smoke detection will not be relied upon to prevent the migration of smoke from one redundant train to another.

Resolution:

The applicant's response to RAI 09.05.01-16 stated that FSAR Section 9.5.1 incorporated by reference ESBWR DCD, Section 9.5.1, which describes the ESBWR plant design features that address building ventilation, fire barriers, and smoke control necessary for safe shutdown. As stated in the ESBWR DCD the ESBWR design satisfies the guidance from the NUREG-0800 SRP Section 9.5.1 and BTP SPLB 9.5-1, that smoke, hot gases, or the fire suppressant does not migrate into other fire areas to the extent that safe shutdown capabilities, including operator actions, could be adversely affected. The ESBWR fire protection design satisfies this guidance with a combination of fire dampers and other barriers, smoke evacuation capabilities, and minimal required operator actions. Additionally, manual smoke control procedures will be developed as part of the Fire Protection Program implementation. Smoke-rated dampers that close on smoke detection are provided in areas where smoke migration into other areas can adversely affect safe shutdown. Details are provided in the FHA in Appendix 9A. There are no fire protection-related site-specific design features that are required to ensure safe-shutdown of the plant.

The NRC staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- STD COL 9.5.1-7-H FHA Compliance Review

The NRC staff reviewed STD COL 9.5.1-7-H related to review for FHA compliance included under Section 9.5.1.12 of the North Anna 3 COL FSAR Revision 1. The staff determined that a compliance review of the as-built design against the assumptions and requirements stated in the FHA will be completed in accordance with the milestones in FSAR Section 13.4. This is acceptable to the staff. ESBWR DCD, Revision 5 added all the specific items to be reviewed into STD 9.5.1-7-H and deleted STD SUP 9.5.1-2. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- STD COL 9.5.1-8-A Fire Protection Program Description

The NRC staff reviewed STD COL 9.5.1-8-A related to the operational status of the Fire Protection Program included under Section 9.5.1.15 of the North Anna 3 COL FSAR Revision 1. The staff determined that the elements of the Fire Protection Program necessary to support receipt and storage of fuel onsite for buildings storing new fuel and adjacent fire areas that could affect the fuel storage area are fully operational prior to receipt for new fuel. Other required elements of the Fire Protection Program described in this section are fully operational prior to initial fuel loading per Section 13.4. NUREG-0800, Section 9.5.1, Revision 5 states that Fire Protection Program should be fully implemented prior to fuel receipt at the plant site. Additionally, the Fire Protection Program requirements are incorporated by reference to the DCD. The staff accepts North Anna 3's fire protection implementation milestones as given in Section 13.4 since they will provide appropriate protection consistent with the plant's completion schedule. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- STD COL 9.5.1-11-A Quality Assurance

The NRC staff reviewed STD COL 9.5.1-11-A related to implementation of the QA program included under Section 9.5.1 of the North Anna 3 COL FSAR Revision 1. The staff determined that the QA controls for activities involved in the design, procurement, installation, and testing and administrative controls of FPS is in accordance with the measures outlined in Chapter 17 and for the operational Fire Protection Program the QA Program implements the requirements of RG 1.189 through site-specific administrative controls procedures. These operational QA procedures will be developed six months prior to fuel receipt and will be fully implemented prior to fuel receipt.

The NRC staff accepts North Anna 3's fire protection QA program milestones since they will provide appropriate protection consistent with the plant's completion schedule and provide sufficient time for NRC review. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- STD COL 9A.7-1-A Fire Zone Drawings

The NRC staff reviewed STD COL 9A.7-1-A related to site fire zone drawings included under Appendix 9A of the North Anna 3 COL FSAR Revision 1. The staff reviewed the revised fire zone drawings, Figures 9A.2-201 through 9A.2-206, and determined that the site-specific fire zones have been included as needed and reflect design evolution changes unrelated to fire

protection, and added missing information. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- NAPS COL 9A.7-2-A Detailed Fire Hazards Analysis of the Yard

The NRC staff reviewed STD COL 9A.7-2-A related to site detailed FHA included under Appendix 9A of the North Anna 3 COL FSAR Revision 1. The staff reviewed the information in Section 9A.4.7, 9A.5.7, 9A.5.8, 9A.5.9, and 9A.5.10 and determined that the detailed FHA of the plant areas that are outside the scope of the certified design will be completed six months prior to fuel load. The staff accepts North Anna 3's site-specific FHA milestones since they will provide appropriate protection consistent with the plant's completion schedule and provide sufficient time for NRC review. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

Supplemental Information

- NAPS SUP 9.5.1-1 and NAPS SUP 9A-01 Codes, Standards and Regulatory Guidance

The NRC staff reviewed NAPS SUP 9.5.1-1 and NAPS SUP 9A-01 related to the codes and standards included under Section 9.5.1 and Appendix 9A of the North Anna 3 COL FSAR Revision 1. The staff determined that revised Table 9.5-201 added the codes and standards that are applicable for those portions of the Fire Protection Program outside the scope of the DCD and for the operational aspects of the Fire Protection Program. These added codes and standards are acceptable for North Anna 3 since the NFPA standards listed are referenced in RG 1.189; the Virginia Statewide Building Code is a local code that is required to be met by North Anna 3; Environmental Protection Agency standards are federal standards that apply to North Anna 3; the ASME Code Section IX is approved for use by the NRC; and the added codes and standards are in accordance with the guidelines given in RG 1.189, Revision 1 where applicable. Additionally, two footnotes were removed from DCD Table 9.5-2 that do not apply to the North Anna 3 COL application. The staff finds that North Anna 3 COL FSAR Revision 1 fully addresses this COL Information Item.

