VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

December 8, 2014

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.: 14-394A
NLOS/ETS: R1
Docket No.: 50-339
License No.: NPF-7

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNIT 2
STATUS OF REQUIRED ACTIONS FOR EA-12-049
ISSUANCE OF ORDER TO MODIFY LICENSES WITH REGARD TO REQUIREMENTS FOR MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS

On March 28, 2012 the NRC issued EA-12-049, "Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" which required a three-phase approach for mitigating beyond-design-basis external events. The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and spent fuel pool (SFP) cooling capabilities. The transition phase requires providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from offsite. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely. Condition C.3 of the Order required all Licensees to report to the Commission when full compliance with the requirements of the order is achieved.

This letter provides notification that Dominion has completed the requirements of EA-12-049 and is in full compliance with the Order for Unit 2. The attachments to this letter provide: 1) a summary of how the compliance requirements were met, and 2) the responses to the Open Items and Confirmatory Items from the Interim Staff Evaluation for EA-12-049 (ML13338A445) from the NRC, plus Dominion's responses to additional items identified in Attachments 4 and 5 of the North Anna Power Station Onsite Audit Report dated September 24, 2014 (ML14259A458).

Should you have any questions or require additional information, please contact Margaret Earle at (804) 273-2768.

Respectfully,

Mark Sartain
Vice President – Nuclear Engineering

Vicki L. Hull
NOTARY PUBLIC
Commonwealth of Virginia
Reg. # 140542
My Commission Expires May 31, 2018

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mr. Mark D. Sartain, who is Vice President – Nuclear Engineering, of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 8TH day of December, 2014.

My Commission Expires: 5-31-18

Notary Public

A151
NRR

Attachments: 1. Order EA-12-049 Compliance Requirements Summary
2. Response to ISE Open Items and ISE Confirmatory Items plus Additional Items Identified in Attachments 4 and 5 of North Anna Power Station Units 1 and 2 Onsite Audit Report, September 24, 2014

Commitments contained in this letter:

1. The Final Integrated Plan for North Anna Power Station, Units 1 and 2, will be submitted no later than 60 days following the end of the North Anna Unit 1 second refueling outage following submittal of the OIP, currently scheduled for Spring 2015.

2. When the new EPRI template for the RCS injection pumps is issued, the guidance in the template will be reviewed and evaluated for incorporation in the periodic maintenance procedure.

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NRC Senior Resident Inspector
North Anna Power Station

Attachment 1

Order EA-12-049 Compliance Requirements Summary

Virginia Electric and Power Company
North Anna Power Station Unit 2

North Anna Power Station, Unit 2
Order EA-12-049 Compliance Requirements Summary

North Anna Power Station developed an Overall Integrated Plan (OIP) (Reference 1), documenting diverse and flexible strategies (FLEX) in response to Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," (Reference 2). The OIP for North Anna Power Station, Units 1 and 2 was submitted to the NRC on February 28, 2013 and was supplemented by Six-Month Status Reports (References 3, 4, and 5), in accordance with Order EA-12-049, along with an additional supplemental letter that was submitted on April 30, 2013 (Reference 6).

Full compliance of Order EA-12-049 was completed on October 8, 2014. This date corresponds to the end of the second refueling outage after submittal of the OIP as required by Reference 2. The information provided herein documents full compliance with Reference 2 for North Anna Power Station, Unit 2.

Completion of the elements identified below for North Anna Power Station, Unit 2, as well as References 1, 3, 4, 5, and 6 document full compliance with Order EA-12-049 for North Anna Power Station, Unit 2.

NRC ISE AND AUDIT ITEMS – COMPLETE

During the ongoing audit process (Reference 7), Dominion provided responses for the following items for North Anna:

- Interim Staff Evaluation (ISE) Open Items
- ISE Confirmatory Items
- Licensee Identified Open Items
- Audit Questions
- Safety Evaluation Review Items

The "NRC North Anna Power Station, Units 1 and 2 – Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spend Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051" (Reference 8) delineated the items reviewed during the North Anna Power Station onsite audit. The report also identified additional audit items, specified as Safety Evaluation Review Items, which were added following the audit and required supplemental information to address these items.

As requested by the NRC, Dominion's responses, or references to the source document for responses, to the ISE Open Items or ISE Confirmatory Items (Reference 13), are provided in

Attachment 2 of this letter. Attachment 2 also provides the responses, or references to the source document for responses, to Open or Pending Audit Questions and Licensee Identified Open Items related to Order EA-12-049 from Reference 7 and responses, or references to the source document for responses to the Safety Evaluation Review Items associated with Order EA-12-049. It is Dominion's position that no further actions related to any of the above items are required.

MILESTONE SCHEDULE – ITEMS COMPLETE

Unit 2 Milestone	Completion Date
Submit Integrated Plan	February 2013
Develop Strategies	October 2013
Develop Modifications	July 2014
Implement Unit 2 Modifications	October 2014
Develop Training Plan	April 2014
Implement Training	September 2014
Issue FSGs and Associated Procedure Revisions	September 2014
Develop Strategies/Contract with NSRC	August 2014
Purchase Equipment	February 2014
Receive Equipment	August 2014
Validation Walk-Throughs or Demonstrations of FLEX Strategies and Procedures	August 2014
Create Maintenance Strategies	August 2014
Unit 2 Outage Implementation	October 2014

STRATEGIES – COMPLETE

Strategy related Open Items, Confirmatory Items, Audit Questions or Safety Evaluation Review Items have been addressed as documented in Reference 8 or Attachment 2 of this letter. The North Anna Power Station, Unit 2 strategies are in compliance with Order EA-12-049.

MODIFICATIONS - COMPLETE

The modifications required to support the FLEX strategies for North Anna Power Station, Unit 2 have been completed in accordance with the station design control process.

EQUIPMENT – PROCURED AND MAINTENANCE & TESTING – COMPLETE

The equipment required to implement the FLEX strategies for North Anna Power Station, Unit 2 has been procured in accordance with NEI 12-06, Section 11.1 and 11.2, received at North Anna Power Station, initially tested, the performance verified as identified in NEI 12-06, Section 11.5, and is available for use.

Maintenance and testing will be conducted through the use of the North Anna Power Station Preventative Maintenance program such that equipment reliability is maintained.

PROTECTED STORAGE – COMPLETE

The storage facility required to protect BDB equipment has been completed for North Anna Power Station. The BDB equipment is protected from the applicable site hazards and will remain deployable to assure implementation of the FLEX strategies for North Anna Power Station, Unit 2.

PROCEDURES – COMPLETE

FLEX Support Guidelines (FSGs), for North Anna Power Station, Unit 2, have been developed and integrated with existing procedures. The FSGs and affected existing procedures have been approved and are available for use in accordance with the site procedure control program.

TRAINING – COMPLETE

Training of personnel responsible for the mitigation of beyond-design-basis events at North Anna Power Station, Unit 2 has been completed in accordance with an accepted training process as recommended in NEI 12-06, Section 11.6.

STAFFING – COMPLETE

The staffing study for North Anna Power Station has been completed in accordance with "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," Enclosure 5 pertaining to Recommendation 9.3, dated March 12, 2012 (Reference 9), as documented in letter dated May 7, 2014, "North Anna Power Station Units 1 and 2, March 12, 2012 Information Request, Phase 2 Staffing Assessment Report," (Reference 10), and in the response to a Request for Additional Information (Reference 11) Regarding Phase 2 Staffing Assessment Report, Recommendation 9.3, dated September 22, 2014.

FSG strategies can be successfully implemented using the current minimum on-shift staffing.

NATIONAL SAFER RESPONSE CENTERS – COMPLETE

Dominion has established a contract with Pooled Equipment Inventory Company (PEICo) and has joined the Strategic Alliance for FLEX Emergency Response (SAFER) Team Equipment Committee for off-site facility coordination. It has been confirmed that PEICo is ready to support North Anna Power Station with Phase 3 equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan (Reference 12).

VALIDATION – COMPLETE

Dominion has completed validation testing of the FLEX strategies for North Anna Power Station, Unit 2 in accordance with industry developed guidance. The validations assure that required tasks, manual actions, and decisions for FLEX strategies are feasible and may be executed within the constraints identified in the Overall Integrated Plan (OIP)/Final Integrated Plan (FIP) for Order EA-12-049. The FIP for North Anna Power Station, Units 1 and 2, will be submitted no later than 60 days following the end of the North Anna Unit 1 second refueling outage following submittal of the OIP, currently scheduled for Spring 2015.

FLEX PROGRAM DOCUMENT – ESTABLISHED

The Dominion FLEX Program Document has been developed in accordance with the requirements of NEI 12-06 and is in effect for North Anna Power Station, Unit 2.

REFERENCES

The following references support the North Anna Power Station, Unit 2 FLEX Compliance Summary:

1. North Anna Power Station Units 1 and 2, "Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," February 28, 2013 (ML13063A182).
2. NRC Order Number EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012 (ML12229A174).
3. Letter from Dominion to NRC, "North Anna Power Station Units 1 and 2 Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated August 23, 2013 (ML13242A012).

REFERENCES (CONTINUED)

4. Letter from Dominion to NRC, "North Anna Power Station Units 1 and 2 Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated February 27, 2014 (ML14069A012).

5. Letter from Dominion to NRC, "North Anna Power Station Units 1 and 2 Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated August 28, 2014 (ML14251A024).

6. Letter from Dominion to NRC, "Supplement to Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated April 30, 2013 (ML13126A207).

7. NRC letter to All Operating Reactor Licensees and Holders of Construction Permits, "Nuclear Regulatory Commission Audits of Licensee Responses to Mitigation Strategies Order EA-12-049," dated August 28, 2013 (ML13234A503).

8. NRC letter from John Boska, Senior Project Manager, JLD, Office of NRR, to David A. Heacock, President and chief Nuclear Officer, Virginia Electric and Power Company, "NRC North Anna Power Station, Units 1 and 2 – Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spend Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051," dated September 24, 2014 (ML14259A458).

9. 10CFR50.54(f), "Request for Information Pursuant to Title 10 of the Code of Federal Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," Recommendation 9.3, dated March 12, 2012 (ML2073A348).

10. Letter from Dominion to NRC, "North Anna Power Station Units 1 and 2, March 12, 2012 Information Request Phase 2 Staffing Assessment Report," May 7, 2014 (ML14133A011).

11. Letter from Dominion to NRC, "North Anna Power Station Units 1 and 2, March 12, 2012 Response to Request for Additional Information Regarding Phase 2 Staffing Assessment Report Recommendation 9.3," dated September 22, 2014.

12. NRC letter from Jack Davis, JLD, Office of NRR, to Joseph E. Pollock, Vice President, Nuclear Operations, NEI, "Staff Assessment of National Safer Response Centers Established in Response to Order EA-12-049," September 26, 2014 (ML14265A107).

13. NRC letter from Jeremy S. Bowen, Chief, Mitigating Strategies Branch Office of NRR, to David A. Heacock, President and Chief Nuclear Officer, Virginia Electric and Power Company, "North Anna Power Station, Units 1 and 2 – Interim Staff Evaluation Related to Overall Integrated Plan in Response to Order EA-12-049 (Mitigating Strategies)," dated January 29, 2014 (ML13338A445).

Attachment 2

Response to Interim Staff Evaluation (ISE) Open Items and ISE Confirmatory Items plus Additional Items Identified in Attachments 4 and 5 of the North Anna Power Station Units 1 and 2 Onsite Audit Report, September 24, 2014

Virginia Electric and Power Company
North Anna Power Station Unit 2

Response to Interim Staff Evaluation (ISE) Open Items and ISE Confirmatory Items plus Additional Items Identified in Attachments 4 and 5 of the North Anna Power Station Units 1 and 2 Onsite Audit Report, September 24, 2014

ISE Open Item (OI) 3.2.1.2.B

Demonstration of the acceptability of the use the Flowserve N-9000 seals with the Abeyance feature and validation of an acceptable leakage rate for these seals.

Dominion Response:

The acceptability of the use of Flowserve N-9000 seals with the Abeyance feature as replacement seals for the North Anna reactor coolant pumps was evaluated as part of the Dominion Design Control Program. The replacement seals were approved for use consistent with the requirements of 10 CFR 50.59. In the Flowserve document "White Paper on the Response for the N-Seal Reactor Coolant Pump (RCP) Seal Package to Extended Loss of AC Power (ELAP)," Revision 0, dated February 11, 2014 (Proprietary), Flowserve documented that, for an ELAP event followed by cooldown and depressurization to a temperature range of 350 °F to 425 °F within six hours, degradation of elastomers in the three primary N-seal stages is not likely, and the expected RCP seal leakage would be limited to the Controlled Bleedoff (CBO) rate at normal operating temperature and pressure conditions. This expected seal leakage is a small percentage of the leakage value assumed in the Reference NOTRUMP ELAP analysis in WCAP-17601 applied for North Anna. A copy of the white paper has previously been provided to the NRC staff and is available for their review.

