UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

August 12, 2009

MEMORANDUM TO: Michael L. Corradini, Chairman
Subcommittee on the North Anna COL A

FROM: Christopher L. Brown, Senior Staff Engineer ***/RA/***

SUBJECT: STATUS REPORT FOR THE MEETING OF THE ESBWR SUBCOMMITTEE ON THE NORTH ANNA COLA, AUGUST 21, 2009, IN ROCKVILLE, MARYLAND

The purpose of this memorandum is forward written materials for your use in preparing for the meeting of the ACRS ESBWR Subcommittee on the North Anna COLA on August 21, 2009. The staff has completed the detailed review of FSAR Chapters 2, 3, and 14, and prepared the SER with OIs. These Chapters were sent via Email on July 21st. The ACRS Full Committee meeting will be held in October and not September. Remember that the North Anna CD contains the most recent ESBWR DCD.

Due to remodeling of the ACRS meeting room, this meeting will be held in the TWF Auditorium.

Attendance by the following members and consultants is anticipated, and reservations have been made at the following hotels for August 21, 2009.

Corradini	*RESIDENCE INN*	Abdel-Khalik	*BETHESDA N MARRIOTT*
Armijo	*BETHESDA N MARRIOTT*	Stetkar	*BETHESDA N MARRIOTT*
Kress	*BETHESDA N MARRIOTT*	Wallis	*BETHESDA N MARRIOTT*
Brown	*N/A*		

Please notify ACRS Travel@nrc.gov if you need to change or cancel the above reservations.

Attachments

1. Agenda
2. Status Report

cc: E. Hackett
S. Duraiswamy
C. Santos

Attachment 1

Advisory Committee on Reactor Safeguards
Meeting of the ESBWR Subcommittee on the NORTH ANNA COLA
Rockville, MD
August 21, 2009

Cognizant Staff Engineer: Christopher L. Brown (301-415-7111, Christopher.Brown@nrc.gov)

Item	Topic	Presenter(s)	Time
1	Opening Remarks and Objectives	**Dr. Michael L. Corradini, ACRS**	8:30 – 8:35 a.m.
2	Staff Opening Remarks	Tom Kevern, NRO	8:35 – 8:40 a.m.
3	**Design of Structures, Components, Equipment, and Systems** a. FSAR Chapter 3 b. SER/OI Chapter 3	a. Gina Borsh, Tom Hicks, Dominion; Rick Wachowiak, GEH b. Michael Eudy, NRO	8:40 – 10:45 a. m.
4	Break		10:45 - 11:00 a. m.
5	**Site Characteristics – Geography & Demography, Hazards, and Meteorology** a. FSAR Sections 2.1 – 2.3 b. SER/OI Sections 2.1 – 2.3	a. Gina Borsh, Tom Hicks, Dominion; Rick Wachowiak, GEH b. Ilka Berrios, NRO	11:00 - 12:00 p. m.
6	Lunch		12:00 – 1:00 p.m.
7	**Site Characteristics – Hydrologic Engineering** a. FSAR Section 2.4 b. SER/OI Section 2.4	a. Gina Borsh, Tom Hicks, Dominion; Rick Wachowiak, GEH b. Ilka Berrios, NRO	1:00 – 2:00 p.m.
8	**Site Characteristics – Geology, Seismology, and Geotechnical Engineering** a. FSAR Section 2.5 b. SER/OI Section 2.5	a. Gina Borsh, Tom Hicks, Dominion; Rick Wachowiak, GEH b. Ilka Berrios, NRO	2:00 – 3:00 p.m.
9	Break		3:00 – 3:15 p.m.
10	**Initial Test Program** a. FSAR Chapter 14 b. SER/OI Chapter 14	a. Gina Borsh, Tom Hicks, Dominion; Rick Wachowiak, GEH b. Tom Kevern, Mike Morgan; NRO	3:15 – 4:30 p.m.
11	Committee Discussion	**Dr. Corradini, ACRS**	4:30 p.m.
12	Adjourn		4:45 p.m.

