



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 24, 2015

CAL No. NRR-2011-002

Mr. David A. Heacock
President and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Blvd
Glen Allen, VA 23060-6711

SUBJECT: CLOSURE OF CONFIRMATORY ACTION LETTER REGARDING NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2 (CAC NOS. MF1807 AND MF1808)

Dear Mr. Heacock:

The purpose of this letter is to acknowledge your response to the Confirmatory Action Letter (CAL) that was issued to you on November 11, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11311A201), in response to the August 23, 2011, earthquake, which resulted in ground motion exceeding the North Anna Power Station (NAPS) Operating Basis Earthquake and Safe Shutdown/Design Basis Earthquake.

By letter dated November 7, 2011 (ADAMS Accession No. ML11314A069), you submitted a revised compilation of long-term actions to be performed in addressing the August 23, 2011, earthquake. You provided periodic updates in letters dated May 8, 2012, January 23, 2013, and May 13, 2013 (ADAMS Accession Nos. ML12135A217, ML13032A078, and ML13135A637 respectively), regarding the status of the long-term action commitments listed in the CAL. These commitments included: (1) addressing the long-term actions identified in the Electric Power Research Institute's (EPRI's) NP-6695, "Guidelines for Nuclear Plant Response to an Earthquake," as endorsed and modified by the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.167, "Restart of a Nuclear Power Plant Shut Down by a Seismic Event;" (2) addressing necessary actions identified by the NRC staff for the long-term reliability of NAPS following the August 23, 2011, earthquake; and (3) revising the NAPS Updated Final Safety Analysis Report.

The final closure summaries of the CAL commitments were provided in a letter to the NRC dated May 13, 2013. The NRC staff reviewed the responses to the CAL commitments as documented in NRC memoranda dated August 13, August 24, and September 9, 2015 (ADAMS Accession Nos. ML15230A216, ML15232A811, and ML15238B592, respectively). For Commitments 1, 2, 4, 5, 8, 9, and 10, the NRC staff found that the response provided sufficient information to determine that the performed actions were satisfactorily completed. For Commitment 3 regarding updates to the Updated Final Safety Analysis Report (UFSAR), the NRC staff performed an audit on June 25, 2014 (ADAMS Accession No. ML14226A395), and found that the updates were incorporated correctly into the UFSAR. For Commitment 6, the NRC staff found that the additional inspections for seismically-induced damage provided reasonable assurance that there has been no damage due to the 2011 earthquake that would impact the function of the reactor vessel internals and that no additional inspections were

D. Heacock

- 2 -

warranted. For Commitment 7, the NRC staff confirmed that the existing leak-before-break (LBB) analysis remains acceptable and that the existing licensing basis for the LBB analysis remains valid. Based on the review of the commitments and resolution of issues identified in the CAL, the NRC concludes that you have completed all long-term actions and, as a result, considers the CAL to be closed.

Enclosed with this letter is a summary detailing the CAL commitments, description of the closure actions, and a summary of the NRC staff's conclusions. Also, enclosed is a list of the documents associated with this CAL closure evaluation. In accordance with Section 2.390 of Title 10 of the *Code of Federal Regulations* (10 CFR) of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your responses will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's ADAMS, accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. If you have any questions or comments, please contact Michael Markley, Branch Chief, Plant Licensing Branch II-1, at (301) 415-5723.

Sincerely,

A handwritten signature in cursive script that reads "William M. Dean for".

William M. Dean, Director
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosures:
As stated

cc: Listserv



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
WASHINGTON, D.C. 20555-0001

COMMITMENT CLOSURE FOR CONFIRMATORY ACTION LETTER NO. NRR-2011-002

By letter dated November 11, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11311A201), the U.S. Nuclear Regulatory Commission (NRC) issued a Confirmatory Action Letter (CAL) to Virginia Electric and Power Company (the licensee) in response to the August 23, 2011, earthquake, which resulted in ground motion exceeding the North Anna Power Station (NAPS), Units 1 and 2, Operating Basis Earthquake and Safe Shutdown/Design Basis Earthquake.