North Anna plans to initiate a cooldown/depressurization no later than two hours after declaration of an ELAP event. At that time, the maximum temperature of the RCS will be 556°F. In accordance with existing Emergency Operating Procedures, cooldown will proceed at 70-100°F per hour, ending at an RCS temperature of ~419°F. The Flowserve white paper documents a test that exceeds the temperature for the North Anna RCP N-9000 seals during approximately the first 10 hours of the ELAP. The integration of the temperature difference between the test temperature and the seal temperature during the ELAP, when converted using the Arrhenius equation to estimate material degradation, shows that the N-9000 seals can remain at 419°F for more than a day before leakage increases. The initial leakage is minimal and improves the RCS response significantly relative to the Westinghouse high temperature seal package. The additional leakage also occurs well after the RCS makeup pump is deployed and installed for RCS inventory makeup.

ISE OI 3.2.1.8.A

The Pressurized-Water Reactor Owners Group (PWROG) submitted to NRC a position paper, dated August 15, 2013 (ADAMS Accession No. ML13235A135 (non-public for proprietary reasons)), which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. During the audit process, the licensee informed the NRC staff that its boric acid mixing model is based on the PWROG method. Since the audit discussions, the NRC endorsed the PWROG guidance with several clarifications in the letter dated January 8, 2014. The licensee should address the clarifications in alignment with the NRC endorsement letter for the development of an adequate model for determining the mixing of boric acid in the reactor coolant system during natural circulation with the potential for two-phase flow conditions.

Dominion Response:

The NRC staff clarifications to the PWROG's position paper on boron mixing are addressed as follows.

Clarification (1): The North Anna evaluation for boron mixing has considered both the case of maximum RCP seal leakage (21 gpm total), as well as the zero leakage case. Westinghouse Letter LTR-FSE-13-46, Revision 0, "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Boron Mixing in Support of the Pressurized Water Reactor Owners Group (PWROG)," August 15, 2013 argued that the zero leakage case is more limiting than the high leakage case from the standpoint of mixing because it delays the boron contribution from accumulator injection, resulting in more reliance on pumped injection from the RCS FLEX pump. However, Dominion has not credited boron from accumulator injection in developing its FLEX strategy. Therefore, the maximum leakage case is the most limiting. A copy of LTR-FSE-13-46 has previously been provided to the NRC staff and is available for their review.

Clarification (2): For the maximum leakage case, North Anna intends to initiate RCS makeup of 45 gpm by the 16th hour following the onset of the ELAP/LUHS condition. This is well in excess of the maximum RCS leakage at 16 hours (see WCAP-17601 Figure 5.2.2-6, Total RCS Leakage Flow). Westinghouse Letter LIS-14-79 , "PWROG ASC Reflux Cooling Position Paper for Westinghouse Designed PWRs," Attachment 1, calculated that for a 3-loop Westinghouse plant, such as North Anna, the time at which two-phase flow drops below single phase natural circulation flow is slightly more than 17 hours. Since makeup flow will begin prior to this time and will exceed that maximum leakage flow, the approach to the condition where two-phase flow drops below single phase natural circulation flow would be halted and, in fact, reversed. Accordingly, the conditions identified in 2a are applicable as the RCS flow stays within the favorable conditions identified for boron mixing The conditions identified in 2b will not occur with the above RCS makeup strategy. A copy of LTR-FSE-14-79 has previously been provided to the NRC staff and is available for their review.

Clarification (3): Provided that the flow in all loops is greater than or equal to the corresponding single-phase natural circulation flow rate, the staff considers a mixing delay period of one hour following the addition of the targeted quantity of boric acid to the reactor coolant system to be appropriate. Dominion's reactivity calculations show that no increase in boron concentration is required prior to 37 hours for steam pressures down to the 290 psig target steam pressure in ECA-0.0. Cooldown below this point is not anticipated until beyond Phase 2. Thus, available boron mixing time will be approximately 21 hours (37 hours - 16 hours) which is much greater that the one hour specified in Clarification (3).

It should be noted that the North Anna maximum RCP seal leakage was determined to be larger for the Westinghouse RCP seals as a result of NSAL-14-1. This change results in no impact to boron mixing since for Unit 2, 2 of 3 Westinghouse RCP seals have been replaced with the Flowserve N-9000 low leakage seals. Therefore, the RCP leakage rate assumptions in the analysis remain bounding for NAPS Unit 2.

ISE CI 3.1.1.1.A

Storage & Protection of FLEX equipment – Confirm final design of FLEX storage structure conforms to NEI 12-06, Sections 5.3.1, 6.2.3.1, 7.3.1, and 8.3.1 for storage considerations for the hazards applicable to North Anna.

Dominion Response:

The North Anna BDB Storage Building has been constructed per the specifications provided in Design Change (DC) NA-13-00061. The design of the BDB Storage Building for North Anna conforms to NEI 12-06, Sections 5.3.1, 6.2.3.1, 7.3.1, and 8.3.1 for storage considerations for the hazards applicable to North Anna as follows:

Section 5.3.1: The North Anna BDB Storage Building has been designed to meet or exceed NEI 12-06, Section 5.3.1.1.a (... a Structure that meets the plant's design basis for the Safe Shutdown Earthquake (SSE)). The actual criteria used for the design of the North Anna BDB Storage Building is in accordance with Dominion Specification CV-0004 which states, "Earthquake motion in terms of acceleration response spectra (in horizontal and vertical directions) at bedrock corresponding to the 8/23/11 earthquake and the design basis earthquake (DBE) site ground response spectra for soil-founded structures shall be considered. The Supplier shall use the governing earthquake data between the two." The final vendor calculation, IND1312902, confirmed compliance with Dominion Specification CV-0004 and has previously been provided to the NRC staff and is available for their review.

Per Section 5.3.1.2, large portable FLEX equipment have been evaluated and are secured as described in Section 11.1.1 of ETE-CPR-2012-0012 to protect them during a design basis seismic event. ETE-CPR-2012-0012 has been previously provided to the NRC staff and is available for their review.

Per Section 5.3.1.3, the stored equipment and structures have been evaluated and protected, as appropriate, from seismic interactions to ensure that unsecured and/or non-seismic components do not damage equipment. This includes shelving which is required to be secured, appropriately loaded, or in an area clear of interactions.

Section 6.2.3: The North Anna BDB Storage Building has been designed to NEI 12-06, Section 6.2.3.1.1.a (...is located above the flood elevation from the most recent site flood analysis) and is not in an area that is subject to a rapid rise of water. Specifically, the North Anna BDB Storage Building has a finished floor elevation of 309.5 feet, which is well above the Probable Maximum Flood (PMF) water elevation of approximately 267.4 feet. The PMF level was taken from the Flood Hazard Re-evaluation Report (ADAMS Accession No. ML13318A090) for North Anna requested by the 10 CFR 50.54(f) letter dated March 12, 2012. The general grade around the BDB Storage Building location slopes away from the building thereby minimizing the possibility of significant water accumulation or ponding in the area.

Section 7.3.1: The North Anna BDB Storage Building has been designed to NEI 12-06, Section 7.3.1.1.a (...a structure that meets the plant's design basis for high wind hazards). The actual criteria being used for the design of the North Anna BDB Storage Building is in accordance with Dominion Specification CV-0004 which states, the minimum design tornado wind load is "360 mph (approximately 332 psf) with a pressure drop of 3 psi in 3 seconds (300 mph rotational velocity, 60 mph translational velocity with 1000 ft overall diameter). The maximum wind pressure shall be multiplied by applicable shape factors and drag coefficients as given in ASCE Paper 3269 and applied to the silhouette of the structure." The final vendor calculation, IND1312902, confirms compliance with Dominion Specification CV-0004, and has previously been provided to the NRC staff and is available for their review.

Section 8.3.1: The North Anna BDB Storage Building has been designed to NEI 12-06, Section 8.3.1.1.a (...a structure that meets the plant's design basis for snow, ice and cold conditions). The actual criteria used for the design of the North Anna BDB Storage Building is in accordance with Dominion Specification CV-0004 which states, "The design of the HVAC systems shall be based on maintaining the following indoor design conditions: Heating: minimum indoor temperature of 50°F; Cooling: maximum indoor temperature of 100°F." This ensures that the FLEX equipment stored in the BDB Storage Building is maintained within its design limits of 35°F to 115°F. The design basis high and low temperatures for North Anna are provided in Section A.1 of the North Anna Overall Integrated Plan dated February 28, 2012 (ADAMS Accession No. ML13036A182) and the UFSAR.

ISE CI 3.1.1.3.A

Procedural Interface Considerations (Seismic) – Confirm FLEX support guideline to provide operators with direction on how to establish alternate monitoring and control capabilities.

Dominion Response:

FLEX Support Guidelines (FSG) 1/2-FSG-7, "Loss of Vital Instrumentation or Control Power," have been confirmed to provide operators with direction on how to establish alternate monitoring and control capabilities. 1/2-FSG-7 include: 1) instructions to restore power to the Remote Monitoring Panel to facilitate reading critical RCS and SG parameters, 2) instructions to obtain key parameter information reading from penetrations, and 3) instructions to read Core exit thermocouples using a battery powered thermocouple calibrator. 1/2-FSG-7 have been developed in accordance with Pressurized Water Reactor Owner's Group (PWROG) guidance and were approved prior to FLEX implementation at North Anna Power Station. Copies of the approved North Anna FSGs have previously been provided to the NRC staff and are available for their review.

ISE CI 3.1.1.4.A

Off-Site Resources – Confirm RRC local staging area, evaluation of access routes, and method of transportation to the site.

Dominion Response:

The National SAFER Response Center (NSRC - previously designated as the RRC) local staging areas, access route evaluations, and transportation evaluations to the site have been completed and documented in the SAFER Trip Report for North Anna Power Station. The SAFER Response Plan for North Anna has also been finalized. Copies of these documents have previously been provided to the NRC staff and are available for their review.

In response to questions received during the May 2014 NRC Onsite Audit, the following additional information is provided:

1) The gravel parking lot located south of the station access road from the new BDB Storage Building has been designated as the Staging Area "B" for equipment to be delivered by helicopter from the NSRC. A clear area of 250' x 250' has been specified to the NSRC for consideration of what helicopter to use to fly in equipment. The overall area that is available for staging equipment is greater (approximately 270 ft. X 600+ ft.) than the clear area dimensions that have been specified to the NSRC for their resource planning.

2) The staging area is slightly sloped to maintain appropriate drainage. However, any equipment or material that is delivered to this staging area will be assessed for stability and will be chocked as necessary to prohibit rolling.

3) Liquefaction of Staging Area B has been evaluated. Staging Area B was not initially included in the evaluation of liquefaction potential performed for the BDB Storage Building and haul routes, however, it is adjacent to these areas and no problems were anticipated. Subsequently, a review of available construction test records and construction specifications was performed. Based upon these test records and the test location elevations it is evident that several feet of fill have been placed in the area that meet or exceed the required compaction density. Using the required density, established with the Modified Proctor Test (ASTM D 1557), as a basis of estimating a relative density for the SM and SW-SM soils placed to construct the parking area (Staging Area "B") and corresponding N60 value, the compacted soils are expected to exhibit N-values in excess of 30 blows per foot. Such soils and associated compactness will typically not liquefy in a seismic event. Additionally, data from a test boring from Staging Area B located on the north side of the station access road and just outside of the BDB Storage Building demonstrated similar characteristics as the borings for the BDB Storage Building; therefore, liquefaction is not a concern.

4) Dominion has placed a decision point within Attachement 4 of procedure EP-AA-FLX-101, "Single Point of Contact." Attachment 4, "Travel Route Assessment and Debris Removal Guidance" is used by Dominion's Single Point of Contact (SPOC) who is responsible for interfaces with the SAFER organization as the NSRC Phase 3 equipment is traveling towards the station. The procedural guidance was enhanced to include a step that states: "If projected road/haul paths from Staging Area C to the station are inaccessible or bridges have not been cleared by the State Emergency Management for NSRC ground transportation, then contact the SAFER SPOC to dispatch ground transportation to Staging Area D for helicopter operation to the station."

5) In a joint effort with the SAFER organization, Dominion's Beyond Design Basis (BDB) and Emergency Preparedness (EP) groups, conducted an information sharing session in April 2014 titled, "Industry Approach to Addressing Order EA-12-049 Mitigating Strategies." This session was attended by both state and local counties emergency responders and was conducted at the Virginia's State Emergency Operations Center. Local county representative from both the Surry and North Anna sites were in attendance. The session consisted of a joint presentation by Dominion's BDB group and the SAFER organization on what is a Beyond Design Basis External Event (BDBEE) and also addressed Dominion's BDB Mitigating Strategies which included the SAFER organization's response to a BDBEE. The presentation was followed by a Q&A session. Also, EP holds periodic meetings with the local county officials to ensure offsite agencies are aware of and will support emergency situations such as BDB External Events in accordance with Dominion's Emergency Response Plan.

ISE CI 3.1.5.2.A

In the Integrated Plan, the licensee did not address considerations for any manual actions required by plant personnel in high temperature conditions as recommended in NEI 12-06, Section 9.3.2. Discuss effects of high temperatures on any manual action performed by plant personnel and any applicable contingencies.

