

VIRGINIA ELECTRIC AND POWER COMPANY  
RICHMOND, VIRGINIA 23261

January 11, 2007

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
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NL&OS/PRW R3  
Docket No. 50-281  
License No. DPR-37

**VIRGINIA ELECTRIC AND POWER COMPANY**  
**SURRY POWER STATION UNIT 2**  
**NRC GENERIC LETTER 2004-02, POTENTIAL IMPACT OF DEBRIS BLOCKAGE**  
**ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT**  
**PRESSURIZED-WATER REACTORS**  
**REQUEST FOR EXTENSION OF COMPLETION DATE FOR CORRECTIVE ACTIONS**

**Background:**

In a letter dated September 1, 2005, Virginia Electric and Power Company (Dominion) submitted a response to NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors." In that letter, Dominion committed to completing corrective actions to resolve NRC Generic Safety Issue (GSI) 191, "Assessment of Debris Accumulation on PWR Sump Performance," by December 31, 2007 for Surry Power Station Units 1 and 2 (SPS1 and SPS2).

The following actions have already been taken by Dominion to resolve GSI-191 for Surry Unit 2:

- Comprehensive walk downs were performed in accordance with NEI 02-01 at Surry to identify and quantify debris within the containments.
- An assessment of approaches was performed to resolve the GSI-191 issue and address challenging plant specific containment parameters (e.g., water level, available NPSH margins, debris mix). Initially Dominion contracted with a vendor to design and fabricate an active strainer. However, the active design was not demonstrated to be feasible, and Dominion changed to a passive design approach.
- Contracts were awarded for engineering, analyses, and manufacturing of the passive design. This included testing and fabrication.
- Extensive testing has been initiated and continues in support of the passive strainer design with Dominion engineering personnel, the passive strainer vendor, and Dominion's engineering contractor participating.

- The first portion of a two phase replacement of the existing trash racks and screens was completed with a substantial portion of the new passive strainers installed during the fall 2006 refueling outage. The previous 150 square foot screens were replaced with 3500 square feet of the new passive strainers.
- Resolution of upstream effects, fuel effects, downstream effects, chemical effects and the impact of coatings response to accident conditions are being addressed through unit specific assessments and participation in/monitoring of a number of industry efforts.
- Dominion Topical Report DOM-NAF-3 was submitted for NRC approval in a letter dated November 1, 2005. DOM-NAF-3 permits use of the GOTHIC Code at Surry. NRC approval of this request was received on August 30, 2006.
- A license amendment request regarding "site specific" containment analysis was submitted in support of the proposed modifications for SPS1 and SPS2 in a letter dated January 31, 2006. NRC approval of this request was received on October 12, 2006.
- An incore sump room drain to decrease holdup of water was installed during the fall 2006 RFO.
- Actuation of the inside recirculation spray pump was changed from a timer to refueling water storage tank (RWST) level during the fall 2006 RFO.

**Discussion:**

Because of the timing of available water levels in the SPS1 and SPS2 containments, the design and testing process identified that a unique and innovative two-tier strainer design best addresses space limitations and performance requirements. That design has the recirculation spray (RS) strainer on the bottom and low head safety injection (LHSI) strainer on the top. The two-tier modules, which will include the full LHSI strainer capacity requirements, are closest to the sump. The remaining single tier modules, attached in series, provide additional capacity for the RS strainer. The RS strainer is submerged prior to initiation of recirculation, and the LHSI strainer is submerged later when more water is available to supply the LHSI pumps prior to recirculation mode transfer.

The iterative nature of the strainer testing and design process for Surry has taken longer than anticipated and has caused overall schedule challenges for engineering, design, and testing. Separately, Dominion's vendor encountered manufacturing difficulties in providing the complete package of strainer components to meet the fall 2006 installation schedule for SPS2. In addition, analytical assessments and testing to address fuel effects, downstream effects, chemical effects, and the impact of coatings response to all accident conditions are still ongoing. These assessments were not completed before the end of 2006, and some industry test efforts are anticipated to extend into the first or second quarter of 2007. When completed, these assessments could potentially require

additional modifications to address such aspects as fuel effects, wear or operation of downstream system components, or result in the need to adjust strainer sizing. A size adjustment to the two-tier portion of the strainer would result in not only substantial design and engineering rework of the single tier portion, but also significant removal and reinstallation.

For SPS1, outage planning activities are underway to support the total replacement of the existing trash racks and screens with the new passive strainers during the fall 2007 refueling outage.

**Request:**

As a consequence, Dominion requests an extension to complete installation of the SPS2 RS pump strainer system until the spring 2008 RFO. This is a period of four months beyond the GL 2004-02 required completion date. Dominion installed a portion of the new strainer system during the SPS2 fall 2006 RFO. This portion of the new strainer system represents a significant improvement over the current design. The two tier strainer portion of the total design provides approximately 1500 square feet to serve the RS pumps and approximately 2000 square feet to serve the LHSI pumps. This total of 3500 square feet compares with the existing screen of approximately 150 square feet which serves both the RS and LHSI pumps.

