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

October 6, 2011

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

SUBJECT: NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2 – REQUEST FOR INFORMATION REGARDING THE EARTHQUAKE OF AUGUST 23, 2011 (TAC NOS. ME7050 AND ME7051)

Dear Mr. Heacock:

The Nuclear Regulatory Commission staff is continuing its review of information submitted by the Virginia Electric and Power Company regarding activities conducted in response to the earthquake that occurred near the North Anna Power Station, Unit Nos. 1 and 2 (NAPS) on August 23, 2011.

This letter forwards requests for information on mechanical and civil engineering topics. Your expeditious response is requested to enable the staff to continue its review of your proposed plans for restarting the NAPS.

Sincerely,

Meena Khanna
Lead of North Anna Restart Team
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosure: Request for Information

cc w/encl: Distribution via Listserv

REQUEST FOR INFORMATION

VIRGINIA ELECTRIC AND POWER COMPANY (VEPCO)

NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-338 AND 50-339

The following requests for information are related to the earthquake of August 23, 2011, that occurred in the vicinity of the North Anna Power Station (NAPS), Unit Nos. 1 and 2. Previous requests for information were issued on September 14, September 26, September 28 and September 30.

Considering the information presented in Virginia Electric Power Company's (VEPCO) report dated September 17, 2011, additional information is requested in the mechanical and civil engineering area regarding the planned inspections, evaluations and testing of systems, structures, and components (SSCs).

PRE-RESTART QUESTIONS

1. Provide (1) a summary result of inspections of the NAPS Units 1 and 2 SSCs listed below; (2) assessment of possible root cause and the extent of condition for any identified damage; and (3) a discussion on the corrective actions (if any) that will be implemented, prior to restart, to demonstrate that the affected SSCs will continue to perform their required design functions:

    a. Exterior of the containment structure. Also, confirm that the results of this inspection have been compared with the IWL inspection history to identify any anomaly.

    b. Containment liner plate. Also, confirm that the results of this inspection have been compared with the IWE inspection history to identify any anomaly.

    c. Containment internal structures, steel and reinforced concrete.

    d. Support structures, including anchor bolts and surrounding concrete, for major equipment (e.g., reactor vessel, steam generators, pressurizer, and reactor coolant pumps).

    e. All seismic Category I structures other than containment and those SSCs that could adversely affect seismic Category I SSCs.

    f. All masonry walls.

    g. Turbine building and turbine pedestal structure.

2. Enclosure 2 to the September 17, 2011, report states that additional inspections of the switchyard are currently being performed. Prior to restart, provide the results of these inspections and a discussion on any identified damage and the repairs (if any) that will

be implemented, to demonstrate that the affected SSCs will continue to perform their required design functions.

3. As depicted in the NAPS Updated Final Safety Analysis Report (UFSAR), a partial height of the containment structure is below grade and is not readily accessible for visual inspection. Provide information, prior to restart, to confirm its structural adequacy.

4. Provide plans to demonstrate leak tightness of the containment penetrations, prior to restart.

5. Confirm that the inspection of the operational gaps to allow thermal movement of major equipment and piping systems, in both NAPS Units 1 and 2, have been performed and discuss the results of these inspections.

6. Confirm that the inspection and verification of all seismic gaps between structures (e.g., the minimum 2-inch rattle space as noted in Section 3.8.1.1 of the NAPS UFSAR) in both NAPS Units 1 and 2 have been performed and provide the summary results of these inspections.

7. Discuss the inspection and verification of all components crossing seismic gaps in both NAPS Units 1 and 2, to confirm the relative motion during the recent earthquake was accommodated without any damage or loss of function.

8. Confirm that inspection of all NAPS Units 1 and 2 load handling systems (cranes, monorails, movable platforms with hoist, etc.) that could potentially affect safety-related SSCs has been performed and discuss the results of these inspections.

9. As indicated in Tables 1 and 2 of Enclosure 1 to the September 17, 2011, report, the Individual Plant Examination of External Events (IPEEE) program identified several safety-related components that had a high confidence low probability of failure (HCLPF) capacity lower than 0.3 g. Also, the summary report indicates that a thorough inspection of these components is being performed and the capacities of these components will be reviewed for potential improvements.

   Provide the results of these inspections and discuss if any upgrades have been implemented to increase the component's capacities.

10. In reference to Enclosures 4 and 5 of the September 17, 2011, report, confirm that during the inspection of the spent fuel pool (SFP) structure, no sign of distress in the SFP structure, the SFP liner or the liner welds was identified. Also, since the presence of the liner does not allow direct inspection of the reinforced concrete SFP structure, please provide further information to demonstrate its structural adequacy.

