Dominion Resources Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
Web Address: www.dom.com

Dominion®

November 15, 2007

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

Serial No.	07-0660
NL&OS/GDM	R5
Docket Nos.	50-305
	50-336/423
	50-338/339
	50-280/281
License Nos.	DPR-43
	DPR-65/NPF-49
	NPF-4/7
	DPR-32/37

DOMINION ENERGY KEWAUNEE, INC.
DOMINION NUCLEAR CONNECTICUT, INC.
VIRGINIA ELECTRIC AND POWER COMPANY
KEWAUNEE POWER STATION
MILLSTONE POWER STATION UNITS 2 AND 3
NORTH ANNA AND SURRY POWER STATIONS UNITS 1 AND 2
NRC GENERIC LETTER (GL) 2004-02, POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS
REQUEST FOR EXTENSION OF COMPLETION DATES FOR CORRECTIVE ACTIONS

In a letter dated September 1, 2005 (Serial No. 05-212), Dominion Energy Kewaunee, Inc. (DEK), Dominion Nuclear Connecticut, Inc. (DNC) and Virginia Electric and Power Company (Dominion) submitted a response to NRC Generic Letter (GL) 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 required by GL 2004-02 to resolve NRC Generic Safety Issue (GSI) 191, "Assessment of Debris Accumulation on PWR Sump Performance," by December 31, 2007 for Kewaunee Power Station (KPS), Millstone Power Station Units 2 and 3 (MPS2 and MPS3), North Anna Power Station Units 1 and 2 (NAPS1 and NAPS2), and Surry Power Station Units 1 and 2 (SPS1 and SPS2). In a subsequent letter dated January 11, 2007 (Serial No. 06-481), Dominion submitted an extension request for SPS2 to permit the completion of the installation of the recirculation spray pump strainer system during the spring 2008 refueling outage (RFO). The NRC approved the SPS2 extension request in their letter dated March 8, 2007.

DEK, DNC and Dominion are fully committed to ensuring that GSI-191 is completely and thoroughly resolved for their respective stations. This is evidenced by the significant amount of work that has been completed to date at each station to address the sump performance concern, including the installation of passive strainers to substantially increase the available strainer surface area. However, it has recently become evident that certain required activities cannot be completed by the December 31, 2007 due date for KPS, MPS2, MPS3, NAPS1, NAPS2, and SPS1 or the spring 2008 RFO for SPS2.

Although the SPS2 sump strainer will be completed during that outage as planned, SPS2 will also require an extension to complete other corrective actions as detailed below. The projected outstanding items for each plant are included in the following table.

Plant	GSI-191 Activities that Require an Extension
KPS	• Review and approve updated strainer performance documentation to support resolution of chemical effects • Revise downstream effects evaluations in accordance with WCAP-16406-P, Rev. 1 and WCAP-16793-NP
MPS2 and 3 NAPS1 and 2 SPS1 and 2	• Complete chemical effects testing and evaluation of test results • Complete downstream effects evaluations in accordance with WCAP-16406-P Rev. 1 and WCAP-16793-NP • Determine 1) whether hardware and/or procedural modifications are needed as a result of the downstream effects evaluations and chemical effects testing/evaluation, and 2) modification implementation schedule, if required

Attachments 1 through 4 provide the bases for the proposed extensions of the corrective action completion dates required by GL 2004-02 for KPS, MPS2 and MPS3, NAPS1 and NAPS2, and SPS1 and SPS2, respectively. The extension basis for each plant provides adequate assurance that safe continued operation during the requested extension period is maintained. KPS, MPS2, MPS3, NAPS1, NAPS2, SPS1 and SPS2 currently meet, and will continue to meet during the period of the requested extensions, the current plant licensing bases regarding the function and operability of the containment sump.

As a result of the remaining required activities noted above and discussed in the attachments, an extension to June 30, 2008 is requested for KPS and an extension to November 30, 2008 is requested for MPS2, MPS3, NAPS1, NAPS2, SPS1 and SPS2 to complete the GL 2004-02 corrective actions.

If you have any questions or require additional information, please contact Mr. Gary D. Miller at (804) 273-2771.

Sincerely,

William R. Matthews
Senior Vice-President - Nuclear Operations

Commitments contained in this letter:

This letter contains no new commitments, only a revision to the completion date for the commitments included in the previous response to GL 2004-02 dated September 1, 2005 (Serial No. 05-212), i.e., June 30, 2008 for KPS and November 30, 2008 for MPS2, MPS3, NAPS1, NAPS2, SPS1 and SPS2.

Attachments:
1. Request for an Extension of the Completion Date for Corrective Actions, Kewaunee Power Station
2. Request for an Extension of the Completion Date for Corrective Actions, Millstone Power Station Units 2 and 3
3. Request for an Extension of the Completion Date for Corrective Actions, North Anna Power Station Units 1 and 2
4. Request for an Extension of the Completion Date for Corrective Actions, Surry Power Station Units 1 and 2

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by William R. Matthews, who is Senior Vice-President - Nuclear Operations, of Dominion Energy Kewaunee, Inc., Dominion Nuclear Connecticut, Inc. and 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 those companies, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 15TH day of November, 2007.