An extension to the spring 2008 RFO is requested for SPS2 to complete the installation of additional RS strainer modules and to address additional actions that may be needed to resolve GSI-191 issues for SPS2 as a result of completion of ongoing testing and analytical assessments. Additional modifications or alterations at SPS2 could include further adjustments to strainer size and insulation removal/mitigation required as a result of the completion of industry testing or on-going assessments for fuel effects, additional downstream effects, chemical effects, and impact of coatings response.

Generic Letter 2004-02 emphasized the requirements for long-term recirculation cooling which primarily relies on operation of the LHSI pumps at SPS. The actions completed during the SPS2 fall 2006 RFO, as well as additional measures described in Attachment 1, provide a significant improvement over the current screen design to address long-term cooling until the GSI-191 issues are fully addressed. Attachment 2 provides the plant specific Technical/Experimental Plan for SPS2.

In summary, for SPS2, a phased installation of the strainer would occur with 3500 square feet having been installed during the fall 2006 RFO, and complete resolution of GSI-191 issues being extended to the spring 2008 RFO.

Should you have any questions regarding the above information or the attachments, please contact Mr. Paul R. Willoughby at (804) 273-3572.

Very truly yours,

A handwritten signature in black ink, appearing to read "David A. Christian". The signature is fluid and cursive, with a long horizontal stroke at the end.

David A. Christian  
Senior Vice President - Nuclear Operations and  
Chief Nuclear Officer

Commitments in this letter: None.

Attachments: (2)

1. Evaluation of Actions
2. Plant Specific Technical/Experimental Plan

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**ATTACHMENT 1**

**NRC GENERIC LETTER: 2004-02 POTENTIAL IMPACT OF DEBRIS  
BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS  
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**EVALUATION OF ACTIONS**

**VIRGINIA ELECTRIC AND POWER COMPANY  
SURRY POWER STATION UNIT 2**

## EVALUATION OF ACTIONS

In Generic Letter (GL) 2004-02, dated September 13, 2004, the NRC staff summarized their bases for concluding that existing pressurized-water reactors (PWRs) could continue to operate through December 31, 2007, while implementing the required corrective actions for NRC Generic Safety Issue 191 (GSI-191), "Assessment of Debris Accumulation on PWR Sump Performance." In the following discussion, Virginia Electric and Power Company (Dominion) has addressed the "Criteria for Evaluating Delay of Hardware Changes," as described in SECY-06-0078, dated March 31, 2006. This discussion supports Dominion's request for an extension of the completion date for the corrective actions at Surry Power Station Unit 2 (SPS2) from December 31, 2007 (required by GL 2004-02) to the completion of the spring 2008 refueling outage (RFO). The proposed extension of the GSI-191 implementation schedule by four months for SPS2 does not alter the original conclusions summarized in GL 2004-02 in which the staff determined that it is acceptable for PWR licensees to operate until the corrective actions are completed because the risk is inconsequential.

### Reason for Request

Dominion, in conjunction with its strainer vendor and engineering contractor, has embarked upon rigorous testing programs to ascertain and/or validate that the proposed strainer design for SPS2 will provide adequate net positive suction head (NPSH) for the low head safety injection (LHSI) pumps and recirculation spray (RS) pumps under accident conditions. This testing has provided much useful information; however, it has taken longer than expected. At this juncture, Dominion has determined strainer sizes that will: 1) fit into the space available within the SPS2 containment, 2) provide adequate NPSH given the debris loading under accident conditions, and 3) will structurally withstand impingement, missile, and differential pressure loading. However, testing is not complete and further adjustments to the strainer size may be necessary to address the remaining open issues associated with GSI-191. As an example, it is possible that further physical modifications to SPS2 regarding insulation, down-stream effects, fuel effects and chemical effects may be required as a result of the outstanding testing. Separately, Dominion's strainer vendor encountered manufacturing difficulties in providing strainer components to meet the fall 2006 installation schedule for SPS2, thereby limiting the scope of installation completed during the RFO to 3500 square feet. As a consequence, Dominion is requesting a schedule extension for SPS2 to complete installation of strainer components during the spring 2008 RFO and to address any additional actions that may be needed as a result of ongoing testing and analytical assessments.

### Mitigative Measures

Dominion is fully committed to resolving the issues associated with GSI-191 and has pursued resolution of the concerns associated with the issue. While Dominion implemented a significant portion of the physical modifications at SPS2 (see Section 1

below) prior to the committed completion date, several issues remain to be resolved as enumerated in the Generic Initiatives section (Section 7 below).