Dominion Response:

During an ELAP on site, ventilation providing cooling to occupied areas and areas containing FLEX strategy equipment will be lost. Loss of ventilation analyses have been performed for North Anna to quantify the maximum steady state temperature reached in specific areas to ensure the environmental conditions remain acceptable for personnel habitability and equipment qualification. Calculation ME-0972 analyzes the heat-up of the following areas during Phases 1 and 2 of the ELAP event to ensure the loss of forced ventilation and resulting room temperatures would not affect any credited mitigation equipment nor limit access of personnel required for performance of FLEX strategies:

- Main Control Room (MCR),
- Emergency Switchgear Room (ESGR),
- Main Steam Valve House (MSVH) S/G Power Operated Relief Valve (PORV) area,
- Mechanical Equipment Room (MER) in the Turbine Building,
- Quench Spray (QS) Pumphouse,
- Auxiliary Building, and
- Auxiliary Feedwater (AFW) Pumphouse Turbine Driven AFW (TDAFW) Pump Room

Results of the analyses concluded no issues in terms of equipment function or personnel access for the duration of an ELAP with the exception of the TDAFW pump room. The TDAFW pump room was previously analyzed in calculation 01040.4410-USB-268 for temperature transients during a Station Blackoput (SBO). The analysis was based on the conservative assumption that the door to the AFW pumphouse was closed. With this assumption, the TDAFW Pump Room maximum temperature was below 130 °F, but was still increasing at the end of the evaluation period (~8 hours). In order to consider the temperatures achievable during the significantly longer time periods associated with an ELAP event, calculation ME-0972 was amended to evaluate the TDAFW Pump Room with the assumption that the TDAFW Pump Room door to the AFW Pumphouse was open. Under this assumption, the TDAFW Pump Room "steady state" temperature remains less than 120 °F.

The North Anna Environmental Zone Description does not state a maximum ambient temperature for the TDAFW Pump Room, but limits the temperature of the pumped AFW fluid to 120 °F. Calculation ME-0972 states that, since the steady state temperature in the TDAFW Pump Room remains below 120 °F, the temperature in this room is not expected to adversely affect the performance or reliability of the pump or pump motor. Therefore, taking the compensatory action to open the AFW Pumphouse door has been included in the FLEX coping procedures which ensures acceptable temperatures following an ELAP event. No other operator action to deploy portable ventilation equipment is expected to be necessary during the plant response to an ELAP.

However, even at 120 °F, heat stress is a concern. Therefore, for this area (or any areas with elevated temperatures requiring access to implement the FLEX mitigating strategies), current station procedures regarding heat stress management would be in effect. Procedure SA-AA-109, "Heat Stress Management" would be used to provide guidelines for stay times, the need for hydration, and to determine the need for cooling garments.

Copies of the calculations referenced above and procedure SA-AA-109 have previously been provided to the NRC staff and are available for their review.

ISE CI 3.2.1.1.A

Confirm that the use of NOTRUMP code for the ELAP analysis of North Anna is limited to the flow conditions before reflux condensation initiates, including specification of an acceptable definition for reflux condensation cooling.

Dominion Response:

The PWROG has documented the applicability of the NOTRUMP code for the evaluation of the ELAP event and application of its results with regards to criteria for boron mixing and reflux cooling for Westinghouse designed PWRs in PWROG-14064. PWROG-14064 provides a comparison of results from the NOTRUMP and NRC's TRACE computer codes for the parameters of interest and shows that the NOTRUMP predicted results agree well or are conservative with respect to the TRACE predicted results. Furthermore, the comparison shows that NOTRUMP provides a conservative estimate of the required time when the RCS Injection pumps are required for an ELAP event as compared to TRACE. Therefore, it is concluded that NOTRUMP is acceptable for simulation of the ELAP event when used within the criteria for reflux cooling and boron mixing.

The definition of reflux cooling can be related to the quality in the SG U-bend region. From PWROG-14064, the onset of "reflux cooling" is considered to exist when the one hour centered moving average flow quality of the steam generator U-bend flow quality has increased to a value of 0.1 in any one loop. This condition is considered to be conservative since it is defined prior to either the onset of inadequate boron mixing in the RCP suction leg or reflux cooling heat transfer. That is, when this set of circumstances occurs, the dilution process in the RCP suction legs has not yet started. As such, the RCS has not yet reached a stratified state where true reflux cooling heat transfer is possible. Thus, the definition of the onset of reflux cooling is conservative for establishing the time when RCS makeup is desired.

The PWROG has documented leakage rates for Westinghouse RCP Original Equipment Manufacturer (OEM) Seals in PWROG-14015, Revision 1 using a bounding plant configuration. The initial leakage information consisted of three points: initial leakage at normal operating temperature and normal operating pressure (NOT/NOP); peak leakage at 1500 psia; and leakage at the cooled-down, depressurized conditions. Additional studies have been documented in PWROG-14015, Revision 1 to evaluate the linear assumptions between points and the effect of minimal subcooling for Category 1 seals. The intermediate flow rates are slightly above what is predicted by the linear assumption for seal leakage between the Revision 0 points. The seal leakage flow rate is almost unaffected from the change from 5°F of sub-cooling to less than 1°F of sub-cooling. For each pressure analyzed, these points are within 0.1 gpm.

ETE-NAF-2012-0150, Revision 2, documents the time to reach the onset of reflux cooling in order to validate the time RCS makeup should be initiated for North Anna Units 1 and 2. The configuration for North Anna Unit 2 is now, subsequent to the Fall 2014 refueling outage, one Westinghouse RCP OEM seal and two Flowserve RCP seals. ETE-NAF-2012-0150, Revision 2 incorporates the Westinghouse RCP OEM seal leakage values from PWROG-14015, Revision 1 for Category 3, and the normal response leakage for the Flowserve seal. As documented in Attachment G, as of the compliance date for North Anna Unit 2 (October 8, 2014) the estimated time to reach reflux cooling is 17.6 hours with the configuration of one Westinghouse OEM seal and two Flowserve seals; and a margin of 1.6 hours is available to the established time of 16 hours for the implementation of the RCS makeup pump.

The PWROG documents and ETE-NAF-2012-0150, Revision 2 have previously been provided to the NRC staff and are available for their review.

ISE CI 3.2.1.1.B

Confirmation that the generic analysis in Section 5.2.1 of WCAP-17601-P is applicable or bounding with respect to North Anna for an appropriate figure of merit for defining entry into the reflux condensation cooling mode.

Dominion Response:

The Pressurized Water Reactor Owner's Group (PWROG) documented the applicability of the NOTRUMP code for the evaluation of the ELAP event and application of its results with regards to criteria for boron mixing and reflux cooling for Westinghouse designed PWRs in PWROG-14064. PWROG-14064 provides a comparison of results from the NOTRUMP and TRACE computer codes for the parameters of interest and shows that the NOTRUMP predicted results agree well, or are conservative, with respect to the TRACE predicted results. Further, the comparison shows that NOTRUMP provides a conservative estimate of the required time when the primary make-up pumps are required for an ELAP event as compared to TRACE. Therefore, it is concluded that NOTRUMP is acceptable for simulation of the ELAP event within the constraints with regards to reflux cooling and boron mixing.

Section 5.2.1 of WCAP-17601 provides a Reference Case which assumes standard RCP seal packages to determine the minimum adequate core cooling time with respect to RCS inventory (i.e., core uncovery). The Reference Case models a Westinghouse 4-loop plant with a core height of 12 feet (i.e., a 412 plant), a T_{cold} upper head, at 3723 MWt, with a Model F steam generator and Model 93A/A-1 reactor coolant pumps.

PWROG-14064 indicates that the initiation time for reflux cooling will be set to 17.0 hours for the WCAP-17601, Section 5.2.1, Westinghouse 4-loop T_{cold} Reference Case. PWROG-14064 also indicates that 17.0 hours will be used, as a conservative basis, for Westinghouse 3-loop T_{hot} upper head plant (i.e., for North Anna Units 1 and 2).

The PWROG issued parameter templates for the reference cases presented in WCAP-17601 and WCAP-17792 that delineated the values for the important parameter used in the analyses. Table F.3 in ETE-NAF-2012-0150, Revision 2 provides these parameter values as compiled for North Anna Power Station (NAPS), Units 1 and 2. These NAPS plant values are available from the UFSAR and are, in general, only slightly different from the PWROG issued parameter templates. (This is expected because the 3-Loop Reference Case in WCAP-17792 is a representation of North Anna.) Therefore, the Westinghouse 3-Loop T_{hot} Reference Case from WCAP-17792 is representative of North Anna.

The WCAPs, PWROG documents, and ETE-NAF-2012-0150, Revision 2 have previously been provided to the NRC staff and are available for their review.

ISE CI 3.2.1.1.C

Confirm the consistency of the margin imposed to prevent accumulator nitrogen injection with the cooldown terminus assumed in WCAP-17601-P

Dominion Response

The generic analysis applicable to North Anna is presented in WCAP-17601, Section 5.2.1. The analysis assumes that the RCS cooldown/ depressurization is terminated at a steam pressure of 300 psia. North Anna procedure ECA-0.0, "Loss of All AC Power," specifies terminating the cooldown at a steam pressure of 290 psig (approximately 305 psia), which is conservative relative to the WCAP-17601 terminus with respect to preventing accumulator nitrogen injection. Terminating the cooldown at 290 psig retains the 100 psi margin to accumulator nitrogen injection, which is stated as potentially occurring at 190 psig in ECA-0.0. A copy of procedure ECA-0.0 has previously been provided to the NRC staff and is available for their review.

ISE CI 3.2.1.2.C

(1) Confirm that stresses resulting from a cooldown of the RCS will not result in the failure of seal materials. (2) As applicable, confirm that reestablishing cooling to the seals will not result in increased leakage due to thermal shock.

Dominion Response:
The following responses are applicable to RCPs with Westinghouse Seals:

(1) North Anna procedure ECA-0.0, "Loss of All AC Power," limits the RCS cooldown rate to 100°F/hr. This constraint on cooldown rate is based on protecting the RCP seals from damage due to thermal shock. A copy of procedure ECA-0.0 has previously been provided to the NRC staff and is available for their review. The Westinghouse Owner's Group Emergency Response Guidelines Background Documents recommend that the intact steam generators should be depressurized quickly, to cool the RCS and minimize RCP seal degradation and resultant inventory loss, but not so rapidly as to thermally shock the RCP seals, at a rate limited to 100°F/hr.

(2) Emergency response procedures direct that the intact steam generators are depressurized to reduce primary system temperature, thus cooling the seals. Seal injection and/or thermal barrier cooling are not restored following a loss of all ac power event until the RCS is cooled to cold shutdown conditions to prevent thermal shock or increased seal leakage.

The following response is applicable to RCPs with Flowserve Seals:

As described in Flowserve document "White Paper on the Response for the N-Seal Reactor Coolant Pump (RCP) Seal Package to Extended Loss of AC Power (ELAP)," Revision 0, dated February 11, 2014 (Proprietary), the Flowserve N-Seal design has been demonstrated by testing to have no negative effects from rapid cooling. Therefore, it is not feasible for RCS cooldown rate or seal cooling (seal injection or thermal barrier cooling) restoration to result in failure of Flowserve N-9000 seal materials or increased seal leakage due to thermal shock. A copy of the white paper has previously been provided to the NRC staff and is available for their review.

ISE CI 3.2.1.6.A

Sequence of Events – Confirm that the final timeline has been time validated after detailed designs are completed and procedures are developed. The results will be provided in a future 6-month update.

Dominion Response:

The validation of response times for the North Anna FLEX Mitigation Strategies was completed on 09/30/14 during the Verification and Validation (V&V) phase of the FSG development/ECA-0.0 revision process. There were no significant changes to the timeline. The results of the validation effort have been documented in ETE-CPR-2014-1004, "North Anna BDB Validation of Time Sensitive Actions." A copy of ETE-CPR-2014-1004 has previously been provided to the NRC staff and is available for their review.

ISE CI 3.2.1.8.B

Complete calculations demonstrating adequate shutdown margin for North Anna in ELAP scenarios with and without seal leakage.

Dominion Response:

Demonstration of adequate shutdown margin for the ELAP scenario is provided in Calculation MISC-11788, "Investigation of Reactivity Control during Extended Station Blackout – North Anna Units 1 and 2," Revision 0. A copy of Calculation MISC-11788, Revision 0 has previously been provided to the NRC staff and is available for their review.

Calculation MISC-11788 is based on the no RCS leakage case, which bounds the high leakage case modeled in WCAP-17601-P. As documented in Calculation MISC-11788, for depressurization to the target ECA-0.0 secondary pressure of 290 psig, boron addition is not needed before 37 hours to maintain K-effective < 0.99. However, borated makeup will be initiated well in advance of this time, i.e. at 16 hours. Additionally, 2,600 gallons of RWST water (or equivalent boron concentration) is required to borate the system to K-effective = 0.99, at the xenon free condition. This requirement is based on complete mixing of the 2,600 gallons at 2,600 ppm with the initial RCS inventory. Assuming the rated BDB RCS Injection pump flow rate (45 gpm), this makeup can be added in just under an hour (i.e., by 17 hours).

