VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

JUL 22 2015

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

Serial No.: 14-395B
NLOS/DEA: R4'
Docket No.: 50-280
License No.: DPR-32

**VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
SURRY POWER STATION UNIT 1
COMPLIANCE LETTER IN RESPONSE TO THE MARCH 12, 2012
COMMISSION ORDER MODIFYING LICENSES WITH REGARD TO
REQUIREMENTS FOR MITIGATING STRATEGIES FOR BEYOND-DESIGN-BASIS
EXTERNAL EVENTS (ORDER NUMBER EA-12-049)**

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

This letter provides notification that Dominion has completed the requirements of the Order and is in full compliance with the Order for Surry Unit 1. The attachments to this letter provide: 1) a summary of how the compliance requirements of the Order were met, and 2) the responses to the Open Items and Confirmatory Items from the Interim Staff Evaluation for the Order (ML14002A145) from the NRC, plus Dominion's responses to additional items identified in Attachment 3 of the Surry Power Station Onsite Audit Report dated April, 2015 (ML15096A391).

Should you have any questions or require additional information, please contact Diane Aitken at (804) 273-2694.

Respectfully,

Mark Sartain
Vice President – Nuclear Engineering

THOMAS CLEARY
NOTARY PUBLIC
MY COMMISSION EXPIRES
FEBRUARY 28, 2016

STATE OF CONNECTICUT)
)
COUNTY OF NEW LONDON)

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

Acknowledged before me this 22ND day of JULY, 2015.

My Commission Expires: ____________.

Notary Public

A151
NRR

Attachments:

1. Order EA-12-049 Compliance Requirements Summary

2. Response to ISE Open Items and ISE Confirmatory Items plus Additional Items Identified in Attachment 3 of Surry Power Station Units 1 and 2 Onsite Audit Report dated April 14, 2015

Commitment contained in this letter:

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

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NRC Senior Resident Inspector
Surry Power Station

Attachment 1

Surry Power Station Unit 1

Order EA-12-049 Compliance Requirements Summary

Virginia Electric and Power Company
Surry Power Station Unit 1

Surry Power Station Unit 1
Order EA-12-049 Compliance Requirements Summary

Surry Power Station developed an Overall Integrated Plan (OIP) (Reference 1), documenting diverse and flexible strategies (FLEX) in response to Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," (Reference 2). The OIP for Surry Power Station, Units 1 and 2 was submitted to the NRC on February 28, 2013 and was supplemented by Six-Month Status Reports (References 3, 4, 5 and 6), in accordance with Order EA-12-049, along with an additional supplemental letter that was submitted on April 30, 2013 (Reference 7).

Full compliance with Order EA-12-049 was achieved for Surry Power Station Unit 1 on May 24, 2015. This date corresponds to the end of the Unit 1 second refueling outage after submittal of the OIP as required by Reference 2. The information provided herein documents full compliance with Reference 2 for Surry Power Station Unit 1.

Completion of the elements identified below for Surry Power Station Unit 1, as well as References 1, 3, 4, 5, 6, and 7 document full compliance with Order EA-12-049 for Surry Power Station Unit 1.

NRC INTERIM STAFF EVALUATION (ISE) AND AUDIT ITEMS – COMPLETE

During the ongoing audit process (Reference 8), Dominion provided responses for the following items for Surry:

- ISE Open Items
- ISE Confirmatory Items
- Licensee Identified Open Items
- Audit Questions
- Safety Evaluation Review Items

The NRC report, "Surry Power Station, Units 1 and 2 – Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051" (Reference 9) delineated the items reviewed during the Surry Power Station onsite audit. The report also identified additional audit items, specified as Safety Evaluation Review Items, which were added following the audit and required supplemental information to address.

Dominion's responses, or references to the source document for responses, to the NRC's ISE Open Items and ISE Confirmatory Items (Reference 10), are provided in Attachment 2 of this letter. Attachment 2 also provides the responses, or references to the source document for responses, to Open or Pending Audit Questions and Licensee Identified Open Items related to Order EA-12-049 from Reference 9. It is Dominion's position that no further actions are required for any of the above items.

MILESTONE SCHEDULE – ITEMS COMPLETE

Unit 1 Milestone	Completion Date
Submit Integrated Plan	February 2013
Develop Strategies	October 2013
Develop Modifications	December 2014
Implement Unit 1 Modifications	May 2015
Develop Training Plan	April 2014
Implement Training	May 2015
Issue FSGs and Associated Procedure Revisions	April 2015
Develop Strategies/Contract with NSRC*	March 2015
Purchase Equipment	February 2014
Receive Equipment	September 2014
Validation Walk-throughs or Demonstrations of FLEX Strategies and Procedures	March 2015
Create Maintenance Procedures	August 2014
Unit 1 Outage Implementation	May 2015

* NSRC is the National SAFER Response Center

STRATEGIES – COMPLETE

Strategy related ISE Open Items, Confirmatory Items, Audit Questions and Safety Evaluation Review Items have been addressed as documented in Reference 9 or Attachment 2 to this letter. The Surry Power Station Unit 1 strategies are in compliance with Order EA-12-049.