## 1. Measures Completed at Surry Power Station Unit 2

Dominion installed a portion of the replacement strainer system during the SPS2 fall 2006 RFO. This portion of the new strainer system represents a significant improvement over the current design. The two-tier strainer portion of the design provides approximately 1500 square feet to serve the RS pumps and approximately 2000 square feet to serve the LHSI pumps. This total of 3500 square feet compares with the existing screen of approximately 150 square feet which serves both the RS and LHSI pumps.

In addition, the following actions in support of the phased installation of the strainer system were completed during the SPS2 fall 2006 RFO:

- Approval and implementation of the license amendment request regarding "site specific" containment analysis submitted in support of the proposed modifications for SPS2 in Dominion letter dated January 31, 2006. (NRC approved the amendment on September 12, 2006.)
- Installation of an incore sump room drain to decrease holdup of water.
- Revision of the inside RS pump actuation from a timer to refueling water storage tank (RWST) level.

An extension to the spring 2008 RFO is requested for SPS2 to complete the installation of additional RS strainer modules and to address additional actions that may be needed to resolve GSI-191 issues for SPS2 as a result of completion of ongoing testing and analytical assessments. Additional modifications or alterations at SPS2 could include further adjustments to strainer size and insulation removal/mitigation required as a result of the completion of industry testing or ongoing assessments for fuel effects, additional downstream effects, chemical effects, and impact of coatings response.

## 2. Containment Cleanliness

Dominion has implemented a number of actions to enhance containment cleanliness as documented in the response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors." Detailed containment cleanliness procedures exist for restart readiness and for containment entry at power for each unit. These procedures incorporate the industry guidance of Nuclear Energy Institute (NEI) 02-01, Revision 1 to minimize miscellaneous debris sources within the containment. Specifically, the procedures require that no loose debris (rags, trash, clothing, etc.) is present in the containment which could be transported to the containment recirculation sumps. In support of these cleanliness standards, walkdowns covering all areas of the containment are

required by procedure after all work has been completed, prior to the restart from an outage. In addition, detailed containment sump inspections are required by the SPS2 technical specifications and are performed during each RFO.

3. Procedural Guidance, Training, and Actions

As discussed in the response to NRC Bulletin 2003-01, Dominion has implemented a number of interim compensatory actions at SPS to assure core cooling and containment integrity. In a letter dated October 3, 2005, the NRC staff concluded that Dominion was responsive to, and met the intent of, Bulletin 2003-01 for SPS.

Operators are trained and have guidance for continuously monitoring LHSI and RS pump parameters, including loss of NPSH as indicated by erratic pump current or discharge flow. Training briefs presented during operator requalification training have increased Operations personnel awareness of the potential for the containment recirculation sump to become clogged during operation of the LHSI and RS pumps in the recirculation cooling mode.

4. Information Notice 2005-06

On September 16, 2005, the NRC issued Information Notice (IN) 2005-26, "Results of Chemical Effects Head Loss Tests in a Simulated PWR Sump Pool Environment." IN 2005-26 applies to plants with calcium silicate insulation and trisodium phosphate as a buffer. SPS2 was not one of the units listed as having the above-described combination in its containment and, therefore, no response to IN 2005-26 was required for SPS2.

5. Risk Evaluation

Included in Generic Letter 2004-02 were the following observations regarding risk significance that remain valid through the proposed extended implementation period of the spring of 2008. The probability of a large break loss of coolant accident (LOCA) remains extremely low, as is the probability of a small break LOCA that may require recirculation. The SPS containments are compartmentalized making total debris transport to the sump strainers less likely. The time to switchover to recirculation (approximately 30 minutes after initiation of an event) allows for debris settling.

6. Safety Features and Margins in Current Configuration/Design Basis

In addition to the measures described in Section 1 above, there are design features that would facilitate mitigation of this issue. Dominion has NRC approval to invoke the leak-before-break methodology to eliminate the dynamic effects (pipe whip and jet impingement) of postulated reactor coolant piping (hot leg, cold leg, and crossover piping) ruptures from the design basis of the plant. The approval was

based on the conclusion that the probability of a pipe failure before noticeable leakage could be detected and the plant brought to a safe shutdown condition is small. While leak-before-break is not being used to establish the design basis load on the sump strainer, it does provide a basis for safe continued operation until the completion of the spring 2008 outage.

