VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

February 27, 2014

10 CFR 2.202
EA-12-049

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

Serial No.: 12-163E
NL&OS/MAE: R0A
Docket Nos.: 50-280/281
License Nos.: DPR-32/37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY 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)

References:

1. 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
2. Virginia Electric and Power Company's 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 February 28, 2013 (Serial No. 12-163B)
3. Virginia Electric and Power Company's 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 (Serial No. 12-163D)
4. NRC letter, "Nuclear Regulatory Audits of Licensee Responses to Mitigating Strategies Order EA-12-049," dated August 28, 2013 (ADAMS Accession No. ML13234A503)

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued an order (Reference 1) to Virginia Electric and Power Company (Dominion). Reference 1 was immediately effective and directed Dominion to develop, implement, and maintain guidance and strategies to maintain core cooling, containment, and spent fuel pool cooling capabilities in the event of a beyond-design-basis external event.

Reference 1 required submission of an Overall Integrated Plan (OIP) (Reference 2) pursuant to Section IV, Condition C. Reference 1 also required submission of a status report at six-month intervals following submittal of the OIP.

Attachment 1 of this letter provides the second six-month status report and an update of milestone accomplishments since the submittal of the first six-month status report (Reference 3), including any changes to the compliance method, schedule, or need for relief and the basis.

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Attachment 2 provides the Phase 3 containment strategy and the ventilation strategy, respectively, identified as Open Items 4 and 14 for the OIP. This information is provided in the template format used for the originally submitted OIP. The pages provided in Attachment 2 for Section D, "Maintain Containment" and Section F5, "Safety Functions Support (Ventilation)" supersede Section D and Section F5 in the originally submitted OIP.

Attachment 3 formally documents responses provided to several Audit Questions received for Surry Power Station during the Audit of Licensee Responses to Mitigating Strategies Order EA-12-049 (Reference 4).

If you have any questions, please contact Ms. Margaret Earle at (804) 273-2768.

Sincerely,

Mark D. Sartain
Vice President - Nuclear Engineering
Virginia Electric and Power Company

Attachments (3)

Commitments made by this letter: No new Regulatory Commitments

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by 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 the Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 27TH day of February, 2014.

My Commission Expires: May 31, 2014.

Vicki L. Hull
Notary Public

(SEAL)

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140542
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NRC Senior Resident Inspector
Surry Power Station

Attachment 1

Six-Month Status Report for the Implementation of Order EA-12-049 Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

February 2014

Surry Power Station Units 1 and 2

Virginia Electric and Power Company (Dominion)

**Six-Month Status Report for the Implementation of Order EA-12-049
Order Modifying Licenses with Regard to Requirements for Mitigation Strategies
for Beyond-Design-Basis External Events**

1 Introduction

Dominion developed an Overall Integrated Plan (OIP) (Reference 1) documenting the diverse and flexible strategies (FLEX) for Surry Power Station in response to NRC Order Number EA-12-049 (Reference 2). This attachment provides an update of milestone accomplishments and open items since submittal of the last status report (Reference 15), including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

2 Milestone Accomplishments

The following milestones have been completed since the development of the OIP and is current as of January 31, 2014.

- Submit OIP
- Develop Strategies

3 Milestone Schedule Status

The following table provides an update to Attachment 2A of the OIP. It provides the activity status of each item, and whether the expected completion date has changed. The dates are planning dates subject to change as design and implementation details are developed.

The revised milestone target completion dates for 'Develop Modifications' and 'Develop Strategies/Contract with RRC' do not impact the Order implementation date.

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date
Submit Integrated Plan	February 2013	Complete	
Develop Strategies	October 2013	Complete	
Develop Modifications	April 2014	Started	July 2014 *
Implement Modifications	May 2015	Started	
Develop Training Plan	April 2014	Started	
Implement Training	August 2014	Started	

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date
Issue FSGs and Associated Procedure Revisions	September 2014	Started	
Develop Strategies/Contract with Regional Response Center (RRC)	April 2014	Started	August 2014 *
Purchase Equipment	February 2014	Started	
Receive Equipment	August 2014	Started	
Validation Walk-throughs or Demonstrations of FLEX Strategies and Procedures	December 2014	Not Started	
Create Maintenance Procedures	August 2014	Not Started	
Unit 1 Outage Implementation	April 2015	Started	
Unit 2 Outage Implementation	October 2015	Not Started	

* Refer to Section 8, Supplemental Information, for an explanation of Milestone changes.

4 Changes to Compliance Method

By letter dated February 28, 2013, Dominion provided an OIP to address Beyond-Design-Basis (BDB) events at Surry Power Station (Surry) Units 1 and 2 (Reference 1) as required by Order Number EA-12-049, dated March 12, 2012 (Reference 2). The first Six-Month Status Update of the OIP for Surry was provided by letter dated August 23, 2013 (Reference 15). The following are changes to the compliance method information provided in the Surry OIP; which continue to meet NEI 12-06 (Reference 3):

a) Details of the strategy for the portable diesel generators (DGs) used to re-power the 120VAC vital bus circuits, as described in Section F1.2 – PWR Portable Equipment Phase 2, of the OIP have changed for Surry. The primary and alternate strategies have been switched. The primary strategy is to deploy a 480VAC diesel generator (DG) from the BDB Storage Building to the locations previously identified in OIP Figure 6. The generator will be used to power the 1/2A-2 and 1/2B-2 Battery Chargers which in turn supply power to the vital AC instrument panels. The 480VAC DG connection strategy is unchanged.

   As an alternate re-powering method for instrumentation, the 120/240VAC portable DGs will be used to power vital AC instrument panels via the BDB distribution panels. The 120/240VAC DGs will be stored in the BDB Storage Building. The deployment locations and connection strategy for the 120/240VAC DGs is unchanged.

The station Class 1E battery duty cycle of 20 hours previously reported in Reference 4 is changed to 14 hours for the purpose of retaining operational margin. Dominion confirms that the Class 1E battery duty cycle for Surry was calculated in accordance with the IEEE-485 methodology using manufacturer discharge test data applicable to the licensee's FLEX strategy as outlined in the NEI white paper on Extended Battery Duty Cycles. The detailed licensee calculations, supporting vendor discharge test data, FLEX strategy battery load profile, and other inputs/initial conditions required by IEEE-485 are available on Dominion's web portal for documents and calculations. The time margin between the calculated battery run-time for the FLEX strategy and the expected deployment time for FLEX equipment to supply the DC loads is approximately 4 hours for Surry.

b) The BDB and Regional Response Center (RRC) equipment details in OIP Table 1, *PWR Portable Equipment Phase 2*, and OIP Table 2, *PWR Portable Equipment Phase 3,* respectively, have changed. Updates to the 'List Portable Equipment', 'Performance Criteria,' and usage categories are included as well as associated changes/deletions in footnotes. Minor changes to the number of components have been included for some of the support equipment categories, but no changes are made to the quantities of any of the major FLEX components. Revised OIP Tables 1 and 2 are included in this attachment.

Footnote 6 has been added to the quantity of BDB High Capacity pumps in Table 1. One BDB High Capacity pump is needed to implement the FLEX core and Spent Fuel Pool (SFP) cooling strategies. This pump will be stored in the Type 1 BDB Storage Building and protected from all hazards. The other pump, the site 10 CFR 50.54(hh)(2) high capacity pump (B.5.b), has adequate capacity to backup the BDB High Capacity pump and serves to meet the N+1 requirement. We are aware that the NRC expectation is that the 10 CFR 50.54(hh)(2) high capacity pump is to be readily available for a imminent threat scenario. However, we have determined that use of the 10 CFR 50.54(hh)(2) high capacity pump as a backup to the BDB High Capacity pump does not degrade the mitigating strategies associated with B.5.b in that the pump remains readily available in the event of a imminent threat scenario. This 10 CFR 50.54(hh)(2) pump is stored onsite in a separate location that is reasonably protected from flooding, extreme heat, and extreme cold events.

c) The OIP, submitted on February 28, 2013, contained an open item for the development of the coping strategy to maintain Containment integrity following an Extended Loss of AC Power (ELAP) event, if required. OIP Section A.4 (Action Item 16) and Attachment 1A, Sequence of Events, Item 16, discussed the timeframe for which action was required to address Containment temperature and pressure. Conservative analysis has concluded that Containment temperature and pressure response will remain below design limits following an ELAP and that key parameter instrumentation subject to the Containment environment will remain functional for at least seven days (Reference 14).

The strategy for coping with Containment temperature and pressure increases has been developed. By maintaining these parameters below their design limits, Containment structural integrity is ensured. To remain within analyzed limits for equipment qualification temperature, the Containment temperature will be procedurally monitored and, if necessary, the temperature will be reduced. This will require the implementation of the Phase 3 Containment cooling strategy such that heat removal from Containment is initiated in a timely manner.

The Phase 3 Containment coping strategy was not provided in the initial submittal of the OIP. It is provided in Attachment 2 of this submittal. The Containment coping strategy is presented in the original OIP template format as Section D and is intended to supersede the previous Section D in its entirety. Attachment 2 also contains two new OIP figures (Figures 11 and 12) in support of the Section D Containment strategy.

d) The OIP for Surry, submitted on February 28, 2013, contained an open item for the development of the coping strategy to account for the loss of forced ventilation following an ELAP event. The loss of ventilation evaluation has been completed and concluded that no special equipment or immediate actions are required to maintain the equipment and personnel habitability in areas requiring access to implement the FLEX strategies (Reference 13). In the case of the upper level of the MSVH, where the SG PORVs are located, access to this area is necessary to isolate the normal air supply to the PORVs such that the local bottle air supply can be utilized for local control from a cooler area. One of the doors which leads to outside the MSVH (either the upper or lower level) will need to be opened to allow a "stack effect" circulation of air between the door and the ventilation openings at the top of the MSVH. This will ensure that the temperatures remain within the acceptable range for personnel habitability.

An additional ventilation concern applicable to Phase 2 is the potential buildup of hydrogen in the battery rooms. Off-gassing of hydrogen from batteries is only a concern when the batteries are charging. Once a 480VAC power supply is restored in Phase 2 and the station Class 1E batteries begin re-charging, the doors to the battery rooms will be opened and portable fans will be used to disperse any hydrogen into the much larger volumes of the ESGR rooms and Turbine Building to prevent any significant hydrogen accumulation.

The coping strategy for the loss of ventilation following an ELAP event at Surry was not provided in the initial submittal of the OIP. It is provided in Attachment 2 of this submittal. Attachment 2 is presented in the original OIP template format as Section

F5 – Safety Function Support (Ventilation) and is intended to supersede the previous Section F5 in its entirety.

e) In response to the NRC staff concern that sufficient time and core flow conditions are available for adequate boron mixing, the PWROG, in conjunction with Westinghouse, developed a boron mixing position paper. This position paper has been endorsed by the NRC with clarifications as stated in a letter from Jack Davis, Director Mitigating Strategies, US NRC to Jack Stringfellow, PWROG, Endorsing PWROG Position Paper, January 8, 2014. The Surry ELAP analyses verify that the conditions set forth in the NRC's endorsement of the boron mixing position paper with the NRC's clarifications are met. Accordingly, the endorsed boron mixing methodology has been applied to the final FLEX RCS inventory and reactivity management strategies.

f) The Emergency Condensate Storage Tank (ECST) and the Emergency Condensate Make-up Tank (ECMT) provide the initial water sources to feed the Turbine-Driven Auxiliary Feedwater (TDAFW) pump. Following depletion of these sources, additional water sources will be connected to continue the supply of water to the TDAFW pump. OIP Figure 3, as modified in the August 2013 Six-Month Status Update, showed the configuration to attach various supplies to the piping which fills the ECST. The discharge from the tank would then continue to supply water to the TDAFW pump from the alternate sources. Construction of the piping tie-in, as proposed, would have resulted in exceeding Technical Specification (TS) Allowed Out of Service Times as a result of the system configuration and the system crosstie with the opposite unit. The revised tie-in location is to the supply piping of the TDAFW pump only and, therefore, does not cause the other pumps in this system to be out of service, thereby ensuring the TS Allowed Out of Service Times were not exceeded. This revision is shown in the attached revised Figure 3. As part of this design adjustment, the pressure indicator was also re-positioned to the suction piping where the new tie-in is located.

g) As stated in Section B.1 of the OIP, the Auxiliary Feedwater (AFW) system is pre-aligned for flow to all three Steam Generators (SGs), and the AC motor operated flow control valves fail as-is (open) to maintain flow to all three SGs. Accordingly, manual control of feedwater (FW) to all three SGs is required to throttle the AFW flow and maintain a symmetric, three steam generator cooldown as stated in OIP Attachment 2B, Item 4. This information is accurate for the majority of the time the Surry Units 1 and 2 are operating. However, during a limited period of time when the plant is between 350 deg F RCS temperature and Hot Shutdown conditions, the AFW supply lines to one SG are required to be isolated due to motor-driven AFW pump runout concerns.

