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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Serial No. NA3-08-092R
Docket No. 52-017
COL/MJL

DOMINION VIRGINIA POWER
NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER No. 022
(FSAR CHAPTER 3)

On August 1, 2008, the NRC requested additional information to support the review of certain portions of the North Anna Unit 3 Combined License Application (COLA). The responses are provided in Enclosures 1 through 13:

- RAI Question 03.09.06-1 Valve Operability Assurance
- RAI Question 03.09.06-2 ASME Code Edition Basis for IST
- RAI Question 03.09.06-3 Dynamic/Static Testing of AOVs
- RAI Question 03.09.06-4 ASME BPV Code Section XI and Snubber Reference
- RAI Question 03.09.06-5 Preservice Testing Program Commencement
- RAI Question 03.09.06-6 Implementation of FIV Program
- RAI Question 03.11-1 EQ Process Implementation
- RAI Question 03.11-2 DCD EQ Approach Implementation
- RAI Question 03.11-3 Additional EQ Equipment in FSAR Clarification
- RAI Question 03.11-4 GEH EQ Topical Report Implementation Plans
- RAI Question 03.11-5 FIV Considerations in the EQ Program
- RAI Question 03.11-6 EQ Program Commencement and Transition Plans
- RAI Question 03.11-7 ITAAC Implementation of EQ Equipment

This information will be incorporated into a future submission of the North Anna Unit 3 COLA, as described in the Enclosures.

Please contact Regina Borsh at (804) 273-2247 (regina.borsh@dom.com) if you have questions.

Very truly yours,

Eugene S. Grecheck

DOB9
HRO

COMMONWEALTH OF VIRGINIA

COUNTY OF HENRICO

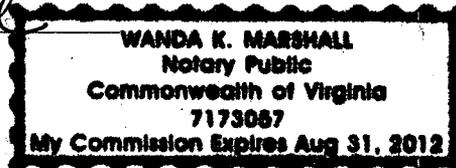
The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Eugene S. Grecheck, who is Vice President-Nuclear Development of Virginia Electric and Power Company (Dominion Virginia Power). He has affirmed before me that he is duly authorized to execute and file the foregoing document on behalf of the Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 11th day of September, 2008

My registration number is 7173057 and my

Commission expires: August 31, 2012


Notary Public



Enclosures:

1. Response to RAI Letter 022, RAI Question 03.09.06-1
2. Response to RAI Letter 022, RAI Question 03.09.06-2
3. Response to RAI Letter 022, RAI Question 03.09.06-3
4. Response to RAI Letter 022, RAI Question 03.09.06-4
5. Response to RAI Letter 022, RAI Question 03.09.06-5
6. Response to RAI Letter 022, RAI Question 03.09.06-6
7. Response to RAI Letter 022, RAI Question 03.11-1
8. Response to RAI Letter 022, RAI Question 03.11-2
9. Response to RAI Letter 022, RAI Question 03.11-3
10. Response to RAI Letter 022, RAI Question 03.11-4
11. Response to RAI Letter 022, RAI Question 03.11-5
12. Response to RAI Letter 022, RAI Question 03.11-6
13. Response to RAI Letter 022, RAI Question 03.11-7

Commitments made by this letter:

1. The information provided in the RAI responses will be incorporated into a future submission of the North Anna Unit 3 COLA, as described in the Enclosures.

cc: U. S. Nuclear Regulatory Commission, Region II
T. A. Kevern, NRC
J. T. Reece, NRC
J. J. Debiec, ODEC
G. A. Zinke, NuStart/Entergy
T. L. Williamson, Entergy
R. Kingston, GEH
K. Ainger, Exelon
P. W. Smith, DTE Energy

ENCLOSURE 1

Response to NRC RAI Letter 022

RAI Question 03.09.06-1

NRC RAI 03.09.06-1

Section 3.9, "Mechanical Systems and Components," of Chapter 3, "Design of Structures, Components, Equipment, and Systems," provided in the proposed revision to the North Anna Unit 3 FSAR submitted in a letter from Dominion dated June 26, 2008, incorporates by reference Revision 5 of the ESBWR DCD with supplemental information. Subsection 3.9.3.5, "Valve Operability Assurance," in ESBWR DCD Tier 2 (Revision 5) specifies that valve designs not previously qualified will meet the requirements of the American Society of Mechanical Engineers (ASME) Standard QME-1-2007, "Qualification of Active Mechanical Equipment used in Nuclear Power Plants." For valve designs that were previously qualified to standards other than ASME QME-1-2007, ESBWR Tier 2 (Revision 5) Subsection 3.9.3.5 specifies an approach for valve qualification that follows the key principals of the ASME QME-1-2007 standard. The NRC staff is performing its review of the COL application for the functional design and qualification of safety-related valves and dynamic restraints using the acceptance criteria in SRP Section 3.9.6 and other applicable SRP sections. Please discuss the process, such as by component examples, for implementing the provisions specified in the ESBWR DCD Tier 2 Subsection 3.9.3.5 for the functional design and qualification of valves and dynamic restraints. As part of the RAI response, please discuss the verification that solenoid-operated valves will meet their Class 1E electrical requirements for the appropriate electrical power supply amperage and voltage.

Dominion Response

As the ESBWR design authority, GEH is responsible for the design and qualification of mechanical equipment including valves and dynamic restraints. The valve procurement process is described in DCD Section 3.9.3.5, however, the valve procurement process has not yet been implemented. GEH is currently developing the procurement specifications and processes and they will be available for review and audit by the NRC.

With respect to solenoid-operated valves, as part of the GEH valve procurement process, GEH will supply the nominal and the minimum power supply parameters to the valve supplier via an auditable purchase specification. The valve supplier will then be responsible for qualifying the valves to those requirements.