## 7. Generic Initiatives

Dominion is participating in a number of efforts, either as fleet initiatives or industry programs, to resolve various aspects of the GSI-191 issue. These include:

- PWR Owners Group fuel evaluations in progress – Dominion is participating in Owners Group initiatives to resolve fuel impact issues.
- Chemical effects evaluations/analyses/testing in progress – Dominion is participating in Owners Group initiatives to resolve chemical effects issues. In addition, due to the different debris combinations found at the Dominion sites, this initiative will be addressed on a site-specific basis. Modification or replacement of insulation may be required, dependent upon the outcome of testing.
- Downstream effects evaluations in progress – As in the case of chemical effects, this effort will be addressed on a site-specific basis due to the differing debris combinations at the Dominion sites.
- Testing is currently underway to confirm that the qualified coatings zone of influence (ZOI) is less than 10 times the diameter of the pipe break (10D), which is the value originally used in the debris generation calculation. The expected result is that the ongoing testing will confirm that a 5D ZOI may be used.

## Conclusion

Based on the above discussion, Dominion has determined that safety will be maintained until the corrective actions are completed during the spring 2008 refueling outage.

**ATTACHMENT 2**

**NRC GENERIC LETTER: 2004-02 POTENTIAL IMPACT OF DEBRIS  
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**PLANT SPECIFIC TECHNICAL/EXPERIMENTAL PLAN**

**VIRGINIA ELECTRIC AND POWER COMPANY  
SURRY POWER STATION UNIT 2**

## PLANT SPECIFIC TECHNICAL/EXPERIMENTAL PLAN

### Surry Plant Specific Technical/Experimental Plan

#### 1. Overview of Planned Actions

Dominion has determined it is physically able to install a replacement strainer that is approximately 8400 square feet in surface area for Surry Power Station Unit 2 (SPS2), given the present status of analysis and testing. Dominion's design for Surry includes a two-tier strainer that provides separate flow to both the recirculation spray (RS) pumps and the low head safety injection (LHSI) pumps. Dominion's strainer vendor encountered manufacturing difficulties in providing strainer components and, therefore, Dominion installed a portion of the replacement strainer system during the SPS2 fall 2006 RFO. This portion of the new strainer system represents a significant improvement over the current design. The two-tier strainer portion of the design installed during the fall 2006 RFO provides approximately 1500 square feet of strainer to serve the RS pumps and 2000 square feet to serve the LHSI pumps. This compares with the existing screen of approximately 150 square feet which served both the RS and LHSI pumps. Additional modules are required to complete the single tier RS strainer system. As a consequence, Dominion is requesting a schedule extension for SPS2 to complete installation of strainer components during the spring 2008 RFO and to address any additional actions that may be needed as a result of ongoing testing and analytical assessments.

The determination of fuel effects, downstream effects, chemical effects, and the impact of coatings response to accident conditions as well as strainer testing are needed to adequately address the GSI-191 issues. The fuel evaluations and chemical effects testing may require strainer sizing changes or other plant modifications and alterations. Because of these evaluations and separate manufacturing issues, the replacement strainer was not completely installed during the SPS2 fall 2006 RFO and a phased approach to installing the two-tier strainer design was implemented to avoid the potential for substantial re-engineering, as well as, implementation rework. A subsequent size adjustment to the two-tier portion of the strainer would result in not only substantial design and engineering rework of the single tier portion, but also significant removal and reinstallation of strainer sections.

In addition to the potential to require strainer size changes, the outstanding assessments and testing may result in other plant modifications and alterations. The timing of these assessments and tests did not support the identification of other modifications and alterations in time to design, procure, and plan installation in the fall 2006 RFO. Accordingly, a schedule extension for SPS2 to the spring 2008 RFO is requested to allow for completion of the phased installation and for any other alterations or modifications needed to fully address GSI-191.

For SPS1, it is Dominion's expectation to resolve the GSI-191 issues in time to support implementation during the fall 2007 RFO. If any of the remaining open issues can not be resolved in time to support the outage, Dominion will provide prompt notification to the NRC.

2. Status of Surry Unit 2 GSI-191 Resolution Plan

- SPS strainer sizing testing (excluding chemical effects) is scheduled to be completed in January 2007.
- SPS strainer size adjustments are being evaluated based on test results.
- The two-tier module design has been finalized for strainer layout within SPS2 containment.
- The SPS license amendment request for containment reanalysis and for initiating sump recirculation on refueling water storage tank (RWST) level was submitted to the NRC January 31, 2006. NRC approval of the amendment was received September 12, 2006.
- A containment sump strainer with a surface area of approximately 8400 square feet is planned to replace the existing sump screen. The first 3500 square feet of a two phase installation was installed during the SPS2 fall 2006 RFO. The remaining 4900 square feet will be installed in the spring 2008 RFO.
- An incore sump room drain to decrease holdup of water was installed during the fall 2006 RFO.
- Dominion implemented the license amendment to initiate recirculation using RWST level during the SPS2 fall 2006 RFO. Actuation of the inside RS pump was changed from a timer to refueling water storage tank (RWST) level.
- A chemical effects testing plan is being developed based on ongoing industry activities.
- A downstream effects analysis is currently in progress.