If a BDB event initiates during this condition, and since the fail-as-is motor-operated AFW isolation valves are located inside Containment (inaccessible following an

ELAP), AFW flow to one of the SGs will be unavailable and an asymmetric plant cooldown will be performed using the remaining two available SGs (References 11 and 12). Justification for the acceptability of this limited condition will be provided through the audit process.

5 Need for Relief/Relaxation and Basis for the Relief/Relaxation

Dominion expects to comply with the Order implementation date and no required relief/relaxation has been identified at this time.

6 Open Items from Overall Integrated Plan

The following table provides a summary of the status of open items documented in Attachment 2B of the Surry Overall Integrated Plan submitted February 28, 2013 and the status of each item.

Overall Integrated Plan Open Item		
OI #	**Description**	**Status**
1	Verify response times listed in timeline and perform staffing assessment.	Not started. Scheduled completion date: December 2014
2	Preliminary analyses have been performed to determine the Class 1E battery life based on implementation of load stripping actions. The final battery life duration will be provided when the analyses are completed.	Complete. (Provided in Reference 4) See Section 4, Item a.
3	Preliminary analyses have been performed to determine the time to steam generator overfill without operator action to reduce AFW flow, time to steam generator dryout without AFW flow, and time to depletion of the useable volume of the ECST and ECMT. The final durations will be provided when the analyses are completed.	Complete. (Provided in Reference 4)
4	The Phase 3 coping strategy to maintain Containment integrity is under development. Methods to monitor and evaluate Containment conditions and depressurize/cool Containment, if necessary, will be provided in a future update.	Complete. See Attachment 2, OIP Section D. See Open Item 5 for confirmation of the effectiveness of Phase 3 Containment strategies.
5	Analyses will be performed to develop fluid components performance requirements and confirm fluid hydraulic-related	Started.

Overall Integrated Plan Open Item		
OI #	Description	Status
	strategy objectives can be met.	Hydraulic calculations for the FLEX pumps deployed using their associated hose networks have confirmed that the core cooling/decay heat removal, RCS Inventory, and Reactivity Control (RCS Injection), and SFP Make-up strategies can be satisfactorily accomplished in response to an ELAP/Loss of Ultimate Heat Sink (LUHS) event. (References 6 and 7) Phase 3: Thermal and hydraulic calculations, which confirm that the Containment strategies are adequate, will be completed by April 2014. Scheduled completion date is revised from September, 2013 to April 2014 **
6	A study is in progress to determine the design features, site location(s), and number of equipment storage facilities. The final design for BDB equipment storage will be based on the guidance contained in NEI 12-06, Section 11.3, Equipment Storage. A supplement to this submittal will be provided with the results of the equipment storage study.	Complete. A single 10,000 sq. ft. Type 1 building will be constructed at Surry for storage of BDB equipment. The building will be designed to meet the plant's design basis for the Safe Shutdown Earthquake, high wind hazards, snow, ice and cold conditions, and will

Overall Integrated Plan Open Item		
OI #	Description	Status
		be located above the flood elevation from the most recent site flooding analysis. The BDB Storage Building will be sited just east of the south employee parking lot, inside the Owner Controlled Area. The location lies in an area between the Surry Nuclear Information Center and the Intake Canal. This update provides the supplemental information referred to in this open item.
7	FLEX Support Guidelines (FSGs) will be developed in accordance with PWROG guidance. Existing procedures will be revised as necessary to implement FSGs.	Started. Scheduled completion date: September 2014
8	EPRI guidance documents will be used to develop periodic testing and preventative maintenance procedures for BDB equipment. Procedures will be developed to manage unavailability of equipment such that risk to mitigating strategy capability is minimized.	Not started. Scheduled completion date: December 2014
9	An overall program document will be developed to maintain the FLEX strategies and their bases and to provide configuration control and change management for the FLEX Program.	Started. Scheduled completion date: December 2014
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).	Started. Scheduled completion date: December 2014
11	Plant modifications will be completed for permanent plant changes required for implementation of FLEX strategies.	Started. Scheduled completion date: See Milestone Schedule above.

Overall Integrated Plan Open Item		
OI #	**Description**	**Status**
12	The following actions will be completed to qualify the ECMT as a source of water to the TDAFW pump in response to an ELAP/LUHS event: (1) Upgrade the piping system from the ECMT to the TDAFW pump suction to Seismic Category I (2) Modify the TDAFW pump discharge piping to install local AFW flowrate indication (3) Confirm adequate TDAFW pump NPSH from the ECMT through the idle AFW booster pumps using conservative analysis.	Started. Scheduled completion date: May 2015
13	Complete the evaluation of TDAFW pump long term operation with </= 290 psig inlet steam pressure.	Complete. TDAFW pump operation and adequate AFW flow to the SGs at SG pressures ≤ 290 psig has been confirmed. (Reference 5)
14	Details of the ventilation strategy are under development and will conform to the guidance given in NEI 12-06. The details of this strategy will be provided at a later date.	Complete. See Attachment 2, OIP Section F5.

Overall Integrated Plan Open Item		
OI #	**Description**	**Status**
15	Analyses will be performed to develop electrical components performance requirements and confirm electrical loading-related strategy objectives can be met.	Started. Phase 2: Preliminary results for the sizing and loading analysis of the 120VAC and 480VAC generators confirm the electrical loading-related strategy objectives can be met. Final calculations confirming these results will be completed by the end of March 2014. Phase 3: Calculations identifying the Phase 3 4160VAC generator load requirements and power cable ampacity rating along with breaker coordination between the RRC equipment and Dominion equipment will be completed by June 2014. Scheduled completion date: June 2014 **
16	An evaluation of all BDB equipment fuel consumption and required re-fill strategies will be developed including any gasoline required for small miscellaneous equipment.	Not started. Scheduled completion date: June 2014
17	A lighting study will be performed to validate the adequacy of supplemental lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions.	Started. Scheduled completion date: June 2014

Overall Integrated Plan Open Item		
OI #	Description	Status
18	A comprehensive study of communication capabilities is being performed in accordance with the commitments made in Dominion letter S/N 12-208F dated October 29, 2012 in response to Recommendation 9.3 of the 10 CFR 50.54(f) letter dated March 12, 2012. The results of this study will identify the communication means available or needed to implement command and control of the FLEX strategies at Surry. Validation of communications required to implement FLEX strategies will be performed as part of Open Item No. 1.	Complete. A study documenting the communications strategy has been completed. The plan concludes that FLEX strategies can be effectively implemented with a combination of sound powered phones, satellite phones and hand-held radios. (Reference 8)
19	Preferred travel pathways will be determined using the guidance contained in NEI 12-06. The pathways will attempt to avoid areas with trees, power lines, and other potential obstructions and will consider the potential for soil liquefaction.	Started. The soil liquefaction study has been completed (Reference 9), which supports the location of the storage building and the haul routes. The results will be included with the final design package for the storage building (Reference 10). Scheduled completion date: June 2014
20	The equipment listed in Table 1 will be received on site.	Started. Scheduled completion date: August 2014

** Refer to Section 8, Supplemental Information, for an explanation of the changes to Open Items.

7 Potential Safety Evaluation Impacts

Dominion is participating in the ongoing industry effort to develop guidance for the Overall Program Document that will support NRC preparation of the Safety Evaluation documenting Surry's compliance with Order EA-12-049. As this Overall Program Document is developed, potential challenges and impacts will be identified in this section of future Six-Month Status Reports.

8 Supplemental Information

This supplemental information provides details of the changes identified in the status updates above and addresses the following topics: a) a revision to Milestone Task 'Develop Modifications' b) a revision to Milestone Task 'Develop Strategies/Contract with RRC', c) a revision to Open Item No. 5, and d) a revision to Open Item No. 15.

a) **Surry, Milestone Task 'Develop Modifications':** The revision to the scheduled milestone target completion date is needed to complete minor modifications supporting FLEX strategies (e.g., standpipe, hose adapters, etc.).

b) **Surry, Milestone Task 'Develop Strategies/Contract with RRC':** The revision to the scheduled milestone target completion date is consistent with the date the RRC will be fully operational.

c) **Surry, Open Item 5:** The Open Item completion date is revised to April 2014. Additional time is required to complete the thermal and hydraulic calculations confirming that the Containment strategies are adequate using the Phase 3 RRC pumps.

d) **Surry, Open Item 15:** This Open Item was previously reported as completed in the August 2013 Six-Month Status Report. However, only the Phase 2 calculations had been completed at that time and the Open Item was therefore not fully complete.

   The completion date for Open Item 15 is revised to June 2014. Additional time is required to obtain design specification information on the Phase 3 RRC electrical components and to complete the calculations needed to confirm the electrical loading-related strategy objectives can be met with this equipment.

9 References

The following references support the updates to the OIP described in this attachment.

1. Virginia Electric and Power Company 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 February 28, 2013 (Serial No. 12-163B).

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.
3. NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*, Revision 0, dated August 2012.
4. Virginia Electric and Power Company Supplement to Overall Integrated Plan in Response to March 21, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis Events (Order Number EA-12-049), dated April 30, 2013 (Serial No. 12-163C).
5. Dominion Calculation ME-0969, "Evaluation of the TDAFW Pump Performance at Low Steam Generator Pressures," August 2013.
6. Dominion Calculation ME-0967, "Beyond Design Basis (BDB) – BDB High Capacity Pump and BDB AFW Pump Hydraulic Analysis for Spent Fuel Pool Makeup and AFW Injection at SPS Units 1 and 2," Rev. 0.
7. Dominion Calculation ME-0964, "Evaluate the 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," Rev. 0.
8. ETE-CPR-2013-0003, Beyond Design Basis Communications Strategy/Plan, Rev. 0.
9. Geotechnical Engineering Report, BDB FLEX Storage Building, Surry Power Station, Surry County, VA, Schnabel Reference #13613080, September 19, 2013, including Addendum No. 1.
10. Design Change SU-13-00015, BDB Storage Building/ Surry Power Station/ Units 1 & 2.
11. ET-NAF-06-0045 "Evaluation of Proposed Change to Surry FW-MOV-151/251 Operation and Alignment," Revision 0.
12. Surry Operating Procedure 1/2-GOP 1.3, "Unit Startup, RCS Heatup From 345°F To HSD," Revision 52/54.
13. Calculation ME-0973, "Evaluation of Room Air Temperatures Following Extended Loss of AC Power (ELAP)," Revision 0 including Addendum 00A.
14. Calculation MISC-11793, Evaluation of Long-Term Containment Pressure and Temperature Profiles Following and Extended Loss of AC Power (ELAP), Rev. 0.
15. Virginia Electric and Power Company's 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 (Serial No. 12-163D).

