

## **6.0 ENGINEERED SAFETY FEATURES**

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

### **6.1 Design Basis Accident Engineered Safety Feature Materials**

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

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

### **6.2 Containment Systems**

#### **6.2.1 Introduction**

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

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

### 6.2.2 Summary of Application

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

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

#### COL Item

- STD COL 6.2-1-H System Design

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

#### Supplemental Information

- STD SUP 6.2-1 Inspections to Limit Debris

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

### 6.2.3 Regulatory Basis

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

In addition, the relevant requirements of the Commission regulations for design of the containment isolation valves and piping, and the associated acceptance criteria, are given in Section 6.2.4 of NUREG-0800 and are summarized below.

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

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

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

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

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

#### 6.2.4 Technical Evaluation

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

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

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

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

The staff reviewed the information contained in the COL FSAR:

##### COL Item

- STD COL 6.2-1-H System Design

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

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

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

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

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

Also, the COL applicant's response referenced DCD design acceptance criteria (DAC) / Inspections, tests, analyses, and acceptance criteria (ITAAC) Item 2.a.iii, which requires that the piping identified in DCD Tier 1, Table 2.15.1-1 as ASME Code Section III be designed in accordance with ASME Code Section III requirements and seismic Category 1 requirements. The applicant stated that this information on piping lengths will be completed as part of the detailed piping design. This ITAAC does not verify that the isolation valves have been located as close as practical to containment. The staff issued RAI 6.02.04-2 to address this issue.

NRC staff has evaluated the applicant's response to RAI 06.02.04-2 (ML083460148) and GEH's response to DCD RAI 6.2-157 S02 (ML083180123). The response from GEH states that GEH plans to delete COL Item 6.2-1-H from DCD Tier 2, Subsection 6.2.8. GEH plans to add the design considerations for locating containment isolation valves as close to the containment as practical to DCD Tier 2, Subsection 6.2.4.2. Additionally, a new ITAAC (DCD Tier 1, Table 2.15.1-2, Item 22) will be added to specifically require verification that containment isolation valves have been located as close as practical to containment. The applicant indicated that these changes will address the concern stated in the RAI. The FSAR will be revised to be consistent with the DCD when the DCD is revised to incorporate the revisions to DCD RAI 6.2-157 S02. The staff finds the response acceptable. This is a **Confirmatory Item 6.02.04-2**.

#### Supplemental Information

- STD SUP 6.2-1                      Inspections to Limit Debris

NRC staff reviewed STD SUP 6.2-1 related to the plant procedures for conducting inspections to limit debris inside containment included under Section 6.2.1 of the North Anna 3 COL FSAR.

Procedures describe the activities necessary to prevent debris from affecting the emergency core cooling and long-term cooling safety functions in accordance with RG 1.82, including: (1) inspection of the cleanliness of pools within containment; (2) a visual examination for evidence of structural degradation or corrosion of debris screens; (3) an inspection of the wetwell and the drywell—including the vents, downcomers, and deflectors—for the identification and removal of debris or trash that could contribute to the blockage of debris screens for the ECC and long-term cooling safety functions; (4) containment cleanliness programs to clean the pools within containment on a regular basis; and (5) plant procedures for control and removal of foreign materials from the containment and abatement procedures to avoid latent debris generation during removal and/or replacement of insulation within containment.

NRC staff determined that the applicant did not provide sufficient information in accordance with Regulatory Guide 1.82, Revision 3. In RAI 6.02.01-1, NRC staff requested the applicant to provide the following information:

North Anna COL application STD SUP 6.2-1 on Inspection to Limit Debris lists procedures of activities necessary to prevent debris from affecting the emergency core cooling and long-term cooling safety functions in accordance with RG 1.82, Revision 3. This list does not contain procedures to control the effects of permanent plant changes inside the containment and maintenance activities based on the assumptions used in designing debris strainers and conclusions. The applicant was asked to fully describe the procedures for the staff's review. The Commission defined "fully described" in a May 14, 2004, SRM for SECY-04-0032, "Programmatic Information Needed for Approval of a Combined License Application Without Inspections, Tests, Analyses, and Acceptance Criteria."

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

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

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

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

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

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

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

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

### **6.2.5 Post Combined License Activities**

The following item was identified as a post COL activity:

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

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

### **6.2.6 Conclusion**

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

The staff is reviewing the information in DCD Section 6.2 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the containment systems incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff's SER on the design certification application for the ESBWR. The SER on the ESBWR is not yet complete and is being tracked as part of Open Item 1-1. The staff will update Section 6.2 of this SER to reflect the final disposition of the design certification application.

### **6.3 Emergency Core Cooling System**

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

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

## **6.4 Control Room Habitability Systems**

### **6.4.1 Introduction**

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

### **6.4.2 Summary of Application**

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

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

#### **COL Item**

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

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

- NAPS COL 6.4-2-A Toxic Gas Analysis

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

#### **Supplemental Information**

- NAPS SUP 6.4-1 System Safety Evaluation

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

### **6.4.3 Regulatory Basis**

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

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

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

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

The applicable regulatory requirements for are as follows:

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

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

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

The applicable regulatory requirements are as follows:

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

#### **6.4.4 Technical Evaluation**

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

The staff reviewed the information contained in the COL FSAR:

##### COL Item

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

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

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

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

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



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

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

- NAPS COL 6.4-2-A Toxic Gas Analysis

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

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

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

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

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

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

### Supplemental Information

- NAPS SUP 6.4-1 System Safety Evaluation

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

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

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

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

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

#### **6.4.5 Post Combined License Activities**

There are no post COL activities related to this section.

#### **6.4.6 Conclusion**

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

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

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

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

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

## **6.5 Atmospheric Cleanup Systems**

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

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

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

### **6.6.1 Introduction**

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

### **6.6.2 Summary of Application**

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

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

COL Items

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

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

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

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

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

- STD COL 6.6-2-A

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

### **6.6.3 Regulatory Basis**

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

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

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

- 10 CFR 50.55a

The related acceptance criteria are as follows:

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

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

#### **6.6.4 Technical Evaluation**

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

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

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

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

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

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

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

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

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

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

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

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

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

- STD COL 6.6-2-A

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

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

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

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

#### **6.6.5 Post Combined Operating License Activities**

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

#### **6.6.6 Conclusion**

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to PSI/ISI of Class 2 and 3 Components and Piping and no outstanding information is expected to be addressed in the COL FSAR related to this subsection.

The staff is reviewing the information in the DCD Section 6.6 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the PSI/ISI of Class 2 and 3 components incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the design certification application for the ESBWR. The SER on the ESBWR is not complete and is being tracked as part of Open Item [1-1]. The staff will update Section 6.6 of this SER to reflect the final disposition of the design certification application.

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