- STP SUP 9.5.1-3 Combustible and Ignition Source Controls

The NRC staff reviewed revised FSAR Section 9.5.1.15.6 and the applicant's responses to RAIs 09.05.01-5, 6, 7, and 13 to add combustible and ignition source controls for areas adjacent to the MCR and in computer rooms that are not part of the control room complex and prohibit storage of transient combustibles below the raised floor in the MCR complex and prohibit the storage of hazardous chemicals in areas that contain or expose equipment important to safety. The staff finds that the responses to these RAIs (significant RAIs for this issue shown below) are acceptable and that the proposed FSAR revision has been incorporated into the North Anna 3 COL FSAR Revision 1 as required.

- RAI 09.05.01-5 "Automatic Suppression in Rooms Adjacent to MCR"

Summary:

Describe the program to control the MCR complex fire hazard presented by paper or other combustible materials, as well as ignition sources (e.g., coffee makers).

Resolution:

The ESBWR DCD took exception to the RG 1.189 guidance to provide automatic suppression in the rooms adjacent to the MCR. The applicant's response to RAI 09.05.01-5 stated that in addition to the administrative controls described in the ESBWR DCD, the North Anna 3 FSAR will be revised to include administrative requirements to specifically control combustible materials and potential sources in rooms adjacent to the MCR. The NRC staff finds that the response to this RAI is acceptable and that the proposed FSAR revision has been incorporated into the North Anna 3 COL FSAR Revision 1 as required.

- RAI 09.05.01-6 "Automatic Suppression below the Raised Floor in the MCR Complex"

Summary:

The ESBWR DCD took exception to the RG 1.189 guidance to providing automatic fire suppression below the raised floor in the MCR complex. Describe the approach to restricting transient combustibles in this area. Also describe the extent to which cabling below the raised floor will be contained in conduit.

Resolution:

The applicant's response to RAI 09.05.01-6 stated that in addition to the administrative controls described in the ESBWR DCD, the North Anna 3 COL FSAR will be revised to prohibit the storage of transient combustibles below the raised floor in the MCR complex. The NRC staff finds that the response to this RAI is acceptable and that the proposed FSAR revision has been incorporated into the North Anna 3 COL FSAR Revision 1 as required.

- RAI 09.05.01-7 "Automatic Suppression for Computer Rooms that are not part of the MCR Complex"

Summary:

The ESBWR DCD took exception to the RG 1.189 guidance to providing fixed automatic suppression for computer rooms for computers performing functions important to safety that are not part of the Control Room Complex. Describe the program to control the fire hazard presented by paper or other combustible materials, as well as potential ignition sources in these rooms.

Resolution:

The applicant's response to RAI 09.05.01-7 stated that in addition to the administrative controls described in the ESBWR DCD, the North Anna 3 COL FSAR will be revised to include administrative requirements to specifically control combustible materials and potential sources in computer rooms that are not part of the MCR complex. The NRC staff finds that the response to this RAI is acceptable and that the proposed FSAR revision has been incorporated into the North Anna 3 COL FSAR Revision 1 as required.

Significant RAI Responses Not addressed above (all RAIs are resolved)

- RAI 09.05.01-2 “Multiple Spurious Actuations”

Summary:

What assumptions and methodologies will be used by the applicant to identify, assess, and resolve the potential for multiple spurious actuations that may prevent post-fire safe-shutdown?

Resolution:

The applicant stated that General Electric-Hitachi will perform all safe shutdown analysis for the ESBWR plant and, therefore, this issue will be addressed in the DCD and is being tracked as Open Item 1-1. The NRC staff finds that the response to this RAI is acceptable and that there are no FSAR changes required.

- RAI 09.05.01-18 “Smoke Detectors in the MCR Cabinets and Consoles”

Summary:

The ESBWR DCD took exception to the RG 1.189 guidance to providing smoke detectors in the control room cabinets and consoles. Describe the cabinet design features that will facilitate the rapid identification of the specific cabinet/console that is on fire and facilitate rapid access to the cabinets/consoles for fire fighting.

Resolution:

The applicant’s response to RAI 09.05.01-18 stated that requirements to develop specific fire fighting procedures and train fire brigade members are addressed in the ESBWR DCD and in the North Anna 3 COL FSAR. ESBWR DCD, Section 9.5.1.15.5 requires that procedures be developed to, in part; define the strategies established for fighting fires in safety-related areas and areas presenting a hazard to safe shutdown equipment. Strategies for fighting fires in the MCR will be included in these procedures and will address specific cabinet design features, as appropriate. The development of these procedures will be as per North Anna 3 COL FSAR Table 13.5-202.