Table 1 – PWR Portable Equipment Phase 2[1] [Open Item 20]								
Use and (potential / flexibility) Diverse Uses							***Performance Criteria***	***Maintenance***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility			Maintenance / Preventive Maintenance Requirements
BDB High Capacity diesel-driven pump (2)[6] and assoc. hoses and fittings	X	X	X				1200 gpm @ 150 psid	Will follow EPRI template requirements
BDB AFW pump (3) and assoc. hoses and fittings	X						300 gpm @ 500 psid	Will follow EPRI template requirements
BDB RCS Injection pump (2)[5] and assoc. hoses and fittings	X						45 gpm @ 3000 psid	Will follow EPRI template requirements
120/240VAC generators (2)[3] and associated cables, connectors and switchgear				X			35 kW	Will follow EPRI template requirements

Table 1 – PWR Portable Equipment Phase 2[1] [Open Item 20]							
Use and (potential / flexibility) Diverse Uses						***Performance Criteria***	***Maintenance***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / Preventive Maintenance Requirements
120/240VAC generators (8)[2] and associated cables, connectors and switchgear (to power support equipment)					X	5-6.5 kW	Will follow EPRI template requirements
480VAC generators (2)[3] and associated cables, connectors and switchgear (to re-power battery chargers, inverters, and Vital Buses)		X		X		320 kW	Will follow EPRI template requirements
Portable boric acid batching tank (2)	X					1000 gal	Will follow EPRI template requirements

Table 1 – PWR Portable Equipment Phase 2[1] [Open Item 20]							
Use and (potential / flexibility) Diverse Uses						***Performance Criteria***	***Maintenance***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / Preventive Maintenance Requirements
Light plants (2) + Light strings (15)[2]					X		Will follow EPRI template requirements
Front endloader (1)[2]					X		Will follow EPRI template requirements
Tow vehicles (2)[2]	X	X	X		X		Will follow EPRI template requirements
Hose trailer (2) and Utility vehicle (1)[2]	X	X	X		X		Will follow EPRI template requirements
Fans / blowers (10)[2]					X		Will follow EPRI template requirements
Air compressors (6)[2]	X				X		Will follow EPRI template requirements

Table 1 – PWR Portable Equipment Phase 2[1] [Open Item 20]							
Use and (potential / flexibility) Diverse Uses						***Performance Criteria***	***Maintenance***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / Preventive Maintenance Requirements
Fuel truck (1) with 1,100 gal. tank and pumps	X	X	X	X	X		Will follow EPRI template requirements
Fuel carts with transfer pumps (2) [2]	X	X	X	X	X		Will follow EPRI template requirements
Communications equipment [4]	X	X	X	X	X		Will follow EPRI template requirements
Misc. debris removal equipment [2]					X		Will follow EPRI template requirements
Misc. Support Equipment [2]					X		Will follow EPRI template requirements

Table 1 – PWR Portable Equipment Phase 2[1] [Open Item 20]							
Use and (potential / flexibility) Diverse Uses						***Performance Criteria***	***Maintenance***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / Preventive Maintenance Requirements
Cables for 4kv DG generator connection (3 sets)	X	X	X	X	X		

NOTES:
1. This table is based on one BDB Storage Building.
2. Support equipment. Not required to meet N+1.
3. 120/240VAC generators are an alternate strategy to the 480VAC generators. Therefore, only N is required.
4. Quantities are identified in ETE-CPR-2013-0003 that was developed in response to the results of the study performed for Recommendation 9.3 of the 10 CFR 50.54(f) letter dated March 12, 2012.
5. One BDB RCS Injection pump can be shared between units if necessary. A BDB RCS Injection pump from the RRC will be deployed from the RRC by 28 hours, if required, to replace an inoperable on-site BDB RCS Injection pump.
6. One BDB High Capacity pump is needed to implement the FLEX core and SFP cooling strategies. This pump is stored in the Type 1 BDB Storage Building and protected from hazards. The 50.54(hh)(2) high capacity pump is credited to meet the N+1 requirement as a backup to the BDB High Capacity pump. This pump is stored onsite in a location other than the BDB Storage Building.

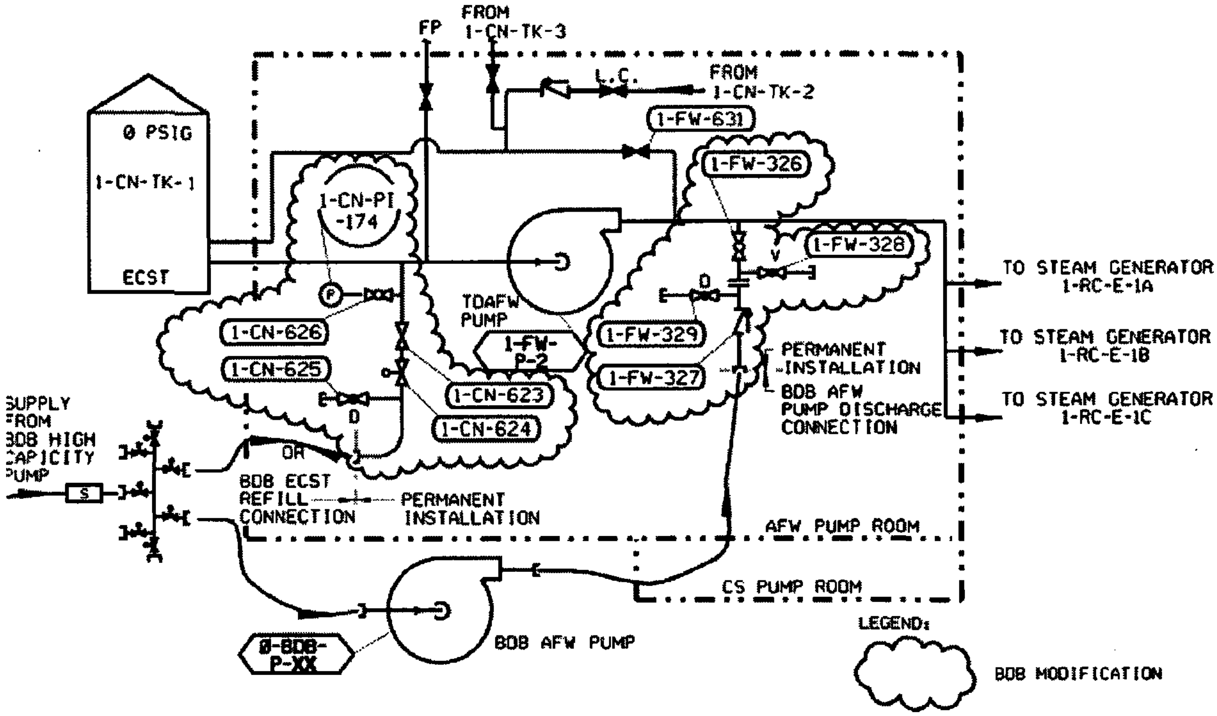
Table 2 – PWR Portable Equipment Phase 3

Use and (Potential/Flexibility) Diverse Uses									Performance Criteria		Maintenance	Notes
List Portable Equipment	**Quantity Req'd /Unit**	**Quantity Provided / Unit**	**Power**	**Core Cooling**	**Cont. Cooling/ Integrity**	**Access**	**Instrumentation .**	**RCS Inventory**			***Preventative Maintenance Required***	
Medium Voltage Generators	1	1	Jet Turb.	X	X		X		4.16 KV	2 MW	Performed by RRC	(1)
Low Voltage Generators	0	1	Jet Turb.		X		X	X	480VAC	1100 KW	Performed by RRC	(2)
High Pressure Injection Pump	0	1	Diesel					X	3000#	60 GPM	Performed by RRC	(2)
S/G RPV Makeup Pump	0	1	Diesel	X				X	500#	500 GPM	Performed by RRC	(2)
Low Pressure / Medium Flow (De-watering) Pump	0	1	Diesel			X			300#	2500 GPM	Performed by RRC	(2)
Low Pressure / High Flow Pump	1	1	Diesel	X	X				150#	5000 GPM	Performed by RRC	(3)

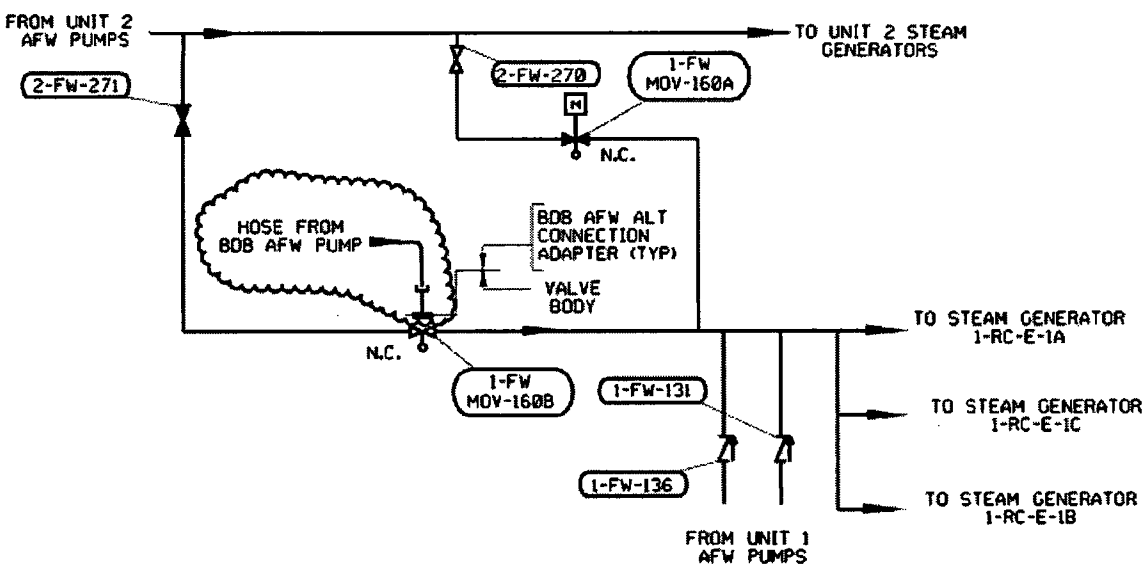
Table 2 – PWR Portable Equipment Phase 3

Use and (Potential/Flexibility) Diverse Uses									Performance Criteria		Maintenance	Notes
List Portable Equipment	**Quantity Req'd /Unit**	**Quantity Provided / Unit**	**Power**	**Core Cooling**	**Cont. Cooling/ Integrity**	**Access**	**Instrumentation .**	**RCS Inventory**			***Preventative Maintenance Required***	
Lighting Towers	0	1	Diesel			X				40,000 Lu	Performed by RRC	(4)
Diesel Fuel Transfer	0	AR	N/A	X	X	X	X	X		500 Gal	Performed by RRC	(2)
Mobile Water Treatment	0	2	Diesel	X				X		150 GPM	Performed by RRC	(2) (5)
Mobile Boration Skid	0	1	N/A					X		1000 Gal	Performed by RRC	(2)

Note 1 - RRC 4KV generator supplied in support of Phase 3 for Core Cooling, Containment Cooling, and Instrumentation FLEX Strategies.
Note 2 - RRC Generic Equipment – Not required for FLEX Strategy – Provided as Defense-in-Depth
Note 3 - RRC Low Pressure / High Flow pump supplied in support of Phase 3 for core cooling and Containment cooling FLEX Strategies.
Note 4 - RRC *components provided for low light response plans.*
Note 5 - Usage dependent on Westinghouse Water Quality Study results.