11. Enclosure 2 of the September 17, 2011, report states that nondestructive examinations (NDE) are planned for the ongoing Unit 2 refueling outage and additional Unit 1 and 2 sample weld inspections are planned for piping and pipe supports. Prior to restart, provide the results of completed NDE activities and discuss any identified damage and/or repairs that will be implemented, to confirm functionality of affected components.

In addition, provide the methodology for selecting the critical sample welds or components for NDE.

12. In reference to Tables 3.7-4 and 3.7-5 of the NAPS UFSAR, discuss VEPCO's evaluation of critical SSCs (i.e., those with design margin close to 1.0 and design basis earthquake (DBE) contribution to the total combined stress is significant in comparison to the other loads) to assess the effects of the recent earthquake and to demonstrate that the affected SSCs will continue to perform their required design functions. If the results of this evaluation indicate that the design basis acceptance criteria may have been exceeded, discuss your planned action to demonstrate the ability of these SSCs to perform their intended design functions.

13. Table 3.7-7 of the NAPS UFSAR summarizes the design margins, in terms of percentage of allowable for most highly stressed locations, for a number of components. Please discuss the results of your evaluation of these components to assess the effects of the recent earthquake and to demonstrate their ability to perform their intended design function.

14. Section 3.8.4.4 of the NAPS UFSAR states that the service water reservoir was evaluated for acceleration values of 0.18 units of acceleration (g) and 0.12 g in the horizontal and vertical directions, respectively. This section of the UFSAR also states that the relative displacement along the centerline of the dikes due to earthquake ground waves will not exceed 3 inches and the impervious core will sustain this relative displacement without cracking.

    Please provide a summary of the inspection results, method of inspection and evaluation to confirm that the reservoir impervious core did not sustain any cracking due to the seismic waves and the expected relative displacement experienced during the recent earthquake.

15. Section 3.8.3.5 of the NAPS UFSAR discusses instrumentation of NAPS main dam structure and continuing surveillance program to monitor the alignment and settlement of the centerline crest. Please discuss your evaluation of the data relative to the alignment and settlement of the centerline crest of the dam in response to the recent earthquake.

16. Enclosure 2 of the September 17, 2011, report states that the service water reservoir and the main dam sustained no significant physical or functional damage. This implies that VEPCO's inspection identified some damage that was considered insignificant. Discuss the nature of the damage identified during VEPCO's inspections and any corrective actions that were taken to address the asfound condition.

17. As stated in Section 3.8.4.5.3 of the NAPS UFSAR, Table 3.8-15 lists the structures and components which are being monitored for settlement. Discuss actions taken, following the recent earthquake, to ensure the acceptability of settlement of these structures and components considering the baseline survey and the allowable differential settlements. Specifically, discuss any potential damages to the rubber expansion joint installed on the service water piping noted in Section 3.8.4.5.4.5 of the NAPS UFSAR.

18. As stated in Section 3.8.5 of the NAPS UFSAR, the differential settlement of the service building with respect to the main steam valve house/quench spray pump house is the only settlement in the main plant that is currently being monitored. Also, as stated in Section 3.8.5.4 of the NAPS UFSAR, the current differential settlement between the service building and the main steam valve room/quench spray pump house has essentially stabilized. However, monitoring of movement between the two buildings will continue to assure that the differential settlement between them will not exceed 9/16-inch to maintain the stresses in the safety related service water buried piping within the design basis code acceptance criteria.

    Enclosure 8 to the summary report dated September 17, 2011, does not list the inspection or evaluation of service water buried piping as a near term action prior to restart. Discuss VEPCO's plan for the evaluation and the inspection, prior to restart, of service water buried piping to confirm its functionality following the recent earthquake.

19. Section 3.8.1.1.7 of the NAPS UFSAR discusses the cracks that were discovered in the reinforced concrete wing walls, subsequent modification of the wing walls to decouple these walls from the service water pump house, and a horizontal shear stress calculation to demonstrate stress transfer across the crack. This section of the NAPS UFSAR also states that "The maximum average shear stresses at the base of the wall have been calculated to be 26.1 pounds per square inch (psi) for the DBE case, and 39.2 psi for the OBE case. These values are within the allowable of 60 psi and 40 psi, respectively."