MODIFICATIONS - COMPLETE

The plant modifications required to support the FLEX strategies for Surry Power Station Unit 1 have been completed in accordance with the station design control process. The plant modification design changes (DCs) implemented in support of the FLEX strategies for Surry Power Station Unit 1 are as follows:

- FLEX Mechanical Connections (SU-12-00022)
- FLEX Power for Essential Instrumentation and Equipment (SU-13-01010)
- Beyond-Design-Basis (BDB) Storage Building (SU-13-00015)
- BDB FLEX Strategy Support Modifications (SU-13-01168)
- BDB Offsite Communications (SU-14-01034)
- BDB Emergency Equipment (SU-12-00005)
- Surry Spent Fuel Pool Mechanical Connections (SU-12-01219)
- Spent Fuel Pool Level Instrumentation (SU-13-01042)

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

EQUIPMENT – PROCURED, MAINTENANCE, AND TESTING - COMPLETE

The equipment required to implement the FLEX strategies for Surry Power Station Unit 1 has been procured in accordance with NEI 12-06, Section 11.1 and 11.2, received at Surry Power Station, initially tested, the performance verified as identified in NEI 12-06, Section 11.5, and is available for use.

Maintenance and testing will be conducted through the use of the Surry Power Station Preventative Maintenance program such that equipment reliability is maintained and is in compliance with EPRI guidelines where applicable to the FLEX equipment.

PROTECTED STORAGE - COMPLETE

The storage facility required to protect BDB equipment has been completed for Surry Power Station. The BDB equipment is protected from the applicable site hazards and will remain deployable to assure implementation of the FLEX strategies for Surry Power Station Unit 1. Dominion acknowledges that the storage of the N+1

50.54(hh)(2) pump in a structure outside of the protected BDB Storage Building represents an alternative to the requirements of NEI 12-06, Sections 5.3.1, 7.3.1, and 11.3.3. Accordingly, appropriate compensatory measures are in place with regard to the allowed unavailability of the BDB equipment. Specifically, if the site FLEX (N) capability is met, but not fully protected for the site's applicable hazards the allowed unavailability is reduced to 45 days.

PROCEDURES - COMPLETE

FLEX Support Guidelines (FSGs), for Surry Power Station Unit 1, have been developed and integrated with existing procedures. The FSGs and affected existing procedures have been approved and are available for use in accordance with the site procedure control program.

TRAINING - COMPLETE

Training of personnel responsible for the mitigation of beyond-design-basis events at Surry Power Station Unit 1 has been completed in accordance with an accepted training process as recommended in NEI 12-06, Section 11.6.

STAFFING - COMPLETE

The staffing study for Surry Power Station has been completed in accordance with "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force review of Insights from the Fukushima Dai-ichi Accident," Enclosure 5 pertaining to Recommendation 9.3, dated March 12, 2012 (Reference 11). The staffing assessment was submitted by letter dated December 17, 2014, "Surry Power Station Units 1 and 2, March 12, 2012 Information Request, Phase 2 Staffing Assessment Report," (Reference 12) and supplemented by letter dated June 9, 2015, "Surry Power Station Units 1 and 2, March 12, 2012 Information Request Supplemental Information Regarding Phase 2 Staffing Assessment Report, Recommendation 9.3." The supplemental information involved the use of Security personnel, procedures, training and staffing for BDB events.

No additional action, procedures, training, or staff are necessary and the FSG strategies can be successfully implemented using the current minimum on-shift staffing.

NATIONAL SAFER RESPONSE CENTERS - COMPLETE

Dominion has established a contract with Pooled Equipment Inventory Company (PEICo) and has joined the Strategic Alliance for FLEX Emergency Response (SAFER) Team Equipment Committee for off-site facility coordination. It has been confirmed that PEICo is ready to support Surry Power Station with Phase 3

equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan (Reference 13).

VALIDATION - COMPLETE

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

FLEX PROGRAM DOCUMENT - ESTABLISHED

The Dominion FLEX Program Document has been developed in accordance with the requirements of NEI 12-06 and is in effect for Surry Power Station Unit 1.

REFERENCES

The following references support the Surry Power Station Unit 1 FLEX Compliance Summary:

1. "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," February 28, 2013 (Serial No. 12-163B) (ML13063A181).
2. NRC Order Number EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012 (ML12229A174).
3. "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)," dated August 23, 2013 (Serial No. 12-163D) (ML13242A013).
4. "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)," dated February 27, 2014 (Serial No. 12-163E) (ML14069A015).

5. "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)," dated August 28, 2014 (Serial No. 14-395) (ML14251A035).

6. "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)," dated March 2, 2015 (Serial No. 14-395A) (ML15069A234).

7. Letter from Dominion to NRC, "Supplement to Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated April 30, 2013 (ML13126A208)

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

9. NRC letter from John Boska, Senior Project Manager, JLD, Office of NRR, to David A. Heacock, President and Chief Nuclear Officer, Virginia Electric and Power Company, "Surry Power Station, Units 1 and 2 – Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051," dated April 14, 2015 (ML15096A391).

10. NRC letter from Jeremy S. Bowen, Chief, Mitigating Strategies Branch Office of NRR, to David A. Heacock, President and Chief Nuclear Officer, Virginia Electric and Power Company, "Surry Power Station, Units 1 and 2 – Interim Staff Evaluation Related to Overall Integrated Plan in Response to Order EA-12-049 (Mitigating Strategies)," dated February 19, 2014 (ML14002A145)

11. 10CFR50.54(f), "Request for Information Pursuant to Title 10 of the Code of Federal Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," Recommendation 9.3, dated March 12, 2012 (ML2073A348).

12. Letter from Dominion to NRC, "Surry Power Station Units 1 and 2, March 12, 2012 Information Request, Phase 2 Staffing Assessment Report," dated December 17, 2014 (SN: 14-200).