PRIMARY BDB AFW CONNECTIONS



ALTERNATE BDB AFW CONNECTION

FIGURE 3 (FEBRUARY 2014 UPDATE)
CORE COOLING AND DECAY HEAT REMOVAL
PRIMARY AND ALTERNATE CONNECTIONS
SURRY POWER STATION UNIT 1
(UNIT 2 TYPICAL)

Attachment 2

Overall Integrated Plan

Section D - Maintain Containment

Section F5 – Safety Functions Support (Ventilation)

Surry Power Station Units 1 and 2

Virginia Electric and Power Company (Dominion)

D - Maintain Containment

Determine Baseline coping capability with installed coping[1] modifications not including FLEX modifications, utilizing methods described in Table 3-2 of NEI 12-06:

- Containment Spray
- Hydrogen igniters (ice condenser Containments only)

D.1 - PWR Installed Equipment Phase 1:

Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain Containment. Identify methods (Containment spray/Hydrogen igniter) and strategy(ies) utilized to achieve this coping time.

The Phase 1 coping strategy for Containment involves verifying Containment isolation per ECA-0.0, Loss of All AC Power, and continuing to monitor Containment temperature and pressure using installed instrumentation.

Evaluations have been performed and conclude that Containment temperature and pressure will remain below design limits, and key parameter instruments subject to Containment environment will remain functional for at least 7 days. (Reference Calculations MISC-11793 and MISC-11794). Therefore, actions to reduce Containment temperature and pressure and to ensure continued functionality of the key parameters will not be required immediately and will utilize off-site equipment and resources during Phase 3.

Details:

D.1.1 - Provide a brief description of Procedures / Strategies / Guidelines	Procedural guidance for monitoring Containment pressure is provided by ECA-0.0, Loss of All AC power.
D.1.2 - Identify modifications	No plant modifications are required to support implementation of this Phase 1 strategy.
D.1.3 - Key Containment Parameters	*List instrumentation credited for this coping evaluation.* <u>Containment Pressure</u> - Containment pressure indication is available in the MCR throughout the event. <u>Containment Temperature</u> - Containment temperature indication is available in the MCR throughout the event.

Notes:

The information provided in this section is based on the following reference(s):

Engineering Technical Evaluation, ETE-CPR-2012-0011, "Beyond Design Basis – FLEX Strategy Overall Integrated Plan Basis Document," Revision 2.

[1] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

D - Maintain Containment
Calculation MISC-11793, "Evaluation of Long Term Containment Pressure and Temperature Profiles Following Loss of Extended AC Power (ELAP)," Revision 0, February 18, 2013. Calculation MISC-11794, "Evaluation of North Anna, Surry, and Millstone Containment Instrumentation Following Extended Loss of AC (ELAP)," Revision 0, February 18, 2013.

D. Maintain Containment	
D.2 - PWR Portable Equipment Phase 2:	
Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain Containment. Identify methods (Containment spray/hydrogen igniters) and strategy(ies) utilized to achieve this coping time. Evaluations have been performed and conclude that Containment temperature and pressure will remain below design limits, and key parameter instruments subject to Containment environment will remain functional for at least 7 days. (Reference Calculations MISC-11793 and MISC-11794). Therefore, actions to reduce Containment temperature and pressure and to ensure continued functionality of the key parameters will not be required immediately and will utilize off-site equipment and resources during Phase 3. There is no separate Phase 2 strategy.	
Details:	
D.2.1 - Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation* None required for Phase 2
D.2.2 - Identify modifications	*List modifications* None required for Phase 2
D.2.3 - Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.* Although a Phase 2 strategy is not required to maintain Containment, the Phase 1 Containment monitoring instrumentation will continue to be powered during Phase 2 from portable generators.
D.2.4 - Storage / Protection of Equipment: **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment is protected or schedule to protect* None required for Phase 2
Flooding	*List how equipment is protected or schedule to protect* None required for Phase 2
Severe Storms with High Winds	*List how equipment is protected or schedule to protect* None required for Phase 2

D. Maintain Containment	
Snow, Ice, and Extreme Cold	*List how equipment is protected or schedule to protect* None required for Phase 2
High Temperatures	*List how equipment is protected or schedule to protect* None required for Phase 2

D.2.5 - Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use. None required for Phase 2	*Identify modifications* None required for Phase 2	*Identify how the connection is protected* None required for Phase 2

Notes:

The information provided in this section is based on the following reference(s):

Engineering Technical Evaluation, ETE-CPR-2012-0011, "Beyond Design Basis – FLEX Strategy Overall Integrated Plan Basis Document," Revision 2.

Calculation MISC-11793, "Evaluation of Long Term Containment Pressure and Temperature Profiles Following Loss of Extended AC Power (ELAP)," Revision 0, February 18, 2013.

Calculation MISC-11794, "Evaluation of North Anna, Surry, and Millstone Containment Instrumentation Following Extended Loss of AC (ELAP)," Revision 0, February 18, 2013.

D. Maintain Containment

D.3 - PWR Portable Equipment Phase 3:

Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain Containment. Identify methods (Containment spray/hydrogen igniters) and strategy(ies) utilized to achieve this coping time.

An evaluation has been performed and concludes that Containment temperature and pressure will remain below design limits, and key parameter instruments subject to Containment environment will remain functional for at least 7 days. To remain within analyzed limits for equipment qualification temperature, the Containment temperature will be procedurally monitored and, if necessary, the temperature will be reduced. This will require the implementation of the Phase 3 Containment cooling strategy such that heat removal from Containment is initiated in a timely manner.

The strategy to reduce Containment temperature is to provide for Containment heat removal through water spray into the Containment atmosphere using portable pumps, the installed Recirculation Spray (RS) system pumps, and Containment Spray (CS) rings. This strategy requires repowering a Class 1E 4160VAC and 480VAC bus using a 4160VAC DG from the Regional Response Center (RRC) and restoration of cooling water flow (Service Water) to the RS heat exchanger. An alternate strategy is also available which will provide Containment ventilation cooling using the Containment Air Recirculation (CAR) system fans.

<u>Primary Containment Cooling Strategy – Containment Recirculation Spray</u>

The 4160VAC DG from the RRC will be aligned to power a Class 1E 4160VAC and 480VAC bus as described in Section F1.3, which will provide power to the RS pump 480VAC motor.

The Containment sump must be filled to provide a suction water source for the RS pump. Water from the Refueling Water Storage Tank (RWST) will be pumped through the spray ring header nozzles into Containment using the BDB AFW pump or the RRC Low Pressure / Medium Flow pump connected to the BDB RCS Pump Suction connection and discharging to the BDB Blind Flange connection, both located in the Containment Spray Pump House (CSPH) (refer to Figure 11). This initial flow will provide heat removal from the Containment atmosphere and will fill the Containment sump in preparation for initiation of Containment RS flow. When the Containment sump level is adequate, an RS pump will be started to draw water from the sump and recirculate flow through an RS heat exchanger and the spray ring nozzles. Service Water (SW) system flow will be established through the RS heat exchangers to provide a heat sink. In this manner, Containment atmosphere heat will be rejected to the ultimate heat sink via the sump water recirculation spray flowpath.

The RWST is not high wind and associated missile protected, and if unavailable as a water source to fill the Containment sump, adequate sump inventory can be provided from the James River via the plant Discharge Canal. Raw water from this source can be pumped to the suction of the BDB AFW pump using the BDB High Capacity pump. Water strainers are provided at the suction of the BDB High Capacity pump for this use to prevent clogging of the CS ring header nozzles. (Refer to Figure 11).

D. Maintain Containment

The CSPH is not high wind and associated missile protected, and if the BDB RCS Pump Suction connection and/or the BDB Blind Flange connection are not available, the alternate strategy for Containment cooling will be implemented (described later under heading Alternate Containment Cooling Strategy – Containment Ventilation Cooling).

SW system flow will be provided to the RS heat exchanger by filling the Circulating Water (CW) system Intake Canal, if necessary, and maintaining level within the canal using the diesel-driven Emergency Service Water (ESW) pumps located at the Low-Level Intake Structure in the seismic Class I Emergency Service Water Pump House. Once sufficient Intake Canal level is established (within approximately 40 hours from empty with one of three ESW pumps operating), the flowpath through the RS heat exchanger will be aligned and water flow established by gravity flow consistent with normal system operation. In the event that the ESW pumps are unavailable, the Intake Canal level will be maintained by a RRC Low Pressure / High Flow pump drawing from the James River and discharging to the Intake Canal. Fueling requirements for the ESW pumps are being evaluated. **[Open Item 16]**

In the event that the CW Intake Canal is not available, SW flow can be provided to the RS heat exchanger by pumping water from the Discharge Canal to the SW system using an RRC Low Pressure / High Flow pump. The RRC Low Pressure / High Flow pump will draw from the Discharge Canal through a strainer and discharge to the SW system through a 24" flanged manway connection in the piping, located below the Turbine Building floor slab, using a hose adapter. This connection is in a seismically-designed portion of the SW system, which is protected from high wind generated missiles. System alignments will be made to direct flow through the RS heat exchanger. (See Figure 12)

Thermal/hydraulic and Containment analyses will be performed to support this Containment cooling strategy **[Open Item 5]**.

Alternate Containment Cooling Strategy – Containment Ventilation Cooling

The 4160VAC DG from the RRC will be aligned to power a Class 1E 4160VAC and 480VAC bus as described in Section F1.3, which will provide power to Component Cooling (CC) Water system 4kV motors and CAR fan 480VAC motors. Containment ventilation flow will be established by starting the CAR fan with air flow through the CAR fan coil unit and recirculating within the Containment. Instrument Air (IA) system pressure will be restored, or portable compressed air bottles will be utilized, to operate valves to align CC water flow to the CAR fan coil unit. SW system flow will be established from the Intake Canal through a CC heat exchanger to provide a heat sink, and CC flow will be established through the CAR fan coil unit and the CC heat exchanger to transfer heat to the SW system. In this manner, Containment atmosphere heat will be rejected to the ultimate heat sink via the recirculation of Containment atmosphere through the CAR fan coil unit.

In the event that the CW Intake Canal is unavailable, cooling water flow to the CC heat exchanger will be established by pumping water to the SW system as described for the primary Containment cooling strategy and aligning flow through the CC heat exchanger. (See Figure 12)

D. Maintain Containment	
Thermal/hydraulic and Containment analyses will be performed to support this Containment cooling strategy **[Open Item 5]**.	
Details:	
D.3.1 - Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation* Site specific procedural guidance governing the Containment cooling strategy will be developed using industry guidance and will address the necessary steps to align and operate permanent plant equipment, deploy portable pumps and hoses, establish connections, and operate the portable equipment to perform the required function. **[Open Item 7]**
D.3.2 - Identify modifications	*List modifications* None.
D.3.3 - Key Containment Parameters	*List instrumentation credited for this coping evaluation.* Containment Pressure - Containment pressure indication is available in the MCR throughout the event. Containment Temperature - Containment temperature indication is available in the MCR throughout the event.

D.3.4 - Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use. The primary strategy for Containment cooling is to provide Containment RS flow using installed plant equipment and portable pumps. Water from the RWST will be pumped into Containment to fill the Containment sump using the BDB AFW pump or the RRC Low Pressure / Medium Flow pump connected to the BDB RCS Pump Suction connection and discharging to	*Identify modifications* None. The BDB RCS Pump Suction connection is described in Section C.3.4.	*Identify how the connection is protected* The protection of the BDB RCS Pump Suction connection is described in Section C.3.4. The BDB Blind Flange connection is located in the seismic category I CSPH, and is protected from flood, and extreme high and low temperatures. The connection is not protected from high wind generated missiles.