The NRC staff finds that the response to this RAI is acceptable and that there are no FSAR changes required.

9.5.1.5 Post Combined License Activities

The applicant identified the following COL Holder Items:

- STD COL 9.5.1-6-H commits to establishing provisions for manual smoke control to address COL Holder Item 9.5.1-6-H.
- STD COL 9.5.1-7-H commits to performing an as-built design compliance review against the assumptions and requirements stated in the FHA to address COL Holder Item 9.5.1-7-H.
- NAPS COL 9.5.1-10-H commits to providing for fire brigade implementation in accordance with the milestones in FSAR Section 13.4 to address COL Holder Item 9.5.1-10-H.

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

9.5.1.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the FPS 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 the DCD Section 9.5.1 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the FPS 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 9.5.1 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR is acceptable and meets the requirements of GDC 3, 5, 19 and 23 of Appendix A to 10 CFR Part 50, 10 CFR 50.48, SECY-90-016, SECY-93-087 and SECY-94-084. The staff based this conclusion on the above technical evaluations of the relevant information given in the COL and Supplemental Information Items, and responses to RAIs.

9.5.2 Communication Systems

9.5.2.1 Introduction

This section of the North Anna 3 COL FSAR describes the communication systems which provide intraplant communications and plant-to-offsite communications during normal, maintenance, transient, fire, and accidents conditions.

9.5.2.2 Summary of Application

Section 9.5.2 of the North Anna 3 COL FSAR incorporates by reference Section 9.5.2 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.5.2.5, the applicant provided the following:

COL Items

- NAPS COL 9.5.2.5-1-A Emergency Notification System

This COL Item requested a description of the Emergency Notification System (ENS). The applicant stated that the information required is addressed in FSAR Section 9.5.2.2.

- NAPS COL 9.5.2.5-2-A Grid Transmission Operator

This COL Item requested a description of the transmission system operator communication link. The applicant stated that the information required is addressed in FSAR Section 9.5.2.2 and in the EP Sections II.F.1.

- NAPS COL 9.5.2.5-3-A Offsite Interfaces (1)

This COL Item requested a description of the means of communication between the MCR, TSC, emergency operations facility (EOF), state and local emergency operation centers and radiological field personnel in accordance with NUREG-0696 and NUREG-0654. The applicant stated that the information required is addressed in FSAR Section 9.5.2.2 and in the EP Sections II.E.1 and II.F.1.

- NAPS COL 9.5.2.5-4-A Offsite Interfaces (2)

This COL Item requested a description of the communication methods from the MCR, TSC, and EOF to the NRC headquarters including establishment of Emergency Response Data Systems (ERDS) in accordance with NUREG-0696. The applicant stated that the information required is addressed in FSAR Section 9.5.2.2 and in the EP Sections II.E.1 and II.F.1.

- NAPS COL 9.5.2.5-5-A Fire Brigade Radio System

This COL Item requested a description of the Fire Brigade Radio System. The applicant stated that the information required is addressed in FSAR Section 9.5.2.2.

9.5.2.3 *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 communications systems and the associated acceptance criteria are given in Section 9.5.2 of NUREG-0800.

The applicable regulatory requirements for the ENS and prompt communications among principal response organizations and emergency response personnel are as follows:

- 10 CFR Part 50, Appendix E, Part IV.E.9
- 10 CFR 50.47(b)(5) and (b)(6)

The related acceptance criteria are as follows:

- NRC Bulletin (BL) 80-15
- NUREG-0696
- NUREG-0654/FEMA-REP-1, Revision 1

9.5.2.4 *Technical Evaluation*

The NRC staff reviewed Section 9.5.2 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.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the Communication Systems.

Section 9.5.2 of the 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 the Communication Systems will be documented in the staff SER on the DCA for the ESBWR.

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

The staff examined the Emergency Plan (EP), Sections II.E and II.F which are relevant to the COL Item responses. The detailed review of EP Sections II.E and II.F is reflected in SER Section 13.3, "Emergency Planning." The detailed review of the completely independent radio subsystem for security purposes is reflected in SER Section 13.6, "Physical Security." The staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the communications system. The staff is reviewing Section 9.5.2 of the ESBWR DCD on Docket No. 50-010. The staff's technical evaluation of the information incorporated by reference related to the communications system will be documented in the corresponding SER. The staff reviewed conformance of Section 9.5.2 of the North Anna 3 COL FSAR to the guidance in RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.2, "Communications Systems." The staff's review finds that the applicant appropriately incorporates by reference Section 9.5.2 of the ESBWR DCD, Revision 5.

The ESBWR DCD, Section 9.5.2, Communications System, list communications systems that are to provide the means to conveniently and effectively communicate between various parts of the nuclear power plant and with offsite company, governmental, support agencies, and other locations during normal operations, testing and drills, and during maintenance, transient, fire, emergency, and accident conditions under maximum potential noise levels.