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

Attachment 2

Response to ISE Open Items and ISE Confirmatory Items plus Additional Items Identified in Attachment 3 of Surry Power Station Units 1 and 2 Onsite Audit Report dated April 14, 2015

Virginia Electric and Power Company
Surry Power Station Unit 1

Response to ISE Open Items and ISE Confirmatory Items plus Additional Items Identified in Attachment 3 of Surry Power Station Units 1 and 2 Onsite Audit Report dated April 14, 2015

<u>NOTE</u>: Documents identified in this attachment as having been previously provided to the Nuclear Regulatory Commission (NRC) staff for review were provided in accordance with NRC letter to All Operating Reactor Licensees and Holders of Construction Permits, "Online Reference Portal for Nuclear Regulatory Commission Review of Fukushima Near-Term Task Force Related Documents," dated August 1, 2013 (ML13206A427).

I. NRC Interim Staff Evaluation (ISE) Open Item (OI) Response

ISE OI 3.2.1.8.A

Core Sub-Criticality - Verify that Surry will apply the generic resolution for boron mixing under natural circulation conditions potentially involving two-phase flow, in accordance with the Pressurized-Water Reactor Owners Group (PWROG) position paper, dated August 15, 2013 (ADAMS Accession No. ML13235A135 (non-public for proprietary reasons)), and subject to the conditions provided in the NRC endorsement letter dated January 8, 2014 (ADAMS Accession No. ML13276A183). Alternatively, justify the boric acid mixing assumptions that will ensure adequate shutdown margin exists through all 3 phases of an ELAP event.

Dominion Response:

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

Clarification (1): The Surry evaluation for boron mixing has considered both the case of maximum Reactor Coolant Pump (RCP) seal leakage, as well as the zero leakage case. Westinghouse Letter LTR-FSE-13-46, Rev. 0, "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Boron Mixing in Support of the Pressurized Water Reactor Owners Group (PWROG)," August 15, 2013 argued that the zero leakage case is more limiting than the high leakage case from the standpoint of mixing because it delays the boron contribution from accumulator injection, resulting in more reliance on pumped injection from the Beyond Design Basis (BDB) Reactor Coolant System (RCS) Injection pump. However, Dominion has not credited boron from accumulator injection in developing its FLEX strategy. Therefore, the maximum leakage case is the most limiting.

Clarification (2): For the maximum leakage case, Surry intends to initiate RCS makeup of 45 gpm by the 16th hour following the onset of the Extended Loss of AC Power/ Loss of Ultimate Heat Sink (ELAP/LUHS) condition. This is well in excess of

the maximum RCS leakage at 16 hours based on the current Surry Flowserve N-9000 RCP seal configuration. Westinghouse Letter LIS-14-79, "PWROG ASC Reflux Cooling Position Paper for Westinghouse Designed PWRs," Attachment 1, calculated that for a 3-loop Westinghouse plant such as Surry, the time at which two-phase flow drops below single phase natural circulation flow is slightly more than 17 hours. This calculation assumed three Westinghouse OEM seals (21 gpm/seal initial leakage). Surry is equipped with a Flowserve N-9000 seal in each reactor coolant pump. With these low leakage seals, the estimated time to reflux cooling or two-phase flow less than single phase flow is greater than 40 hours. (See also our response to ISE CI 3.2.1.2.A). Makeup flow will begin prior to this time and will exceed maximum leakage flow. Since the Surry RCP seal configuration has significantly less seal leakage than assumed in the Westinghouse calculation, the approach to the condition where two-phase flow drops below single phase natural circulation flow would be halted and reversed. Accordingly, the conditions identified in Clarification 2a of the NRCs endorsment letter dated January 8, 2014 are applicable as the RCS flow stays within the favorable conditions identified for boron mixing Therefore, the conditions identified in Clarification 2b will not occur with the above RCS makeup strategy.

Clarification (3): Provided that the flow in all RCS loops is greater than or equal to the corresponding single-phase natural circulation flow rate, the staff considers a mixing delay period of one hour following the addition of the targeted quantity of boric acid to the reactor coolant system to be appropriate. Dominion's reactivity calculations show that no increase in boron concentration is required for greater than one hour following anticipated completion of RCS makeup injection for cooldown to the 300 psig target steam pressure in ECA-0.0. Beginning at 16 hours, RCS make-up to accommodate shrink during cooldown to 300 psig provides additional boration margin and allows for continued RCS cooldown when desired. Thus, the available boron mixing time will be much greater than the one hour specified in Clarification (3).

The documents referenced in the above response have previously been provided to the NRC staff and are available for review.

ISE OI 3.2.4.10.A

Battery Duty Cycle. Verify that the licensee will abide by the generic approach for demonstrating that vented lead-acid batteries can be credited for durations longer than 8 hours, or justify an acceptable alternate approach.

Dominion Response:

Dominion confirms that the Class 1 E battery duty cycle for Surry was calculated in accordance with the IEEE-485 methodology using manufacturer discharge test data

applicable to Surry's FLEX strategy as outlined in the NEI white paper on Extended Battery Duty Cycles. This confirmation was provided in Section 4a) of the second Six-Month Status Report dated February 27, 2014 (Serial No. 12-163E).

The detailed Surry battery duty cycle calculations, supporting vendor discharge test data, FLEX strategy battery load profile, and other inputs/initial conditions required by IEEE-485 were made available for review. From Section 10.2 of Calculation EE-0046, Rev. 2, Addendum D, "125V DC System Analysis", the following duty cycles have been evaluated using IEEE-485-2010 battery sizing methodology.

Unit 1 Batteries (cross-tied at T=45 min)*

0-1 min	1-60 min	60-75 min	>75min
937.81A	230A	140.5A	51A

Unit 2 Batteries (cross-tied at T=45 min)*

0-1 min	1-60 min	60-75 min	>75min
952.36A	230A	139.5A	49A

* The ability to cross-tie the Class 1E battery busses is a design feature of each of the Surry units.

The documents referenced in the above response have previously been provided to the NRC staff and are available for review.