D. Maintain Containment		
the BDB Blind Flange connection, located in the CSPH, through flexible hoses. The BDB AFW pump will be deployed from the BDB Storage Building and staged in the yard area near the RWST. If used instead, the RRC Low Pressure / Medium Flow pump will be received from the RRC and staged similarly. Hoses will be routed to inside the CSPH to the BDB connections providing pump suction and discharge flowpaths. See Figure 11. The RWST is not protected from high winds and associated missiles. If this tank is not available for response to an ELAP, raw water from the James River (via the plant Discharge Canal) can be pumped to the suction of the BDB AFW pump or the RRC Low Pressure / Medium Flow pump using the BDB High Capacity pump. The BDB High Capacity pump would be deployed from the BDB Storage Building and located near the Discharge Canal. Pump discharge flexible hoses would be routed to the BDB AFW pump (or RRC Low Pressure / Medium Flow pump) suction. Water strainers are provided at the BDB High Capacity pump suction to prevent clogging of the CS ring header nozzles. See Figure 11. SW system flow will be provided to the RS heat		The SW connections in the Turbine Building are in a seismically-designed portion of the SW system, which is protected from high wind generated missiles, flood, and extreme high and low temperatures.

D. Maintain Containment		
exchanger by filling the CW system Intake Canal, if necessary, and maintaining level within the canal using the diesel-driven ESW pumps located at the Low-Level Intake Structure in the seismic Class I Emergency Service Water Pump House. In the event that the ESW pumps are unavailable, the Intake Canal level will be maintained by a RRC Low Pressure / High Flow pump drawing from the James River and discharging to the Intake Canal. The RRC Low Pressure / High Flow pump will be received from the RRC and staged near the river's edge. Flexible hoses will be routed from the pump suction to the James River and from the pump discharge to the Intake Canal. In the event that the CW Intake Canal is not available, SW flow can be provided to the RS heat exchanger by pumping water from the Discharge Canal to the SW system using an RRC Low Pressure / High Flow pump. The RRC Low Pressure / High Flow pump will be received from the RRC, and located near the Discharge Canal. Flexible hoses will be routed from the pump suction to the canal and draw water through a strainer. The pump discharge will be routed using flexible hoses to the SW system through a 24" flanged manway connection in the piping, located below the Turbine Building floor slab,		

D. Maintain Containment		
using a hose adapter. (See Figure 12) The alternate strategy for Containment cooling is to provide Containment ventilation cooling using installed plant equipment and portable pumps. In the event that the CW Intake Canal is unavailable, cooling water flow to the CC heat exchanger will be established by pressurizing the SW system as described for the primary Containment cooling strategy. See Figure 12.		
Notes: The information provided in this section is based on the following reference(s): Engineering Technical Evaluation, ETE-CPR-2012-0011, "Beyond Design Basis – FLEX Strategy Overall Integrated Plan Basis Document," Revision 2.		

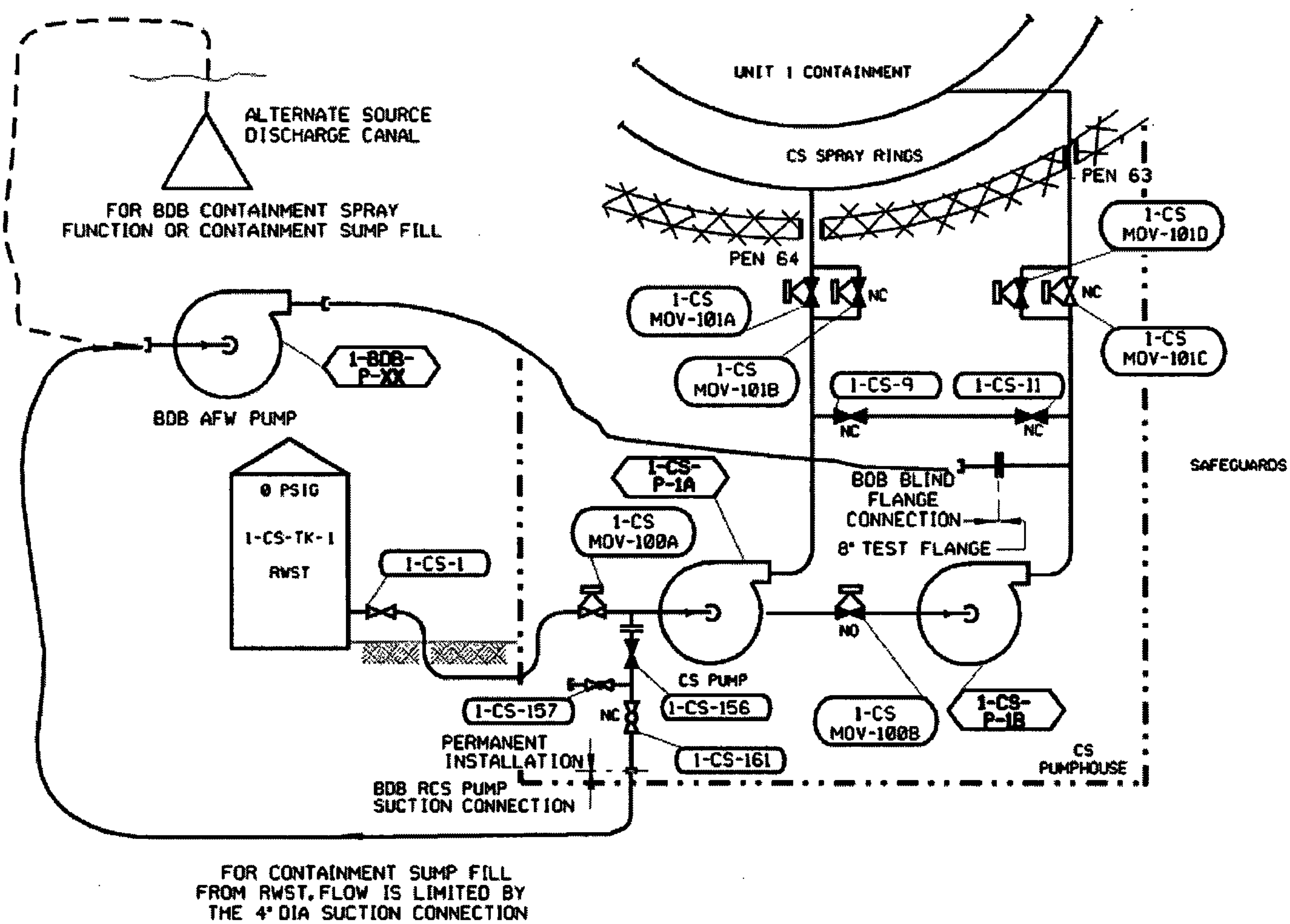
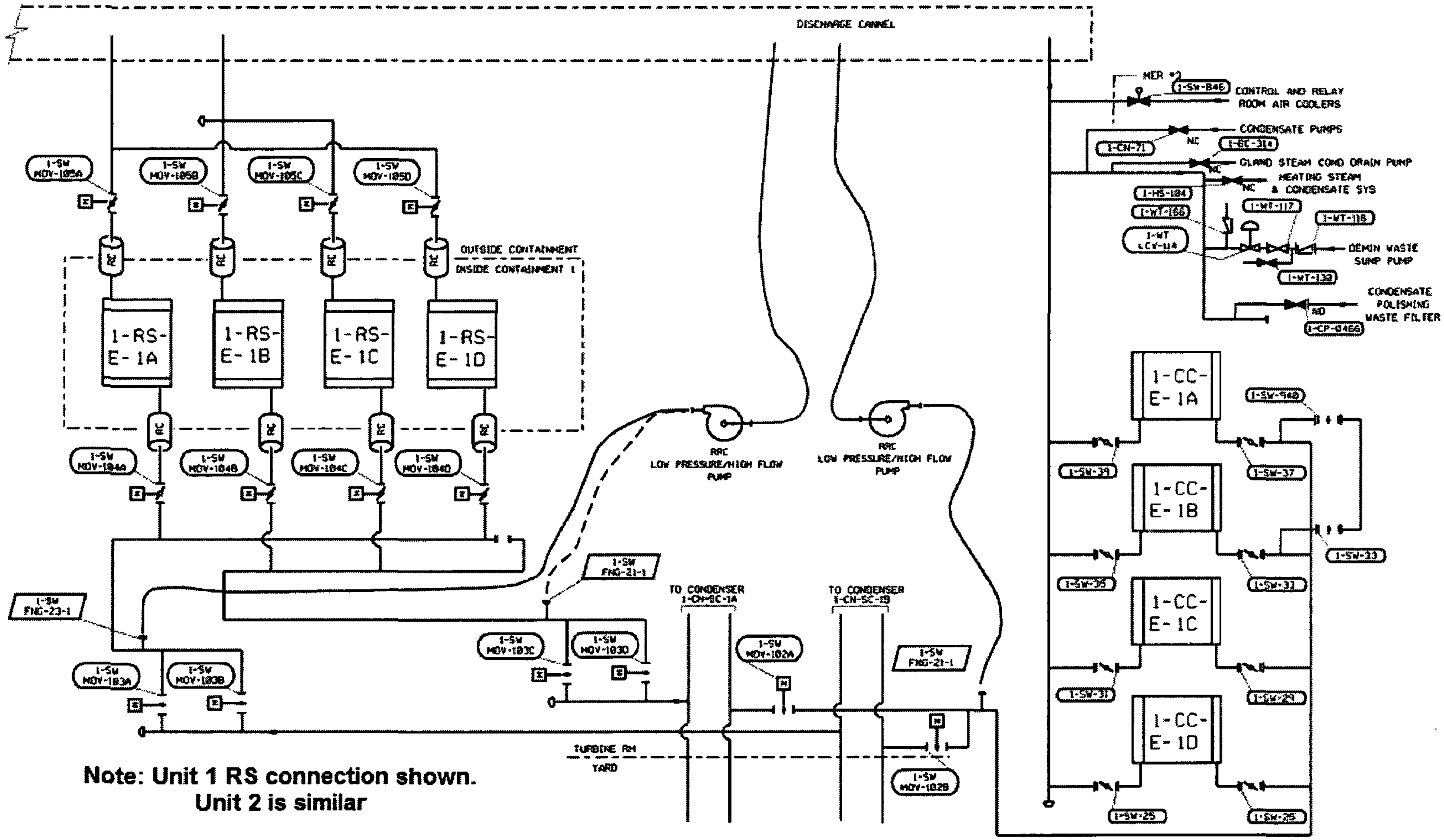


FIGURE 11
CONTAINMENT COOLING
BDB FLEX PRIMARY MECHANICAL CONNECTIONS
SURRY POWER STATION



Note: Unit 1 RS connection shown.
Unit 2 is similar

FIGURE 12
CONTAINMENT COOLING
BDB FLEX ALTERNATE MECHANICAL CONNECTIONS
SURRY POWER STATION

F5 - Safety Functions Support (Ventilation)
Determine Baseline coping capability with installed coping[2] modifications not including FLEX modifications.
F5.1 - PWR Installed Equipment Phase 1
Provide a general description of the coping strategies using installed equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times. The FLEX strategies for maintenance and/or support of safety functions involve several elements. One element is to ensure that ventilation, heating, and cooling are adequate to maintain acceptable environmental conditions for equipment operation and personnel habitability. Per the guidance given in NEI 12-06, FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDB External Event resulting in an ELAP/LUHS. The primary concern with regard to ventilation is the heat buildup which occurs with the loss of forced ventilation in areas that continue to have heat loads. The key areas identified for all phases of execution of the FLEX strategy activities are the MCR, ESGR, MSVH (SG PORV area), MSVH (TDAFW pump room), Containment Spray Pumphouse, and the Auxiliary Building. These areas have been evaluated using the GOTHIC-7.2a computer code to determine the temperature profiles following an ELAP/LUHS event. With the exception of the SG PORV area in the upper portion of the MSVH, results of the calculation have concluded that temperatures remain within acceptable limits based on conservative input heat load assumptions and with no actions being taken to reduce heat load or to establish either active or passive ventilation (e.g., portable fans, open doors, etc.) In the case of the upper level of the MSVH, where the SG PORVs are located, access to this area is necessary in order to isolate the normal air supply to the PORVs such that the local bottle air supply can be utilized for local control from a cooler area. One of the doors which leads to outside air (either the upper or lower level) in the MSVH will need to be opened to allow a "stack effect" circulation of air between the door and the ventilation openings at the top of the MSVH. This will ensure that the temperatures remain within the acceptable range for equipment and personnel habitability. The high temperatures expected in the MSVH for local operation of the SG PORV (OIP Section B.1) are similar to conditions experienced during normal station operations, testing, and maintenance. Therefore, actions performed for FLEX activities will be

[2] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

essentially the same as those performed for the current site procedure ECA-0.0, *Loss of All AC Power*, which also addresses local operation of the SG PORVs. This action is only necessary for access to isolate the normal air supply to the PORVs as stated above. Once this action is performed, no further access is required to this area for Phase 1 or any other phase during the ELAP/LUHS event response.	
Details:	
F5.1.1 - Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* The FLEX strategy procedures will include the action to open the door at the upper elevation of the MSVH to create a "stack effect" circulation of air. This action alone will ensure that the temperatures in the room remain within the range normally experienced during operation. No other actions are required to maintain equipment operation or personnel habitability following an ELAP/LUHS event in Phase 1.
F5.1.2 - Identify modifications	*List modifications and describe how they support coping time.* No ventilation related modifications are required for any phase of the ELAP/LUHS response.
F5.1.3 - Key Parameters	*List instrumentation credited for this coping evaluation phase.* No key ventilation parameters have been identified as required to maintain acceptable equipment and personnel environments for any phase of the ELAP/LUHS response.
Notes: The information provided in this section is based on the following reference(s): – Calculation ME-0973, Evaluation of Room Air Temperatures Following Extended Loss of All AC Power (ELAP), Revision 0, Addendum A.	