The ESBWR DCD, Section 9.5.2 identified site communication systems that are made up of the following subsystems

- Plant page/party-line subsystem;
- Private automatic branch exchange subsystem;
- Plant sound-powered telephone subsystem;
- Plant radio subsystem;
- Evacuation alarm and remote warning subsystem;
- Emergency offsite communication subsystem; and
- Completely independent radio subsystem for security purposes.

The ESBWR DCD, Section 9.5.2.1 provides the safety design basis and the power generation design basis while ESBWR DCD, Section 9.5.2.2 provides a summary system description for these site communications except for the completely independent radio subsystem for security purposes that is described in ESBWR DCD, Section 13.6.

The staff reviewed the relevant information in the North Anna 3 COL Part 2: FSAR and examined the relevant information in Part 5: EP, Sections II.E and II.F.

COL Items

- NAPS COL 9.5.2.5-1-A Emergency Notification System

The NRC staff reviewed NAPS COL 9.5.2.5-1-A related to the ENS included under Section 9.5.2 of the North Anna 3 COL FSAR. The DCD COL Item 9.5.2.5-1-A states that “The COL applicant will describe the Emergency Notification System provisions required by 10 CFR 50.47(b)(6) and address recommendations described in BL-80-15.” The applicant addressed this Item in Section 9.5.2.5 with departure/supplement NAPS COL 9.5.2.5-1-A in their application by stating, “This COL item is addressed in Section 9.5.2.2.” The staff reviewed the resolution to the DCD COL item 9.5.2.5-1-A involving the ENS included under Section 9.5.2.2 of the North Anna 3 COL application. In Section 9.5.2.2 under Emergency Communication Systems, the parenthetical “(COL 9.5.2.5-1-A)” in the first bullet is replaced by a paragraph labeled “NAPS COL 9.5.2.5-1-A” that describes key features of the ENS.

The regulation 10 CFR 50.47(b)(6) requires that provisions exist for prompt communications among response organizations to emergency personnel and to the public. The key provisions of NRC BL 80-15 states in part that, “... all extensions of the ENS located at your facility(ies) would remain fully operable from the facility(ies) to the NRC Operations Center in the event of a loss of offsite power to your facility(ies).” The ENS phone lines are fiber-optic phone lines through a telephone utility switch that is located on site in the telephone equipment building. They are routed directly to the local telephone company central office. The normal power source for the ENS telephone utility switch is non-safety related station power, which will be lost during a loss of offsite power event. The phone system normal power source is provided with a battery backup that lasts for a period of approximately 8 hours. Through NAPS COL 9.5.2.5-1-A, North Anna Unit 3 committed that the ENS is in compliance with the recommendations of NRC BL 80-15, which is concerned with having a, “... safeguards instrumentation bus backed up by automatic transfer to batteries and an inverter or equally reliable power supply.” Accordingly, based on the description provided in NAPS COL 9.5.2.5-1-A, and North Anna 3 COLA Part 5, EP, Section F on emergency communications, and the IBR ESBWR DCD, Section 9.5.2, and verification by ITAAC in North Anna COL application Part 10: Table 2.3-1, Section 3.0, the ENS has adequately addressed the recommendations in NRC BL 80-15. As a backup, in addition to the circuits to the local telephone company, a separate Company-owned communication network exists which provides communication between the nuclear power station, the Company system operations center, and the NRC. Based on the above, the staff finds that the applicant adequately addressed the DCD COL Item 9.5.2.5-1-A.

- NAPS COL 9.5.2.5-2-A Grid Transmission Operator

The NRC staff reviewed NAPS COL 9.5.2.5-2-A related to the grid transmission operator communications included under Section 9.5.2 of the North Anna 3 COL FSAR. The DCD COL Item 9.5.2.5-2-A states, “The COL applicant will describe the voice communication link

availability with the grid transmission operator.” The applicant addressed this Item in Section 9.5.2.5 with departure/supplement NAPS COL 9.5.2.5-2-A by stating, “This COL item is addressed in Section 9.5.2.2 and Emergency Plan Section II.F.1. “

The NRC staff reviewed the resolution to the DCD COL Item 9.5.2.5-2-A involving the grid transmission operator communication link included under Section 9.5.2.2 of the North Anna 3 COL application and addressed in EP Section II.F.1. In Section 9.5.2.2 under Emergency Communication Systems, the parenthetical “(COL 9.5.2.5-1-A)” in the last bullet is replaced by a paragraph labeled “NAPS COL 9.5.2.5-2-A” that states “Transmission System Operator Communications Link: Voice communications with the grid operator are provided via a Company-owned and maintained fiber optic transmission system that allows telephone communications with the entire Corporate System. Access to this mode of transmission is made via the plant telephone system. A dedicated handset is provided between the Control Room and the power system operator.” Further, this mode of communication to the grid transmission operator is backed up by the regular commercial telephone system. The North Anna 3 COL application Part 5: EP, Section II.F.1 states that the applicant maintains reliable, 24-hour per day communications links within the plant and between the plant and external emergency response organizations. Based on this, the staff finds that the applicant adequately addressed the DCD COL Item 9.5.2.5-2-A.