II. NRC Interim Staff Evaluation (ISE) Confirmatory Item (CI) Responses

ISE CI 3.1.1.3.A

Procedural Interface Considerations - Seismic Hazard. Confirmation that the FLEX Support Guidelines (FSG) being developed for obtaining local instrument readings addresses critical actions to perform until alternate indications can be connected.

Dominion Response:

FLEX Support Guidelines (FSG) 1/2-FSG-7, "Loss of Vital Instrumentation or Control Power", provide operators with direction on how to establish alternate monitoring and control capabilities. 1/2-FSG-7 include: 1) instructions to restore power to the Remote Monitoring Panel to facilitate reading critical RCS and SG parameters, 2) instructions to obtain key parameter information readings from containment penetrations, and 3) instructions to read core exit thermocouples using a battery powered thermocouple calibrator. Procedures 1/2-FSG-7 were developed in accordance with Pressurized Water Reactor Owner's Group (PWROG) guidance and have been approved to support FLEX implementation at Surry Power Station.

Copies of the approved Surry FSGs have previously been provided to the NRC staff and are available for review.

ISE CI 3.1.1.4.A

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

Dominion Response:

The National SAFER Response Center (NSRC – previously designated as the RRC) local staging areas, access route evaluations, and transportation evaluations to the site have been completed and documented in the SAFER Trip Report for Surry Power Station, 12-9217625-000. The SAFER Response Plan for Surry, (Document #51-9233430-000), has also been finalized. Copies of these documents have previously been provided to the NRC staff and are available for review.

ISE CI 3.2.1.A

RCS Cooling and RCS Inventory Control. Confirm the appropriate use of the analysis from Section 5.2 of WCAP-17601-P by demonstrating the important parameters and assumptions are representative of Surry.

Dominion Response:

WCAP-17601 provides simulations of an extension of current emergency operating guidance and an extensive plant cooldown and depressurization for the ELAP event. WCAP-17601, Section 5.2.1 provides a Reference Case for a Westinghouse 4-loop plant with a core height of 12 feet (i.e., a 412 plant), at 3723 MWt, with a Model F SG and Model 93A/A-1 RCPs. This Westinghouse Reference Case assumed standard Westinghouse OEM RCP seal packages to determine the minimum adequate core cooling time with respect to RCS inventory (i.e., core uncovery).

WCAP-17792 documented additional information for Westinghouse and CE plants for use in the FLEX Support Guidelines (FSGs). As part of this work, Westinghouse generated reference cases for the Westinghouse 2-loop and 3-loop plants. The PWROG issued parameter templates (PWROG Letter OG-14-175, "Transmittal of Final Templates to Support PA-ASC-1272 'Address NRC Confirmatory Item 3.2.1.X for all Domestic PWR Designs', LTR-LIS-14-219, LTR-SCC-14-009, Revision 0, and ANP-3301, Revision 0," dated May 7, 2014) for the reference cases presented in WCAP-17601 and WCAP-17792. These templates provide the values for the important parameters used in the Surry analyses. The applicability of these

templates to Surry is evaluated in ETE-NAF-2012-0150, Rev. 2, Section 6.4 and Table F.4.

The documents referenced in the above response have previously been provided to the NRC staff and are available for review.

ISE CI 3.2.1.1.A

ELAP Analysis – Reliance on the NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow conditions prior to reflux condensation initiation. This includes specifying an acceptable definition for reflux condensation cooling. Confirm that the NOTRUMP code is used within acceptable limits.

Dominion Response:

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

Deployment of the RCS injection capability by 16 hours will preclude operation in the reflux cooling mode for Surry. See also the response to ISE CI 3.2.1.2.A.

Use of the NOTRUMP code for analysis of SPS response to an ELAP event is discussed further in ETE-NAF-21012-0150, Rev. 2.

The documents referenced in the above response have previously been provided to the NRC staff and are available for review.

ISE CI 3.2.1.2.A

RCP Seal Leakage. Confirm that, if the seals are changed to non-Westinghouse seals, the licensee addresses the acceptability of the use of non-Westinghouse seals, and provides the acceptable justification for the RCP seal leakage rates for use in the ELAP analysis, to include whether the Flowserve white paper justifies the use of the Flowserve N-9000 seals and bounds the 21 gpm/seal leakage rate assumed in the analysis.

Dominion Response:

The Surry Reactor Coolant Pumps have been equipped with Flowserve N-9000 seals, which reduce seal leakage compared to the Westinghouse OEM seals, thus extending the time by which the RCS makeup must be deployed to ensure adequate mixing and allowing sufficient time to deploy equipment for RCS inventory makeup. Because of the similarities between Dominion's North Anna Power Station and the Surry Power Station, the specific analysis performed for North Anna has been used as a basis for the seal evaluation for Surry.

PWROG Letter OG-14-60, "Generic Information to Support Requests for Additional Information in USNRC Reviews of FLEX Overall Integrated Plans with Regard to Reflux Cooling, LTR-LIS-14-79, (PA-ASC-1197)," dated February 13, 2014 provided: 1) post-ELAP times to reflux cooling (Steam Generator U-bend 1-hour average flow quality = 0.1); and 2) times to violate the condition for adequate mixing of added boric acid (two phase RCS loop flow decreases to less than the single phase flow in the same loop, but mixing can be credited one hour after the condition has been ensured or restored. The PWROG Letter OG-14-60 results were based on the reference RCP seal leakage assumptions of WCAP-17601 (initial leakage of 21 gpm/seal and decreasing with pressure based on critical flow through the seal).