By comparison, for the high leakage case (all Westinghouse seals) modeled in WCAP-17601, Section 5.2.1, and shown in Figure 5.2.2-8, total RCS inventory has decreased to about 88% of its initial value at 16 hours (57,600 seconds) due to RCS leakage. With RCS mass at about 88% of its initial value, the requirement for borated makeup to achieve the Xenon-free reactivity requirement would be reduced from 2,600 gallons of RWST water to approximately 2,300 gallons. At the rated BDB RCS Injection pump flow rate (45 gpm), this makeup can be achieved within about 51 minutes. Note that the indicated leakage in Figure 5.2.2-8 is offset somewhat by accumulator injection between around 10,000 – 15,000 seconds. Dominion's reactivity analysis does not credit the boron concentration from the accumulators. For either case (high leakage or low leakage), deployment of the BDB RCS Injection pump by 16 hours ensures that adequate boration is achieved approximately 20 hours prior to any required increase (i.e., 37 hours - 16 hours - 1 hour). Furthermore, deployment of the BDB RCS Injection pump by 16 hours ensures that the reflux cooling condition is avoided and many hours of boron mixing time are available before the boron increase is required.

ISE CI 3.2.1.8.C

Confirm that shutdown margin calculations will be verified to remain bounding for future operating cycles and clarify the method that will be used to make this determination.

Dominion Response:

A check has been incorporated into the normal reload design and safety analysis process to confirm that the ELAP reactivity analyses remains bounding for new cycle designs. A simple statepoint check has been incorporated into the North Anna section of the Dominion standard for the Reload Safety Analysis - Overview. The appropriate statepoint for a reload core is the calculated boron concentration required for a 1% shutdown margin (SDM) at the conditions of end-of-cycle (EOC), all control rods in (ARI), no xenon, and at 290 psig steam pressure (~419°F RCS cold leg temperature). The corresponding statepoint value determined from the ELAP reactivity analysis, Calculation MISC-11788, is 131 ppm. Any significant increase from the statepoint value of 131 ppm would initiate a more detailed evaluation to determine the time at which boron addition would be required to maintain a 1% SDM considering time-dependent xenon reactivity. The current ELAP reactivity analysis reference value is 37 hours for this statepoint. Any time less than 37 hours would have to be justified through consideration of the margin available based on the RCS make-up strategy.

ISE CI 3.2.1.9.A

Confirm that the licensee provides sufficient BDB RCS Injections Pumps to conform to the spare capability (N+1) guidance of NEI 12-06, Section 3.2.2.

Dominion Response:

Two BDB RCS Injection pumps are sufficient to comply with the guidance of NEI 12-06, Section 3.2.2. If one of the two pumps stored in the on-site BDB Storage Building is inoperable, the operable pump may be used to supply RCS inventory makeup from either Refueling Water Storage Tank (RWST) to both units by alternating RCS injection between the units.

In this configuration, the RCS Injection pump would discharge to the alternate RCS Injection connection located in the Hydrogen Recombiner Vault so that the single pump can supply borated water to either unit through valve manipulation of the charging system cross-tie piping. Flow is alternated between Unit 1 and Unit 2 by manually operating the normal charging headers cross-tie valves. Components in this CVCS flow path are safety-related, seismically constructed/mounted and located in missile protected facilities. Once aligned, the transfer of flow from one unit to the other is controlled by two manual valves, one for each unit. Flow to the reactor coolant system will be through the Cold Leg injection path via the Boron Injection Tanks (BITs).

RCS injection would begin with the BDB RCS Injection pump supplying makeup to the unit with the lower indicated RCS inventory for approximately 1 hour, starting no later than 15 hours from the onset of ELAP. One hour of RCS inventory addition at rated BDB RCS Injection pump flow rate (45 gpm) recovers more than 2 hours of RCP seal leakage at the maximum assumed Westinghouse seal leakage rate. The BDB RCS Injection pump would then be used to supply makeup to the opposite unit for approximately 1 hour.

The alternating RCS injection process would be repeated until either: 1) RCS level was indicated in the pressurizer(s), or 2) a replacement RCS Injection pump was received from the NSRC (approximately 28 hours from the onset of the ELAP condition) and deployed for RCS makeup for one of the two units.

[Note: Refer to the response to Safety Evaluation Review Item #8 for a discussion of this scenario with no RWSTs available.]

ISE CI 3.2.1.9.B

Confirm that calculations documenting the AFW supply, SFP makeup, and RCS inventory hydraulic analysis demonstrate the pumps have adequate capacity for the strategies they support.

Dominion Response:

Calculation ME-0966, "BDB High Capacity Pump and BDB AFW Pump Hydraulic Analysis for Spent Fuel Pool Makeup and AFW Injection at NAPS Units 1 and 2," Revision 0 documents the hydraulic analysis of the BDB High Capacity pump and the associated hoses and installed piping systems to confirm that the BDB High Capacity pump minimum flow rate and head capabilities exceed the FLEX strategy requirements for AFW supply and SPF makeup. Calculation ME-0965, "Evaluate the BDB High Head Injection pump for Beyond Design Basis (BDB) at the primary and alternative supply locations in Modes 1-4 and the BDB AFW Pump in Modes 5 and 6," Revision 0, documents the hydraulic analysis of the BDB RCS Injection pump with the associated hoses and installed piping systems to confirm that the BDB RCS Injection pump minimum flow rate and head capabilities exceed the FLEX strategy requirements for maintaining RCS inventory and controlling reactivity. Calculations ME-0966 and ME-0965 have previously been provided to the Staff and are available for their review.

ISE CI 3.2.2.A

SFP venting – Confirm that opening of the roll-up doors would provide an adequate ventilation path for the SFP area.

Dominion Response:

The Fuel Building and the adjoining Decontamination Building have several large roll-up doors that when opened would allow significant airflow through the Fuel Building with no fans operating.

The Southeast section of the Fuel Building (South wall of the New Fuel Area Enclosure area), has an 18' wide by 16' high roll-up door (1-BLD-DR-FA71-3) which opens to the outside. Approximately 65' north of this door, there is an 18' wide by 20' high roll-up door (1-BLD-DR-F72-2) between the New Fuel Area Enclosure and the main Fuel Building area. Both of these doors are at grade elevation (271') and when open establish a direct path of outside air to the lower level of the main Fuel Building.

In the Southwest corner of the Decontamination Building at elevation 291', there are two 15' wide by 40' high rolling steel doors in series (1-BLD-DR-D91-2, 1-BLD-DR-D91-3). The first door connects the Fuel Building to the Decontamination Building; the second door connects the Decontamination Building to the outside. Together these doors, when open, establish a direct path from the upper portion of the main Fuel Building to the outside.

Opening these roll-up doors in accordance with procedures provides a direct path for air to flow into the Fuel Building at elevation 271', over the SFP, and outside through the doors at the 291' elevation. Given the elevation difference between the mid-points of openings (approximately 30') and large open area (minimum opening of approximately 290 ft2), these open roll-up doors would allow significant natural circulation airflow through the Fuel Building and provide an adequate ventilation path for the SFP area.

In Attachment 5 of the North Anna Onsite Audit Report, Dominion was requested to "Provide SFP area habitability analysis and/or hose deployment strategy." The response to that request is as follows:

> A bounding estimate of the airborne contamination in the Fuel Building following an ELAP event has been performed and is documented in ETE-CPR-2012-0012, Revision 5. The evaluation concluded that the expected maximum level of airborne contamination in the Fuel Building following an ELAP / loss of SFP cooling event would not prevent implementation of any BDB FLEX strategies for SFP inventory makeup and cooling. Therefore, deployment of hoses inside the Fuel Building at a time beyond 24 hours is acceptable. A copy of ETE-CPR-2012-0012, Revision 5 has previously been provided to the NRC staff and is available for their review.

ISE CI 3.2.3.A

Containment – Confirm containment analysis to determine any containment temperature and pressure actions beyond 7 days.

Dominion Response:

Overall Integrated Plan (OIP) Open Item No. 4 was completed and documented as "Complete" in the Six-Month Status Update letter dated February 27, 2014 (SN: 12-162E). Section 4c and Attachment 2 of the update letter provided the Containment cooling strategy.

Calculation MISC-11793, Revision 0, "Evaluation of Long-Term Containment Pressure and Temperature Profiles Following an Extended Loss of AC Power (ELAP)," is a conservative analysis, which concluded that Containment temperature and pressure response will remain below design limits following an ELAP event and that key parameter instrumentation subject to the Containment environment will remain functional for at least seven days.

As described in Chapter 5 of ETE-CPR-2012-0012, Revision 5, multiple Containment cooling methods are available as options to remove heat from Containment in order to maintain the Contatinment temperature within the equipment design limits, However, these methods are not required to be specifically designated as primary and alternate strategies since they are Phase 3 actions and occur many days following the ELAP event. Adequate time is available utilizing onsite personnel resources and equipment received from the NSRC to deploy and implement the various Containment cooling methods described.

In documenting the closure for OIP Open Item No.4, it was indicated that OIP Open Item No. 5 would encompass the thermal and hydraulic calculations which would determine the adequacy of any containment temperature and pressure reduction actions beyond 7 days, if any. Calculation ME-12126, Revision 0, "FLEX Beyond Design Basis (BDB) Service Water (SW) Containment Integrity Strategy Hydraulic Analysis," was completed and has confirmed that the SW flows available based on NSRC supplied pumps for Containment cooling options are adequate. OIP Open Item No. 5 was subsequently closed in the August 2014 Six-Month Status Report.

Copies of ETE-CPR-2012-0012, Revision 5, Calculation MISC-11793, Revision 0 and Calculation ME-12126, Revision 0 have previously been provided to the NRC staff and are available for their review.

ISE CI 3.2.4.2.A

Ventilation – Equipment Cooling – Confirm development of the ventilation strategy.

Dominion Response:

The commitment for Overall Integrated Plan (OIP) Open Item No. 13 for North Anna, was to provide details of the ventilation strategy that conform to the guidance given in NEI 12-06. This information was provided and documented as "Complete" in the Six-Month Status Update letter dated February 27, 2014 (SN: 12-162E). Attachment 2 of the update letter provided the ventilation strategy for North Anna following an ELAP event. Calculation ME-0972, Revision 0, Addendum A, "Evaluation of Room Air Temperatures Following Extended Loss of AC Power (ELAP)," supporting the North Anna Unit 1 and 2 ventilation strategies has previously been provided to the NRC staff and is available for their review.

In Attachment 5 of the North Anna Onsite Audit Report, Dominion was requested to "Provide the analysis assumptions for the actions specified in the FSGs." The response to that request is as follows:

The ventilation actions specified in FSG-5, "Initial Assessment and FLEX Equipment Staging," Step 7 involve the following:

1. Blocking open the doors to the Turbine Driven Auxiliary Feedwater (TDAFW) pump room in each unit,
2. Establishing natural circulation ventilation in the Fuel Building,
3. Establishing battery room exhaust fans when battery charging is initiated
4. Opening of equipment room doors, energized cabinet doors, and deployment of portable fans.

FSG-5 has previously been provided to the NRC staff and is available for their review.

1. Regarding the basis for blocking the TDAFWP Rooms open, Section 13 of Calculation ME-0972, Revision 0, Addendum A indicates:

   "The bulk air temperature in the TDAFWP room will remain below 120 °F (119.4 °F as noted in Section 11) during an ELAP event, providing the room door to the outside is opened within approximately 4 hours. Note that the NUMARC method does not credit the heat sink effect of the floor or other steel in the room. The analysis also does not credit the effect of opening the supply and exhaust ventilation dampers."

   Sections 8 and 9 of Calculation ME-0972, Revision 0, Addendum A list all of the design inputs and analysis assumptions, respectively. Calculation ME-0972, Revision 0, Addendum A, has previously been provided to the NRC staff and is available for their review.

2. Regarding the basis for natural circulation in the Fuel Building, no analysis was performed since, by engineering judgment, the configuration of Fuel Building doors would be more than sufficient to support natural circulation ventilation through the structure. The response to NAPS ISE CI 3.2.2.A provided the door sizes, locations, and elevations of the doors to be opened by Attachment 2 of FSG-5 (per Step 7). Additionally, during the May 2014 NRC Onsite Audit the Fuel Building area was walked down and the ventilation path was identified.

3. Regarding the use of the battery room exhaust fans, no analysis was performed since the exhaust fans are required to be running in their normal plant configuration prior to energizing the battery chargers. The temperature and hydrogen considerations for the battery rooms have been addressed in the responses to ISE CI 3.2.4.2.B

4. Regarding the statements for opening equipment room doors, energized cabinet doors, and deployment of portable fans, calculation ME-0972 concluded that opening doors and cabinets in the Main Control Room and Emergency Switchgear Room would not be required. This conclusion was based on GOTHIC analyses of these areas with no ventilation or cooling, coincident with loss of the heat load during an ELAP. The ventilation strategy for North Anna was provided for staff review in Attachment 2 to the second Six-Month Status Report dated February 27, 2014. In the ventilation strategy it was identified that, for the purpose of defense in depth, area temperatures would be monitored and opening doors and the use of portable fans were available options.

ISE CI 3.2.4.2.B

Confirm the adequacy of the battery room ventilation provided in the context of an ELAP.