- NAPS COL 9.5.2.5-3-A Offsite Interfaces (1)

The NRC staff reviewed NAPS COL 9.5.2.5-3-A related to the offsite interfaces included under Section 9.5.2 of the North Anna 3 COL FSAR and examined the EP, Sections II.E and II.F as related to emergency communications. The DCD COL Item 9.5.2.5-3-A states, “The COL applicant will describe the means of communication between the control room, TSC, EOF, state and local emergency operation centers and radiological field personnel in accordance with NUREG-0696 and NUREG-0654.” The applicant addressed this item with departure/supplement NAPS COL 9.5.2.5-3-A stating, “This COL item is addressed in Section 9.5.2.2 and Emergency Plan Sections II.E.1 and II.F.1.” In Section 9.5.2.2 under Emergency Communication Systems the parenthetical “(COL 9.5.2.5-3-A)” in the second bullet is replaced with “NAPS COL 9.5.2.5-3-A The Health Physics Network (HPN) is described in the Emergency Plan.” In Section 9.5.2.2 under Emergency Communication Systems the parenthetical “(COL 9.5.2.5-3-A)” in the fourth bullet is replaced with “NAPS COL 9.5.2.5-3-A The crisis management radio system is part of the plant radio system described in DCD Section 9.5.2.2.” In Section 9.5.2.2 under Emergency Communication Systems the following is added as an additional bullet after the last bullet, “NAPS COL 9.5.2.5-3-A • Insta-Phone System – The primary method for notification of State and local authorities is the Insta-phone, which is accessible from the MCR , TSC, and EOF. The Insta-phone is described in the Emergency Plan.” The North Anna 3 COL application Part 5: EP including Sections II.E and II.F is evaluated elsewhere in SER Section 13.3, “Emergency Planning.”

In the North Anna 3 COL application Part 5: EP, Section II.E and II.F, the applicant states that systems and procedures needed to provide the capability for 24 hour per day prompt notification to affected Commonwealth of Virginia, risk jurisdiction, and Federal authorities following the declaration of any emergency condition, consistent with emergency classification and action levels are provided and maintained. The primary notification and communication method is the Insta-phone system, which is accessible from the MCR, TSC, and EOF. Back-up notification and communication is through the commercial telephone network system. Message content and verification methods are established in advance in implementing procedures. Communication systems that allow communications between the site and fixed and mobile

medical support facilities are maintained and include both commercial telephone communications with fixed facilities and radio communications to ambulances. Further, the equipment, methods, and procedures for communication are tested and evaluated on a periodic basis through test and drills. For example, communication with the facility and EOF and the Commonwealth of Virginia and risk jurisdiction warning points are tested monthly, while communications between Virginia/risk jurisdiction emergency operating centers and field assessment teams are tested annually. Battery backup or alternate power in the case of the loss of AC power is provided for most subsystems. The North Anna 3 COL application Part 5: EP lists the requirements and the corresponding COL application EP provision where the requirement is addressed. Based on the above and that it will be verified by ITAAC described in COL application Part 10: Table 2.3-1, the staff finds that the applicant adequately addressed the DCD COL Item 9.5.2.5-3-A.

- NAPS COL 9.5.2.5-4-A Offsite Interfaces (2)

The NRC staff reviewed NAPS COL 9.5.2.5-4-A related to the offsite interfaces included under Section 9.5.2 of the North Anna 3 COL FSAR and examined the EP, Sections II.E and II.F. The DCD COL Item 9.5.2.5-4-A states, "The COL applicant will describe the communication method from the control room, TSC, and EOF to NRC headquarters, including establishment of Emergency Response Data Systems (ERDS) in accordance with NUREG-0696." The applicant addressed this item with departure/supplement NAPS COL 9.5.2.5-4-A stating, "This COL item is addressed in Section 9.5.2.2 and Emergency Plan Sections II.E.1 and II.F.1." In Section 9.5.2.2 under Emergency Communication Systems the parenthetical "(COL 9.5.2.5-4-A)" in the third bullet is replaced with "NAPS COL 9.5.2.5-4-A." Communication from the MCR, TSC, and EOF to NRC headquarters including establishment of ERDS is described in the EP. The North Anna 3 COL application Part 5: EP including Sections II.E and II.F is evaluated elsewhere in SER Section 13.3, "Emergency Plan."