The PWROG has developed a White Paper on NOTRUMP [PWROG-14-45-P]. The purpose of this white paper is to document the applicability of the NOTRUMP code for the evaluation of the ELAP event and application of its results with regards to criteria for boron mixing and reflux cooling for Westinghouse designed PWRs. From PWROG-14-45-P, the comparison of results from the NOTRUMP and TRACE computer codes for the parameters of interest show that the NOTRUMP predicted results agree well or are conservative with respect to the NRC's TRACE predicted results. The comparison shows that NOTRUMP provides a conservative estimate of the required time when the primary make-up pumps are required for an ELAP event. Therefore, it is concluded that NOTRUMP is acceptable for simulation of the ELAP event within the criteria for reflux cooling and boron mixing. The application of the NOTRUMP simulations reference cases required the implementation of the RCS makeup pump by 17.0 hours for all Westinghouse plants, including Westinghouse 3-loop T-hot upper head plants such as Surry. This was a conservative bounding requirement based on the 4-loop reference case and superseded information provided in OG-14-60.

PWROG-14015, Revision 1 transmitted the results of the calculation of the seal flow rates for North Anna, a Category 3 plant according to the information provided in PWROG-14008. The analysis of maximum flow and maximum pressure values for the seal leak-off lines to address PA-SEE-1196 was performed using the Westinghouse two phase flow code ITCHSEAL.

Dominion's ETE-NAF-2012-0150 Rev. 2, "Core Cooling Evaluation for Dominion Fleet and Proposed Input for Dominion's Response to NRC Order EA-12-049," provides a "quantitative" assessment for the North Anna configuration of three Flowserve N-9000 RCP seals. The estimated time for the reference plant RCS mass to reach the threshold for less than single-phase flow is 17 hours. For the North Anna configuration of three Flowserve N-9000 RCP seals, the estimated time to reach this threshold would be 42.6 hours. Since all three RCP seals at each Surry unit are the low leakage Flowserve N-9000 seals, the North Anna evaluation for the three Flowserve N-9000 seals case is a representative case for Surry. Therefore, no specific calculations were performed for Surry and engineering judgment is used to conclude that the Surry configuration of three low leakage RCP seals considerably lengthens the time for the onset of reflux cooling to a time greater than 40 hours similar to North Anna.

The Flowserve N-9000 seal leakage assumed in the evaluation is "normal" seal leakage of 2.5 gpm based on Flowserve Corporation, "White Paper on the Response of the N-Seal Reactor Coolant Pump (RCP) Seal Package to Extended Loss of All Power (ELAP)", dated February 11, 2014 (Proprietary). The analysis conservatively assumes the 2.5 gpm seal flowrate (normal operating controlled bleed off line (CBO) flowrate) continues even after cooldown and depressurization. Refer to the ISE CI 3.2.1.2.B response for further discussion on seal temperature impacts on leakage.

The documents referenced in the above response have previously been provided to the NRC staff and are available for review.

ISE CI 3.2.1.2.B

RCP Seal Leakage. Confirm Flowserve white paper justifies that the integrity of the 0-rings will be maintained above the temperature conditions experienced during the ELAP event (approximately 556°F) and if the SG PORV modification to add a protected backup air bottle system has an impact in the analysis.

Dominion Response:

Flowserve has provided information on the leakage of the N-9000 RCP seals in the Flowserve document "White Paper on the Response for the N-Seal Reactor Coolant Pump (RCP) Seal Package to Extended Loss of AC Power (ELAP)," Revision 0, dated February 11, 2014 (Proprietary). Surry plans to initiate a cooldown/ depressurization no later than two hours after declaration of an ELAP event. At that time, the maximum temperature of the RCS will be 556°F. In accordance with existing Emergency Operating Procedures, cooldown will proceed at 70-100°F per hour, ending at an RCS temperature of ~422°F. The Flowserve White Paper documents a test that exceeds the temperature for the Surry Flowserve N-9000 RCP

seals during approximately the first 10 hours of the ELAP. The integration of the temperature difference between the test temperature and the seal temperature during the ELAP, when converted using the Arrhenius equation to estimate material degradation, shows that the N-9000 seals can remain at 422°F for more than a day before leakage increases. The initial leakage is minimal. The additional leakage also occurs well after the RCS makeup pump is deployed and installed for RCS inventory makeup.

The steam release will be controlled by manually opening / throttling the seismically qualified, missile protected, SG PORVs using a protected backup air bottle system installed in each Unit's MSVH AFW pump room. (The Unit 1 modification is complete and the corresponding modification for Unit 2 will be completed and documented in the Unit 2 Order compliance notification.) The SG PORVs for both Units 1 and 2 are equipped with an existing backup air bottle system for manual operation. However, the existing backup air bottle systems are located on the ground floor of each Unit's Containment Spray (CS) pump house. The CS pump Houses are seismic concrete structures but are not designed for tornado missiles on two of the four walls and the ceilings. Therefore, the existing SG PORV backup air bottle systems are not credited for the RCS core cooling strategy.

The new backup air bottle system has no impact on the evaluation of RCS seal performance since the time required to initiate the cooldown is less than two hours. Validation of the two hour maximum time to initiate cooldown using the new backup system has been performed as part of the formal staffing analysis and validation of time sensitive actions.

The documents referenced in the above response have previously been provided to the NRC staff and are available for review.

ISE CI 3.2.1.9.A

Use of Portable Pumps. Confirm that intermittent RCS injection by alternating between units is adequate using only one RCS injection pump.

Dominion Response:

The unlikely worst case scenario for RCS injection is when only one BDB RCS Injection pump is available and both RWSTs are unavailable. In this case, the RCS injection sources are the two Boric Acid Mixing Tanks (BAMTs) available in the BDB Storage Building. A gated wye is provided to allow connection of both BAMTs to the suction hose of the available BDB RCS Injection pump. Additionally, a wye and valves are provided to allow connection of the available BDB RCS Injection pump's discharge hose to the RCS injection points of both units.