Notes:

- During the meeting, 301-415-7360 should be used to contact anyone in the ACRS Office.
- Presentation time should not exceed 50 percent of the total time allocated for a given item. The remaining 50 percent of the time is reserved for discussion.
- Thirty five (35) hard copies of each presentation or handout should be provided to the Designated Federal Official 30 minutes before the meeting.
- One (1) electronic copy of each presentation should be emailed to the Designated Federal Official 1 day before the meeting. If an electronic copy cannot be provided within this timeframe, presenters should provide the Designated Federal Official with a CD containing each presentation at least 30 minutes before the meeting.

Attachment 2

Advisory Committee on Reactor Safeguards
Meeting of the ESBWR Subcommittee on the NORTH ANNA COLA
Rockville, MD
August 21, 2009

- Status Report -

PURPOSE AND INTRODUCTION

The staff, GEH and Dominion (the applicant) will present multiple SER/OI chapters (2, 3, and 14) to the ESBWR subcommittee for the North Anna COLA. There are OI and confirmatory items in these three chapters that are **site-specific** to North Anna.

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

Most of the SER Chapters contain information Incorporated By Reference (IBR) from the DCD (or ESP). Under provisions of Part 52, the staff evaluates information contained in the DCD in the SER pertaining to the DCD; and, as a separate licensing activity, evaluates the COLA in the staff's SER related to North Anna.

The ACRS Full Committee meeting will be held in October.

BACKGROUND

The ESBWR is a direct-cycle power conversion system with natural circulation cooling in the reactor vessel under normal operation. It has a passive emergency core cooling system that operates without the need for emergency alternating current power systems or operator actions within the first 72 hours following a reactor transient or accident. The ESBWR also has passive containment cooling to ensure heat transport to the ultimate heat sink for all accident scenarios. To cope with a severe reactor accident, the ESBWR design incorporates a lower drywell core retention device and allows passive drywell flooding to provide long-term debris cooling.

The proposed plant is to be located on the existing NAPS site, in Louisa County, Virginia, adjacent to existing Units 1 and 2, and is designated as North Anna 3. Currently, Dominion is considering another design and may abandon the ESBWR in the near-term.

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

In preparation for the upcoming ACRS subcommittee meeting on August 21, 2009, Dominion completed the proprietary review of SER/OI chapters 2, 3, and 14 and confirmed no proprietary information is contained in these documents.

DISCUSSION

Discussions below with a red italic heading are excerpts from the Committee's Letters. Also, the open and confirmatory items are under a red heading.

<u>Chapter 2 Site Characteristics</u>

Descriptions of the site area and reactor location are used to assess the acceptability of the reactor site. The staff's review covered the following specific areas: (1) specification of reactor location with respect to latitude and longitude, political subdivisions; and prominent natural and manmade features of the area; (2) site area map to determine the distance from the reactor to the boundary lines of the exclusion area, including consideration of the location, distance, and orientation of plant structures with respect to highways, railroads, and waterways that traverse or lie adjacent to the exclusion area; and (3) any additional information requirements prescribed within the "Contents of Application" sections of the applicable subparts to the Title of the 10 *Code of Federal Regulations* (CFR) Part 52. The purpose of their review was to ascertain the accuracy of the applicant's description for use in independent evaluations of the exclusion area authority and control, the surrounding population, and nearby manmade hazards.

The center of the Unit 3 reactor building is approximately 450 meters (1,476 feet) southwest of the center of the Unit 2 Containment Building.

The descriptions of exclusion area authority and control are used to verify the applicant's legal authority to determine and control activities within the designated exclusion area, as provided in the application, and are sufficient to enable the reviewer to assess the acceptability of the reactor site. The staff's review covered the following specific areas as to the establishment of (1) the applicant's legal authority to determine all activities within the designated exclusion area, (2) the applicant's authority and control to exclude or remove personnel and property in the event of an emergency, (3) verification that proposed or permitted activities in the exclusion area unrelated to operation of the reactor do not result in a significant hazard to public health and safety, and (4) verification related to any additional information requirements prescribed within the "Contents of Application" sections of the applicable subparts to 10 CFR Part 52.