F5 - Safety Functions Support (Ventilation)	
F5.2 - PWR Portable Equipment Phase 2	
Provide a general description of the coping strategies using on-site portable equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times. Per the guidance given in NEI 12-06, FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDBEE resulting in an ELAP/LUHS. A calculation has been performed to evaluate ventilation concerns for areas where Phase 2 FLEX strategy activities are performed. Results of the calculation have concluded that temperatures remain within acceptable limits in these areas based on conservative input heat load assumptions and with no additional actions being taken to reduce heat load or to establish either active or passive ventilation (e.g., portable fans, open doors, etc.). Therefore, no Phase 2 actions are required to maintain equipment operation or personnel habitability. An additional ventilation concern applicable to Phase 2 is the potential buildup of hydrogen in the battery rooms. Off-gassing of hydrogen from batteries is only a concern when the batteries are charging. Once a 480VAC power supply is restored in Phase 2 (OIP Section F1.2) and the station Class 1E batteries begin re-charging, power will be restored to the ESGR room power receptacles. The doors to the battery rooms will be opened and portable fans will be used to disperse any hydrogen into the much larger volume of the ESGR rooms to prevent any significant hydrogen accumulation.	
Details:	
F5.2.1 - Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.* No procedures/strategies are required to maintain any Phase 2 equipment operation or personnel habitability following an ELAP/LUHS event.
F5.2.2 - Identify modifications	*List modifications necessary for phase 2* No ventilation related modifications are required for any phase of the ELAP/LUHS response.
F5.2.3 - Key Parameters	*List instrumentation credited or recovered for this coping evaluation.*

F5 - Safety Functions Support (Ventilation)	
F5.2 - PWR Portable Equipment Phase 2	
	No key ventilation parameters have been identified as required to maintain acceptable equipment and personnel environments for any phase of the ELAP/LUHS response.
F5.2.4 - Storage / Protection of Equipment : Describe storage / protection plan or schedule to determine storage requirements	
Seismic	*List how equipment is protected or schedule to protect* No Phase 2 BDB equipment is required.
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	*List how equipment is protected or schedule to protect* No Phase 2 BDB equipment is required.
Severe Storms with High Winds	*List how equipment is protected or schedule to protect* No Phase 2 BDB equipment is required.
Snow, Ice, and Extreme Cold	*List how equipment is protected or schedule to protect* No Phase 2 BDB equipment is required.
High Temperatures	*List how equipment is protected or schedule to protect* No Phase 2 BDB equipment is required.

F5.2.5 - Deployment Conceptual Design		
Strategy	**Modifications**	**Protection of connections**
a. *Identify Strategy including how the equipment will be deployed to the point of use.* There is no required deployment of supplemental ventilation equipment in the	*Identify modifications* No ventilation related modifications are needed to support the implementation	*Identify how the connection is protected* No ventilation related connections are needed to support the implementation

F5 - Safety Functions Support (Ventilation)		
F5.2 - PWR Portable Equipment Phase 2		
ELAP/LUHS coping strategies. No additional compensatory cooling measures are expected to be necessary, other than those identified for the upper level of the MSVH. However, for defense in depth, the operating staff will periodically monitor area temperatures to insure habitability and equipment survivability conditions are acceptable. Additional natural convection flow paths or portable ventilation fans and/or stand alone AC units may be utilized if the area temperature measurements indicate unacceptable increasing trends.	of any ELAP/LUHS coping strategies.	of any ELAP/LUHS coping strategies.
Notes: The information provided in this section is based on the following reference(s): – Calculation ME-0973, Evaluation of Room Air Temperatures Following Extended Loss of All AC Power (ELAP), Revision 0.		

F5 - Safety Functions Support (Ventilation)	
F5.3 - PWR Portable Equipment Phase 3	
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times. Per the guidance given in NEI 12-06, FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDBEE resulting in an ELAP/LUHS. A calculation has been performed to evaluate ventilation concerns for areas where Phase 2 FLEX strategy activities are performed. Results of the calculation have concluded that temperatures remain within acceptable limits in these areas based on conservative input heat load assumptions and with no additional actions being taken to reduce heat load or to establish either active or passive ventilation (e.g., portable fans, open doors, etc.). Therefore, no Phase 3 actions are required to maintain equipment operation or personnel habitability.	
Details:	
F5.3.1 - Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.* No procedures/strategies are required to maintain any Phase 3 equipment operation or personnel habitability following an ELAP/LUHS event.
F5.3.2 - Identify modifications	*List modifications necessary for phase 3* No ventilation related modifications are required for any phase of the ELAP/LUHS response.
F5.3.3 - Key Parameters	*List instrumentation credited or recovered for this coping evaluation.* No key ventilation parameters have been identified for any phase of the ELAP/LUHS response since no ventilation strategy is required to maintain acceptable equipment and personnel environments.

F5 - Safety Functions Support (Ventilation)		
F5.3 - PWR Portable Equipment Phase 3		
F5.3.4 - Deployment Conceptual Design		
Strategy	**Modifications**	**Protection of connections**
a. *Identify Strategy including how the equipment will be deployed to the point of use.* There is no required deployment of supplemental ventilation equipment in the ELAP/LUHS coping strategies. No additional compensatory cooling measures are expected to be necessary, other than those identified for the upper level of the MSVH. However, for defense in depth, the operating staff will periodically monitor area temperatures to insure habitability and equipment survivability conditions are acceptable. Additional natural convection flow paths or portable ventilation fans and/or stand alone AC units may be utilized if the area temperature measurements indicate unacceptable increasing trends.	*Identify modifications* No ventilation related modifications are needed to support the implementation of any ELAP/LUHS coping strategies.	*Identify how the connection is protected* No ventilation related connections are needed to support the implementation of any ELAP/LUHS coping strategies.
Notes: The information provided in this section is based on the following reference(s): – Calculation ME-0973, Evaluation of Room Air Temperatures Following Extended Loss of All AC Power (ELAP), Revision 0.		

Attachment 3

Formal Responses to October 2013 Audit Questions

Surry Power Station Units 1 and 2

Virginia Electric and Power Company (Dominion)

Response to October 2013 Audit Questions
Surry Power Station

Background

By letter dated February 28, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13063A181), Virginia Electric and Power Company (Dominion) submitted an Overall Integrated Plan (OIP) in response to the March 12, 2012, U.S. Nuclear Regulatory Commission (NRC) Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049; ADAMS Accession No. ML12056A045) for Surry Power Station Units 1 and 2, which is consistent with NEI 12-06.

The NRC staff has reviewed the February 28, 2013 OIP submittal and determined that the following information is needed to complete its technical review.

NRC Audit Question No. 1

NEI 12-06, Section 5.3.1, Protection of FLEX Equipment states in part:

2. Large portable FLEX equipment such as pumps and power supplies should be secured as appropriate to protect them during a seismic event (i.e., Safe Shutdown Earthquake (SSE level)).

3. Stored equipment and structures should be evaluated and protected from seismic interactions to ensure that unsecured and/or non-seismic components do not damage the equipment.

The licensee's plan did not provide sufficient information to address the securing of large portable equipment to protect them during a seismic event or to ensure unsecured and/or non-seismic components do not damage the equipment during a seismic event as required by NEI 12-06, Section 5.3.1, consideration (2) and (3).

Provide additional details to demonstrate conformance to NEI 12-06, Section 5.3.1, considerations 2, and 3.

Dominion Response:

The BDB Storage Building will have tie downs integrated into the floor slab. These tie downs will be used to secure any equipment that is not considered stable to ensure the stored BDB equipment remains protected from damage during a seismic event.

Additionally, the fire protection and HVAC systems are being seismically installed. The lighting, conduits, electrical, and fire detection are not being seismically installed but are considered insignificant and not able to damage BDB equipment.

NRC Audit Question No. 2

NEI 12-06, Section 5.3.3, identifies that four procedural interface considerations should be addressed. Considerations 2 and 3 states:

2. Consideration should be given to the impacts from large internal flooding sources that are not seismically robust and do not require ac power (e.g., gravity drainage from lake or cooling basins for non-safety-related cooling water systems).

Another example (not stated in NEI 12-06) is a turbine building flooding event coupled with an ELAP that is a challenge to mitigate. The 96" circ water headers are not rated for withstanding a seismic event. Recent nearby seismic activity, at North Anna, has exceeded predicted SSE levels. The emergency switchgear room is in the basement with a doorway with a small dike to separate it from the turbine building. The majority of sump pumps will be lost upon a loss of AC.

3. For sites that use ac power to mitigate ground water in critical locations, a strategy to remove this water will be required.

The licensee's plan did not contain any information in regards to seismic hazards associated with large internal flooding sources that are not seismically robust and do not require ac power; or the use of ac power to mitigate ground water in critical locations.

Provide information to address considerations 2 and 3 above and how your proposed mitigation strategy will cope with a worse case turbine building flooding event during an ELAP.

Dominion Response:

Regarding NEI 12-06, Section 5.3.3, Consideration 2, fire protection water piping and other water system piping within the plant, including flooding sources that are not seismically robust and do not require ac power, were evaluated during the Individual Plant Examination for External Events (IPEEE) as potential seismic event induced flooding sources. The results of this evaluation concluded that seismic-induced leakage from these systems would not result in flooding that adversely affected safe-shutdown equipment.

Additionally, in response to a 2004 NRC inspection finding and unresolved issue (IR 2004-006, URI 2004006-001, Letter No. 04-322 dated May 21, 2004), Dominion performed a detailed evaluation of a Turbine Building/Emergency Switchgear Room internal flooding scenario caused by a seismic event. The evaluation considered an earthquake magnitude sufficient to result in seismic loadings equivalent to twice the design basis earthquake (2xSSE). Flooding from Circulating Water (CW) and Service Water (SW) system sources were evaluated due to the potential for gravity flow to the Turbine Building from the CW Intake Canal in the event of piping or component failures in these systems. The evaluation determined that the risk of internal flooding due to failure of the SW/CW system components under this scenario was acceptably small. NRC Inspection Report 2005-002, (Letter No. 05-285 dated 4/19/05), documented the resolution of this finding and closed the URI. In addition, the high confidence of low probability of failure (HCLPF) values calculated for the evaluated structures and components indicate that the definition of a "robust design" in NEI 12-06 is met such that these components would not be assumed to fail for an ELAP/LUHS. Therefore, mitigation strategies to cope with Turbine Building internal flooding resulting from non-seismically robust components during an ELAP are not required to be developed.