Proposed COLA Revision

None.

ENCLOSURE 2

Response to NRC RAI Letter 022

RAI Question 03.09.06-2

NRC RAI 03.09.06-2

FSAR Subsection 3.9.6 incorporates by reference Subsection 3.9.6, "In-Service Testing of Pumps and Valves," in the ESBWR DCD Tier 2. Subsection 3.9.10, "References," in the ESBWR DCD Tier 2 lists the ASME OM Code, 2001 Edition with the 2003 Addenda. Please clarify the edition and addenda of the ASME Code for Operation and Maintenance of Nuclear Power Plants (OM Code) that will be the basis for the IST program description for North Anna Unit 3 for COL issuance.

Dominion Response

The basis for the IST program description for North Anna Unit 3 is the OM Code edition and addenda as indicated in the DCD.

FSAR Section 3.9 incorporates by reference DCD Section 3.9.6, "In-Service Testing of Pumps and Valves," and Section 3.9.10, "References," which includes the following:

- 3.9-5 American Society of Mechanical Engineers Code for Operation and Maintenance of Nuclear Power Plants, 2001 Edition with 2003 Addenda.

Proposed COLA Revision

None.

ENCLOSURE 3

Response to NRC RAI Letter 022

RAI Question 03.09.06-3

NRC RAI 03.09.06-3

In a proposed revision to the North Anna Unit 3 FSAR submitted by Dominion on June 26, 2008, FSAR Subsection 3.9.6 incorporates by reference the POV IST provisions specified in Subsection 3.9.6 of the ESBWR DCD Tier 2 (Revision 5) with a supplemental description of the POV IST program. The revised Subsection 3.9.6 in the FSAR describes the incorporation of lessons learned from valve experience at operating nuclear power plants into the air-operated valve (AOV) IST program. In the revised FSAR section, Dominion states that periodic static testing will be performed on high-risk AOVs unless those valves are stroked during plant operation. Dominion also states that periodic dynamic testing of AOVs is performed if required by valve qualification. Please discuss this provision in the FSAR for the periodic verification of AOV capability. In addition, please discuss the application of valve performance lessons learned to POVs other than AOVs. Discuss the basis for the statement in Subsection 3.9.6 of the proposed revision to the FSAR that post-maintenance procedures are applied where high-risk valve performance could be affected. For example, quality assurance criteria in 10 CFR Part 50, Appendix B, require the use of procedures when performing activities affecting safety-related valves regardless of their risk ranking.

Dominion Response

Periodic Static and Dynamic Testing of AOVs

DCD Section 3.9.3.1 indicates that the design life of the ESBWR standard plant is 60 years, and that essentially all piping systems, components and equipment are designed for a 60-year design life. DCD Section 3.9.3.5, Valve Operability Assurance, discusses operability assurance of active Code valves, including actuators (DCD Section 3.9.2.2) and provides a detailed discussion of valve qualification requirements to ensure that design life is achievable. As discussed in DCD Section 3.9.3.5, for ESBWR standard plant valve qualification, valves will either, be qualified in accordance with QME-1-2007, or for valve designs previously qualified to standards other than ASME QME-1-2007, a gap analysis will be performed to justify deviations from QME-1-2007. Qualification of valves to QME-1 provides verification of the valve's capability to meet its design basis performance requirements, considering all operating conditions and potential degradation mechanisms, assuming the valve is set up properly (e.g., lower benchset and regulator pressure are within their allowable ranges for pneumatically-operated valves) and design assumptions remain within assumed limits (e.g., valve running load is less than the assumed value). Valves will undergo periodic static testing following installation in the plant to verify valve setup and design assumptions are consistent with valve qualification. Consistent with current industry standards, valves that are stroked at their design basis conditions during normal plant operation may not be periodically tested. DCD Section 3.9.6.8, incorporated by reference in the FSAR, states that the design basis capability of active, safety-related power-operated valves is verified as part of the design and qualification process, but that power-operated valves that perform an active safety function are tested again after installation in the plant, as required, to ensure valve setup is acceptable to perform their required functions, consistent with valve qualification. Assuming all potential degradation mechanisms are addressed in valve qualification, periodic dynamic testing is not required.

In the event valve qualification cannot establish that valve performance will be acceptable over the design life of 60 years (e.g., for a gate valve, the disk-to-seat coefficient of friction cannot be shown to be bounding for the 60-year design life), periodic dynamic testing of the valve and its actuator may be required following valve installation in the plant as discussed in FSAR Section 3.9.6.8.

Application of Valve Performance Lessons Learned

As discussed in DCD Section 3.9.3.5, functional qualification of ESBWR valves incorporates lessons learned from industry programs (e.g., AOV and MOV programs). These lessons learned, some of which are listed in DCD Section 3.9.3.5, are applied to all power-operated valves, as applicable.

DCD Sections 3.9.6.1.4 and 3.9.6.1.5(1) state that power-operated valves are tested in accordance with the ASME OM Code, Subsection ISTC. FSAR Section 3.9.6.1.4 supplements the DCD, indicating that other specific testing requirements for power-operated valves include, as applicable, diagnostic testing to evaluate valve condition and to verify the valve will continue to function under design-basis conditions, and FSAR Section 3.9.6.1.5(1) indicates that Section 3.9.6.8 describes additional (non-Code) testing of power-operated valves as discussed in Regulatory Issue Summary (RIS) 2000-03. DCD Section 3.9.6.8, incorporated by reference in the FSAR, states that the design basis capability of active, safety-related power-operated valves is verified as part of the design and qualification process, but that power-operated valves that perform an active safety function are tested again after installation in the plant, as required, to ensure valve setup is acceptable to perform their required functions, consistent with valve qualification. This is applicable for AOVs and power-operated valves other than AOVs.