The description of population distribution addresses the need for information about the following: (1) the population in the site vicinity, including transient populations; (2) the population in the exclusion area; (3) whether appropriate protective measures could be taken on behalf of the populace in the specified low-population zone (LPZ) in the event of a serious accident; (4) whether the nearest boundary of the closest population center containing 25,000 or more residents is at least one and one-third times the distance from the reactor to the outer boundary of the LPZ; (5) whether the population density in the site vicinity is consistent with the guidelines in Regulatory Position C.4 of Regulatory Guide (RG) 4.7; and (6) any additional information requirements prescribed within the "Contents of Application" sections of the applicable subparts to 10 CFR Part 52.

The section on transportation and military facilities provides information on the site characteristics that could affect the safe design and siting of the plant. This section also provides information on locations and routes; describes nearby industrial transportation facilities (airports, airways, roadways, railways, etc.) and military facilities; and evaluates potential hazards. Note that the applicant evaluated hydrogenand Nalco H-130, and hydrazine (for units 1 and 2) for potential explosions resulting in blast overpressure using 1 psi overpressure as a criterion for adversely affecting plant operations or preventing the safe shutdown of the plant. In accordance with RG 1.91, peak-positive incident overpressures below 1 psi are not considered to cause significant damage. The applicant determined a minimum safe-standoff distance from an in-vessel, confined vapor explosion by conservatively considering a volume of chemical vapor equal to the empty volume of the largest storage vessel that was available for combustion, with an explosion yield factor of 100 percent. The applicant also addressed the potential detonation and deflagration in a plume due to a flammable vapor cloud from the release of chemicals. The staff noted that there are two 10,000 gallon underground gasoline storage tanks onsite at Unit 3 as identified in FSAR Table 2.2-202. The applicant did not address the hazards posed by these tanks from either a confined vapor explosion or a flammable vapor cloud explosion. The staff requested additional information from the applicant in a request for additional information (RAI) **RAI 2.2.3-1**, which asked the applicant to address the potential hazards of these tanks from the perspective of fuel storage and onsite delivery of fuel to the tanks.

To ensure that a nuclear power plant or plants can be designed, constructed, and operated on an applicant's proposed site in compliance with the Commission's regulations, NRC staff evaluated regional and local climatological information, including climate extremes and severe weather occurrences that may affect the design and siting of a nuclear plant. The staff reviewed information on the atmospheric dispersion characteristics of a nuclear power plant site to determine whether the radioactive effluents from postulated accidental releases, as well as routine operational releases, are within Commission guidelines.

The hydrologic description of the nuclear power plant site includes the interface of the plant with the hydrosphere, hydrological causal mechanisms, surface and groundwater uses, hydrologic data, and alternate conceptual models. The staff's review covered the following specific areas: (1) interface of the plant with the hydrosphere including descriptions of site location, major hydrological features in the site vicinity, surface- and groundwater related characteristics, and the proposed water supply to the plant; (2) hydrological causal mechanisms that may require special plant design bases or operating limitations with regard to floods and water supply requirements; (3) current and likely future surface and groundwater uses by the plant and water users in the vicinity of the site that may impact safety of the plant; (4) available spatial and temporal data relevant for the site review; (5) alternate conceptual models of the hydrology of the site that reasonably bound hydrological conditions at the site; (6) potential effects of seismic and nonseismic data on the postulated design bases and how they relate to the hydrology in the vicinity of the site and the site region; and (7) any additional information requirements prescribed within the "Contents of Application" sections of the applicable Subparts to 10 CFR Part 52.

The section on geologic and seismic information related to the North Anna Unit 3 site summarizes the relevant geologic and seismic information in FSAR Section 2.5.1 of the North Anna COL application.