Each BAMT holds 1000 gallons of water. It is conservatively assumed that only 90% (900 gallons) is injected into the RCS with each "batch." At the BDB RCS Injection pump flow rate of 45 gpm, injection will take 20 minutes. Another five minutes is considered necessary to align the pump discharge to the opposite unit and to align the other BAMT to the RCS Injection pump suction. During this 25 minute cycle, the BAMT not being pumped from is being batched. It takes less than 10 minutes to fill the tank and add the boric acid crystals. This allows 15 minutes for mixing with the tank agitator which is powered by a small portable electric generator. Complete dissolution of the boric acid crystals is not necessary since agitation will continue during injection and any undissolved crystals would be injected into the RCS.

Based on the batching scenario, approximately 900 gallons of boric acid will be added to each core every 50 minutes (or an 18 gpm average). This flow rate is more than twice the expected total leak rate of the current Surry seal configuration of three (3) Surry Flowserve N-9000 RCP seals plus a one gpm unidentified leakage rate per unit. Since two BAMTs are needed to provide the capability to batch one tank while the other tank is being injected, Dominion has obtained a third BAMT in order to be consistent with the N+1 philosophy contained in NEI 12-06.

ISE CI 3.2.1.9.B

Use of Portable Pumps. Confirm the capacity of one high capacity pump can supply 300 gpm AFW flow to each unit's SG and 500 gpm to the dual unit SFP simultaneously.

Dominion Response:

Calculation ME-0967, Rev. 0 confirms the ability of the BDB High Capacity pump to simultaneously deliver at least 300 gpm to each unit's AFW system and at least 500 gpm to the SFP with margin for pump placement. A copy of calculation ME-0967, Rev. 0 has previously been provided to the NRC staff and is available for review.

ISE CI 3.2.3.A

Containment. Confirm the Phase 3 coping strategy for containment is appropriate.

Dominion Response:

Overall Integrated Plan (OIP) Open Item No. 4 was completed and documented as "Complete" in the second Six-Month Status Update letter dated February 27, 2014 (SN: 12-163E). Attachment 2 of the update letter provided the Containment cooling strategy. Additional clarification of this strategy was provided in Section 4e of the third Six-Month Status Report dated August 28, 2014.

OIP Open Item No. 5 addressed the thermal and hydraulic calculations for Phase 2 and Phase 3 activities. Regarding Phase 3, a hydraulic calculation to confirm that the Service Water (SW) flow to justify that the Containment cooling options are adequate is not required for Surry since the source of cooling water is gravity fed from the Intake Canal (UHS).

The documents referenced in the above response have previously been provided to the NRC staff and are available for review.

ISE CI 3.2.4.2.A

Ventilation - Equipment cooling. Confirm that the licensee's ventilation strategy adequately supports equipment cooling.

Dominion Response:

Overall Integrated Plan (OIP) Open Item No. 14 was completed and documented as "Complete" in the second Six-Month Status Update letter dated February 27, 2014 (SN: 12-163E). Attachment 2 of the update letter provided the ventilation strategy for Surry following an ELAP event.

The documents referenced in the above response have previously been provided to the NRC staff and are available for review.

ISE CI 3.2.4.4.A

Communications. Confirm that upgrades to the site's communications systems have been completed.

Dominion Response:

The study documenting the communications strategy has been completed. Subsequently, Overall Integrated Plan (OIP) Open Item No. 18 was documented as "Complete" in the second Six-Month Status Update letter dated February 27, 2014 (SN: 12-163E). The plan concluded that FLEX strategies can be effectively implemented with a combination of sound powered phones, satellite phones and hand-held radios.

The quantity of components needed to implement the communications strategy has been determined to be 20 satellite phones, 30 hand held radios, and 10 sets of sound powered phone headsets and extension cords dedicated for use during a BDB event. Distribution of the satellite phones includes the Control Room (CR), the Technical Support Center (TSC), Security, Health Physics Survey Teams, and the

surrounding county Offsite Response Organizations. The hand held radios are for command and control of the FLEX mitigating strategies and include 10 spare radios and 3 batteries per device.

The CR and TSC satellite phones are installed units and include the needed communications infrastructure required to ensure availability of off-site communications, thereby enabling the FLEX coping strategies after a BDB event. Three satellite phones, a Cisco network switch, and one UPS is installed in the Unit 1 Computer Room. Four satellite phones and a Cisco network switch are stored in the TSC Computer Room. A portable satellite dish for deployment outdoors is permanently stored in the TSC HVAC Room.

The deployable antennae (satellite dish) setup is a system with fiber optics cable from the inside "desk sets" to an outdoor portable dish antennae. Several hand held satellite phones are available for initial notifications until the portable dish antennae is deployed. This portion of the communications strategy is intended for approximately the first six hours following an ELAP event. Once augmented staff arrives on site a mobile communications trailer designed to handle both satellite voice and data traffic, as well as to function as a radio repeater to enhance on-site communications, will be deployed from the BDB Storage Building.

The current communications strategy is detailed in ETE-CPR-2013-003, Revision 2 which has previously been provided to the NRC staff and is available for review.

ISE CI 3.2.4.6.A

Personnel Habitability - Elevated Temperature: Confirm appropriate plans are made to account for the results of the ventilation study for personnel habitability when complete.

Dominion Response:

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 Main Control Room, Emergency Switchgear Room, Main Steam Valve House (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. This evaluation is documented in Calculation ME-0973, Rev. 0,

"Evaluation of Room Air Temperatures Following Extended Loss of AC Power (ELAP)."