    Considering the existing condition of these walls as described in the NAPS UFSAR, exceedence of the design basis operating basis earthquake (OBE) and safe shutdown earthquake (SSE) during the recent earthquake, and minimal margin in shear stress calculation, please discuss VEPCO's approach to confirm the seismic adequacy of these walls and the rationale that likely exceedance of design limits will not impact their ability to perform their required design functions.

20. Discuss the engineering evaluation and inspection activities for safety-related buried components (tanks, pipes, electrical duct banks, tunnels, etc.) to provide assurance that these safety related components withstood the recent earthquake without exceeding the design basis acceptance criteria. Also, discuss the rationale for concluding that possible exceedance of design acceptance criteria does not render the buried components mentioned above inoperable. The response should explain the planned testing of buried components as a measure for assuring functionality prior to restart.

    Specifically, the response should provide: (1) pertinent information relative to the interface of the buried components with structures; (2) visual inspection of these buried structures (e.g. tunnels), if practical, to supplement the engineering evaluation , and (3) planned operational testing of buried components, as appropriate, in accordance with the plant's procedures.

21. For components originally qualified by testing in accordance with Institute of Electrical and Electronics Engineers, Inc. (IEEE)-344, "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," confirm their capability to withstand a future ground motion DBE, even when deemed functional following the recent earthquake. In the response, address how the testing requirements

in IEEE-344 (i.e. 1 SSE and 5 OBEs) would provide the assurance of functionality during a future DBE.

22. For a representative sample of safety-related components, confirm, prior to restart, that the test response spectrum (TRS), or the seismic input motion used in the original seismic qualification of the component, envelop the instructure response spectra (required response spectrum (RRS)) developed using the recent earthquake input motion data. As a minimum, the sample for this evaluation should include the following:

    a. Those components that were identified in IPEEE effort as having HCLPF capacity less than 0.3 g.

    b. The equipment listed in Table 3.7-6 of the NAPS UFSAR that has a low margin (i.e., TRS is equal to or minimally greater than the RRS).

    c. The components listed in Table 3.7-8 of the NAPS UFSAR.

23. Enclosure 1, Attachment 2, of the summary report dated September 17, 2011, includes several figures that show seismic instrumentation data for auxiliary building 244-foot elevation and the 273-foot elevation. In these figures, specifically Figure 2.9, there is a significant exceedance above 6 Hertz. Discuss VEPCO's plan and provide further information to address these exceedances and their effects on safety-related SSCs, prior to restart.

24. As the level of the recent earthquake exceeded the design basis SSE, please discuss VEPCO's plan for evaluation and augmented inspection to demonstrate, prior to restart, that the anchor bolts, including expansion anchors will continue to perform their required design functions. Also discuss the significance of exceeding the original design basis capacity of anchorages.

25. As stated in the NAPS IPEEE submittal, a relay chatter review was not performed since low ruggedness relays were not found at NAPS during the resolution of unresolved safety issue (USI) A-46 relays. Considering the operating experience during the recent earthquake with relays, discuss your plan and provide further information to confirm the functionality and seismic qualification of relays, in both NAPS Units 1 and 2, prior to restart.

26. The September 17, 2011, report states that the lack of any significant physical or functional damage to safety-related SSCs and the limited damage to nonsafety-related systems are consistent with an EPRI damage intensity of 0, the indicator of least damage. However, the damage intensity discussion in the report does not address the operating experience related to the shift of TN-32 casks. Please provide further information and discuss the EPRI damage intensity in relation to this operating experience.

27. If there are any structures at NAPS that were designed for OBE only, provide further information relative to detailed inspection and additional evaluation of these structures for the input motion experienced during the recent earthquake to confirm their structural integrity. The results of this evaluation may indicate vulnerable areas where the design

basis acceptance criteria have been exceeded. Discuss how VEPCO confirmed that these highly stressed areas will continue to perform their intended design function.

28. VEPCO stated in its submittal of September 17, 2011, that the submittal was based on the guidance contained in Regulatory Guide (RG) 1.166, "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-Earthquake Actions," and EPRI NP-6695, "Guidelines for Nuclear Plant Response to an Earthquake," but does not indicate, whether VEPCO is implementing the methods described in the RG on a complete or partial basis. RG 1.166 assumes that the nuclear power plant has operable seismic instrumentation, including the computer equipment and software required to process the data within 4 hours after an earthquake. As stated in the September 8, 2011, public meeting, there were no onsite resources at NAPS to interpret the instrumentation data and the time required for data interpretation using an outside vendor significantly exceeded 4 hours. Also, during the recent earthquake, there was no annunciation in the NAPS main control room that the design basis SSE was exceeded. Considering this operating experience, please discuss your plan for modernization of the seismic instrumentations at both NAPS Units 1 and 2, for both rock and soil supported structures, to provide a reliable system and to accommodate onsite data interpretation.