Dominion Response:

North Anna Units 1 and 2 are designed with four battery rooms for each unit. Two battery rooms are partitioned in each Emergency Switchgear Room (ESGR) at elevation 254'. The normal ventilation for these battery rooms is provided by recirculation of air via a small exhaust fan on the top of the battery room which pulls air from the ESGR via an inlet near the floor and exhausts the air back into the ESGR. The other two battery rooms are located in each Cable Tray Spreading Room at elevation 294'. These rooms are above each Main Control Room (MCR). The normal ventilations for these battery rooms is provided by recirculation of air via a small fan in the battery room which pulls air from the MCR ceiling level and exhausts the air back into the MCR via an inlet near the floor. The fire dampers in the inlet and exhaust openings for both of these battery room locations remain open on loss of power or during a design basis accident. Explicit modeling of the four battery rooms is not necessary since during battery discharge in Phase 1 of the ELAP scenario the exhaust fans are not operating and the heat addition internal to the battery rooms from the batteries is negligible. During Phase 2 when power is available to the battery chargers and the ventilation fans are running, the rooms would essentially be in equilibrium with the areas associated with the recirculation paths, either the MCR or the ESGR. There are no significant heat loads in the battery rooms and heat from the batteries during re-charging is minimal. Since FSG-4 requires the battery room fan to be operating before starting the chargers, the battery room ventilation will be in its normal configuration, therefore, also accounting for the generation of hydrogen during charging. The battery chargers are located in the ESGR and their heat loads were accounted for in Calculation ME-0972, Revision 0, Addendum A, "Evaluation of Room Air Temperatures Following Extended Loss of AC Power (ELAP)." The calculation shows that the expected loss of ventilation transient temperatures in the sources of suction for the battery room ventilation systems (i.e., the ESGR and CR) are expected to remain below 120°F indefinitely. The impact of extreme low temperatures is not expected to be significant due to the continuous connection with the CR and ESGR spaces and the heat storage capacity of the battery room concrete walls/floors/ceilings. However, if decreasing battery room temperatures become a concern, the FSG procedures provide for the use of portable heating equipment. A copy of FSG-4 and calculation ME-0972, Revision 0, Addendum A have previously been provided to the NRC staff and are available for their review.

ISE CI 3.2.4.4.A

Verify the lighting study validates the adequacy of supplemental lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions.

Dominion Response:

In order to validate the adequacy of supplemental lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions, an evaluation of the tasks to be performed and the available lighting in the designated task areas was completed. The results are documented in Section 10.5 of ETE-CPR-2012-0012, Revisioin 5, "Beyond Design Basis Overall Integrated Plan Basis Document." Tasks evaluated included traveling to/from the various areas necessary to implement the FLEX strategies, making required mechanical and electrical connections, performing instrumentation monitoring, and component manipulations. Battery Powered (Appendix "R") emergency lights were determined to provide adequate lighting for all primary connection points in the BDB Strategies including the illumination for all interior travel pathways needed to access the connection points. These emergency lights are designed and periodically tested to insure the battery pack will provide a minimum of 8 hours of lighting with no external AC power sources. Prior to the depletion of the Appendix "R" lighting units, portable battery powered Remote Area Lighting Systems (RALS) would be deployed to support the FLEX strategy tasks. These RALS's are rechargeable LED lighting systems designed to power the LED lights for 7 hours at 6000 Lumens and 40 hours at 500 lumens. In addition to installed Appendix "R" lighting, and the stored RALSs and portable light plants, the BDB storage building includes a stock of flashlights and head lights to further assist the staff responding to a BDB event during low light conditions.

There are no emergency lighting fixtures in the yard outside of the protected area to provide necessary lighting in those areas where portable BDB equipment is to be deployed. Therefore, the diesel powered pumps and generators are outfitted with light plants that are powered from their respective diesels to support connection and operation. In addition to the lights installed on the portable BDB equipment, portable light plants are included in the FLEX response strategies. These portable diesel powered light plants can be deployed from the BDB Storage Building as needed to support night time operations.

A copy of ETE-CPR-2012-0012, Revision 5 has previously been provided to the NRC staff and is available for their review.

ISE CI 3.2.4.4.B

Communications - Confirm the licensee's proposed enhancements and interim measures to the site's communications systems and that they have been completed.

Dominion Response:

The study documenting the communications strategy has been completed. Subsequently, Overall Integrated Plan (OIP) Open Item No. 18 was documented as "Complete" in the Six-Month Status Update letter dated February 27, 2014. The study concluded that FLEX strategies can be effectively implemented with a combination of sound powered phones, satellite phones and hand-held radios. Although the overall communications plan has not changed, the details regarding the components to be used and the number of components have continued to evolve. At this time, the quantity of components needed to implement the communications strategy has been determined to be 20 satellite phones, 30 hand held radios, and 10 additional, dedicated sets of sound powered phone headsets and extension cords. Distribution of the satellite phones includes the Control Room (CR), the Technical Support Center (TSC), Security, Health Physics Survey Teams, and the surrounding county Offsite Response Organizations (OROs). The hand held radios are for command and control of the FLEX mitigating strategies and include 10 spare radios and 3 batteries per device.

The CR and TSC satellite phones are installed "desk set" units which required a plant Design Change to be installed. Design Change NA-14-01077 installed these satellite phones. The antennae setup will be a deployable system with fiber optics cable from the inside "desk sets" to outdoor portable dish antennae. Handheld satellite phones are available and adequate for initial notifications. This portion of the communications strategy is intended to suffice for approximately the first 6 hours.

Once augmented staff arrives on site, a mobile communications trailer designed to handle both satellite voice and data traffic, as well as to function as a radio repeater to enhance on-site communications, will be deployed from the BDB Storage Building. The final communications strategy has been completed and is detailed in ETE-CPR-2013-003, Revision 2. Copies of ETE-CPR-2013-0003, Revision 5 and Design Change NA-14-01077 have previously been provided to the NRC staff and are available for their review.

In response to an additional question received during the May 2014 NRC Onsite Audit regarding the connections for the "desk set" satellite phones, the following detail is provided:

Design Change NA-14-01077 installed the communications infrastructure in the plant required to ensure availability of off-site communications. Three satellite phones, a Cisco network switch, and one UPS were installed in the Unit 1 Computer Room. Four satellite phones and a Cisco network switch are stored in the TSC Computer Room. The portable satellite dish for deployment outdoors is permanently stored in the TSC HVAC Room.

ISE CI 3.2.4.8.A

Electrical Power Sources – Confirm load calculations for the phase 2 and 3 FLEX generators will support supplied loads.

Dominion Response:

The North Anna Phase 2 load calculations for the 120 VAC and the 480 VAC diesel generators (DGs), for Unit 1 (Calculation EE-863) and Unit 2 (Calculation EE-865) confirm the BDB portable DGs are sized properly to support the required BDB loads. Additionally, the calculations include the determination of the corresponding cable ampacity rating along with the breaker settings and coordination with the North Anna system components.

The North Anna Unit 1 and 2 Phase 3 load calculation for the 4kV NSRC generator rating and power cable ampacity rating (Calculation EE-871) confirm that 2 1MW NSRC EDGs are adequate to properly support the required BDB Phase 3 loads. Initially, calculation EE-871, was going to incorporate information regarding the breaker settings and coordination with the NAPS systems once the NSRC 4kV DG information/specs became available. However, it was later determined that this revision was not required because the 4 kV generators are not needed for several days following an ELAP event and at that time, sufficient time and engineering resources will be available to address this interface. Also, a breaker coordination study was not needed because, in addition to the existing NAPS system electrical protection schemes, the NSRC generators and distribution panel are protected by breakers that are sufficiently sized and tested to provide both equipment and personnel safety. If a fault occurs, the existing system/component breaker should trip. In the unlikely event that the NSRC breaker at the 4kV distribution panel would trip before the existing faulted system/component breaker, the fault would be located and isolated, the NSRC breaker would be reset, and the NSRC breaker would be adjusted if necessary to provide appropriate coordination with the existing plant breakers. NSRC personnel will be available to provide technical expertise to Dominion personnel during the startup and operation of the 4kV generators. Any coordination interface issues could be promptly addressed at that time.

Copies of Calculations EE-863, EE-865, and EE-871 have previously been provided to the NRC staff and are available for their review.

During the May 2014 NRC Onsite Audit, Dominion was requested to provide additional information regarding potential derating of the portable DGs due to high ambient temperatures. The response to this request is as follows:

> Performance data tables for altitude and temperature for both the 120/240 VAC and 480 VAC DGs shows no derating at elevations corresponding to the North Anna site elevation and for temperatures up to 120 Deg °F. Therefore, the 120/240 VAC and the 480 VAC diesel generator loading calculations for North Anna did not address derating due to high ambient temperatures. The vendor supplied performance data

showing no derating at the elevation corresponding to the North Anna site and for temperatures up to 120 Deg °F for the 480 VAC DGs is shown in Attachment 13.5 of Calculation EE-0863, Revision 2. This information is typical of both the 120/240 and 480 VAC DGs.

The 120/240 VAC DGs have approximately 20% margin between the maximum loads and the generator design capacity and the 480 VAC DGs have approximately 45% margin between the maximum loads and the generator design capacity. Therefore, margin is available in the generator sizing to accommodate potential derating concerns.

ISE CI 3.2.4.9.A

Fuel Supplies – Confirm the adequacy of the fuel consumption evaluation. Confirm that the procedural guidance governing re-fueling strategies addresses: (a) how the quality of the fuel oil and gasoline supplies will be controlled in order to ensure proper diesel or gasoline-powered FLEX equipment operation, (b) available sources of gasoline and how those sources will be protected to ensure availability following a BDB event, and (c) if the onsite fuel capacity provides an indefinite supply of fuel or if the RRC is capable of providing an indefinite, ongoing supply of fuel (both diesel and gasoline).

Dominion Response:

The BDB FLEX equipment includes a refueling tank truck. This truck is stored in the fully protected FLEX Storage Building and is used to refuel diesel fueled BDB event response equipment. This refueling truck has a capacity of 1100 gallons and is maintained approximately 80% full (880 gal). The tank truck is equipped with necessary pumps, hoses, meters and valve necessary to fill the truck and refuel the BDB equipment. The re-fueling strategy (sources, frequencies, locations, etc.) is directed as part of the FSGs. All of the key BDB equipment (generators, pumps, vehicles, etc.) is maintained with full tanks of fuel. This strategy helps protect the equipment from moisture accumulation in the fuel and corrosion of the fuel tanks. In addition, this strategy will facilitate the prompt deployment and placing the BDB equipment in service following a BDB external event. Preventative maintenance will be performed to sample, condition and/or replace the fuel in all of the BDB equipment to insure proper fuel conditions are maintained for equipment operation.

The refueling tank truck is equipped with an on-board Blackmere TDA 2A pump driven from the truck's PTO. This pump is used for filling the truck as well as refueling the BDB Equipment. The pump has a variable flow rate adjustment with a max capacity of > 50 GPM. The truck is also equipped with 125 ft. of 1" discharge hose and line nozzle for refueling operations. It is expected the truck can be filled in approximately 20 minutes. The fuel truck can be refilled from any of the three diesel fuel sources identified in Section 10.7.1 of ETE-CPR-2012-0012, Revision 5, "Beyond Design Basis Overall Integrated Plan Basis Document" using the fuel truck's on-board fuel oil pump. Two of these diesel fuel sources are protected for all of the BDB hazards. A copy of ETE-CPR-2012-0012, Revision 5 has previously been provided to the NRC staff and is available for their review.

The table below identifies the components and fuel requirements to support the FLEX strategy implementation. Not all of the BDB equipment listed below (which includes the N+1 equipment) would be required and operating simultaneously at full load during a BDB external event response. However, using a conservative combined fuel consumption rate of 120 Gal/hr, the refueling tank truck has sufficient capacity to support continuous operation of the major BDB equipment expected to be deployed and placed into service following a BDB external event. At this conservative fuel consumption rate, the two protected 45,000 gallon underground Fuel Oil Storage Tanks, which are protected for BDB hazards, have adequate capacity to provide the on-site BDB equipment with diesel fuel for >30 days. The NSRC will also be able to provide diesel fuel for diesel operated equipment thus providing additional margin.

The diesel fuel consumption information above does not include the large 4KV generators to be received from the RRC. More than adequate diesel fuel is available onsite for these generators if the partially protected above ground 275,000 gallon Fuel Oil Storage Tank is available. If it is not, provisions for receipt of diesel fuel from offsite sources would be necessary prior to implementing the Phase 3 re-powering strategy with the 4Kv diesel generators.

The BDB external event response strategy includes a very limited number of small support equipment that is powered by gasoline engines (chain saws, chop saws and small electrical generator units). These components will be re-fueled using portable containers of fuel. Gasoline fuel will be obtained from the station's two (2) 8,500 gal underground gasoline fuel storage tanks or from private vehicles on site. Gasoline Fuel sources are discussed further in section 10.7.1 of ETE-CPR-2012-0012, Revision 5, "Beyond Design Basis Overall Integrated Plan Basis Document".