FSAR Section 3.9.6.8 describes features of the AOV program, discusses incorporation of lessons learned from previous power-operated valve testing programs, indicating that the AOV program incorporates the attributes for a successful power-operated valve long-term periodic verification program, as discussed in RIS 2000-03, Resolution of Generic Safety Issue 158: Performance of Safety-related Power-Operated Valves Under Design Basis Conditions, by incorporating key lessons learned from previous nuclear power plant operations and research programs as they apply to the periodic testing of air and other power-operated valves included in the IST program. The attributes of the AOV testing program described, to the extent that they apply to and can be implemented on other power-operated valves, such as electro-hydraulic valves, would be applied to those other power-operated valves. Safety-related nitrogen-operated valves included in the ESBWR design, DCD Table 3.9-8, would be included in the AOV program and would be tested accordingly.

Post-Maintenance Procedure Requirements for High-Risk Valves

FSAR Section 3.9.6.8 states that post-maintenance procedures include appropriate instructions and criteria to ensure baseline testing is re-performed as necessary when maintenance on the valve, valve repair or replacement, have the potential to affect high-risk valve functional performance. However, this statement was not intended to imply that only maintenance on high-risk valves would be governed by procedure. Appendix 17BB of the FSAR includes the North Anna QAPD applicable to operations of North Anna Unit 3. Section 5 of the QAPD provides requirements for procedures, and states that NAPS3 has established the necessary measures and governing procedures to

ensure that activities affecting quality are prescribed by and performed in accordance with instructions, procedures or drawings of a type appropriate to the circumstances and which, where applicable, include quantitative or qualitative acceptance criteria to implement the QAP as described in the QAPD. FSAR Section 3.9.6.8 will be revised to remove the reference to high-risk valves, for clarity.

Proposed COLA Revision

Revise FSAR 3.9.6.8, sixth bullet, to remove the specific reference to "high-risk" valves.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

3.9.6.5 Valve Replacement, Repair and Maintenance

Add the following to the end of the paragraph.

STD COL 3.9.9-3-A

When a valve or its control system has been replaced, repaired, or has undergone maintenance that could affect valve performance, a new reference value is determined, or the previous value is reconfirmed by an inservice test. This test is performed before the valve is returned to service, or immediately if the valve is not removed from service. Deviations between the previous and new reference values are identified and analyzed. Verification that the new values represent acceptable operation is documented.

3.9.6.6 10 CFR 50.55a Relief Requests and Code Cases

Add the following at the end of the first paragraph.

STD SUP 3.9-1

No relief from or alternative to the ASME OM Code is being requested.

3.9.6.7 Inservice Testing Program Implementation

Delete the last paragraph.

3.9.6.8 Non-Code Testing of Power-Operated Valves

Replace the second sentence of the first paragraph with the following.

STD COL 3.9.9-3-A

These tests, which are typically performed under static (no flow or pressure) conditions, also document the "baseline" performance of the valves to support maintenance and trending programs.

Replace the fifth sentence of the first paragraph with the following.

STD COL 3.9.9-3-A

Uncertainties associated with performance of these tests and use of the test results (including those associated with measurement equipment and potential degradation mechanisms) are addressed appropriately.

Replace the last sentence of the first paragraph with the following.

STD COL 3.9.9-3-A

Uncertainties affecting both valve function and structural limits are addressed.

Replace the second paragraph with the following.

STD COL 3.9.9-3-A

Additional testing is performed as part of the air-operated valve (AOV) program, which includes the key elements for an AOV Program as identified in the JOG AOV program document, Joint Owners Group Air Operated Valve Program Document, Revision 1, December 13, 2000 (References 3.9.201 and 3.9.202). The AOV program incorporates the attributes for a successful power-operated valve long-term periodic verification program, as discussed in RIS 2000-03, Resolution of Generic Safety Issue 158: Performance of Safety-related Power-Operated Valves Under Design Basis Conditions, (Reference 3.9.203) by incorporating lessons learned from previous nuclear power plant operations and research programs as they apply to the periodic testing of air- and other power-operated valves included in the IST program. For example, key lessons learned addressed in the AOV program include:

- Valves are categorized according to their safety significance and risk ranking.
- Setpoints for AOVs are defined based on current vendor information or valve qualification diagnostic testing, such that the valve is capable of performing its design-basis function(s).
- Periodic static testing is performed, at a minimum on high risk (high safety significance) valves, to identify potential degradation, unless those valves are periodically cycled during normal plant operation under conditions that meet or exceed the worst case operating conditions within the licensing basis of the plant for the valve, which would provide adequate periodic demonstration of AOV capability. If required based on valve qualification, periodic dynamic testing is performed to re-verify the capability of the valve to perform its required functions.
- Sufficient diagnostics are used to collect relevant data (e.g., valve stem thrust and torque, fluid pressure and temperature, stroke time, operating and/or control air pressure, etc.) to verify the valve meets the functional requirements of the qualification specification.
- Test frequency is specified, and is evaluated each refueling outage based on data trends as a result of testing. Frequency for periodic testing is in accordance with References 3.9.201 and 3.9.202, with a minimum of 5 years (or 3 refueling cycles) of data collected and evaluated before extending test intervals.

- Post-maintenance procedures include appropriate instructions and criteria to ensure baseline testing is re-performed as necessary when maintenance on the valve, valve repair or replacement, have the potential to affect ~~high risk~~ valve functional performance.
- Guidance is included to address lessons learned from other valve programs in procedures and training specific to the AOV program.
- Documentation from AOV testing, including maintenance records and records from the corrective action program are retained and periodically evaluated as a part of the AOV program.