In the North Anna 3 COL application Part 5: EP, Section II.F.1, the applicant states that separate telephone lines are dedicated and maintained for communications with the NRC. These include the ENS, the Management Counterpart Link (MCL), the HPN, the Reactor Safety Counterpart Link (RSCL), the Protective Measures Counterpart Link (PMCL), the Local Area Network (LAN) Access, and an ERDS. The ENS lines located in the MCR, TSC, and EOF, are used for initial notifications, as well as ongoing information about plant systems, status, and parameters. The MCL lines located in the TSC and EOF provide for internal discussion between NRC Executive Team Director and members of his/her team and the NRC site director, or between licensee site management. The HPN lines located in the TSC and EOF provide for communication concerning radiological and meteorological matters. The RSCL lines located in the TSC and EOF provide for internal NRC discussions regarding plant and equipment conditions. PMCL lines located in the TSC and EOF provide for internal NRC discussions on radiological releases, meteorological conditions, and protective measures. The LAN Access with jacks in the TSC and EOF provides access to the NRC LAN. The applicant committed to having an ERDS that will be activated within one hour of the declaration of an Alert or higher emergency classification in accordance with regulations and facility procedures. The North Anna 3 COL application Part 5: EP lists the requirements and the corresponding COL application EP provision where the requirement is addressed. Based on the above and that it will be verified by ITAAC described in COL application Part 10: Table 2.3-1, the staff finds that the applicant has adequately addressed the DCD COL Item 9.5.2.5-4-A.

- NAPS COL 9.5.2.5-5-A Fire Brigade Radio System

The NRC staff reviewed NAPS COL 9.5.2.5-5-A related to the Fire Brigade Radio System included under Section 9.5.2 of the North Anna 3 COL FSAR. The DCD COL Item 9.5.2.5-5-A states, "The COL applicant will describe the Fire Brigade Radio System." The applicant addressed this item with departure/supplement NAPS COL 9.5.2.5-5-A stating, "This COL item is addressed in Section 9.5.2.2." In Section 9.5.2.2 under Emergency Communication Systems the parenthetical "(COL 9.5.2.5-5-A)" in the fifth bullet is replaced with "NAPS COL 9.5.2.5-5-A. The Fire Brigade Radio System is part of the plant radio system described in DCD Section 9.5.2.2." The ESBWR DCD, Section 9.5.2.2 described the plant radio system for use during normal and emergency communications within the plants. The plant radio system radios are equipped with multiple channels including a fire brigade channel and an emergency channel, each which can be used as alternate security channels if required. Portable, hand-held radios provide two-way voice communication between the various units for fire brigade members who need mobile communications and communications to communication consoles in selected plant locations including the MCR and remote shutdown rooms. The radio system includes antennas distributed throughout the plant with a centralized rebroadcast transmitter providing communication within the plant and satellite buildings. Lower power portable radios are used with this system to ensure that there is no Electromagnetic Interference with Instrumentation and Control circuits, and operate at frequencies that ensure they do not interfere with DCIS functions. By using radio equipment equipped with tone-coded squelch communications can be directed to an individual, all-channel (zoned), or all-system calls except the emergency channel is not coded. Capability is provided for whereby calls can be made between the telephone system and the in-plant radio system. The power for base stations and consoles is provided by security system power supply backed by batteries and a standby generator. Based on the above, the staff finds that the applicant adequately addressed the DCD COL Item 9.5.2.5-5-A.

9.5.2.5 Post Combined License Activities

There are no post COL activities related to this section.

9.5.2.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the Communication Systems 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 the DCD Section 9.5.2 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the Communication Systems 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 9.5.2 of this SER to reflect the final disposition of the DCA.

In addition, the staff concludes that the relevant information presented within the COL FSAR, to the extent it addresses that portion of the communications system used in intra-plant and plant-to-offsite communications, is acceptable and meets the requirements of 10 CFR Part 50, Appendix E, IV.E.9 and 10 CFR 50.47 (b)(5) and (b)(6). The staff based its conclusion on the following: (1) The design provides for at least one acceptable onsite and one acceptable offsite

communication system; each with a backup power source as described directly through COL application information or information incorporated by reference of the ESBWR DCD; (2) The design provides communications systems with capability for prompt notification and continuing communication to the NRC; (3) The design provides communications systems with capability for prompt notification and continuing communication with site, local and state response organizations; (4) The design provides a variety of diverse communications system involving both private links, commercial links, site public address, and radio with the capability of adequately supporting both normal use and emergency situations; and (5) the non-safety communication systems do not prevent completion of safety functions.

9.5.3 Lighting System

Section 9.5.3 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.5.3, "Lighting System" of Revision 5 of the ESBWR DCD. The 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 9.5.3 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Lighting System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.5.3 of this SER to reflect the final disposition of the DCA.

9.5.4 Diesel Generator Fuel Oil Storage and Transfer System

9.5.4.1 Introduction

This section of the North Anna 3 COL FSAR describes the diesel generator (DG) fuel oil system which stores and transfers fuel oil for the diesel engines that provide standby onsite power. The system for each diesel engine includes a fuel oil storage tank, fuel oil day tank, fuel oil transfer pump, strainers/filters, oil purifier (or tank connections for tying into a purification system), instrumentation, controls, and the necessary interconnecting piping and valves.

9.5.4.2 Summary of Application

Section 9.5.4 of the North Anna 3 COL FSAR incorporates by reference Section 9.5.4 of the ESBWR DCD, Revision 5.