Open Items for Chapter 2

1. The applicant identified two chemicals requiring control room habitability analyses that were reviewed by the staff and evaluated in Section 6.4 of the SER. The applicant identified eight additional chemicals that are stored onsite, but the applicant provided no rationale as to why those chemicals are not a hazard to the control room. This issue is **Open Item 2.2.3-5**. As a follow-up to the applicant's response to **RAI 2.2.3-2 and 2.2.3-3**, the staff issued **RAI 2.2.3-7** requesting a revised response regarding the modeling details for its conclusions. This RAI is being tracked as **Open Item 2.2.3-7**.

2. Additional information was requested in **RAI 2.4.2-2** and **RAI 2.4.2-3**, which incorporated changes related to Revision 1 to the application. These requests are associated with the locally intense precipitation flood event described in FSAR Section 2.4.2 and assurances that this event will not adversely impact Unit 3's safety-related SSCs, or those that satisfy the regulatory treatment of non-safety systems (RTNSS) criteria. The applicant responded to this RAI on April 3, 2009, in RAI Letter Number 33. The staff is currently reviewing the RAI response. This RAI is being tracked as **Open Item 2.4.2-2**.

3. As currently presented in FSAR Section 2.4.13, the groundwater transport analysis has not been shown to be conservative with respect to two factors. The transport analysis uses K_d values based on literature data that, in some cases, are greater than the minimum observed site-specific values. In addition, the transport analysis uses a groundwater hydraulic conductivity (to compute groundwater velocity) that is less than the maximum value observed at the site. **RAI 2.4.13-4** was sent to the applicant and staff has not yet received a response to this RAI. This is being tracked as **Open Item 2.4.13-4**.

4. The applicant indicated that concrete may have a lower strength and that the shear wave velocity will be the same as the Zone III-IV rock. The staff noted that in addition to having a shear wave velocity within the same range as the bedrock, the concrete fill should also have a similar strength. In order for the staff to fully evaluate and determine the acceptability of the engineering properties of the concrete fill, the strength of the fill needs to be considered along with the shear wave velocity of the fill material. Accordingly, in supplemental **RAI 2.5.4-12**, the staff asked the applicant to provide the engineering properties of concrete fill, and, if the properties are assumed, to clarify how to ensure the in-place concrete fill will have the same engineering properties as that assumed in stability analyses. This RAI is being tracked as **Open Item 2.5.4-12**.

5. The applicant provided ITAAC in Tables 2.4.1-1 "Compaction Requirements for Backfill under Category I Structures" and 2.4.1-2 "ITAAC for Backfill under Category I Structures" in Part 10 "Tier 1/ITAAC," Section 2.4 "Site-Specific ITAAC" of their Combined License Application. The backfill ITAAC does not specify how the standard design site parameter for the minimum shear wave velocity. The staff considers the need to specify how the standard design site parameter for the minimum shear wave velocity will be met beneath the FWSC as part of **Open Item 2.5.4-13**.

6. The staff noted that the minimum shear wave velocity listed in FSAR Table 2.0-201 is misleading, because it includes the bedrock in the calculation of the average soil shear wave velocity. Furthermore, the staff noted that, as stated in the ESBWR DCD, the equivalent uniform shear wave velocity is a lower bound value after taking into account uncertainties of soil over the entire soil column underneath the structure at seismic strain, and as such, the averaging of shear wave velocity should be used for similar soils

exclusive of the bedrock at the site. In supplemental RAI 2.5.4-14, the staff asked the applicant to provide the minimum shear wave velocity parameter for soil below the foundation so that the staff can evaluate the adequacy of backfill properties used in the site stability analysis. This RAI is being tracked as **Open Item 2.5.4-14.**

7. The ESP showed higher strength parameters for the saprolite soil by comparing FSAR Table 2.5-212 and ESP SSAR Table 2.5-45. As the applicant indicated, "the value of cyclic stress ratio used as input to the dynamic settlement analysis is directly proportional to the peak ground acceleration." However, even the peak ground accelerations used in the FSAR analysis were more than 40 percent lower than those used in the ESP SSAR. The applicant did not explain why the ESP estimated dynamic settlement was close to 3 times that of the dynamic settlement presented in the FSAR. Accordingly, in supplemental RAI 2.5.4-18, the staff asked the applicant to explain why the ESP estimated dynamic settlement was almost 3 times of that estimated in the FSAR while there is only a 40 percent difference for peak ground accelerations used in these two calculations. This RAI is being tracked as Open Item 2.5.4-18.