29. Confirm that visual inspections were conducted of the penetration assembly to the liner plate areas. Specially, equipment hatch, personnel air-lock, and the emergency air-lock.

30. Discuss if visual inspections were conducted of the transformer supporting pads and its fire protection walls for cracking, tilting, and spalling. If not, discuss the reason for not inspecting these locations.

31. Confirm that the radwaste storage tank area (near the bottom of the building, including the hold down bolts) has been inspected. If not, discuss the reason for not inspecting these locations.

32. Prior to restart, provide the basis for VEPCO's continued use of the cumulative absolute velocity criterion to explain the level of damage given that there was no seismic recording from instrumentation located on a free surface in the free field.

33. VEPCO indicated that Engdahl seismometers are less reliable than Kinemetrics seismometers (i.e., inconsistent with Kinemetrics in readings and also missing frequency readings). But even the Kinemetrics seismometers may not have accurate timing for the recorded time history because the start time for the seismic data is estimated. Address how this potential uncertainty impacts the use of the seismic time history when matching it to other recorded events (e.g., the nuclear instrumentation (NI) signal changes) for the reactor shutdown root cause analysis. Considering this issue, discuss any plans to update the seismic instrumentation at the plant to provide better ground motion recordings for any future earthquake events.

34. Prior to restart, confirm the operability and reliability of the seismic instrumentation (specifically, channel orientation, sensor calibration, sensitivity test implementation) and alarming systems to ensure they accurately record earthquake ground motion and provide real time alarm notifications to the plant operators during any earthquake events.

35. The September 17, 2011, report, Enclosure 1, Attachment 3, page 7 of 7, "Kinemetrics Data for Containment Elevation 291[feet] – Vertical Direction," shows a peak recorded value at about 10 hertz that is greater than 1 g. Discuss the sensitivity of this value with respect to the methodology used (for example, sampling rates) and any other alternative calculations.

POST-RESTART QUESTIONS

36. In order to better define site-specific ground motion or Ground Motion Response Spectrum, the license is to confirm its understanding of the seismic source characteristics of the August 23, Mineral, Virginia earthquake in terms of its faulting mechanism, geometry, recurrence interval and maximum magnitude.

37. Because of the closeness of the August 23 earthquake to the NAPS site, and possible reverse faulting mechanism for the earthquake, the licensee is to confirm if there is any potential special ground motion effect due to the relative locations of the fault and the site (for example, a hanging wall effect from a reverse fault).

October 6, 2011

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

SUBJECT: NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2 – REQUEST FOR INFORMATION REGARDING THE EARTHQUAKE OF AUGUST 23, 2011 (TAC NOS. ME7050 AND ME7051)

Dear Mr. Heacock:

The Nuclear Regulatory Commission staff is continuing its review of information submitted by the Virginia Electric and Power Company regarding activities conducted in response to the earthquake that occurred near the North Anna Power Station, Unit Nos. 1 and 2 (NAPS) on August 23, 2011.

This letter forwards requests for information on mechanical and civil engineering topics. Your expeditious response is requested to enable the staff to continue its review of your proposed plans for restarting the NAPS.

Sincerely,

/RA/

Meena Khanna
Lead of North Anna Restart Team
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosure: Request for Information

cc w/encl: Distribution via Listserv

DISTRIBUTION:

Public	RidsNrrLACSola Resource	LPL2-1 R/F
RidsOgcRp Resouce	RidsNrrLpl2-1 Resource	RidsRgn2MailCenter Resource
RidsAcrsAcnw_MailCTR Resource	RidsNrrDorlDpr Resource	PClifford, NRR
RidsNrrPMNorthAnna Resource	PBoyle, NRR	DRoth, OGC
MKhanna, NRR	PHiland, NRR	GMcCoy, Rgn2
RidsNrrDorl	KKarwoski, NRR	GWilson, NRR

ADAMS Accession No. ML11278A132

OFFICE	NRR/LPL2-1/PM	NRR/LPL2-1/PM	NRR/LA	NRR/BC
NAME	RMartin	PBoyle	CSola	MKhanna
DATE	10/6/11	10/6/11	10/6/11	10/6/11

OFFICIAL RECORD COPY