North Anna BDB Equipment Diesel Fuel Consumption Evaluation				
Component	**Tank Capacity**	**Max. Fuel Usage Rate**	**Min. Run Time w/Full Tank**	**Tank Construction**
BDB AFW Pump #1	275 Gal	10.9 Gal / Hr	24 hrs	Double Wall
BDB AFW Pump #2	275 Gal	10.9 Gal / Hr	24 hrs	Double Wall
BDB AFW Pump #3	275 Gal	10.9 Gal / Hr	24 hrs	Double Wall
BDB RCS Injection Pump #1	300 Gal	7.75 Gal / Hr	24 Hrs	Double Wall
BDB RCS Injection Pump #2	300 Gal	7.75 Gal / Hr	24 Hrs	Double Wall
BDB High Capacity* Pump #1 (Godwin HL130M)	500 Gal	14.3 Gal / Hr	30 Hrs	Double Wall
BDB High Capacity Pump #2 (Godwin HL5M B.5.b pump)	175 Gal	11.7 Gal / Hr	15 Hrs	Double Wall
Diesel Fire Pump*	220 Gal	13.2 Gal / Hr	16.5 Hrs	Single Wall

North Anna BDB Equipment Diesel Fuel Consumption Evaluation				
Component	**Tank Capacity**	**Max. Fuel Usage Rate**	**Min. Run Time w/Full Tank**	**Tank Construction**
480 VAC Gen #1	500 Gal	28.4 Gal / Hr	17 Hrs	Double Wall
480 VAC Gen #2	500 Gal	28.4 Gal / Hr	17 Hrs	Double Wall
480 VAC Gen TSC**	500 Gal	28.4 Gal / Hr	17 Hrs	Double Wall
120 VAC Gen #1	100 Gal	4.2 Gal / Hr***	24 Hrs	Double Wall
120 VAC Gen #2	100 Gal	4.2 Gal / Hr***	24 Hrs	Double Wall
120 VAC Gen #3	100 Gal	4.2 Gal / Hr***	24 Hrs	Double Wall
John Deere – M6125 Tractor	58 Gal	Varies	Varies	Single Wall
John Deere – M6125 Tractor	58 Gal	Varies	Varies	Single Wall
John Deere – Utility Vehicle (Gator)	6 Gal	Varies	Varies	Single Wall
Caterpillar 924 loader	60 Gal	Varies	Varies	Single Wall
Fuel Truck	40 Gal	Varies	Varies	Single Wall
Fuel Truck Tank	880 Gal	N/A	N/A	Single Wall
Communications Trailer (COW)	32 Gal	0.4 Gal/Hr	80 Hrs	Single Wall
Light Plant #1	30 Gal	0.3 Gal/Hr	> 3 days	Single Wall
Light Plant #2	30 Gal	0.3 Gal/Hr	> 3 days	Single Wall

* Diesel Driven Fire Pump is bounded by the operation of the BDB High Capacity pump.

** Optional- Not FLEX credited equipment.

*** Estimated from run time specification.

ISE CI 3.4.A

Confirm the implementation of considerations 2 through 10 in NEI 12-06, Section 12.2.

Dominion Response:

Considerations 2 through 10 in Section 12.2 of NEI 12-06 are, in general, considerations applicable to the third party organization handling the Phase 3 portion of the FLEX Mitigating Strategies. This organization, SAFER, has prepared a White Paper addressing these 9 considerations. This White Paper was formally transmit to the NRC for endorsement on September 11, 2014, (ADAMS Accession No. ML14259A222), and endorsed by the NRC by letter dated September 26, 2014 (ADAMS Accession No.ML14265A107).

Licensee Identified OI 10

The Dominion Nuclear Training Program will be revised to assure personnel proficiency in the mitigation of BDB events is developed and maintained. These programs and controls will be developed and implemented in accordance with the Systematic Approach to Training (SAT).

Dominion Response:

FLEX Support Guidelines (FSGs) have been developed to provide guidance to Operations personnel for implementing new FLEX strategies and operating new FLEX equipment necessary to mitigate the consequences of beyond-design-basis external events (BDBEE). Dominion Nuclear Training used the SAT process to review the draft FSGs and identified that there were new tasks that were required to be performed by operations personnel. Consequently, the SAT process was used to perform a Job Analysis of these new operational tasks utilizing the FSGs.

The results of the Job Analysis for the new operational tasks were presented and approved by the Operations Curriculum Review Committee. The new operational tasks have been integrated into the Initial and Continuing Operations Training Programs. For example, the Nuclear Control Room Operator Development Program (NCRODP) Program Guide has been updated to include the new tasks.

The completed Job Analysis Worksheets and a copy the NCRODP Program Guide have previously been provided to the NRC staff and are available for their review.

Licensee Identified OI 11

Complete the evaluation of TDAFW pump long term operation with < 290 psig inlet steam pressure.

Dominion Response:

TDAFW pump operation and adequate AFW flow to the steam generators (SGs) at SG pressures < 290 psig has been confirmed by Calculation ME-0968, Revision 0, "Evaluation of the TDAFW Pump Performance at Low Steam Generator Pressures," August 2013. A copy of Calculation ME-0968, Revision 0 has previously been provided to the NRC staff and is available for their review.

Licensee Identified OI 12

Plant modifications will be completed for permanent plant changes required for implementation of FLEX strategies.

Dominion Response:

The plant modification design changes (DCs) implemented in support of the FLEX strategies for Unit 2 compliance, including Spent Fuel Pool Level Instrumentation, are as follows:

Unit 2 Modifications: FLEX Mechanical Connections (NA-12-00066), FLEX Electrical Connections (NA-13-01018), Quench Spray (QS) Piping Connection (NA-13-00081), Primary Grade Water Tank Mechanical Connection (NA-13-00084), Power Feeds to Support Pre-Stage 120VAC Generators (NA-13-00088), and Condenser Hotwell Connections (NA-14-00035).

Modifications common to both Units 1 and 2: Spent Fuel Pool Mechanical Connections (NA-12-01218), Alternate RCS Injection Connection (NA-13-00085), Alternate Auxiliary Feedwater (AFW) Connection (NA-13-00083), Service Water Mechanical Connection (NA-13-00090), Concrete Pads and Grounding Connection for Pump Draft Locations (NA-14-00027), BDB Storage Building (NA-13-00061), BDB Offsite Communications (NA-14-01077), and Spent Fuel Pool Level Instrumentation (NA-13-01043).

Copies of these DCs have previously been provided to the NRC staff and are available for their review.

Safety Evaluation item 1

Feb 2014 Update Section 4a. Portable 120/240VAC DG will now be pre-staged.

Dominion Response:

Attachment 1, Item 4a, of the Six Month Status Update letter dated February 27, 2014 [ML14069A009] revised the strategy for repowering key instrumentation by pre-staging the BDB portable 120/240 VAC diesel generator. This strategy change was not required, but was proposed to facilitate the connection of the 120/240 VAC generators in a timely manner. Since the pre-staged 120/240 VAC generators were not fully protected against BDB External Event hazards, it has always been the case that either the backup 120/240 VAC generator or the alternate 480 VAC generator were available in the protected BDB Storage Building and were capable of being deployed and connected prior to the depletion of the station batteries at 8 hours following the onset of the ELAP event.

However, it was recently determined that pre-staging the generators in the alleyways adjacent to the Units 1 and 2 Service Buildings resulted in a fire safety issue due to the concern that the generator would contain approximately 100 gallons of diesel fuel and could not be positioned to meet the required safe distance requirements applicable at North Anna.

Therefore, the re-powering strategy using the 120/240 VAC diesel generators has reverted back to the original proposed strategy presented in the February 2013 OIP. Specifically, the 120/240 VAC diesel generators will be stored in the BDB Storage Building and are capable of being deployed and connected prior to the depletion of the station batteries at 8 hours following the onset of the ELAP event.

Additionally, the North Anna Onsite Audit Report, Attachment 5, requested Dominion to: "Provide time validation study results confirming equipment can be deployed, staged, connected to the electrical distribution system, and supply power to the loads within the times assumed in the licensee's overall integrated plan." This NRC request is addressed as follows:

The time validation for transporting and setting up the 120/240 VAC Diesel Generators (DGs) has been completed for North Anna and is documented in ETE-CPR-2014-1004, "North Anna Power Station Beyond Design Basis FLEX Validation for Time Sensitive Actions (TSA's)." As documented in the validation ETE, the time to transport and place the generators was validated separately from the connection and startup of the DG. Validation was performed for both units and was assumed to start 3 hours following the ELAP. This includes the 1 hour delay for declaration of the ELAP and a 2 hour period for debris removal.

The transport time assumed travel from the station to the BDB Storage Building, the connection of the DG to the tow vehicle, transport of the DG to its deployment location, and placement of the DG at the deployment location. The resulting validation times were 0.7 hours and 0.75 hours for Units 1 and 2, respectively.

The connection/setup validation included routing and connection of the 120 VAC cables and simulation of the DG startup per FSG-4, Attachments 4 and 5. Again, both units were validated separately with the results being 0.75 hour and 0.9 hours for Units 1 and 2, respectively.

The connection/setup for the first DG would begin following completion of its deployment and coincident with the transport and placement of the second generator. Considering the longest transportation time (0.75 hours) and the longest connection/setup time (0.9) hours, the time required to deploy and connect both the Unit 1 and 2 120 VAC DGs would be approximately 2.40 hours.

These times, combined with the initial 1 hour delay prior to the declaration of an ELAP and the two hour debris removal period, demonstrate DG availability for both units can be achieved in less than 5.5 hours providing a minimum 2.5 hour margin until depletion of the station batteries.

FSG-4 and a copy of ETE-CPR-2014-1004 have previously been provided to the NRC staff and are available for their review.

Safety Evaluation Item 4

2. *(Westinghouse Standard RCP Seals: NSAL-14-1) On February 10, 2014, Westinghouse issued Nuclear Safety Advisory Letter (NSAL)-14-1, which informed licensees of plants with standard Westinghouse RCP seals that 21 gpm may not be a conservative leakage rate for ELAP analysis. This value had been previously used in the ELAP analysis referenced by many Westinghouse PWRs, including the generic reference analysis in WCAP-17601-P. Therefore, please clarify whether the assumption of 21 gpm of seal leakage per RCP (at 550 degrees F, 2250 psia) remains valid in light of the issues identified in NSAL-14-1. In so doing, please identify the specifics of the seal leak off line design and #1 seal faceplate material relative to the categories in NSAL-14-1 and identify the corresponding presumed leakage rate from NSAL-14-1 that is deemed applicable.*

Dominion Response:

Westinghouse issued a Nuclear Safety Advisory Letter, NSAL-14-1, which concluded that based on Westinghouse RCP Seal leakoff line configuration, the previously assumed value of 21 gpm following a loss of seal cooling event could be non-conservative. The NSAL determined that for four potential seal configuration cases based on seal type, seal leakoff line piping size and length, and flow orifice size, the seal leakage rates vary. Based on a review of North Anna's seal leakoff configuration, the NSAL Case 2 represents the NAPS RCP seal design for those pumps with Westinghouse seals (i.e., No. 1 seal faceplate material made from Silicon Nitride (Si_3N_4), greater than 3/4" leakoff lines, and a 3/8" diameter flow orifice). The estimated leakage from this configuration per the NSAL is 24 gpm, which is greater than the 21 gpm currently assumed in the reference analysis. For Unit 2, 2 of 3 Westinghouse RCP seals have been replaced with the Flowserve N-9000 low leakage seals. By the full compliance date for Unit 1 (4/1/15), at least 2 of the 3 Westinghouse RCP seals will have been replaced with Flowserve N-9000 low leakage seals. Therefore, the expected maximum RCP seal leakages would also be around 65% of the value assumed in the reference analysis. Maximum total RCP seal leakage (all three pumps) is therefore expected to be around 65% of the value assumed in the reference analysis. These seal configurations account for the increased potential leakage in the remaining Westinghouse seal identified in NSAL-14-1. Therefore, the assumptions for the total RCP seal leakage rate in the analysis remain bounding for NAPS Units 1 and 2.

In response to NSAL 14-1, the Pressurized Water reactor Owner's Group (PWROG) has documented leakage rates for Westinghouse RCP Original Equipment Manufacturer Seals in PWROG-14015, Revision 1. The initial leakage information consisted of three points: initial leakage at normal operating temperature and normal operating pressure (NOT/NOP); peak leakage at 1500 psia; and leakage at the cooled-down, depressurized conditions. Additional studies have been completed that demonstrate the reasonableness of the linear assumptions between points, the peak leakage, and the effect of minimal subcooling.

Leakage values have been incorporated in ETE-NAF-2012-0150, Revision 2 that calculates the estimated time for the onset of reflux cooling in order to validate the time RCS makeup should be initiated for North Anna Units 1 and 2. The estimated time to reach reflux cooling for Unit 2 is 17.6 hours. The margin to the established time of 16 hours for the implementation of the RCS makeup is 1.6 hours for Unit 2 with two Flowserve seals.

Copies of PWROG-14015, Revision 1 and ETE-NAF-2012-0150, Revision 2 have previously been provided to the NRC staff and are available for their review.

Safety Evaluation Item 8

Please provide adequate basis that, when considering mixing time, there is sufficient flow capacity to support borated makeup to both units from a single RCS makeup pump taking suction from a portable batching tank.