Regarding NEI 12-06, Section 5.3.3, Consideration 3; as described in Updated Final Safety Analysis Report (UFSAR) Section 15.5.1.3, non-safety-related pumps are installed to remove subsurface seepage water collected from beneath the Containment structure preventing water levels from reaching the top of the Containment base mat and exerting hydrostatic pressure on the top of the mat liner. In the event that groundwater would rise to the site finished ground grade level at Elevation 26'-6" mean sea level, flotation of the Containment is not credible. Therefore, Surry does not rely on ac power to mitigate ground water in critical locations.

NRC Audit Question No. 3

As discussed in NEI 12-06, Section 5.3.3, the following four procedural interface considerations should be addressed:

Seismic studies have shown that even seismically qualified electrical equipment can be affected by beyond-design-basis seismic events. In order to address these considerations, each plant should compile a reference source for the plant operators that provides approaches to obtaining necessary instrument readings to support the implementation of the coping strategy. This reference source should include control room and non-control room readouts and should also provide guidance on how and where to measure key instrument readings at Containment penetrations, where applicable, using a portable instrument (e.g., a Fluke meter). Such a resource could be provided as an attachment to the plant procedures/guidance. Guidance should include critical actions to perform until alternate indications can be connected and on how to control critical equipment without associated control power.

The licensee's plan did not contain any information in regards to any plans for conforming to the following parts of consideration 1 above:

a) The development of procedure/guidelines on critical actions to perform until alternate indications can be connected (measure); and

b) The development of procedures/guidelines on how to control critical equipment without control power.

Please provide a discussion of your plans to conform to the above considerations.

Dominion Response:

a) FLEX Support Guideline (FSG) 7, "Loss of Vital Instrumentation or Control Power," is being developed to enable plant personnel to obtain instrument readings locally in the event that instrument power is disabled. The guideline will indicate the location where readings can be obtained and include conditions required to access the areas needed to get the readings, special tools and equipment needed, etc. Portable meters will be used to display an electrical output which will be compared to a conversion chart included in the guideline to determine the converted parametric value of the readout. Key instrumentation required to implement the FLEX strategies can be accessed using this method.

Development, training, and implementation of FSGs are included in OIP Open Item #7, which will be completed by September 2014 as stated in the OIP Six-month Status Report submitted in August 2013.

b) Critical plant equipment credited for implementation of FLEX strategies do not rely on control power for operation. Existing emergency procedures provide guidance for manual start of the turbine driven AFW pump if the pump does not automatically start. Guidance for local manual operation of the SG PORVs for steam release is being developed and will be included in procedures for response to an ELAP.

NRC Audit Question No. 4

As discussed in NEI 12-06, Section 8.2.1 all sites should consider the temperature ranges and weather conditions for their site in storing and deploying their equipment consistent with normal design practices. All sites outside of Southern California, Arizona, the Gulf Coast and Florida are expected to address deployment for conditions of snow, ice, and extreme cold. NEI 12-06, Section 8.2.1, further specifies that all sites located North of the 35th Parallel should provide the capability to address extreme snowfall with snow removal equipment. Finally, all sites except for those within Level 1 and 2 of the maximum ice storm severity map contained in Figure 8-2 should address the impact of ice storms.

The licensee's screening for hazards due to snow, ice and extreme cold fails to provide reasonable assurance that the licensee has appropriately screened in the need to address deployment for conditions of ice because the plan does not discuss the hazards of ice in the determination of extreme external hazards.

Provide a discussion on the external hazards of ice in the appropriate screening section of the plan.

Dominion Response:

The Surry UFSAR does not provide historical data on ice storms in the site characterization and, therefore, was not included in Section A.1 of the OIP. Ice storms can occur at Surry Power Station and may cause hazardous travel and downed trees which may block the site access road and possibly deployment haul paths. The station maintains a supply of ice melting chemicals and the equipment to deploy the chemicals as a matter of routine site safety. If an ice storm causes access route issues due to downed trees and icy conditions, two tractors and a front-end loader will be available to help clear debris and ice from roadways. The BDB Storage Building is located adjacent to the site but is outside of the site Protected Area. Therefore, the distances for hauling equipment to the designated deployment locations is relatively short and the assumed 2 hour duration for the clearing of haul paths remains reasonable.

Icing of the Discharge Canal and the deployment of the BDB High Capacity pump is addressed in the response to Audit Question #14.

The impact of extreme cold and icy conditions on deployed distribution hoses and BDB equipment is addressed by heat tracing as discussed in the response to Audit Question #8.

NRC Audit Question No. 7

NEI 12-06, Section 3.2.2 guideline (3) states:

Plant procedures/guidance should specify actions necessary to assure that equipment functionality can be maintained (including support systems or alternate method) in an ELAP/LUHS or can perform without ac power or normal access to the UHS.

Cooling functions provided by such systems as auxiliary building cooling water, service water, or component cooling water may normally be used in order for equipment to perform their function. It may be necessary to provide an alternate means for support systems that require ac power or normal access to the UHS, or provide a technical justification for continued functionality without the support system.

For permanently installed equipment used to support FLEX strategies, the licensee has provided insufficient information to provide reasonable assurance that the strategies and guidelines developed pursuant to the plan will comply with NEI 12-06, Section 3.2.2, guideline (3).

The licensee is requested to provide a discussion as to whether equipment functionality can be maintained in regards to cooling functions for permanent equipment used to support FLEX strategies.

Dominion Response:

Permanently installed plant equipment used to support core cooling and heat removal, RCS inventory control, and Spent Fuel Pool (SFP) cooling FLEX strategies do not require cooling support systems, such as component cooling water and service water, to perform their required functions.

NRC Audit Question No. 8

NEI 12-06, Section 3.2.2, guideline (12) states:

Plant procedures/guidance should consider loss of heat tracing effects for equipment required to cope with an ELAP. Alternate steps, if needed, should be identified to supplement planned action.

Heat tracing is used at some plants to ensure cold weather conditions do not result in freezing important piping and instrumentation systems with small diameter piping. Procedures/guidance should be reviewed to identify if any heat traced systems are relied upon to cope with an ELAP. For example, additional condensate makeup may be supplied from a system exposed to cold weather where heat tracing is needed to ensure *control systems are available. If any such systems are identified, additional backup sources of water not dependent on heat tracing should be identified.*

The licensee plan did not address the loss of heat tracing in the integrated plan. The licensee screened in for extreme cold, ice and snow and thus there is a need for the licensee to address loss of heat tracing affects on FLEX strategies.

Provide a discussion on the effects of the loss of heat tracing in regards to the effects for equipment required to cope with an ELAP, including alternate steps, if needed, to supplement planned actions.

Dominion Response:

Heat trace is used to provide two protection functions:

- Heat trace is used to maintain highly concentrated soluble boron solutions above the temperature where the soluble boron will precipitate out of solution.

- Heat trace is also used to protect piping systems and components from freezing in extreme cold weather conditions.

The FLEX strategies that have been developed do not depend on highly concentrated soluble boron solutions. The FLEX strategies will use borated water sources with boron concentrations below 4000 PPM; therefore, boron precipitation is not expected to occur.

Additionally, the FLEX strategies have been developed to protect piping systems and components from freezing. Commercially available Heat Tape and insulation rolls will be maintained in the BDB Storage Building for use on piping systems and components that will be used during an ELAP event where freezing is a concern in extreme cold weather conditions. In addition, major components being procured for FLEX strategies are being provided with cold weather packages and small electrical generators to power the heat tape circuits, as well as protect the equipment from damage due to extreme cold weather and to help assure equipment reliability. In addition, the Emergency Condensate Storage Tank level instrument tubing credited for BDB and subject to freezing conditions in an ELAP will be protected with the use of heat lamps which can be powered from small generators that have been procured for FLEX strategies or from the small generators that will be included as part of the large BDB pump skids being purchased.

Equipment used for the mixing of borated water in the portable Boric Acid Batch Tanks will include components such as an agitator and a tank heater to facilitate complete dissolution of the boric acid crystals. FLEX Strategies will provide guidance for mixing to maintain concentrations below the solubility limit corresponding to freezing temperatures. This will ensure that boron precipitation does not occur during an extreme cold weather event.

NRC Audit Question No. 9

Describe how electrical isolation will be maintained such that (a) Class 1E equipment is protected from faults in portable/FLEX equipment and (b) multiple sources do not attempt to power electrical buses.

Dominion Response:

(a) For permanently installed BDB equipment connections, connection hardware is either procured/installed to the requirements of safety-related equipment or is isolated from the class IE buses in accordance with the approved license basis for each unit.

FLEX Support Guidelines (FSG-5) provides guidance for energizing a Class 1E bus using portable generators consistent with NEI 12-06, Section 3.2.2. The BDB portable diesel generators will only be used when the Class 1E Diesel Generators have been isolated. Each of the BDB portable diesel generators will be provided with output electrical protection (breakers, fuses, relays, etc.) that will provide protection for the output cables and the connection buses. Existing load circuit protection will be used for the bus loads. Class 1E equipment is protected by existing protection relaying. The FLEX re-powering strategies do not change any existing equipment protection scheme.

(b) Electrical isolation to prevent simultaneously supplying power to the same bus from different sources will be administratively controlled. FSG-5 ensures the breakers from other potential supply sources are racked out and tagged before power is supplied to the buses by the BDB portable diesel generators which are connected directly to the emergency buses for the 4160VAC tie-in and to permanently installed receptacles for the 480VAC tie-in.

NRC Audit Question No. 14

NEI 12-06, Section 8.3.3 requires addressing procedural interfaces associated with a snow, ice and extreme cold hazard. The licensee indicates snow can occur at the site. The licensee does not discuss ice storms. Additionally, Surry experienced a severe icing event (1998?) where the James River iced over. The plant response was to try to get a tug boat to the Intake Structure to keep it functional. However, circumstances deteriorated and circ water flow decreased to the point the delta T across the condenser was extremely high (100 degrees). Ultimately, the discharge water heated the river water sufficiently to help the intake area.

The licensee is requested to provide a discussion regarding the deployment and operation of Phase-2 equipment during snow and ice conditions at the plant which lead to an ELAP. Provide a discussion on how the plant would respond using its mitigating strategy if an icing event such as the 1988 event would progress into an ELAP. Include *discussion on assuring access to the UHS if both units were shutdown and no heat added to Discharge Canal to melt ice.*

Dominion Response:

Ice storms and freezing conditions can occur at the Surry site. Deployment of Phase 2 equipment under these conditions is discussed in the response to Audit Question #4.

As stated in the OIP Section A.1, freezing of the James River is unlikely due to its brackish nature. However, in the case of the event cited involving icing at the Low-Level Intake Structure, there would be no impact on FLEX strategies. Neither the Intake Structure nor the Intake Canal is involved in the strategy to provide core cooling with water supplied by the BDB High Capacity pump.

Suction for the BDB High Capacity pump will be taken from the Discharge Canal. The BDB High Capacity pump and suction line with an inline floating strainer will be deployed into the discharge when augmented staff arrives on-site at 6 hours, or sooner.

Some degree of warm water would be available in the Discharge Canal to prevent freezing even with both units shutdown. However, in the event that ice was present on the surface of the Discharge Canal, tools and equipment will be available in the BDB Storage Building to create an opening in the ice in order to drop the suction line and strainer into the canal.

NRC Audit Question No. 15

There appears to be a single access road to the site. Please discuss the possibility of an external event (hurricane, snow or ice storm, etc.) blocking the access road. Include in the discussion the ability to open the access road sufficiently to permit supplemental staff to arrive and deploy Phase-2 equipment.