3.9.7 Risk-Informed Inservice Testing

Replace this section with the following.

STD SUP 3.9-2

Risk informed inservice testing is not being utilized.

3.9.8 Risk-Informed Inservice Inspection of Piping

Replace this section with the following.

STD SUP 3.9-3

Risk informed inservice inspection is not being utilized.

3.9.9 COL Information

3.9.9-1-H Reactor Internals Vibration Analysis, Measurement and Inspection Program

NAPS COL 3.9.9-1-H

This COL item is addressed in [Section 3.9.2.4](#).

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

STD COL 3.9.9-2-H

This COL item is addressed in [Section 3.9.3.1](#).

3.9.9-3-A Inservice Testing Programs

STD COL 3.9.9-3-A

This COL item is addressed in [Section 3.9.6](#).

3.9.9-4-A Snubber Inspection and Test Program

STD COL 3.9.9-4-A

This COL item is addressed in [Section 3.9.3.7.1\(3\)e](#) and [Section 3.9.3.7.1\(3\)f](#).

3.9.10 References

- 3.9.201 Joint Owners Group Air Operated Valve Program Document, Revision 1, December 13, 2000.

ENCLOSURE 4

Response to NRC RAI Letter 022

RAI Question 03.09.06-4

NRC RAI 03.09.06-4

Subsection 3.9.3.7.1, "Piping Supports," in the ESBWR DCD Tier 2 specifies provisions for snubber design, testing, installation, and pre-service examination and testing. Revision 5 to the ESBWR DCD Tier 2 in Subsection 3.9.3.7.1 also states in paragraph e, "Snubber Pre-service and In-service Examination and Testing," that the COL applicant will provide a full description of the snubber inspection and test program. Table 1.9-203, "Conformance with the FSAR Content Guidance in RG 1.206," in the FSAR on page 1-109 states that the COL application conforms with Paragraph C.III.1.3.9.6.4 of RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," with the exception that a plant-specific snubber table will be prepared in conjunction with closure of ITAAC Table 3.1-1. In a letter dated June 26, 2008, Dominion submitted a proposed revision to Section 3.9 of the FSAR that describes the snubber inservice examination and testing program, including specifying that the program will satisfy ASME OM Code, Section ISTD, and providing specific examples of the program content to supplement the ESBWR DCD. Please clarify the reference to the ASME Boiler and Pressure Vessel Code, Section XI, with respect to snubbers at North Anna Unit 3 in paragraph 3(b) of Subsection 3.9.3.7.1 of the ESBWR DCD Tier 2.

Dominion Response

This RAI seeks information requested of GEH in DCD RAI 3.9-248. Please refer to GEH's response to DCD RAI 3.9-248 in GEH Letter MFN 08-683 dated September 9, 2008. GEH's response is repeated here for convenience.

GEH Response to RAI 3.9-248

"The snubber inservice examination and testing program will be in accordance with the ASME OM Code. The reference to Section XI of the ASME B&PV Code will be deleted from the DCD."

Proposed COLA Revision

None.

ENCLOSURE 5

Response to NRC RAI Letter 022

RAI Question 03.09.06-5

NRC RAI 03.09.06-5

FSAR Section 13.4, "Operational Program Implementation," states that FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations," lists each operational program, the regulatory source for the program, the associated implementation milestones, and the FSAR section in which the operational program per the guidance in RG 1.206. FSAR Table 13.4-201 specifies the implementation milestone for the Preservice Testing Program as "prior to fuel load." Please discuss the commencement of the Preservice Testing Program such as tying its commencement to construction activities for the component, system, or elevation.

Dominion Response

As described in RG 1.206, Section C.IV.4.3, the COL will contain a license condition that requires Dominion to submit to the NRC a schedule, 12 months after issuance of the COL, that supports planning for and conduct of NRC inspections of operational programs of which Preservice Testing is one. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the operational programs in FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial service, whichever comes first.

Commencement of preservice testing will be commensurate with the operational status of the equipment and its readiness to support preservice testing, with completion of the preservice testing as indicated in FSAR Table 13.4-201, prior to fuel load. This means that, for example, installation of the valve in the piping system must be complete, along with the majority of the piping system itself, with valve power and controls ready to support valve stroking. Any post-installation construction testing and valve setup activities such as setting of torque and/or limit switches, lubrication of the valve, packing installation/adjustment, etc. must be completed. These activities are driven by the plant construction and turnover schedules.

Proposed COLA Revision

None.

ENCLOSURE 6

Response to NRC RAI Letter 022

RAI Question 03.09.06-6

NRC RAI 03.09.06-6

The FSAR incorporates by reference Section 3.9.2, "Dynamic Testing and Analysis of Systems, Components, and Equipment," in the ESBWR DCD Tier 2, which addresses criteria, testing procedures, and dynamic analyses employed to ensure the structural and functional integrity of piping systems, mechanical equipment, reactor internals, and their supports under vibratory loadings. ESBWR DCD Tier 2 Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," addresses methods of test and analysis employed to ensure the operability of mechanical and electrical equipment under the full range of normal and accident loadings to ensure conformance with the NRC regulations. ESBWR DCD Tier 2 Subsection 14.2.8.1.42, "Expansion, Vibration and Dynamic Effects Preoperational Test," states that its objective is to verify that critical components and piping runs are properly installed and supported such that expected steady-state and transient vibration and movement due to thermal expansion does not result in excessive stress or fatigue to safety-related plant systems and equipment. Nuclear power plant operating experience has revealed the potential for adverse flow effects from vibration caused by hydrodynamic loads and acoustic resonance within reactor coolant, steam, and feedwater systems. Please describe the implementation of the program to address potential adverse flow effects on safety-related valves and dynamic restraints.