Dominion Response:

The ability to provide makeup to the RCS of both units using a single RCS Injection pump in conjunction with the on-site portable BDB Boric Acid Mixing Tanks (BAMTs) is a viable strategy with a reasonable amount of margin (>15%). The entry conditions of this scenario are that both RWSTs are unavailable, only one RCS injection pump is available, and both portable BAMTs from the BDB Storage Building are available. If one of the two BDB RCS Injection Pumps stored in the on-site BDB Storage Building is inoperable, the single operable RCS Injection pump may be used to supply RCS inventory makeup to both units by alternating RCS injection between the units. In this configuration, the RCS Injection pump would discharge to the alternate RCS Injection connection located in the Hydrogen Recombiner Vault so that the single pump can supply borated water to either unit through valve manipulation of the charging system cross-tie piping.

Flow is alternated between Unit 1 and Unit 2 by manually operating the normal charging headers cross-tie valves. Components in this CVCS flow path are Safety Related, seismically constructed/mounted and located in missile protected facilities. Once aligned, the transfer of flow from one unit to the other is controlled by two manual valves, one for each unit. Based on the location of the valves, it is reasonable to assume that the transfer of flow can be achieved within a 5 minute period. Flow to the RCS will be through the Cold Leg injection path via the Boron Injection Tanks (BIT's).

The borated water supply for the RCS Injection Pump would be the 1,000 gallon portable BAMTs deployed from the BDB Storage Building. The two portable BAMTs will be transported from the BDB Storage Building and positioned next to the BDB RCS Injection pump. Bags of boric acid crystals can be added to the portable BAMTs and mixed with dilution water from the BDB AFW pump or from the BDB High Capacity pump. Each 1,000 gallon batch of borated water would use 2½ 50 lb bags of dry boric acid to provide a boron concentration comparable to the RWST boron concentration of 2,600 ppm. The dry boric acid is added to a basket strainer at the top of the tank which enhances the dispersion of dry boric acid into the tanks. Dilution water to the BAMTs will be from one of the following sources, based on operating staff evaluation of availability and any competing demands (e.g., addition to the steam generators or spent fuel pool) and in the order of priority as listed:

- The Emergency or Main Condensate Storage Tanks (ECST / CST)
- The Primary Grade Water Storage Tanks 1-PG-TK-1A/1-PG-TK-1B
- The Condenser Hotwell 1/2-CN-SC-1A/B
- Lake Anna
- Fire Protection
- Service Water

Using the BDB AFW Pump (or the BDB High Capacity Pump), the fill time for a portable BAMT is less than 10 minutes (≤1,000 gallons at ≥100 gpm). Mixing is performed using a mechanical agitator (one available for each tank) powered by a portable 120 VAC generator. Mechanical agitation will prevent settling of undissolved acid particles below the tank outlet, therefore, complete dissolution of the acid in the tank is not necessary. Assuming a 15 minute mixing time, the complete cycle to prepare a 1,000 gallon batch of borated water with a concentration greater than the RWST is approximately 25 minutes (<10 minutes fill and 15 minutes mixing).

It is assumed only 90% of the BAMT volume is injected with each injection cycle. Injecting 900 gallons of borated water into the RCS at a rate of 45 gpm with the RCS Injection pump will take 20 minutes. The time remaining until the next batch is available (using the other tank and a 25 minute batch cycle) is 5 minutes. As previously stated, this is more than adequate time to re-align the two valves necessary to swap the injection feed to the opposite unit. Therefore, it is reasonable to credit 900 gallons of borated water makeup to each RCS every 50 minutes.

It is conservatively assumed that the borated water temperature in the BAMT is 90°F. At this temperature, the amount of borated water injected into the RCS over a 50 minute period is 7,474 lbm. If the loss of RCS inventory due to seal leakage is less than 7,474 lbm, then the RCS inventory will be increasing.

The following is an assessment of the RCS inventory loss due to seal leakage assuming the most conservative RCP seal configuration for North Anna which consists of 1 Westinghouse seal and 2 Flowserve seals for Unit 2. RCS makeup will commence no later than 16 hours after the onset of the ELAP event. This is well after the RCS cooldown and depressurization has been performed in accordance with ECA-0.0, which starts at 2 hours and will be take approximately 4 hours to complete. Therefore, RCP seal leakage at the initiation of the RCS makeup activity will be significantly reduced below its initial value. Based on conservative RCP seal leakage rates for a configuration of 1 Westinghouse seal and 2 Flowserve seals and the inclusion of a 1 gpm unidentified leakage rate, a total RCS leakage rate of 2.15 lbm/sec is assumed. This corresponds to a 6,450 lbm reduction of RCS inventory over a 50 min period from RCP seal leakage and unidentified leakage. As stated above, 900 gallons of borated water from the BAMT corresponds to approximately 7,476 lbm of RCS inventory makeup. This makeup mass is ~15% greater than the mass lost due to RCP seal leakage. Therefore, based on the most limiting configuration of installed seals, conservative RCP seal leak rates, and the time necessary to prepare and inject batches of borated water using the portable BAMTs, the RCS inventory for Unit 2 would be increasing at a rate of approximately 1,026 lbm every 50 minute period or an average of 1,230 lbm/hr.

The NRC requested Dominion to "evaluate the case when both units achieve full compliance in Spring 2015 using the latest seal leakage values." In this configuration, the Unit 2 seals would be as discussed above and the expected Unit 1 seal configuration would consist of 3 Flowserve seals. Calculation MISC-11788, Addendum B, "Investigation of Reactivity Control During Extended Station Blackout, North Anna Units 1 and 2 - Boric Acid Mixing/Batching Operations," examines the timing of mixing and batching of boric acid to support RCS injection during an ELAP with both North Anna units in full compliance status.

The leakage from the Unit 1 Flowserve seals (and 1 gpm of unidentified leakage) would be less than half of the evaluated Unit 2 seal leakage. The makeup mass from the BAMT is that same for both units; therefore, the RCS inventory for Unit 1 would be increasing at an average rate greater than twice that of Unit 2. In the event Unit 1 only replaces 1 Westinghouse RCP seal; then the Unit 1 configuration would be the same as the current Unit 2 configuration. This Unit 1 seal configuration (like Unit 2) would be acceptable for compliance with regards to maintaining sufficient flow capacity to support borated makeup to both units.

The following conclusions are drawn:

1. For the worst-case scenario of no RWST's and only 1 BDB RCS injection pump available, it is possible to batch and mix two portable tanks and inject them in a manner that keeps up with worst-case reactor coolant pump seal leakage in both units.

2. The time available to perform the operations is adequate. There is ~15% margin between integrated makeup and leakage for the highest leakage configuration (1 Westinghouse and 2 Flowserve seals) and ~145% margin on the lowest leakage configuration (all Flowserve seals).

3. The exact strategy, timing and sequencing of injection between units would depend on RCS leakage trends, which can be estimated by the operators using

available pressurizer and RVLIS level indications, as well as an assessment of available equipment.

Calculation MISC-11788, Addendum B, has previously been provided to the NRC staff and is available for their review.

Safety Evaluation item 11

Unprotected water sources in Modes 5 & 6

Dominion Response:

North Anna Power Station will abide by the Nuclear Energy Institute position paper entitled "Shutdown / Refueling Modes" addressing mitigating strategies in shutdown and refueling modes that is dated September 18, 2013 and has been endorsed by the NRC staff. The primary source of borated water for injection into the RCS is the RWST. Although, the RWSTs are not missile protected, credit as a borated water source was based on the assumption that it was improbable that both tanks would be destroyed by a single tornado. Subsequently, the strategy has been revised to address the scenario where both RWSTs are unavailable. The revised strategy includes the provision to utilize other non-borated onsite water sources with priority given to the highest quality sources first, as available. The prioritization of these non-borated sources is given in Section 2.2.1 of ETE-CRP-2012-0012, Revision 5. The constraint with this approach is that flow must be controlled in order to match the rate of water loss (due to boiling) so that dilution of the boron concentration in the RCS does not occur.

Guidance to prevent dilution of the boron concentration during RCS makeup in Modes 5 and 6 is contained in FSG-14. This FSG includes a prioritized list of water sources for RCS makeup water to the core. If a borated source is used, the RCS makeup flow rate must be equal to or greater than the minimum injection flow identified in the curve provided in Attachment 9 of FSG-14, Minimum RCS Flow Rate vs. Time After Trip. If a non-borated source is used, FSG-14 includes guidance that the RCS makeup flow rate must equal the minimum flow shown in the curve provided in Attachment 9.

Copies of ETE-CRP-2012-0012, Revision 5 and FSG-14 have previously been provided to the NRC staff and are available for their review.

Safety Evaluation Item 12

FLEX 120/480 VAC cable storage, testing, and maintenance.

Dominion Response:

Details on maintenance and testing and storage of 120v/240v pre-staged cables and the 480v cables stored in the BDB Storage Building are provided below.

Both the 120v/240v and 480v cables are inspected and tested on initial receipt. This includes:

- Visual inspection for damage or breakdown.
- Inspection of cord ends to ensure supplied dust caps are snug and in place and there is no internal damage.
- Performance of OHM measurement (continuity check) of each conductor.
- Performance of megger check between each current carrying conductor and the conductor to ground.
-

The 120v/240v pre-staged power cables will be stored on cable reels located in the Hydrogen Recombiner Control Panel Vault. Additional (spare) cables will be stored in the BDB Storage Building.

Periodic Maintenance procedures for BDB FLEX equipment have been reviewed against existing EPRI Templates in accordance with the Dominion Equipment Reliability Process. When the new EPRI template for the RCS injection pumps is issued, the guidance in the template will be reviewed and taken into consideration for incorporation.

In Attachment 5 of the North Anna Onsite Audit Report, the NRCstaff requested Dominion to provide additional input regarding the following: "The staff expects some periodic maintenance will be performed to uncover any degradation over time. Also address how the cables will be stored to prevent any damage as a result of an earthquake (i.e., anchored/secured to the floor or wall within a seismically protected structure)."

Based on the request for additional input, Dominion has revised the FLEX 120/240 VAC and 480 VAC Cables Fleet Template and Maintenance Strategies to include a periodic visual/tactile inspection for evaluating cable system component aging and a continuity test in addition to the visual inspection on the molded ends of the cable to ensure their reliability.

The cable storage location is the Hydrogen Recombiner Control Panel Vault area in the Unit 2 Alleyway. This location is missile protected with the exception of the access door. This is acceptable since the cables are staged away from the door and the outside is not visible from the storage location. The cables are stored on K-Kart cable reels. There is no seismic sensitive equipment in the area where the cable carts are located. It should be noted that the cable carts are designed to be tip-proof. This tip-proof design further prevents the possibility of any damage to the carts or surrounding equipment during a seismic event. The ratio of the cable cart height to the smallest base is less than two, and thus the carts will remain stable during a seismic event. The carts do have two wheels in the back to make them carts and are thereby classified as a mobile stable commodity. The front of the cart consists of a flat plate or foot, which creates a high friction contact area that prevents the cart from rolling. The carts are configured in a row, front to back, with the wheels of the last cart chocked. Storage of the cable carts in this configuration will avoid movement during a seismic event; therefore, preventing the possibility of any damage to the carts or surrounding equipment.

Safety Evaluation Item 16

Please provide adequate justification for the seal leakage rates calculated according to the Westinghouse seal leakage model that was revised following the issuance of NSAL-14-1. The justification should include a discussion of the following factors:

a. benchmarking of the seal leakage model against relevant data from tests or operating events,

b. discussion of the impact on the seal leakage rate due to fluid temperatures greater than 550°F resulting in increased deflection at the seal interface,

c. clarification whether the second-stage reactor coolant pump seal would remain closed under ELAP conditions predicted by the revised seal leakage model and a technical basis to support the determination, and,

d. justification that the interpolation scheme used to compute the integrated leakage from the reactor coolant pump seals from a limited number of computer simulations (e.g., three) is realistic or conservative.

Dominion Response:

16a) The PWROG is performing a benchmark of the EDF 7" seal. Testing of the EDF 7" seal occurred in the mid-1980's. WCAP-10541, Revision 2 includes a summary of the test. The benchmark will use the analysis methodology described in the response to Item 16b below.

WCAP-10541, Revision 2 documented the No. 1 seal leakage rates of an 8" Westinghouse reactor coolant pumps (RCP) following a loss of all Alternating Current (AC) power for a reference case. MPR Associates was contracted by Westinghouse to perform independent calculations of RCP seal leakage, the results of which are provided in MPR-797. In addition, the NRC contracted with Energy Technology Engineering Center (ETEC) to perform an independent investigation of the seal leakage rates for Westinghouse RCPs following a loss of all seal cooling. The ETEC work is summarized in WCAP-10541, Revision 2. These analyses used the same overall methodology which is summarized in the response to Item 16b below. The seal flow rate predicted by ETEC at low RCS pressure is approximately one-half of that predicted by Westinghouse.

The estimated times to reach reflux cooling for the North Anna units is 17.6 hours which provides a margin to the established time of 16 hours for the implementation of the RCS makeup of 1.6 hours. This margin is judged to be sufficient based on the comparison of the independent evaluations of the RCP leakage in WCAP-10541, Revision 2. This will be confirmed by the benchmark analysis.