8. The staff reviewed the sample bearing capacity calculations and identified several deficiencies in the information. One deficiency was the difference in dynamic bearing capacity for the RB and FB, which was stated as both 10,200 kPa (214 ksf) in FSAR Table 2.5-215 and 12,401 kPa (259 ksf) in FSAR Table 2.0-201. In **RAI 2.5.4-6**, the staff asked the applicant to clarify the values of allowable dynamic bearing capacity for the RB and FB. The applicant's response stated that the dynamic bearing capacity value of 10,200 kPa (214 ksf) was the computed value for concrete while the 12,401 kPa (259 ksf) value was calculated for the Zone III-IV bedrock. The applicant also stated that since the value for the concrete was lower, FSAR Table 2.0-201 would be revised to reflect the concrete dynamic bearing capacity. However, less clear to the staff is how the applicant determined the properties of the concrete fill layer to be used in the analyses, because there is 3-D information available about the fill layer nor has the applicant finalized the design of the concrete fill. Accordingly, in supplemental **RAI 2.5.4-15**, the staff asked the applicant to clarify how the properties of the concrete fill, such as engineering properties and thickness underneath the foundation in all directions, were determined and used in the allowable bearing capacity calculation without knowing the actual concrete fill design and placement at foundation. This RAI is being tracked as **Open Item 2.5.4-15**.

9 The staff reviewed the applicant's statement that local failure would not occur in the concrete mat foundation. The staff noted that local failure not occurring in the concrete mat does not exclude the possibility of local failure in the backfill layers beneath the concrete mat. Accordingly, in supplemental **RAI 2.5.4-16**, the staff asked the applicant to address the possibility of local failure within the backfill layer beneath the concrete mat in the foundation stability analysis. This RAI is being tracked as **Open Item 2.5.4-16**.

10. Although the staff agrees that the c/d ratio under dynamic loading condition can be smaller than that under static loading condition, increasing one-third to allowable foundation pressure values that are listed in Table 1804.2 of the *International Building Code* (2003) and using it as dynamic bearing capacity does not mean that only one and one-third of the calculated static bearing capacity as dynamic bearing capacity should be used in the calculation. This is because the *International Building Code,* which the applicant's response cited, clearly indicates that this bearing capacity must be estimated using "the alternate load combinations in Section 1605.2.2 that include wind or

earthquake loads." Accordingly, in supplemental **RAI 2.5.4-19**, the staff asked the applicant to provide details on what load combinations were used in the dynamic bearing capacity estimate and why one and one-third of static bearing capacity can be used as dynamic bearing capacity for this site without actual analysis. This RAI is being tracked as **Open Item 2.5.4-19**

11. In reviewing the earth pressure determinations of FSAR Section 2.5.4.10.3, the staff identified two areas where the information provided was insufficient for evaluation. The staff reviewed the FS against sliding of gravity wall or structure foundation against the criteria of the ESBWR DCD. The applicant stated the FS against sliding was taken as 1.1, while the ESBWR detailed the need for waterproofing material at the basemat-underlying the material boundary. In **RAI 2.5.4-8**, the staff requested the applicant to provide further clarification and justification of the coefficient of friction used to calculate the FS against sliding for the aforementioned interface. The issue is currently being addressed in **DCD RAI 2.8-96 S03**, and the applicant noted that the response to COL **RAI 2.5.4-8** relies on the standard plant design information currently in development. The information will be provided to the staff upon completion of the work by GEH. Accordingly, in supplemental **RAI 2.5.4-17**, the staff asked the applicant to justify and clarify the site-specific coefficient of friction used to calculate the site-specific factor of safety against sliding between the basemat and underlying material. This RAI is being tracked as **Open Item 2.5.4-17**.