Dominion Response

Dominion intends to use the overall Initial Test Program (which includes pre-operational and start-up testing) to address the concern of potential adverse flow effects on safety-related valves and dynamic restraints. The program will confirm attributes of the components design as described in the DCD. Implementation of the test program is described in FSAR Section 14.2 and Table 13.4-201.

DCD Section 3.9.2, "Dynamic Testing and Analysis of Systems, Components and Equipment," presents the criteria, testing procedures, and dynamic analyses employed to ensure the structural and functional integrity of piping systems, mechanical equipment, reactor internals, and their supports under vibratory loadings, including those due to fluid flow and postulated seismic events as discussed in SRP 3.9.2.

DCD Section 3.9.2.1, "Piping Vibration, Thermal Expansion and Dynamic Effects," further states that, "(T)he overall test program is divided into two phases: the preoperational test phase and the initial startup test phase. Piping vibration, thermal expansion and dynamic effects testing is performed during both of these phases as described in Chapter 14." DCD Section 3.9.2.1.1, "Vibration and Dynamic Effects Testing," states that the purpose of these tests is to confirm that the piping, components, restraints and supports of specified high and moderate-energy systems have been designed to withstand the dynamic effects of steady state flow-induced vibration (FIV) and anticipated operational transient conditions.

DCD Section 3.9.3.5, "Valve Operability Assurance," discusses operability assurance of active Code valves, including actuators and states that, "(T)he ESBWR general valve requirements specification includes requirements related to design and functional qualification of safety-related valves that incorporate lessons learned from nuclear power

plant operations and research programs.” DCD Section 3.9 tables also address load combinations that include SRV opening loads (acoustic wave).

With respect to component supports of which dynamic restraints are one type, DCD Sections 3.9.3.7 and 3.9.3.8 address analyses or tests that are performed for component supports to assure their structural capability to withstand the seismic and other dynamic excitations.

The above referenced preoperational and startup tests are described in more detail in DCD Section 14.2.8.1.42, “Expansion, Vibration and Dynamic Effects Preoperational Test,” and in DCD Section 14.2.8.2.10, “System Vibration Test.”

Proposed COLA Revision

None.

ENCLOSURE 7

Response to NRC RAI Letter 022

RAI Question 03.11-1

NRC RAI 03.11-1

FSAR Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," incorporates by reference Section 3.11 of the ESBWR DCD Tier 2, with supplemental information. The process for implementation of the provisions for environmental qualification of safety-related mechanical equipment (such as by procurement specifications) is not described in the FSAR. Please provide or reference the following information, or indicate the status of and schedule for its availability, related to the environmental qualification (EQ) operational program for safety-related mechanical equipment including (a) a description of the process to determine the suitability of environmentally sensitive mechanical equipment needed for safety-related functions and to verify that the design of such materials, parts, and equipment is adequate, such as (i) identifying safety-related mechanical equipment located in harsh environmental areas, (ii) identifying nonmetallic subcomponents of such equipment, (iii) identifying environmental conditions and process parameters for which this equipment must be qualified, (iv) identifying nonmetallic material capabilities, and (v) evaluating the environmental effects on the nonmetallic components of the equipment; and (b) a description of the approach to document the successful completion of qualification tests and/or analysis, and qualification status for each type of equipment.

Dominion Response

FSAR Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," incorporates by reference DCD Revision 4, Section 3.11 with supplemental information. After the initial submittal of the North Anna Unit 3 COLA, DCD Revision 5 was issued, substantially revising DCD Section 3.11. As part of that revision, DCD Section 3.11.2.2 was renumbered to 3.11.4 and COL Item 3.11-1-A was revised to require providing a full description of the environmental qualification program along with a milestone for program implementation. FSAR Section 3.11 will be revised to indicate that DCD Section 3.11 provides the full description of the environmental qualification program.

This RAI specifically requests the following (with the responses included and referring to DCD Revision 5):

- (a) *a description of the process to determine the suitability of environmentally sensitive mechanical equipment needed for safety-related functions and to verify that the design of such materials, parts, and equipment is adequate, such as*
- (i) *identifying safety-related mechanical equipment located in harsh environmental areas,*

Response: Equipment identification is discussed in DCD Section 3.11.2 and DCD Table 3.11-1 identifies the systems that contain environmental qualification (EQ) equipment and their locations. If the component is located in a harsh environment, Table 3.11-1 depicts this by placing an 'H' in the last column labeled "Qualification Program." See Note 4 of Table 3.11-1. There is no site specific safety-related equipment beyond that described in the DCD, as indicated in the conformance evaluation of RG 1.206 Regulatory Position C.III.1.3.11 in FSAR Table 1.9-203.

- (ii) *identifying nonmetallic subcomponents of such equipment,*

Response: Equipment identification is discussed in DCD Section 3.11.2 and DCD Section 3.11.4.1, indicates that "...the qualification of mechanical equipment includes materials that are sensitive to environmental effects (e.g., seals, gaskets, lubricants, fluids for hydraulic systems and diaphragms), required operating time, non-metallic subcomponents of such equipment; the environmental conditions and process parameters for which this equipment must be qualified; non-metallic material capabilities; and the evaluation of environmental effects."