In addition, in FSAR Section 9.5.4, the applicant provided the following:

COL Items

- STD COL 9.5.4-1-A Fuel Oil Capacity

The applicant provided additional information in STD COL 9.5.4-1-A to address DCD COL Item 9.5.4-1-A. The applicant described the procedural controls in place to ensure that sufficient fuel oil is available onsite to allow each DG to operate continuously for seven days.

- NAPS COL 9.5.4-2-A Protection of Underground Piping

The applicant provided additional information in NAPS COL 9.5.4-2-A to address DCD COL Item 9.5.4-2-A. The applicant stated that the underground piping portion of the fuel oil transfer system is made of carbon steel and that it is protected with a waterproof coating and an impressed current cathodic protection system to control external corrosion.

9.5.4.3 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 procedural controls to ensure a seven day supply of fuel oil and the associated acceptance criteria are given in Section 9.5.4 of NUREG-0800.

The applicable regulatory requirements for procedural controls to ensure a seven day supply of fuel oil are as follows:

- GDC 17 of Appendix A to 10 CFR Part 50

9.5.4.4 Technical Evaluation

The NRC staff reviewed Section 9.5.4 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the Diesel Generator Fuel Oil Storage and Transfer System (DGFOSTS).

Section 9.5.4 of the 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 the DGFOSTS will be documented in the staff SER on the DCA for the ESBWR.

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

The standby and ancillary diesel generators are not classified as safety-related. However, since the diesels are RTNSS Criterion B and C systems, availability of both standby and ancillary diesel generators is required according to the Availability Controls Manual (Availability Control Limiting Condition for Operation 3.8.1 and 3.8.2).

COL Items

- STD COL 9.5.4-1-A Fuel Oil Capacity

The NRC staff reviewed STD COL 9.5.4-1-A related to the fuel oil capacity included under Section 9.5.4 of the North Anna 3 COL FSAR. DCD COL Item 9.5.4-1-A in Section 9.5.4.6, "COL Information," of the ESBWR DCD specifies that the COL applicant needs to establish procedural controls to ensure a minimum fuel oil capacity is maintained onsite. In FSAR Section 9.5.4.2, "System Description," the applicant addressed DCD COL Item 9.5.4-1-A (STD COL 9.5.4-1-A) by indicating that procedures will be developed in accordance with the

milestone and processes described in FSAR Section 13.5, "Plant Procedures." Those procedures will ensure sufficient diesel fuel oil inventory is available onsite so that the DG can operate continually for seven days. The procedures will ensure that the quantity of DG fuel oil in the fuel oil storage tanks is monitored on a periodic basis and that the diesel fuel oil usage is tracked against planned deliveries. Regular transport will replenish the fuel oil inventory during periods of high demand and ensure continued supply in the event of adverse weather conditions. The staff finds that the applicant has satisfactorily addressed DCD COL Item 9.5.4-1A in that the necessary procedures will be developed in accordance with FSAR Section 13.5.

The applicant stated that the procedures will ensure sufficient fuel oil to operate the DGs continually for seven days. In RAI 09.05.04-02, the staff asked the applicant to verify that enough fuel oil inventory is available to operate the DGs at continuous maximum rating for seven days. In their response dated August 4, 2008, the applicant provided an FSAR markup stating that procedures ensure sufficient diesel fuel oil inventory is available onsite so that the standby diesel generators (SDGs) and ancillary DGs can operate continually for seven days with each operating at its calculated design load, with appropriate margins. The staff finds that the term "appropriate margins" is an ambiguous term for use in the FSAR. Therefore the staff requested the applicant, in supplemental RAI (eRAI 2468, Question 10135), to specify that the margins are in accordance with American Nuclear Society 59.51-1997, "Fuel Oil Systems for Safety-Related Emergency Diesel Generators." This is being tracked as **Open Item 9.5.4-01**.

- NAPS COL 9.5.4-2-A Protection of Underground Piping

The NRC staff reviewed NAPS COL 9.5.4-2-A related to the protection of underground piping included under Section 9.5.4 of the North Anna 3 COL FSAR. DCD COL Item 9.5.4-2-A in Section 9.5.4.6, "COL Information," of the ESBWR DCD specifies that the COL applicant needs to describe the material and corrosion protection for the underground piping portion of the fuel oil transfer system. In FSAR Section 9.5.4.2, the applicant addressed DCD COL Item 9.5.4-2-A (NAPS COL 9.5.4-2-A) by indicating that the material for the underground piping portion of the fuel oil transfer system is carbon steel and that a corrosion protection system is in place for the internal and external surfaces of piping systems. The buried section of the piping is protected with a waterproof protective coating and an impressed current type cathodic protection is used to control external corrosion.

Subsection 9.5.4.2 of the DCD states the system will be designed and constructed according to "the latest industry standards for buried pipe including provisions for corrosion protection," but it does not identify the standards to be used. Therefore, the staff asked the applicant to clarify the corrosion protection methods for the internal and external surfaces of buried DG fuel oil piping and identify the applicable industry standards (**RAI 09.05.04-6**).