Dominion Response:

The access road to Surry could become blocked due to debris or heavy snow; however, BDB equipment will include two John Deere 6125M Cab Tractors and one Caterpillar 924H Front-end Loader. These three pieces of equipment have buckets that are capable of snow, ice, and debris removal and the front-end loader will have the capability to clear large items of debris. The loader and tractors will be located in the BDB Storage Building to provide protection from external events.

As stated in Dominion's NTTF Recommendation 9.3, Phase 1 Staffing Assessment dated April 29, 2013, if the access road cannot be cleared to support the arrival of augmented staff, an alternate staging location will be designated. From this location, personnel would be shuttled to the site via helicopter.

NRC Audit Question No. 27

In the 6-month update, the licensee is changing their strategy from: installing manual operators on the SG PORVs, to installing a backup air bottle system.

Note that Surry already has a backup air bottle system for the PORVs that allow the operators to operate the PORVs from the adjacent Containment spray room.

The staff requests the licensee describe the new backup air bottle system and its operation (e.g., expected cycles), include a discussion on where operators will be required to operate this system and evaluate effects of the environmental conditions, noise, communications, heat, etc.

Dominion Response:

Currently, the SG PORVs are equipped with an existing backup air bottle system that allows for manual operation. However, the existing backup air bottle system is located on the ground floor of the seismic Class I Containment Spray Pump House (CSPH), which is not tornado missile protected on two of its four walls and the ceiling.

A new seismically-designed, tornado missile protected backup air bottle system will be installed in the Main Steam Valve House (MSVH) AFW pump room to allow manual control of the SG PORVs. Check valves will be installed in the air supply tubing to isolate the new backup air bottle system from the existing backup air bottle system. The capacity of the new backup air system will be sufficient to support SG PORV manual operation to respond to the ELAP event. The backup air system compressed air bottles can be re-pressurized during event response, as necessary, using portable air compressors that are included with the BDB response support equipment. Steam flow through the SG PORVs will be controlled by manually throttling air pressure to the valve air operators from the location of the air bottles in AFW Pump Room.

Brief access to the 55-foot elevation of the MSVH is required to align the backup air system in order to manually operate the SG PORVs. Normal access to the MSVH (via the AFW pump room) is through the ground floor of the CSPH. In the event of tornado-generated missile damage to the CSPH that prevents normal access to the MSVH and AFW Pump Room, the MSVH can be alternately accessed through an exterior door located on the 55-foot elevation. If the MSVH permanently installed exterior building ladders also experience tornado missile damage, portable ladders will be utilized for alternate accessibility.

Based on preliminary results of the loss of ventilation temperature transient analysis for the upper elevation of the MSVH, the ambient temperature in the SG PORV area is expected to be near the normal operating temperature once stabilized with either the exterior access door at the 55-foot elevation or the AFW pump room access door open to provide supplemental ventilation. At normal operating temperatures, this area is routinely accessed during plant operation; therefore, access during ELAP response is not expected to be limited. The ventilation analyses are the subject of OIP Open Item 14 and are provided in the Six-Month Status Update which is included as Attachment 1 of this letter.

The loss of ventilation temperature transient analysis for the AFW pump room shows that the ambient temperature in the room with the Turbine Driven Auxiliary Feedwater (TDAFW) pump operating remains below 120°F for the entire transient. Although not expected to be necessary during low outdoor temperature conditions, FSG procedures provide for supplemental space heating for the AFW pump room.

During an ELAP, the associated noise level from the TDAFW pump in the AFW pump room will be significant. Steam flow through the SG PORVs will also generate a significant level of noise when operating. Consequently, communications with the control room will be established using methods suitable for the high-noise environment. Details of the communications plan are the subject of Surry OIP Open Item 18.

NRC Audit Question No. 29

The staff requests the licensee provide the discharge pressure of the procured FLEX pumps in order to meet their functions. Discuss pump lift capacities, pump placements, and discharge flow paths, to assure FLEX pumps can get UHS water up to and into the plant piping systems.

Dominion Response:

The FLEX strategies require the following BDB pumps: 1) the BDB High Capacity Pump (one common pump for both units, which lifts water from the UHS to supply both Units 1 and 2 AFW pumps/systems and to supply SFP makeup for the dual unit Surry SFP); 2) the BDB AFW Pumps (one for each unit, which delivers flow to the SGs for decay heat removal and RCS cool down); and 3) the BDB RCS Injection Pumps (one for each unit, which delivers borated water to the RCS for inventory makeup and reactivity control when needed). The placement of these pumps and the discharge flow paths are shown in Figures 1 and 2 of the Surry OIP. Additional figures are available in the OIP that show the BDB connection points in more detail.

The BDB High Capacity Pump is a diesel driven Godwin HM130L pump which develops more than 150 psid at 1200 gpm. The Godwin HM130L is equipped with a totally automatic self-priming system which can achieve suction lifts from a completely dry condition to 28 feet. The BDB High Capacity Pump will be placed such that the suction nozzle is approximately 10 feet above the elevation of the UHS water level.

The BDB AFW Pump is a diesel driven Hale Model TBP50-M pump which develops approximately 500 psid at 350 gpm. The Hale Model TBP50-M pump is equipped with a priming system and is guaranteed to have 10 foot lift capability with 20 feet of 6" suction hose and a suction strainer. However, the BDB AFW pump is used in flooded suction conditions in FLEX strategies with the suction being supplied by either the discharge of the BDB High Capacity pump or the Emergency Condensate Storage Tank (ECST) which is the normal AFW water storage tank.

A Dominion hydraulic calculation confirms the ability of the BDB High Capacity pump to deliver at least 300 gpm to the AFW pump/system of both units and at least 500 gpm to the SFP with margin for pump placement.

The BDB RCS Injection Pump is a diesel driven Hydra-Cell Model T8045 positive displacement pump which develops over 2000 psig discharge pressure at 45 gpm. The Hydra-Cell Model T8045 pump has dry lift (self priming) capability of approximately 9 feet. However, the BDB RCS Injection pump is used in flooded suction conditions in FLEX strategies with the suction being supplied by the RWST or the portable Boric Acid Batch Tank. Calculations documenting the RCS makeup hydraulic analysis have been completed.

NRC Audit Question No. 30

The staff requests the licensee provide additional information on the continued operation of the TDAFW pump during an ELAP event.

A) discuss dependency on DC, AC, and air on the pump and associated valve operators

B) discuss reliability of continued operation with respect to steam moisture content (previously attributed to pump trips), steam trap operation; and do trip valves close stopping trap drain

C) discuss operation of the steam admission valves; do they fail close on loss of DC or nitrogen, what measures need to be taken to ensure continued operation.

D) discuss affects of environment conditions on governor operation

E) discuss whether the TDAFW pump and its support systems (e.g., exhaust and recirculation) are robust as defined by NEI 12-06, Appendix A [such that it would meet the guidance of NEI 12-06, Section 3.2.1.3, initial condition (6) and Section 3.2.1.4, boundary condition (4)] and the effect of their consequential failure if appropriate, including any operator actions required to preserve inventory.

Dominion Response:

As described in the Surry OIP, Section B.1, the TDAFW pump automatically starts in the event of an ELAP/LUHS event on the loss of offsite power condition and does not require AC or DC electrical power to provide AFW to the SGs.

A) The TDAFW pump does not rely on AC or DC power, or on compressed air pressure, to function. The TDAFW pump turbine is supplied with motive steam through two parallel, normally closed air-operated valves. The valves fail open upon loss of DC power and fail as-is upon loss of compressed air pressure. DC power will be available at the initiation of the ELAP and these valves are expected to open as a result of the TDAFW pump start signal. The valves will remain open following ELAP DC load stripping and will not be cycled open/closed to control the TDAFW pump. During an ELAP, the TDAFW pump turbine steam flow will be controlled automatically by the governor valve or manually with the overspeed trip/throttle valve. Neither the TDAFW pump turbine governor valve nor the overspeed trip/throttle valve require electrical power or compressed air to function.

Therefore, continued operation of the TDAFW pump does not rely on AC or DC power, or on compressed air.

B) The TDAFW pump turbine steam supply lines are designed with steam condensate traps in the low points of the lines for condensate removal. The traps drain to the main condenser through a common header that includes a normally open air operated isolation trip valve. The steam trap common drain line isolation trip valve closes on a Containment isolation signal, which is concurrent with certain AFW pump start signals, and fails closed on loss of Instrument Air pressure. The steam turbine that drives the TDAFW pump can operate on steam of any moisture content, or on a steam / condensate mixture, but can be subject to over speed trip on start-up when significant condensate is present in the inlet steam line. Since the steam traps are aligned to drain to the condenser during power operation prior to TDAFW pump start, insignificant moisture is expected to accumulate in the turbine steam supply lines. Consequently, significant condensate will not be introduced to the turbine on an automatic start. Further, the turbine governor controls initial startups such that the pump/turbine gradually ramps up to operating speed, which tends to gradually introduce any minimal condensate that could potentially be in the steam supply lines to the turbine in a controlled fashion as it comes up to speed. When the TDAFW pump/turbine is at normal operating speed, the steam flow in the steam supply line will carry any small amounts of non-drained water that might condense in the line through the steam supply line to the turbine and thus tend to preclude condensate buildup in the steam supply line. Thus, the design of the steam supply lines and steam trap system limits the possibility of turbine trips due to excess condensate in the steam supply lines.

C) See response to A) above.

D) The TDAFW pump governor operation will not be adversely affected by the environmental conditions within the AFW pump room during an ELAP/LUHS. A Dominion calculation for the loss of ventilation transient temperature analysis shows that the temperature in the ground level of the MSVH (AFW pump room) will remain below 120°F, which is below the qualification temperature of the governor. Although not expected to be necessary during low ambient temperature conditions, FSG-5 will provide for supplemental space heating for the AFW pump room, such that TDAFW pump governor operation will not be affected.

E) The TDAFW pump and associated components (e.g., turbine exhaust and pump recirculation piping, etc.) that support operation of the TDAFW pump are designed to meet the current plant design basis for the applicable external hazards identified in Surry OIP Section A.1. Thus, failures of the TDAFW pump and its support systems are not postulated for BDB events.

NRC Audit Question No. 37

Discuss impact of injecting raw water through the main feedwater header on the "J" nozzles inside the steam generators. Include filtering requirements.

Dominion Response:

The injection of raw water from the Surry Discharge Canal, following depletion of the Emergency Condensate Storage Tank (ECST) and the Emergency Condensate Makeup Tank (ECMT), would not occur until 14 hours after the event at the earliest and will not affect the SG feedwater ring J-nozzles. The J-nozzles are fabricated from erosion resistant material (Inconel) and are of sufficient internal diameter to prevent blockage. The BDB High Capacity Pump, drawing raw water from the Surry Discharge Canal, includes strainers to prevent downstream pump damage, flow blockage, and excessive sediment or debris accumulation.

Although the Surry Discharge Canal is the ultimate credited source of AFW supply because it will be available for all considered extreme events, other site water sources are expected to be used preferentially, if available. These sources include the normal Condensate Storage Tanks, the main condenser hotwell, and the Fire Protection System water storage tanks, which would provide a clean source of fresh water for SG injection.

Studies are currently being performed by Westinghouse (SG supplier) to assess the long-term effects of the use of available water sources on SG performance in response to the ELAP/LUHS. The study will result in a list of prioritized water sources. The final results of the Westinghouse study are expected in March 2014 and will be provided in a future Six-Month Update.

NRC Audit Question No. 44

Please clarify whether you plan to abide by the Nuclear Energy Institute position paper addressing mitigating strategies in shutdown and refueling modes that is dated September 18, 2013 (ADAMS Accession No. ML13273A514), and which has been endorsed by the NRC staff (ADAMS Accession No. ML13267A382). If not, please clarify how mitigating strategies for shutdown and refueling modes will be addressed and provide justification for the planned approach.

Dominion Response:

Surry 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.