- (iii) *identifying environmental conditions and process parameters for which this equipment must be qualified,*

Response: Environmental conditions are discussed in DCD Section 3.11.3 and DCD Table 3.11-1 identifies the systems that contain EQ equipment and whether the equipment is in a harsh environment. DCD Section 3.11.3.1 discusses analyzing EQ equipment for significant aging mechanisms as well as several other conditions.

- (iv) *identifying nonmetallic material capabilities, and (v) evaluating the environmental effects on the nonmetallic components of the equipment;*

Response: DCD Section 3.11.4.1 indicates that "...the qualification of mechanical equipment includes materials that are sensitive to environmental effects (e.g., seals, gaskets, lubricants, fluids for hydraulic systems and diaphragms)."

- (b) *a description of the approach to document the successful completion of qualification tests and/or analysis, and qualification status for each type of equipment.*

Response: DCD Section 3.11.4 discusses the qualification program, methods and documentation. Additionally, completion of the plant-specific environmental qualification documentation (part of COL Item 3.11-1-A) is addressed in FSAR Section 3.11.4.4. Completion of the ITAAC specified in DCD Tier 1 Table 3.8-1, ITAAC for Environmental Qualification of Mechanical and Electrical Equipment, will ensure the successful completion of the EQ of equipment.

In summary, DCD Section 3.11, which is incorporated by reference into the North Anna Unit 3 FSAR, provides a description of the environmental qualification program.

Proposed COLA Revision

FSAR Section 3.11 will be revised as shown in the attached markups.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

3.11 Environmental Qualification of Mechanical and Electrical Equipment

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

3.11.4.4 Environmental Qualification Documentation

Replace the last paragraph with the following.

STD COL 3.11-1-A

A description of the environmental qualification program is provided in [DCD Section 3.11](#).

Implementation of the environmental qualification program, including development of the plant specific Environmental Qualification Document (EQD), will be in accordance with the milestone defined in [Section 13.4](#).

~~Following program implementation, DCD Table 3.11-1 will be supplemented, as necessary, in a subsequent FSAR update to include additional equipment covered by the program but not identified in the table.~~

3.11.7 COL Information

3.11-1-A Environmental Qualification Document

STD COL 3.11-1-A

This COL item is addressed in [Section 3.11.4.4](#).

STD SUP 3.12-1

3.12 Piping Design Review

Information on seismic Category I and II, and nonseismic piping analysis and their associated supports is presented in [DCD Sections 3.7, 3.9, 3D, 3K, 5.2 and 5.4](#).

STD SUP 3.12-2

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

STD SUP 3.13-1

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

Criteria applied to the selection of materials, design, inspection and testing of threaded fasteners (i.e., threaded bolts, studs, etc.) are presented in [DCD Section 3.9.3.9](#), with supporting information in [DCD Sections 4.5.1, 5.2.3, and 6.1.1](#).

ENCLOSURE 8

Response to NRC RAI Letter 022

RAI Question 03.11-2

NRC RAI 03.11-2

Subsection 3.11.2.2, "Qualification Program, Methods and Documentation," of the ESBWR DCD Tier 2 states that safety-related mechanical equipment that is located in a harsh environment is qualified by analysis of materials data, which are generally based on test and operating experience. Subsection 3.11.2.2 further states that safety-related equipment located in a mild environment is qualified per IEEE 323. The North Anna Unit 3 FSAR does not discuss the implementation of the environmental qualification approach identified in the ESBWR DCD. Discuss the plan for the implementation of the environmental qualification approach, including the application of industry standards.

Dominion Response

FSAR Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," incorporates by reference DCD Revision 4, Section 3.11 with supplemental information. After the initial submittal of the North Anna Unit 3 COLA, DCD Revision 5 was issued, substantially revising DCD Section 3.11. As part of that revision, DCD Section 3.11.2.2 was renumbered to 3.11.4 and COL Item 3.11-1-A was revised to require providing a full description of the environmental qualification program along with a milestone for program implementation. FSAR Section 3.11 will be revised to indicate that DCD Section 3.11 provides the full description of the environmental qualification program (see response to RAI 03-11-1, Enclosure 7).

FSAR Section 3.11 currently commits to implementation of the environmental qualification program in accordance with the milestones defined in FSAR Section 13.4. (Also refer to Dominion's responses to NRC RAI 03.11-6 (Enclosure 12) regarding an environmental qualification program implementation schedule and RAI 03.11-7 (Enclosure 13) regarding an implementation schedule for environmental qualification ITAAC).

The qualification of safety-related mechanical equipment is performed by Dominion's vendor, GEH. The qualification processes used by GEH are available for audit by the NRC.

Proposed COLA Revision

FSAR Section 3.11 will be revised as shown in the attached markups.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

3.11 Environmental Qualification of Mechanical and Electrical Equipment

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

3.11.4.4 Environmental Qualification Documentation

Replace the last paragraph with the following.

STD COL 3.11-1-A

A description of the environmental qualification program is provided in [DCD Section 3.11](#).

Implementation of the environmental qualification program, including development of the plant specific Environmental Qualification Document (EQD), will be in accordance with the milestone defined in [Section 13.4](#).

~~Following program implementation, DCD Table 3.11-1 will be supplemented, as necessary, in a subsequent FSAR update to include additional equipment covered by the program but not identified in the table.~~

3.11.7 COL Information

3.11-1-A Environmental Qualification Document

STD COL 3.11-1-A

This COL item is addressed in [Section 3.11.4.4](#).

STD SUP 3.12-1

3.12 Piping Design Review

Information on seismic Category I and II, and nonseismic piping analysis and their associated supports is presented in [DCD Sections 3.7, 3.9, 3D, 3K, 5.2 and 5.4](#).