By letter dated November 7, 2011 (ADAMS Accession No. ML11314A069), the licensee submitted a revised compilation of long-term actions to be performed in addressing the August 23, 2011, earthquake. The licensee provided periodic updates in letters dated May 8, 2012, January 23, 2013, and May 13, 2013 (ADAMS Accession Nos. ML12135A217, ML13032A078, and ML13135A637 respectively), regarding the status of the long-term action commitments listed in the CAL. These commitments included: (1) addressing the long-term actions identified in the Electric Power Research Institute's (EPRI's) NP 6695, "Guidelines for Nuclear Plant Response to an Earthquake," as endorsed and modified by the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.167, "Restart of a Nuclear Power Plant Shut Down by a Seismic Event;" (2) addressing necessary actions identified by the NRC staff for the long-term reliability of NAPS following the August 23, 2011, earthquake; and (3) revising the NAPS Updated Final Safety Analysis Report (UFSAR).

The NRC staff's review of the licensee's actions regarding the CAL commitments is provided below.

Commitment 1:

The licensee will perform long-term evaluations of plant structures, systems and components [SSCs] in accordance with RG [Regulatory Guide] 1.167/EPRI [Electric Power Research Institute] NP-6695, Section 6.3 (ADAMS Accession No. ML003740093). Any anomalies identified during the evaluations will be entered into the corrective action system and evaluated for extent of condition.

Action Taken and NRC Conclusion:

By letter dated May 13, 2013 (ADAMS Accession No. ML13135A637), the licensee submitted a "Notification of Commitment Action Completion" report to the NRC. The licensee stated that Commitment 1 was completed on April 30, 2013. The licensee provided a summary of its response to Commitment 1 in Attachment 2 of its letter and stated that the NAPS, Units 1 and 2, UFSAR was updated to include this information. The anomalies identified during the evaluations were entered into the licensee's corrective action program and components were inspected and evaluated to assess the extent of condition. The licensee identified no issues

during these inspections and concluded that the August 23, 2011, earthquake did not cause any damage to plant SSCs or their anchorages.

The NRC reviewed the results provided in the licensee's letter dated May 13, 2013, and concluded that the licensee evaluated the physical and functional damage properly. Therefore, based on the NRC staff's evaluation dated September 9, 2015 (ADAMS Accession No. ML15238B592), the NRC staff concludes that the licensee has satisfactorily completed this commitment.

Commitment 2:

The licensee will develop a plan to characterize the seismic source and any special ground motion effects due to the relative locations of the fault and the site and will update the NRC accordingly.

Action Taken and NRC Conclusion:

By letter dated May 13, 2013, the licensee stated Commitment 2 was completed on March 31, 2012. The licensee stated that they developed a plan to characterize the seismic source and any special ground motion effects due to the relative locations of the fault and site. The earthquake catalog contained within the Central and Eastern US Seismic Source Characterization (CEUS-SSC) model and the database was updated to include the last three years of seismicity data (through mid-December 2011). This update included the magnitude 5.8 earthquake in Louisa County, Virginia, and was issued on March 8, 2012.

On March 12, 2012 (ADAMS Accession No. ML12053A340), the NRC issued a request for information pursuant to Title 10 of the *Code of Federal Regulations* Part 50, Section 50.54(f) (hereafter referred to as the 50.54(f) letter). In response to the 50.54(f) letter, the licensee characterized their plan to re-evaluate the seismic hazard and updated the NRC. Because the reevaluation is based on the current NRC's standards and criteria, this seismic reevaluation process included seismic source characterization and special ground effects. The licensee submitted the reevaluation report on September 12, 2013 (ADAMS Accession No. ML13256A070). After review that was supported by confirmatory analyses, the NRC staff did not identify any issues with the licensee's final ground motion response spectrum. Specifically, the NRC staff verified the licensee's plan to characterize the seismic source and any special ground motion effects due to the relative locations of the fault. The NRC staff finds that the licensee's response to the 50.54(f) letter satisfactorily addressed the actions in Commitment 2. Therefore, the NRC staff concludes that the licensee has satisfactorily completed this commitment.