Committee Comments from ESBWR Letter Dated November 20, 2007 for Chapter 2

Site characteristics include potential hazards in proximity of the plant, meteorology, hydrology, geology, seismology, and geotechnical parameters. An applicant for a COL that references the ESBWR design control document (DCD) will establish the site characteristics when it applies for a COL, or it will reference an early site permit (ESP) that reflects these characteristics. In either case, the COL applicant must show that the site parameters considered in the ESBWR DCD bound the actual site characteristics. Should the ESBWR design parameters not encompass the actual site characteristics, the COL applicant will need to demonstrate by other means, that the proposed reactor plant design is acceptable at the proposed site.

The staff identified several open items and COL action items in this Chapter. The open items seek to clarify inconsistencies in the documentation, to require additional information, and to verify that certain site meteorological assumptions are bounding. The SRP specifies that the plant site parameters in the design certification be representative of a reasonable number of sites. The staff has found that this provision has been met.

Chapter 3 Design of Structures, Components, Equipment, and Systems

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

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

The staff is reviewing the information in DCD Section 3.2.1 on Docket No. 52-010. The results of the staff's technical evaluation of the information related to the seismic classification of SSCs, incorporated by reference in the North Anna 3 COL FSAR, will be documented in the staff SER on the DCA for the ESBWR.

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

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

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

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

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

Open Items for Chapter 3

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

2. The staff issued RAI 03.09.06-1, which requested Dominion to discuss the process, such as by component examples, for implementing the provisions specified in ESBWR DCD Tier 2, Section 3.9.3.5 for the functional design and qualification of valves and dynamic restraints. Dominion's response in a letter dated September 11, 2008, stated that GEH is responsible for the design and qualification of mechanical equipment, including valves and dynamic restraints. Dominion noted that GEH is currently developing the procurement specifications and processes that will be made available for NRC review. With respect to solenoid-operated valves, Dominion stated that GEH will supply the power supply parameters to the valve supplier, and that the supplier will be responsible for qualifying the valves to those requirements. NRC staff will conduct an on-site review of the GEH design and procurement specifications for the ESBWR components to resolve this RAI, which is **Open Item OI 3.9.6-01.**

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

Confirmatory Item

The staff review found that, for selected design acceptance criteria (DAC), a closure schedule provided within 1 year would not support the NRC's need to project staff resource and budget requirements to verify DAC/ITAAC closure. In an ESBWR DCWG public meeting on September 4, 2008, the staff expressed this concern to industry and stated that there were unique needs associated with closing out DAC for (1) piping design, (2) human factors engineering, and (3) digital instrumentation and controls. At subsequent ESBWR DCWG public meetings, the staff and industry discussed the resolution of this DAC closure schedule issue. At the public meeting on April 1, 2009, the industry proposed resolutions for the piping design and human factors engineering that the staff determined to be acceptable. For piping DAC, the NRC staff will be notified at least 6 months before (1) scheduled completion of all ASME Code design reports for risk-significant piping packages, and (2) scheduled completion of all the pipe-break hazard analyses. For human factors engineering DAC, the NRC will be notified at least 6 months before the scheduled completion of each results summary report. At the public meeting on May 14, 2009, the industry proposed a resolution for digital instrumentation and controls that the staff determined to be acceptable. For instrumentation and controls DAC, the NRC staff will be notified at least 6 months before the scheduled completion of each baseline review report and software plan designated as DAC. The COL applicant agreed to incorporate the acceptable resolutions for the DAC closure schedule to address COL 14.3A-1-1 in the next revision to the NAPS-3 COLA. **This issue is being tracked as Confirmatory Item 14.3A-1.**