The applicant responded in a letter dated December 3, 2008. The applicant stated a corrosion allowance, rather than a corrosion protection system, is included in the pipe wall thickness to address the possibility of internal corrosion. This is acceptable to the staff because it is a method listed in ASME B31.1, which is the code applicable to this piping system. For the coating and impressed current cathodic protection system for external corrosion control, the applicant stated it would follow the applicable guidance in ASME B31.1 Nonmandatory Appendix IV ("Corrosion Control for ASME B31.1 Power Piping Systems") and American Petroleum Institute (API) Recommended Practice 1632 ("Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems"). The staff finds the API Recommended Practice acceptable because it refers users to National Association of Corrosion Engineers

(NACE) RP-0169 and recommends the same corrosion protection criteria contained therein. NACE RP-0169 is the cathodic protection guidance accepted by RG 1.137. ASME B31.1 Appendix IV is an acceptable industry standard for external corrosion control because it addresses underground piping.

Based on the RAIs, the applicant proposed the paragraph below for NAPS COL 9.5.4-2-A. This deletes the reference to a corrosion protection system for the internal surface and adds a sentence to identify piping as the only underground component:

The only underground component of the SDGs fuel oil storage and transfer system is carbon steel piping. A corrosion protection system is provided for external surfaces of buried piping systems. The buried sections of the piping are provided with waterproof protective coating and an impressed current type cathodic protection system to control external corrosion.

As discussed above, the corrosion control methods and industry standards applied to the buried piping are appropriate. However, the staff considers the response to RAI 09.05.04-06 incomplete until the industry standards referenced in the response are identified in the NAPS FSAR. Therefore the staff requested the applicant, in supplemental RAI (eRAI 2468, Question 10136), to add the referenced industry standard to the NAPS FSAR. This is being tracked as **Open Item 9.5.4-02**.

9.5.4.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.5.4.6 *Conclusions*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the relevant information relating to the DGFOSTS and there is no outstanding information expected to be addressed in the COL FSAR related to this subsection. However, as a result of Open Items 9.5.4-01 and 9.5.4-02, the staff is unable to finalize its conclusions on this subsection relating to the DGFOSTS in accordance with the requirements of NRC regulations.

The staff is reviewing the information in the DCD Section 9.5.4 on Docket No. 52-010. The results of the NRC's staff's technical evaluation of the information related to the DGFOSTS 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 9.5.4 of this SER to reflect the final disposition of the DCA.

In addition, NRC staff has evaluated STD COL 9.5.4-1-A and NAPS COL 9.5.4-2-A provided by the applicant in the North Anna FSAR in response to the two listed DCD COL Information Items for the ESBWR DCD, Section 9.5.4. The staff has evaluated STD COL 9.5.4-1-A and NAPS COL 9.5.4-2-A to the relevant NRC regulations and acceptance criteria defined in NUREG-0800 Section 9.5.4 and finds that **Open Item 9.5.4-01** needs to be satisfactorily addressed before the staff approves the applicant's submittal.

In addition, NRC staff also concludes that **Open Item 9.5.4-02** needs to be closed before the staff can conclude DCD COL Item 9.5.4-2-A has been adequately addressed. This second COL

information item in Section 9.5.4.2 of the COL FSAR addresses the commitment in the DCD to provide corrosion protection to the underground portions of the fuel oil transfer system. This is based on the use of acceptable industry standards for corrosion protection of underground piping and clarification that piping is the only underground component of the fuel oil system. The Open Item is based on the need to identify the corrosion protection industry standards in the FSAR.

9.5.5 Diesel Generator Jacket Cooling Water System

Section 9.5.5 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.5.5, "Diesel Generator Jacket Cooling Water System" of Revision 5 of the ESBWR DCD. The 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 9.5.5 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Diesel Generator Jacket Cooling Water System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.5.5 of this SER to reflect the final disposition of the DCA.

9.5.6 Diesel Generator Starting Air System

Section 9.5.6 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.5.6, "Diesel Generator Starting Air System" of Revision 5 of the ESBWR DCD. The 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 9.5.6 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Diesel Generator Starting Air System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.5.6 of this SER to reflect the final disposition of the DCA.

9.5.7 Diesel Generator Lubrication System

Section 9.5.7 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.5.7, "Diesel Generator Lubrication System" of Revision 5 of the ESBWR DCD. The 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 9.5.7 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Diesel Generator Lubrication System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.5.7 of this SER to reflect the final disposition of the DCA.

9.5.8 Diesel Generator Combustion Air Intake and Exhaust System

Section 9.5.8 of the North Anna 3 COL FSAR incorporates by reference, with no departures or supplements, Section 9.5.8, "Diesel Generator Air Intake and Exhaust System" of Revision 5 of the ESBWR DCD. The 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 9.5.8 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the Diesel Generator Combustion Air Intake and Exhaust System incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the DCA for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 9.5.8 of this SER to reflect the final disposition of the DCA.