Commitment 3:

The licensee will revise the North Anna [NAPS, Units 1 and 2] UFSAR to document:

- a. The recorded August 23, 2011, seismic event.
- b. A summary of the evaluation and results of the seismic analysis of the recorded event completed per RG 1.167/EPRI NP-6695.
- c. Design controls on seismic margin management (i.e., the Seismic Margin Management Plan).
- d. Incorporation of Regulatory Guide (RG) 1.166, "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-Earthquake Actions," and RG 1.167, "Restart of a Nuclear Power Plant Shut Down by a Seismic Event," into the North Anna licensing basis.

Action Taken and NRC Conclusion:

In its letter dated May 13, 2013, the licensee provided the following status regarding Commitment 3:

- a. On April 30, 2012, the licensee completed revisions to Section 2.7 of the UFSAR to include a description of the August 23, 2011, seismic event.
- b. On April 30, 2013, the licensee created Section 3.7.8 of the UFSAR to include a description of the evaluations of plant SSCs in accordance with RG 1.167/EPRI NP-6695, Section 6.3.
- c. On April 30, 2012, the licensee revised Section 3.7.7 of the UFSAR to include a description of the Seismic Margin Management Plan.
- d. On December 31, 2012, the licensee revised Section 3.7.4 to include Dominion's commitment to RG 1.166 and RG 1.167.

The NRC staff completed an audit of the NAPS, Units 1 and 2, commitment management program on June 26, 2014 (ADAMS Accession No. ML14226A395, dated August 22, 2014). The NRC reviewed the NAPS UFSAR updates and concluded that the licensee revised and properly documented the four items in the NAPS UFSAR. Therefore, the NRC staff concludes that the licensee satisfactorily completed this commitment.

Commitment 4:

The licensee will implement a design change to replace the existing seismic equipment and main control room indication with upgraded and enhanced seismic monitoring instrumentation equipment, which includes installation of a permanent, free field seismic monitor. Permanent, seismically qualified backup power to a new Seismic Monitoring Panel will also be installed including a backup battery power supply. The seismic instrumentation will be installed and maintained in accordance with RG 1.12, Revision 2, "Nuclear Power Plant Instrumentation for Earthquakes." The project will also install seismic recording instrumentation at the station Independent Spent Fuel Storage Installation (ISFSI) pad.

Action Taken and NRC Conclusion:

By letter dated May 13, 2013, the licensee stated that new seismic instruments and associated controls/indication were installed in the Unit 1 containment and main control room during the spring 2012 refueling outage. The remainder of the instruments (auxiliary building, ISFSI, and free field) were installed in November 2012. Seismic instrumentation for the operating reactors following RG 1.12, Revision 2, has been documented in UFSAR 3.7.4.

On December 31, 2012, the NRC completed an inspection at NAPS, Units 1 and 2 (ADAMS Accession No. ML13031A312 dated January 30, 2013). The inspectors reviewed the completed permanent plant modification design change and conducted walkdowns of the installations. No findings were identified during this inspection. Based on the NRC staff's December 31, 2012, inspection and the evaluation dated September 9, 2015, the NRC concludes that the licensee has installed upgraded and enhanced seismic monitoring equipment for the North Anna site and thus, has satisfactorily completed this commitment.

Commitment 5:

The licensee will perform a re-evaluation of the plant equipment identified in the IPEEE [Individual Plant Examination of External Events] review with HCLPF [high confidence of low probability of failure] capacity <0.3g, which will include an assessment of potential improvements.