The staff found that the North Anna 3 FSAR and the ESBWR DCD (Revision 5) provide a reasonable description of the Operational Program for dynamic restraints at North Anna 3. The specific requirements of the ASME OM Code, Section ISTD, incorporated by reference in 10 CFR 50.55a, take precedence over the summary description in the North Anna 3 FSAR and the ESBWR DCD. The staff issued **RAI 03.09.06-4**, which requested Dominion to clarify the reference to the ASME BPV Code Section XI, with respect to snubbers at North Anna 3 that are described in paragraph 3(b) of ESBWR DCD Tier 2, Section 3.9.3.7.1. Dominion's response to this RAI in a letter dated September 11, 2008, referred to an RAI response from GEH indicating that the reference to the ASME BPV Code Section XI would be deleted from this section in the ESBWR DCD Tier 2. The staff found that the planned action by GEH, as referenced by Dominion, resolves this RAI. This is **Confirmatory Item OI 3.9.6-01.**

Committee Comments from ESBWR Letter Dated July 21, 2008, for Chapter 3

The ESBWR design certification application was accepted formally by the staff in December 2005. Since that time, revisions to the DCD have been issued, with the most recent being DCD Revision 5, dated June 1, 2008. These revisions have included updates to the overall design and modifications that address the staff's requests for additional information originating from the staff's review of DCD Revision 3. Although many of these updates have added more specificity and completeness to the ESBWR design, some design modifications have changed key systems as well as components. In addition, detailed design information for certain systems and components has been replaced with general specifications.
Some examples to illustrate this design fluidity are:

Addition of two ancillary diesel generators and associated switchgear in a new building,

Changes in the method of structural support and fixture of the chimney and its internals to the core, Replacement of detailed design information for the main steam isolation valves with general specifications, Replacement of detailed design information for the gravity driven cooling system squib valves with general specifications.

The number and nature of design changes at this stage of the design certification affect the efficiency of the review.

The ESBWR has a passive emergency core cooling system that operates without the need for emergency alternating current power systems or operator actions in the first three days following a reactor transient or accident. It also has passive reactor isolation condenser and containment cooling system heat exchangers immersed in large elevated water pools to ensure heat transport to the ultimate heat sink during accidents. GEH and the staff discussed the effect of seismic events on these elevated pools. Seismically induced dynamic loads could affect the structural integrity of the heat exchangers submerged in these pools. We want to be assured that dynamic forces from seismic events have been treated properly in analyses of heat exchangers immersed in elevated water pools. During future meetings, we will review the resolution of open items in SER Chapter 3.

Chapter 14 Initial Test Program

This chapter of the SER addressed the initial test program (ITP) for SSCs and design features for both the nuclear portion of the North Anna Power Station (NAPS), Unit 3, and the balance of plant. The information includes major phases of the test program, including preoperational tests, initial fuel loading and initial criticality, low-power tests, and power-ascension tests. This chapter described the scope of the ITP, as well as the general plans for accomplishing it.

The technical aspects of the ITP include the test program to verify the functional requirements of plant SSCs and the sequence of testing. The sequence of testing is to be organized such that the safety of the plant does not depend on untested SSCs. In addition, the measures demonstrate the following: (1) the ITP is accomplished with adequate numbers of qualified personnel, (2) adequate administrative controls will be established to govern the ITP, (3) the test program is used, to the extent practicable, to train and familiarize the plant's operating and technical staff with the operation of the facility, and (4) the adequacy of plant operating and emergency procedures is verified, to the extent practicable, during the period of the ITP.

This chapter also provides information on the inspections, tests, analyses, and acceptance criteria (ITAAC) that are intended to demonstrate that, when the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformance with the COL.

The ITP includes preoperational tests, initial fuel loading and initial criticality, low-power tests, and power-ascension tests. The applicant addresses the scope of the ITP, as well as its general plans for accomplishing it. The technical aspects of the ITP include (1) ITP objectives to verify the functional requirements of plant SSCs, and (2) the sequence of the ITP. The sequence of testing is organized so that the safety of NAPS Unit 3 (NAPS-3) does not depend on untested SSCs.