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. Isolating the normal air supply to the PORVs will allow the local bottle air supply to be utilized for local control from a cooler area (Refer to Audit Question #27). 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 PORVs are similar to conditions experienced during normal station operations, testing, and maintenance. Therefore, actions performed for FLEX activities will be 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. As stated above, this action is only necessary for access to isolate the normal air supply to the PORVs. Once this action is performed, no further access to this area is required for Phase 1 or any other phase during the ELAP/LUHS event response.

The documents referenced in the above response have previously been provided to the NRC staff and are available for review.

ISE CI 3.2.4.8.A

Electrical Power Source/Isolation and Interactions. Confirm that 2MW portable DGs are adequate to supply loads assumed in Phase 3.

Dominion Response:

Calculation EE-0872, Rev. 0, "Calculation for Surry Power Station Beyond Design Basis -FLEX Electrical 4160 VAC System Loading Analysis" provides the Phase 3 4160 VAC BDB diesel generator loading analysis. The results indicate that the total loads will be approximately 1.35 MW for either unit. Therefore, the two (2) 1-MW portable diesel generators per unit, that will be available from the NSRC, will be more than adequate to supply the total loads required for each unit.

The calculation referenced in the above response has previously been provided to the NRC staff and is available for review.

ISE CI 3.4.A

Confirm the licensee's arrangements for off-site resources address the guidance of Guidelines 2 through 10 in NEI 12-06, Section 12.2.

Dominion Response:

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

III. Licensee Identified Overall Integrated Plan (OIP) Open Item Responses

Licensee Identified Open Item 1

Verify response times listed in timeline and perform staffing assessment

Dominion Response:

Dominion conducted an Emergency Preparedness (EP) staffing assessment for Surry Units 1 and 2 and transmitted the results to the NRC on December 17, 2014, via letter 14-200, "Phase 2 Staffing Assessment Report." Attachment 2 to letter 14-200 noted the need to reevaluate the staffing assessment using the final approved versions of FSG procedures, personnel formally trained on FSG strategies, and the final approved on-shift communications equipment. This staffing assessment reevaluation has been performed and the results submitted to the NRC on June 9, 2015, via letter 14-200A, "Supplemental Information Regarding Phase 2 Staffing Assessment Report."

Verification of response times has been validated and documented in ETE-CPR-2014-1010, Rev. 0, "Surry Power Station Beyond Design Basis FLEX Validation of Time Sensitive Actions (TSAs)."

The ETE referenced in the above response has previously been provided to the NRC staff and is available for review.

IV. Audit Question Responses

Audit Question 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 protected against tornado missiles on its roof and two of its four walls.

A new seismically-designed, tornado missile protected backup air bottle system has been installed in the Unit 1 Main Steam Valve House (MSVH) AFW pump room to allow manual control of the SG PORVs. Likewise, check valves have been installed in the Unit 1 air supply tubing to isolate the new backup air bottle system from the existing backup air bottle system. The Unit 2 air bottle system and check valves will be installed prior to the Fall 2015 Refueling Outage and documented in the Unit 2 Order compliance notification. The capacity of the new backup air system has been determined by calculation to be sufficient to support SG PORV manual operation for RCS cooldown in response to an ELAP event. In addition, the backup air system compressed air bottles can be re-pressurized during an event response, if necessary, using portable air compressors that are included on the BDB equipment inventory list. Steam flow through the SG PORVs will be controlled by manually throttling air pressure to the SG PORV air operators from air bottles in the AFW pump room located in the lower level of the MSVH (El. 27'-6"). Brief access to the upper level of the MSVH (El. 57'-0") is required to isolate the normal instrument air supply line to the SG PORVs and align the backup air bottle system directly to the SG PORVs' air operators for manual operation. The upper level of the MSVH is accessible from stairs located in the MSVH lower level and from a security door leading to the roof of the CSPH.

Accessibility:

Normal access to the MSVH (lower level) is through a tornado missile protected door inside of the CSPH. However, the exterior door to the CSPH, which is located at ground level (El. 27'-6"), is not protected from tornado missiles. Likewise, two of the four walls and the roof of the CSPH are not protected from tornado missiles. Therefore, the possibility exists that following a high wind / tornado event, the normal access into the lower level of the MSVH may be inaccessible. However, several other methods are available to gain access to the MSVH in order to support manual operation of the SG PORVs to cooldown the RCS in response to an ELAP event.

An alternate access point into the MSVH is through the security door located in the upper level of the MSVH (El. 57'-0"). The MSVH upper level security door also has an interior missile shield. The interior missile shield is procedurally closed upon approaching high winds, and later can be reopened using handles from either inside or outside the MSVH. Normal access through this door from the outside is via the roof of the CSPH. Consequently, the same event that can render the normal access door into the MSVH inaccessible, may also impact normal access (via the roof) of the alternate MSVH security door. However, if this were to occur, there are available alternate routes, via ladders on the backside of the MSVH, by which to obtain access to the MSVH roof. These ladders are on the side of the MSVH opposite from both the ground level of the CSPH and the upper level MSVH security door and are protected from tornado missiles by surrounding structures with the exception of missiles coming in from above. Reaching the upper level MSVH security door from the MSVH roof is discussed later.

The CSPH and the MSVH for each unit at Surry are protected from horizontal tornado missiles by its respective Containment structure, Service Building, Auxiliary Building and Refueling Water Storage Tank (RWST). For the areas not specifically protected by these structures, the two-story Administration Building for Unit 1 and the Radwaste Facility for Unit 2 block the majority of the remaining angles. Therefore, only a few degrees of arc around each unit's CSPH and MSVH doors and ladders are vulnerable to a horizontal tornado missile. The more probable scenario for high wind / tornado missile damage is from debris coming downward (falling) from above the surrounding structures. The roof of both units MSVH is protected from tornado missiles, however, as previously stated, the roof of the CSPHs and the various exterior access ladders around the MSVHs are not.