Action Taken and NRC Conclusion:

By letter dated May 13, 2013, the licensee stated that they completed the re-evaluation and provided a summary in Attachment 2 of its letter. By letter dated December 17, 2014 (ADAMS Accession No. ML14357A059), the licensee provided its Expedited Seismic Evaluation Process (ESEP) report in response to the March 12, 2012, Fukushima related 50.54(f) letter.

The NRC staff assessed the licensee's implementation of the ESEP guidance through the completion of a reviewer checklist. Based on the NRC staff review of the ESEP report, the NRC staff concluded that the licensee's implementation of the interim evaluation met the intent of the guidance. The licensee's ESEP assessment provided additional assurance that supported continued plant safety while the longer-term seismic evaluation is completed to support regulatory decision making. The NRC issued a review of the NAPS interim evaluation associated with the reevaluated seismic hazard of Near-Term Task Force Recommendation 2.1 (ADAMS Accession No. ML15182A392) on July 7, 2015. In addition, the NRC staff reviewed

the summary of the reevaluated HCLPF calculation results submitted by the licensee in their letter dated May 13, 2013, and determined that the licensee satisfactorily completed the actions in Commitment 5, therefore, the NRC staff concludes that the licensee has satisfactorily completed this commitment.

Commitment 6:

The licensee will develop a plan with the NSSS [Nuclear Steam Supply System] vendor consisting of additional evaluations or inspections, as warranted, to assure long-term reliability of the reactor internals.

Action Taken and NRC Conclusion:

By letter dated May 13, 2013, the licensee stated that the inspections of the Reactor Vessel Internals (RVIs) during the 2012 Unit 1 refueling outage were completed and no seismically induced issues were identified. By letter dated October 10, 2011 (ADAMS Accession No. ML11286A018), the licensee summarized the additional inspections performed on the Unit 2 RVIs in 2011 following the earthquake. As a result of this evaluation, the licensee concluded the RVIs remain capable of reliably performing their function in the future. The licensee concluded that developing a plan consisting of additional inspections and evaluations of the RVIs beyond those already required by existing programs is not warranted for assuring the long term reliability of the RVIs.

The NRC staff reviewed the licensee's response in the May 13, 2013 letter. The NRC staff also reviewed the supplementary inspections that were performed by the licensee at Unit 2 in 2011 and Unit 1 in 2012, and finds that these inspections provide reasonable assurance that there has been no damage due to the 2011 earthquake that would impact the function of the RVIs. Based on the NRC staff's evaluations dated September 9, 2015, and August 24, 2015, (ADAMS Accession No. ML15232A811), the NRC staff concludes that no additional inspections of the RVI beyond those required by existing programs are warranted. Therefore, the NRC staff concludes that the licensee satisfactorily completed this commitment.

Commitment 7:

The licensee will perform a comparison of the calculated load from the August 23, 2011, earthquake and the existing leak-before-break (LBB) analysis and submit the results [to the NRC].

Action Taken and NRC Conclusion:

By letter dated May 13, 2013, the licensee submitted details evaluating the postulated leakage size flaws that were evaluated for bounding loads. Since the normal operating load was not altered by the earthquake loading, the leakage size flaws remained the same. The licensee's comparison of the calculated load from the August 23, 2011, earthquake and existing LBB analysis showed that the existing licensing basis LBB analysis remains valid.

The NRC staff reviewed the licensee's response in the May 13, 2013, licensee status update letter. The NRC staff determined that the applied operating loads to the postulated leakage size flaws in reactor coolant system piping, as analyzed in the existing LBB analysis, were not

affected by the earthquake and the existing LBB analysis remained valid. Therefore, based on NRC staff's evaluation dated August 13, 2015 (ADAMS Accession No. ML15230A216), the NRC staff concludes the licensee has satisfactorily completed this commitment.

Commitment 8:

The licensee will perform inspections at NAPS in accordance with the latest [Materials Reliability Program] MRP-227 revision approved by the NRC.