STD SUP 3.12-2

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

STD SUP 3.13-1

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

Criteria applied to the selection of materials, design, inspection and testing of threaded fasteners (i.e., threaded bolts, studs, etc.) are presented in [DCD Section 3.9.3.9](#), with supporting information in [DCD Sections 4.5.1, 5.2.3, and 6.1.1](#).

ENCLOSURE 9

Response to NRC RAI Letter 022

RAI Question 03.11-3

NRC RAI 03.11-3

FSAR Subsection 3.11.2.2 states that following implementation of the environmental qualification program, ESBWR DCD Table 3.11-1 will be supplemented, as necessary, in a subsequent FSAR update to include additional equipment covered by the program but not identified in the table. The reference to additional equipment is not clear if the ESBWR design is complete when certified in 10 CFR Part 52. Clarify the statement in Subsection 3.11.2.2 of the North Anna Unit 3 FSAR that an FSAR update will include additional equipment not identified in the ESBWR DCD Tier 2 Table 3.11-1.

Dominion Response

For North Anna Unit 3, there is no safety-related equipment or safe shutdown equipment outside the scope of the ESBWR design. This is stated in FSAR Table 1.9-203, "Conformance with FSAR Content Guidance in RG 1.206," Section C.III.1 (3.11). Therefore, there is no additional equipment covered by the environmental qualification program not identified in DCD Table 3.11-1. Dominion agrees with the staff comment that the second paragraph of FSAR Section 3.11.2.2 is not clear and, therefore, it will be deleted.

Note that Dominion responses to RAI 03.11-1 (Enclosure 7) and RAI 03.11-2 (Enclosure 8) also result in deletion of the paragraph.

Proposed COLA Revision

FSAR Section 3.11.2.2 will be revised as indicated on the attached markup.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

3.11 Environmental Qualification of Mechanical and Electrical Equipment

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

3.11.4.4 Environmental Qualification Documentation

Replace the last paragraph with the following.

STD COL 3.11-1-A

A description of the environmental qualification program is provided in [DCD Section 3.11](#).

Implementation of the environmental qualification program, including development of the plant specific Environmental Qualification Document (EQD), will be in accordance with the milestone defined in [Section 13.4](#).

~~Following program implementation, DCD Table 3.11-1 will be supplemented, as necessary, in a subsequent FSAR update to include additional equipment covered by the program but not identified in the table.~~

3.11.7 COL Information

3.11-1-A Environmental Qualification Document

STD COL 3.11-1-A

This COL item is addressed in [Section 3.11.4.4](#).

STD SUP 3.12-1

3.12 Piping Design Review

Information on seismic Category I and II, and nonseismic piping analysis and their associated supports is presented in [DCD Sections 3.7, 3.9, 3D, 3K, 5.2 and 5.4](#).

STD SUP 3.12-2

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

STD SUP 3.13-1

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

Criteria applied to the selection of materials, design, inspection and testing of threaded fasteners (i.e., threaded bolts, studs, etc.) are presented in [DCD Section 3.9.3.9](#), with supporting information in [DCD Sections 4.5.1, 5.2.3, and 6.1.1](#).

ENCLOSURE 10

Response to NRC RAI Letter 022

RAI Question 03.11-4

NRC RAI 03.11-4

Subsection 3.11.2.2 of the ESBWR DCD Tier 2 states that the qualification program and methodology are described in the NRC approved proprietary licensing Topical Report NEDE-24326-1-P. In a letter dated November 19, 2007 (MFN 07-174, Supplement 2), GEH stated that the NRC staff review of NEDE-24326-1-P was addressed in NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design." On page 3-90 of NUREG-1503, the NRC staff found that the topical report conforms to 10 CFR 50.49 and its associated standards, except for the position on time margin. The COL applicant is requested to discuss its implementation of the topical report including the exception to its acceptance indicated in NUREG-1503. Describe the plan for the implementation of NEDE-24326-1-P, "General Electric Environmental Qualification Program," for environmental qualification of safety-related mechanical equipment.

Dominion Response

DCD Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," was updated and revised substantially from Revision 4 to Revision 5. This was mostly due to incorporating much of the subject Licensing Topical Report NEDE-24326-1-P. As a result, Dominion will incorporate by reference the information provided in DCD Revision 5.

In Revision 5, GEH not only incorporated the topical report into the DCD, they specifically addressed the time margin issue in Section 3.11.3, "Environmental Conditions," subsection "Operating Time."

Proposed COLA Revision

None.

ENCLOSURE 11

Response to NRC RAI Letter 022

RAI Question 03.11-5

NRC RAI 03.11-5

Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," in the ESBWR DCD Tier 2 addresses methods of test and analysis employed to ensure the operability of mechanical and electrical equipment under the full range of normal and accident loadings to ensure conformance with the NRC regulations. Operating experience from nuclear power plants has revealed the potential for adverse flow effects during normal plant operation that can impact safety-related components (such as safety relief valves). As a result, equipment qualification programs need to address these adverse flow effects to provide confidence in the capability of safety-related equipment to be capable of performing their safety functions. The FSAR does not specifically address the consideration of potential adverse flow effects for the equipment qualification program. Describe the consideration of flow-induced vibration in the qualification of safety-related mechanical equipment, such as valves, actuators, and piping, resulting from acoustic resonance and hydraulic loading.

Dominion Response

The design and qualification of safety-related mechanical equipment is within the scope of the certified design. DCD Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," describes the requirements for the environmental qualification (EQ) elements of the equipment qualification program. The equipment qualification program also includes dynamic and seismic qualification. Dynamic qualification is addressed in Section 3.9, "Mechanical Systems and Components," Section 3.10 "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," for Seismic Category I equipment and Appendix 3L, "Reactor Internals Flow Induced Vibration Program."