If as a result of multiple missile strikes, the CSPH experiences sufficient missile damage to cause both the normal MSVH access at ground level and the alternate access through the MSVH security door at El. 57'-0" to be inaccessible and the MSVH exterior access ladders also experience missile damage, then FSG-5 directs alternate measures for gaining access to the MSVH using BDB FLEX support equipment.

The MSVH security door at El. 57'-0" can be accessed from the roof of the MSVH using BDB FLEX support equipment (i.e., a 15' sectional ladder) stored in the nearby protected Auxiliary Building. The 15' sectional ladder will be taken up the MSVH roof by way of the access ladders on the opposite side of the MSVH from the 57'-0" elevation MSVH security door. The sectional ladder can be mounted on a support structure that is permanently installed on the MSVH roof to permit operator access to the upper level MSVH security door from the roof of the MSVH. If the permanently installed exterior ladders to the MSVH roof (on the opposite side from the access doors) are damaged, a 32' extension ladder and fall protection are also included with the BDB FLEX support equipment stored in the Auxiliary Building as an additional contingency to access the MSVH roof.

If the upper level MSVH security door is damaged to the extent that prevents its opening, additional BDB FLEX support equipment, including a cutting torch, is available in the Auxiliary Building to facilitate opening / demolition of the damaged door. The most obvious approach to gain entry is that the hinges for the upper level MSVH security door are on the outside of the door. In order to gain access to the upper level of the MSVH in minimal time, removal of these hinges by using a cutting torch or saw should allow the door to be quickly removed.

Timing:

When normal access to the MSVH is prevented, the time to access the MSVH from the roof access ladders is limited by the FLEX strategy time sensitive action (TSA) to manually throttle AFW flow within 1.5 hours to prevent SG overflow. The TSA to perform this activity has been validated using the alternate access to the MSVH from the roof access ladders, including the 15' sectional ladder from the roof of the MSVH to the MSVH security door (El. 57'-0") discussed above.

If outside conditions exist during a high wind / tornado event such that it may be prudent to delay accessing the MSVH roof from the roof access ladders, FSG-5 directs entry to Step 21 of ECA-0.0 for stop / start control of the TDAFW pump to control SG level from the Control Room. This is a backup strategy to the credited FLEX strategy of locally throttling the AFW pump discharge header valves to prevent SG overfill. Although stop/start control of the TDAFW pump is an effective means to control SG level, it comes with the risk that if the TDAFW pump trips on restart, it would no longer be available for use until access into the MSVH is achieved. However, if a TDAFW pump does becomes unavailable, the ability exists at Surry to cross-tie the AFW system from the opposite unit to provide adequate AFW to all SGs.

Delaying entry into the MSVH also delays the ability to manually control the SG PORVs for RCS cooldown and decay heat removal. The time delay for taking

manual control of the SG PORVs is limited by the necessity to initiate a two hour RCS cooldown within four hours in order to preclude potential Flowserve N-9000 RCP seal damage from exposure to full RCS temperature conditions for an extended time. The basis for initiating RCS cooldown within four hours is described below and is applicable to the Surry Flowserve N-9000 RCP seals.

Flowserve Corporation document, "White Paper on the Response of the N-Seal Reactor Coolant Pump (RCP) Seal Package to Extended Loss of All Power (ELAP)," February 11, 2014, states: "*In general, elastomers (even the high-temperature Ethylene Propylene compounds tested and used in the N-Seal) are not capable of remaining intact for extended times at temperatures approaching full RCS conditions (e.g. days at ~550°F).*" and "*On the other hand, if pressure and temperature are reduced from full system conditions (approximately 555°F) to 425-350°F or less in a shorter duration, such as two to six hours, then the elastomer degradation rate is greatly reduced ... it is concluded that degradation of the elastomers in the first three primary N-seal stages is not likely if pressure and temperature are reduced in the first six hours.*" Thus, to preclude N-seal degradation, the limiting time for entering the MSVH via the roof access ladders during adverse weather conditions and initiating a two hour RCS cooldown is four hours. Initiating the cooldown in four hours ensures that a two hour cooldown can be completed within the first six hours, which provides reasonable assurance that the Flowserve N-Seals will remain intact for the remaining duration of the event response. Therefore, the validated time to enter the MSVH (1.5 hours) has a 2.5 hour margin for initiating RCS cooldown within four hours from initiation of the BDB event in order to preclude potential N-seal degradation. This margin will allow for delays in initiating access to the MSVH roof and alternate means of entering the MSVH due to adverse outside conditions and also account for any delays in opening the MSVH security door due to physical damage to the door.

In the event of N-seal elastomer degradation, the Flowserve seal design further limits leakage to less than an additional two gpm per seal. Therefore, if an RCS cooldown is not initiated within four hours of the ELAP event and seal degradation were to occur, the potential leakage from the Surry Flowserve N-9000 RCP seals remains well within the RCS inventory makeup capability provided by the BDB equipment.

Environmental Conditions:

Based on results of the loss of ventilation temperature transient analysis for the upper level 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 MSVH security door at El. 57'-0" or the AFW pump room access door open to provide supplemental ventilation/airflow. At normal operating temperatures, this area is

routinely accessed during plant operation, therefore, access during an ELAP response is not expected to be limited.

The loss of ventilation temperature transient analysis for the AFW Pump Room shows that the ambient temperature in the room with the 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 Turbine Driven Auxiliary Feedwater (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 (i.e., sound powered headphones, face-to-face).