Action Taken and NRC Conclusion:

By letter dated May 13, 2013, the licensee stated that this commitment has been completed. The licensee provided its inspection plan for RVIs, which conforms to MRP-227-A, and stated no additional inspections or evaluations beyond the planned MRP-227 inspection are necessary.

The NRC staff reviewed the licensee's response in the May 13, 2013, letter. The NRC staff evaluated the licensee's submitted inspection plan and determined that the inspections are consistent with those specified in MRP-227-A. In addition, the licensee stated that it will implement its RVIs Inspection Program consistent with MRP-227-A without deviations. The NRC staff reviewed Attachment 2 to the licensee's May 13, 2013, letter, and confirmed that the licensee has a sufficient plan for conducting evaluations in accordance with MRP-227 and for expansion of the scope, schedule, and inspection methods using appropriate criteria. Based on NRC staff's evaluation dated August 24, 2015, the NRC concludes that the licensee satisfactorily completed this commitment.

Commitment 9:

The licensee will re-evaluate the Time-Limiting Aging Analyses (TLAAs) that include seismic inputs to either: 1) quantitatively demonstrate that the TLAAs are still bounding, or 2) re-analyze the TLAAs, based on the August 23, 2011, earthquake.

Action Taken and NRC Conclusion:

By letter dated May 13, 2013, the licensee quantitatively demonstrated that the TLAAs are still bounding, after the effects of the August 23, 2011, earthquake were considered. The results of the review demonstrated that the August 23, 2011, earthquake did not have a significant impact on component fatigue.

The NRC staff reviewed the licensee's response in letters dated May 13, 2013, and August 18, 2015 (ADAMS Accession No. ML15231A585). The NRC staff confirmed that the licensee adequately addressed the impact of the 2011 Mineral Virginia earthquake on fatigue of Class 1 component and piping in TLAAs. In majority of the cases, the forces and movements from the 2011 earthquake were enveloped by the corresponding values used in the previous seismic case. In a few cases where some increases were noted, the licensee found them to be acceptable by reviewing the margins or by a re-analysis. The NRC staff confirmed that the August 2011 earthquake has insignificant impact on component fatigue, and the conclusions of TLAAs continue to remain valid. Based on these evaluations, the NRC concludes that the licensee satisfactorily completed this commitment.

Commitment 10:

The licensee will implement a long-term Seismic Margin Management Plan (SMMP) to address the impact of the August 23, 2011 earthquake. Specifically, to ensure adequate seismic margins are maintained for plant SSCs, the licensee will revise the design change process for NAPS to require explicit evaluation of plant modifications for the effects of the August 23, 2011, earthquake using In-Structure Response Spectra (ISRS) for the event for the Containment, Auxiliary Building, and other buildings containing safety-related SSCs based on actual time-histories recorded during the event. In support of future plant design changes, the evaluation of plant SSCs will require design verification and code compliance with the stresses, loads, accelerations, and displacements generated from the analysis with the design basis ISRS or the analysis with the ISRS for the August 23, 2011, earthquake, whichever are higher.

Action Taken and NRC Conclusion:

In its letter dated May 13, 2013, the licensee stated that the Nuclear Design Control Program was revised on December 31, 2011, to incorporate controls that will ensure that seismic margin is maintained at NAPS for plant modifications implemented after the August 23, 2011, earthquake event.

The NRC staff reviewed the licensee's response in the May 13, 2013, letter. The licensee revised the Nuclear Design Control Program to incorporate controls that will ensure that seismic margin is maintained, and that plant modifications will be evaluated for the effects of the August 23, 2011, earthquake. Future design changes will include evaluation of plant SSCs for code compliance with the stresses, loads, accelerations, and displacements generated from the analysis. The NRC confirmed that the licensee's SMMP provides for adequate control and verification to ensure seismic margins are maintained. Therefore, based on NRC staff's evaluation dated September 9, 2015, the NRC concludes that the licensee satisfactorily completed this commitment.