16b) PWROG-14013, Revision 1 "Summary of Validation of Seal Flow Calculations at Reduced Reactor Coolant System Pressures Report," provides a description of the overall analysis methodology which is summarized in Section 2.4 as follows:

- Determination of seal deformation due to pressure and temperature gradients using a finite element evaluation,
- Determination of seal flow and seal gap as a function of seal inlet and outlet pressures based on assumed seal gap, and
- Determination of seal outlet pressure due to No. 1 seal leak-off line pressure drop.

Westinghouse performed a finite element evaluation to determine the effect of pressure and temperature boundary conditions on the mechanical deformation of the No. 1 seal.

The Westinghouse seal flow rates provided in PWROG-14015, Revision 2, used the ITCHSEAL code to determine the seal flow rate. The ITCHSEAL code is a merger of two programs: the ITCH program, which is used to model general thermal hydraulic transients, and the SEAL program, which solves the hydraulic and force balances for the film riding seals. The ITCHSEAL code uses the results of the finite element analysis as input.

Therefore, the impact on the seal leakage rate due to fluid temperatures greater than 550°F (increased deflection) has been incorporated into the ITCHSEAL analyses. The results of these calculations are documented in PWROG-14015, Revision 2.

16c) Section 3.1.1 of PWROG-14017, Revision 1, provides a discussion of the evaluation of the No. 2 seal performance from WCAP-10541, Revision 2. Section 4.3 of WCAP-10541, Revision 2, states that Westinghouse performed thermal-hydraulic and mechanical finite element analysis for the pressure and temperature conditions on the No. 2 seal ring and runner assemblies similar to the No. 1 seal described in Section 4.1 of WCAP-10541. The analysis indicates that the converging film induced in the No. 2 seal by pressure forces, causing mechanical face rotation, is reversed by the large thermal gradient the phase change in the No. 2 leak-off in situations where the No. 1 seal remains functional. Further, it is stated that the thermal face rotation is more than an order of magnitude greater than the pressure induced deflection. Testing of the 7" EDF seal was discussed in Section 7 of WCAP-10541. Therein, it is stated that the No. 2 seal established the thermal gradients and pressure loadings which forced the seal faces to be diverging resulting in the closure of the No. 2 seal in the manner predicted by the analysis of the 8-inch standard and 8-inch cartridge seal. Therefore, it was concluded that the No. 2 seal is considered to be functioning, but is modeled as a tightly closed obstruction which does not allow flow to pass.

16d) The PWROG has documented leakage rates for Westinghouse RCP Original Equipment Manufacturer (OEM) Seals in PWROG-14015, Revision 2 using bounding plant configurations. The initial leakage information consisted of three points: initial leakage at normal operating temperature and normal operating pressure (NOT/NOP); peak leakage at 1500 psia; and leakage at the cooled-down, depressurized conditions. Additional studies have been documented in PWROG-14015, Revision 2 to evaluate the linear assumptions between points and the effect of minimal subcooling for Category 1 seals. The intermediate flow rates are slightly above what is predicted by the linear assumption for seal leakage between the Revision 0 points. The seal leakage flow rate is almost unaffected from the change from 5°F of sub-cooling to less than 1°F of sub-cooling. For each pressure analyzed, these points are within 0.1 gpm. PWROG-14015, Revision 2 transmits the results of the calculation of the seal flow rate for each category of plant identified in PWROG-14008, Revision 1. Westinghouse has performed sufficient calculations to confirm the reasonableness of linear interpolation between points, that the peak leakage occurs at 1,500 psia, and to include minimal subcooling.

Safety Evaluation item 17

The NRC staff understands that Westinghouse has recently recalculated seal leakoff line pressures under loss of seal cooling events based on a revised seal leakage model and additional design-specific information for certain plants.

a. Please clarify whether the piping and all components (e.g., flow elements, flanges, valves, etc.) in your seal leakoff line are capable of withstanding the pressure predicted during an ELAP event according to the revised seal leakage model.

b. Please clarify whether operator actions are credited with isolating low-pressure portions of the seal leakoff line, and if so, please explain how these actions will be executed under ELAP conditions.

c. If overpressurization of piping or components could occur under ELAP conditions, please discuss any planned modifications to the seal leakoff piping and component design and the associated completion timeline.

d. Alternately, please identify the seal leakoff piping or components that would be susceptible to overpressurization under ELAP conditions, clarify their locations, and provide justification that the seal leakage rate would remain in an acceptable range if the affected piping or components were to rupture.

Dominion Response:

PWROG-14008-P, Revision 2, "No. 1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of All AC Power, Task 1: Documentation of Plant Configurations" (September 2014) defines North Anna as a "Category 3" plant relative to PWROG-14015-P. PWROG-14015-P, Revision 0, "No. 1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of All AC Power, Task 2: Determine Seal Flow Rates" (June 2014) defines a Category 3 plant as a plant with a maximum 2,250 psia operating pressure at the pump/seal connection and 224 psia (209 psig) downstream of the seal leakoff line flow elements. The Westinghouse analysis assumes the seal leakoff line relief valve is lifting at its set point of 150 psig and the piping downstream of the flow element pressurizes above the set point due to flow resistance from the flow elements to the relief valve.

a. The Westinghouse analysis assumptions for line size for determining the maximum operating pressure downstream of the flow elements are conservative relative to the NAPS seal leakoff line configuration. Specifically, the Westinghouse analysis conservatively assumes a 1.5" diameter for the downstream piping. The majority of the piping and piping components (fitting and valves) downstream of the flow element at NAPS is 2" and 3" diameter Class 153A (TP304SS) Sch. 40S piping, however, NAPS does have a relatively small amount of ¾" piping (both Class 1502 and Class 153A) immediately downstream of the flow elements. The Class 1502 ¾" piping and associated isolation valves is 1,500 psig class piping. All of the Class 153A (TP304SS) Sch. 40S piping and fittings have maximum working pressures greater than 1500 psig at temperatures up to 600°F. The only components in the system that are rated below 1500 psig are the Class 153A valves. However, all of these valves are located downstream of the seal leakoff line relief valve and would not be subject to pressures in excess of 150 psig (RV setpoint). Therefore, Dominion does not anticipate the components downstream of the flow elements to be in danger of failure at the conservative Westinghouse analysis maximum pressure downstream piping conditions.

b. Operator actions are not taken to isolate the Class 153A (TP304SS) sections of seal leakoff line piping for RCPs with Westinghouse seals. Per ECA-0.0, Operator actions are taken to isolate the Class 153A sections of the seal leakoff line piping for RCPs with Flowserve seals. However, during an ELAP, the Containment Instrument Air system is not credited and, therefore, isolation of the seal leakoff lines for RCPs with Flowserve seals is not assumed.

c. No modifications to the piping configuration are planned for the Class 153A sections of seal leakoff line piping.

d. No components in the seal leakoff lines between the pressure reducing flow element and the relief valve are susceptible to over-pressurization under ELAP conditions.

Audit Question 44

Provide a detailed discussion on the loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), and the required operator actions needed to be performed and the time to complete each action. In your response, explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy.

Dominion Response:

There are four (4) 125 VDC buses per unit at North Anna. The four DC bus distribution panels per unit are located in the Emergency Switchgear Room (ESGR) at elevation 254', directly below the Main Control Room (MCR) at elevation 274'. The ESGR has multiple access points including the stairwell behind the MCR, two access points from elevation 254' in the Turbine Building, and the Control Rod Drive Room. The ESGR is a part of the MCR pressure envelope and is in a Category 1 turbine-missile and flood protected room. Multiple access points provide reasonable assurance that the 125 VDC panels will remain accessible during any BDB ELAP scenario.

Upon declaration of an ELAP, an operator will be dispatched from the MCR to perform DC Bus load stripping per the guidance in FLEX Support Guideline, 1/2-FSG-4, "ELAP DC Bus Load Shed and Management." Within 60 minutes following the onset of an ELAP event, 1/2-ECA-0.0 instructs the operator to secure the DC Seal Oil Pump and DC Turbine Oil Pump after ensuring the hydrogen gas has been vented from the Main Generators. After declaration of an ELAP event (at 60 minutes), the operator will then strip the remaining DC loads from the DC buses and the AC loads from the vital buses within the following 30 minutes. Therefore, all load stripping will be completed within 90 minutes following initiation of the ELAP event.

The four (4) DC buses per unit each provide power to their respective vital bus inverters, which convert 125 VDC to 120 VAC. All loads are stripped from the DC busses with the exception of these vital bus inverters. Load stripping in FSG-4 also includes the guidance to strip selected 120 VAC vital bus loads to preserve the emergency batteries. The required actions to strip the 120 VAC loads from the AC buses are performed in the Hathaway and Computer Rooms, which are an extension of the Main Control Room, elevation 274'. The DC bus loads and the 120 VAC vital bus loads that are being stripped are identified in Tables provided in Section 19.1 (Appendix 7A) of ETE-CPR-2012-0012, Revision 5. These tables provide a detailed description of the vital bus AC loads and the DC loads that are being stripped and the basis for stripping the load. The tables are provided for Unit 1 only, but are typical for Unit 2.

Per NEI 12-06, Section 3.2.1.3(9), FLEX strategies do not need to assume additional failures beyond those attributed to the BDB External Event directly. Therefore, instrumentation redundancy is not a requirement for the key parameter indications which remain available after load stripping has been performed. However, as a defense in depth approach, alternate indications are available from an independent sources, such as a local pressure gauge, level versus flow indication, etc., for many of the North Anna key parameters identified in the Overall Integrated Plan. Tables 7.1.1.1 thru 7.1.1.4 in ETE-CPR-2012-0012, Revision 5 address this alternate indication.

During the May 2014 NRC Onsite Audit, a question was received regarding clarification on the timing of the load stripping activities. The response to that question is as follows:

Calculation EE-0009, Rev 1, Addendum J, "125DC System Analysis," assumes the DC powered Emergency Turbine Oil Pumps (ETOP) and the DC powered Air Side Seal Oil Backup Pumps (ASSOBP) are secured at or prior to 1 hour (T= 60 minutes) following a BDB External Event (BDBEE). The shutdown of these two critical DC powered oil pumps is directed by Emergency Procedure 1/2-ECA-0.0 "Loss of All AC Power" at or PRIOR to T=60 minutes. Specifically, Step 21 of ECA-0.0 provides direction to the Control Room Operator to shutdown these DC powered oil pumps. This action is accomplished using control switches located on each units main control boards. Additionally, a "NOTE" prior to step 21 of ECA-0.0 has been upgraded to a "CAUTION" to warn the operator that "Operation of the DC powered Turbine Oil Pumps and DC powered Air Side Seal Oil Pumps for more than 1 hour with the Battery Chargers out of service significantly reduces remaining battery capacity."

Calculation EE-0009, Rev 1, Addendum J, further assumes the remaining non-critical DC and Vital AC loads are stripped PRIOR to T=90 Minutes following a BDBEE. ECA-0.0 directs the operators to restore AC power within 60 minutes OR declare an Extended Loss of All AC Power (ELAP) event has occurred and initiate FLEX Strategy Guideline 1/2-FSG-4 "ELAP DC Bus Load Shed / Management." If the ELAP event is declared at T= 60 minutes the operators have 30 minutes to complete the load stripping of the remaining non-critical DC and Vital AC loads per the guidance provided in 1/2-FSG-4.

A tabletop review for the load stripping activity assumed 10 minutes would pass from an ELAP declaration to the time when operators would begin to execute load stripping in accordance with the attachments for load shedding in FSG-4. A time of 15 minutes was considered reasonable for the completion of each attachment that accomplished a portion of the load shedding. There are a total of four attachments (two for each unit) needed to perform the load shedding. 1/2-FSG-4 directs the load shedding attachments to be performed simultaneously by two operators per unit (total of four operators) to ensure that BDB response times are met. These four operators are included in the minimum staffing requirements.

An actual timed walk down of the two Unit 2 attachments (which have more actions than the Unit 1 attachments) was performed from the direction point (Control Room) until the attachments were completed utilizing all safety precautions, PPE and Human Performance tools. These Unit 2 attachments were executed in six and seven minutes each which was considerably less than the assumed time of 15 minutes per attachment.

This timed walkdown executed the Unit 2 attachments one after the other, however, per the direction in 1/2-FSG-4, the attachments would be executed simultaneously. When added to the delay time of 10 minutes after an ELAP is declared, the simultaneous execution of the four load stripping attachments is easily less than the 30 minutes assumed in the battery life calculations.

The load stripping of non-critical DC and Vital AC loads within 30 minutes is considered an Operator Time Sensitive Action and has been identified as such in Table 9.1-1 of ETE-CPR-2012-0012, Revision 5.

The North Anna Onsite Audit Report, Attachment 5, requested Dominion to: "Provide formal results of the time validation of dc load shedding." The response to this request is as follows:

The time validation of the DC and Vital AC load stripping activities was completed for North Anna and is documented in ETE-CPR-2014-1004, "North Anna Power Station Beyond Design Basis FLEX Validation for Time Sensitive Actions (TSA's)," As previously indicated, the load stripping activities are performed simultaneously using four separate operators, each with one of four separate load stripping attachments from FSG-4.

Copies of FSG-4, ETE-CPR-2012-1004, and ETE-CPR-2014-1004 have previously been provided to the NRC staff and are available for their review.