For valve design and qualification, DCD Section 3.9.3.5, "Valve Operability Assurance," discusses operability assurance of active Code valves, including actuators and also states that the "(T)he ESBWR general valve requirements specification includes requirements related to design and functional qualification of safety-related valves that incorporate lessons learned from nuclear power plant operations and research programs." Additionally, DCD Section 3.9 tables address load combinations that include SRV opening loads (acoustic wave).

DCD Section 3.10 addresses methods of test and analysis employed to ensure the operability of mechanical and electrical equipment (includes instrumentation and control) under the full range of normal and accident loadings (including seismic). Appendix 3L discusses evaluations and testing related to reactor internals flow induced vibration. In addition to reactor components such as the steam dryer assembly and chimney assembly, Appendix 3L also addresses Standby Liquid Control internal piping.

To provide confidence in the capability of safety-related equipment to perform their safety functions, Dominion will perform testing as described in DCD Section 3.9.2 and FSAR Section 14.2. DCD Section 3.9.2.1.1 discusses vibration and dynamic effects testing that will be performed during the Initial Test Program (which includes pre-operational and start-up testing) as described in DCD Section 14.2.8.1.42, "Expansion, Vibration and Dynamic Effects Preoperational Test," and DCD Section 14.2.8.2.10, "System Vibration Test."

The DCD states that the objective of these tests is to confirm that the piping, components, restraints and supports of specified high and moderate-energy systems have been designed to withstand the dynamic effects of steady state flow-induced vibration (FIV) and anticipated operational transient conditions.

Proposed COLA Revision

None.

ENCLOSURE 12

Response to NRC RAI Letter 022

RAI Question 03.11-6

NRC RAI 03.11-6

FSAR Subsection 3.11.2.2 states that the implementation of the environmental qualification program, including development of the plant specific Equipment Qualification Document (EQD), will be in accordance with the milestone defined in Section 13.4 "Operational Program Implementation." FSAR 13.4 indicates that FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations," lists each operational program, the regulatory source for the program, the FSAR section in which the operational program is described, and the associated implementation milestones. FSAR Table 13.4-201 specifies the implementation milestone for the Environmental Qualification Program as "prior to fuel load." This milestone is not sufficiently clear to establish the commencement of the Environmental Qualification Program and its subsequent transition to an ongoing program during plant operation. For example, will commencement of this program be tied to the completion of construction activities for the component, system, or elevation? What will be the process for turnover of the EQ program to plant operational staff? Please clarify the plans for commencement of the Environmental Qualification Program and its transition into an operating reactor program.

Dominion Response

Guidance to the COL applicant regarding implementation of operational programs is contained in Regulatory Guide 1.206, C.III.1, Section C.1.13.4, "Operational Program Implementation," and C.IV.4, Section C.IV.4.3; "Implementation of Operational Programs." FSAR Table 13.4-201 contains the level of detail requested by Table 13.4-1 of RG 1.206.

As described in RG 1.206, Section C.IV.4.3, the COL will contain a license condition that requires Dominion to submit to the NRC a schedule, 12 months after issuance of the COL, that supports planning for and conduct of NRC inspections of operational programs of which Equipment Qualification Program is one. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the operational programs in FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial service, whichever comes first.

This schedule will address additional program implementation details, such as the commencement of the EQ program.

The transition of the EQ program into an operating program occurs during system jurisdictional control as part of the plant turnover process from the EPC Contractor to Dominion.

Proposed COLA Revision

None.

ENCLOSURE 13

Response to NRC RAI Letter 022

RAI Question 03.11-7

NRC RAI 03.11-7

ESBWR DCD Tier 1 Section 3.8, "Environmental Qualification of Mechanical and Electrical Equipment," specifies the environmental qualification ITAAC for safety-related mechanical and electrical equipment in Table 3.8-1, "ITAAC for Environmental Qualification of Mechanical and Electrical Equipment." The inspections, tests, and analysis for safety-related mechanical equipment located in harsh environments states that (i) analysis will be performed to identify the environmental design basis including the definition of anticipated operational occurrences and normal, accident, and post-accident environments, (ii) type tests and/or analysis or material data will be performed on safety-related mechanical equipment identified as located in a harsh environment; and (iii) inspection will be performed to verify proper non-metallic materials of the as-installed safety-related mechanical equipment located in a harsh environment. FSAR Section 3.11 does not address implementation of the ITAAC for safety-related mechanical equipment specific in the ESBWR DCD Tier 1. Please describe the plan for the implementation of the inspections, tests, analysis, and acceptance criteria (ITAAC) for safety-related mechanical equipment located in a harsh environment specified in the ESBWR DCD Tier 1.

Dominion Response

DCD Tier 1, Section 1.1.2.2 provides a general plan description of ITAAC implementation. The North Anna Unit 3 COLA, Part 10, incorporates the DCD ITAAC by reference.

With respect to specific ITAAC implementation, 10 CFR 52.99, "Inspection During Construction," requires that the licensee submit to the NRC, no later than 1 year after issuance of the combined license or at the start of construction as defined in 10 CFR 50.10(b), whichever is later, its schedule for completing the inspections, tests, or analyses in the ITAAC. This regulation further states that the licensee shall submit updates to the ITAAC schedule every 6 months thereafter and, within 1 year of its scheduled date for initial loading of fuel, the licensee shall submit updates to the ITAAC schedule every 30 days until the final notification is provided to the NRC under paragraph (c)(1) of 10 CFR 52.99.

Dominion ITAAC implementation plans and schedules will be provided in accordance with 10 CFR 52.99.

Proposed COLA Revision

None.