**Chronological List of Documents Associated with
Confirmatory Action Letter No. NRR-2011-002**

ADAMS

| <u>Accession Number</u> | <u>Title</u> | <u>Date</u> |
|-------------------------|---|-------------------|
| ML003740093 | Regulatory Guide 1.167 (Draft was DG-1035) Restart of a Nuclear Power Plant Shut Down By a Seismic Event | March 31, 1997 |
| ML11286A018 | North Anna, Units 1 & 2, Response to Request for Additional Information Restart Readiness Determination Plan | October 10, 2011 |
| ML11311A201 | Confirmatory Action Letter Regarding North Anna Power Station, Unit Nos. 1 and 2, Long-term Commitments to Address Exceeding Design Basis Seismic Event (TAC Nos. ME7254 AND ME7255) | November 11, 2011 |
| ML11314A069 | North Anna Power Station, Units 1 and 2, Independent Spent Fuel Storage Installation, Revised Long-Term Actions Commitment List | November 7, 2011 |
| ML12053A340 | Request for information pursuant to Title 10 of the Code of Federal Regulations Part 50, Section 50.54(f) | March 12, 2012 |
| ML12135A217 | Licensee Status Update | May 8, 2012 |
| ML13031A312 | IR 05000338-12-005 & 05000339-12-005, on 10/01/12 - 12/31/12, North Anna Power Station, Units 1 and 2, Baseline Inspection. | January 30, 2013 |
| ML13135A637 | Licensee Status Update | May 13, 2013 |
| ML14226A395 | North Anna Power Station, Unit Nos. 1 and 2 - Audit of the Licensee's Management of Regulatory Commitments (TAC Nos. MF4565 and MF4566). | August 22, 2014 |
| ML14357A059 | North Anna Power Station Units 1 & 2 Response To March 12, 2012 Information Request Expedited Seismic Evaluation Process Report For Recommendation 2.1 | December 17, 2014 |
| ML15182A392 | North Anna Power Station, Units 1 And 2 - Staff Review Of Interim Evaluation Associated With Reevaluated Seismic Hazard Implementing Near-Term Task Force Recommendation 2.1 (TAC Nos. MF5252 And MF5253) | July 7, 2015 |
| ML15231A585 | 2015/08/18 NRR E-mail Capture - [External_Sender] Information requested to support closeout of NAPS CAL Item #9 | August 18, 2015 |

ADAMS

| <u>Accession Number</u> | <u>Title</u> | <u>Date</u> |
|-------------------------|--|-------------------|
| ML15232A811 | North Anna Power Station, Units 1 and 2 - Evaluation of Information Related to Commitments 6 and 8 from Confirmatory Action Letter No. NRR-2011-002 (TAC Nos. MF1807 and MF1808) | August 24, 2015 |
| ML15238B592 | Review of Commitment Action Completion Confirmation Action Letter Regarding Earthquake in 2011 (TAC Nos. MF1807 and MF1808). | September 9, 2015 |

warranted. For Commitment 7, the NRC staff confirmed that the existing leak-before-break (LBB) analysis remains acceptable and that the existing licensing basis for the LBB analysis remains valid. Based on the review of the commitments and resolution of issues identified in the CAL, the NRC concludes that you have completed all long-term actions and, as a result, considers the CAL to be closed.

Enclosed with this letter is a summary detailing the CAL commitments, description of the closure actions, and a summary of the NRC staff's conclusions. Also, enclosed is a list of the documents associated with this CAL closure evaluation. In accordance with Section 2.390 of Title 10 of the *Code of Federal Regulations* (10 CFR) of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your responses will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's ADAMS, accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. If you have any questions or comments, please contact Michael Markley, Branch Chief, Plant Licensing Branch II-1, at (301) 415-5723.

Sincerely,

/RA/ Michele G. Evans for

William M. Dean, Director
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosures:
As stated

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| DATE | 09/09/15 | 12/02/15 | 12/04/15 | 12/24/15 |

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