Confirmatory Item for Chapter 14

1. The staff review found that, for selected design acceptance criteria (DAC), a closure schedule provided within 1 year would not support the NRC's need to project staff resource and budget requirements to verify DAC/ITAAC closure. In an ESBWR DCWG public meeting on September 4, 2008, the staff expressed this concern to industry and stated that there were unique needs associated with closing out DAC for (1) piping design, (2) human factors engineering, and (3) digital instrumentation and controls. At subsequent ESBWR DCWG public meetings, the staff and industry discussed the resolution of this DAC closure schedule issue. At the public meeting on April 1, 2009, the industry proposed resolutions for the piping design and human factors engineering that the staff determined to be acceptable. For piping DAC, the NRC staff will be notified at least 6 months before (1) scheduled completion of all ASME Code design reports for risk-significant piping packages, and (2) scheduled completion of all the pipe-break hazard analyses. For human factors engineering DAC, the NRC will be notified at least 6 months before the scheduled completion of each results summary report. At the public meeting on May 14, 2009, the industry proposed a resolution for digital instrumentation and controls that the staff determined to be acceptable. For instrumentation and

controls DAC, the NRC staff will be notified at least 6 months before the scheduled completion of each baseline review report and software plan designated as DAC. The COL applicant agreed to incorporate the acceptable resolutions for the DAC closure schedule to address COL 14.3A-1-1 in the next revision to the NAPS-3 COLA. This issue is being tracked as **Confirmatory Item 14.3A-1.**

2. In Revision 0 of the FSAR, the applicant adopted the conceptual design information described in ESBWR DCD Tier 2, Section 11.4, Revision 4, as the plant-specific design. This design approach has since been revised in ESBWR DCD, Section 11.4, Revision 5, and ESBWR DCD Tier 1, Section 2.10.2, by including specific design details for the solid waste management system (SWMS) for permanently installed subsystems not previously described in Revision 4 of the DCD. The staff's review of Section 11.4.1 of the FSAR, Revision 1, indicates that it no longer refers to conceptual design information for the SWMS. However, the heading of Part 10, Section 2.4.11, still refers to a mobile solid radwaste system with a design that is outside the scope of the certified design. In RAI 14.03.07-2, the staff requested an update of the designation of the SWMS in Part 10, Section 2.4.11, to be consistent with the ESBWR DCD. In its response, the applicant proposed to delete Section 2.4.11 from Part 10 in a subsequent revision of the COLA. The staff found the response to be acceptable, and this RAI is tracked as **Confirmatory Item 14.03.07-2.**

Committee Comments from ESBWR Letter Dated December 22, 2008, for Chapter 14

The Initial Test Program is described in DCD Tier 2, Section 14.2, "Initial Plant Test Program for Final Safety Analysis Reports." This program includes the preoperational testing phase as well as the initial startup-testing phase. Provided that open items are properly addressed, the staff concluded that the applicant provided sufficient information in the Initial Test Program to test all the systems and components important to safety and adequately addressed the methods and guidance contained in the Standard Review Plan. We concur with the staff's conclusion.

The DCD and associated ITAAC are designed to ensure that a specific plant will be constructed and operated to conform to the certified design in all areas that are safety-significant. This means that the DC application must be complete. There are two exceptions for which the applicant may choose not to provide a complete design: Items for which the technology is rapidly changing and may be significantly different at the COL stage and Items for which the level of detail cannot be provided at the time of certification review (or for which the as-procured and as-built characteristics are needed).

If the applicant chooses to take an exception, DAC are required as part of the ITAAC. DAC are a set of prescribed limits, parameters, procedures, and attributes for particular systems and components that must be verified for the completed design and construction. The precedent for the use of DAC was established with the certifications of the Combustion Engineering System 80+ Pressurized Water Reactor, the General Electric Advanced Boiling Water Reactor, and the Westinghouse AP600 and AP1000 designs. For these designs, the staff accepted DAC for the I&C system, for the control room design with regard to human factors, and for the detailed piping design.

EXPECTED SUBCOMMITTEE ACTION

The Subcommittee Chairman will provide a report to the Full Committee during the September, 2009, ACRS meeting. In October, the Full Committee will issue an interim letter on all Chapters presented to the Subcommittee.