My Commission Expires: May 31, 2010.

VICKI L. HULL
Notary Public
Commonwealth of Virginia
140642
My Commission Expires May 31, 2010

Vicki L. Hull
Notary Public

cc: U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, Pennsylvania 19406-1415

U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Suite 23T85
Atlanta, Georgia 30303

U.S. Nuclear Regulatory Commission
Region III
2443 Warrenville Road
Suite 210
Lisle, Illinois 60532-4352

Mr. S. C. Burton
NRC Senior Resident Inspector
Kewaunee Power Station

Mr. S. W. Shaffer
NRC Senior Resident Inspector
Millstone Power Station

Mr. J. T. Reece
NRC Senior Resident Inspector
North Anna Power Station

Mr. C. R. Welch
NRC Senior Resident Inspector
Surry Power Station

Mr. P. D. Milano
NRC Project Manager
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O-8 H4A
11555 Rockville Pike
Rockville, Maryland 20852-2738

Ms. C. J. Sanders
NRC Project Manager Millstone Units 2 and 3
U. S. Nuclear Regulatory Commission,
One White Flint North
Mail Stop O-8 B3
11555 Rockville Pike
Rockville, MD 20852-2738

Mr. R. A. Jervey
NRC Project Manager
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O-8 G9A
11555 Rockville Pike
Rockville, Maryland 20852

Mr. S. P. Lingam
NRC Project Manager
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O-8 G9A
11555 Rockville Pike
Rockville, Maryland 20852

ATTACHMENT 1

NRC GENERIC LETTER 2004-02 POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS

REQUEST FOR AN EXTENSION OF THE COMPLETION DATE FOR CORRECTIVE ACTIONS

DOMINION ENERGY KEWAUNEE, INC.
(DEK)
KEWAUNEE POWER STATION

Request for an Extension of the Completion Date for Corrective Actions
Kewaunee Power Station

1.0 Background

In Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," 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 a letter dated September 1, 2005 (Serial No. 05-212), Dominion Energy Kewaunee, Inc. (DEK) submitted a response to GL 2004-02 for Kewaunee Power Station (Kewaunee). In that letter, DEK committed to completing the corrective actions required by GL 2004-02 by December 31, 2007 for KPS.

During the ensuing work to complete the GL 2004-02 corrective actions, it has become apparent that certain activities required to resolve the containment sump issues cannot be completed within the current schedules and, therefore, extensions to complete the corrective actions are necessary. DEK is performing a mechanistic analysis of the potential for adverse effects of post-accident debris blockage and of the potential for debris-laden fluids to affect the recirculation functions of the Emergency Core Cooling System (ECCS) and Recirculation Spray (RS)[1] following postulated design basis accidents for which the recirculation of these systems is required. Necessary hardware modifications identified to date have been completed. However, final documentation summarizing the results of recent strainer testing activities and the overall performance of Kewaunee's ECCS strainer arrangement, and the revision to downstream effects evaluations have not been completed. Consequently, DEK is requesting a schedule extension until June 30, 2008 to complete the remaining activities for resolution of GSI-191 for Kewaunee.

The following information provides the basis for Kewaunee's extension request and specifically addresses the "Criteria for Evaluating Delay of Hardware Changes," as described in SECY-06-0078, dated March 31, 2006. This discussion supports DEK's request for an extension of the completion date for the analytical work that is expected to confirm that no additional hardware modifications will be required for Kewaunee.

---

[1] Kewaunee does not credit containment spray in the recirculation mode in its safety analyses. However, recirculation spray was included in the scope of evaluations for resolution of GSI-191.

The proposed extension for Kewaunee 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 of sufficiently low plant risk.

2.0 Justification for the Proposed Extension

The NRC provided a justification for continued operation (JCO) in the "Summary of July 26-27, 2001 Meeting with Nuclear Energy Institute and Industry on ECCS Strainer Blockage in PWRs" dated August 14, 2001, that supports continued operation through December 31, 2007. Elements of the JCO that continue to be applicable to Kewaunee include the following:

- The Kewaunee containment is compartmentalized making transport of debris to the sump difficult.
- The probability of the initiating event is extremely low (large break LOCA).
- Leak-Before-Break (LBB) qualified piping is of sufficient toughness that it will most likely leak (even under safe shutdown conditions) rather than rupture.
- Kewaunee is not susceptible to primary water stress corrosion cracking associated with pressurizer Alloy 600/82/182 dissimilar metal welds since the Kewaunee pressurizer does not contain these types of welds.
- The time to switchover to recirculation (approximately 23 minutes after initiation of an event) allows for debris settling.
- No credit is taken for containment overpressure in the net positive suction head (NPSH) analyses for the Residual Heat Removal (RHR) system in the recirculation mode.
- The replacement ECCS recirculation strainer installed in October 2006, was designed to include margin for particulate, fibrous and chemical debris.
- 5.8 feet of NPSH margin is available for the Residual Heat Removal (RHR) pumps when operating in the containment sump recirculation mode with the new ECCS recirculation strainer arrangement and the maximum allowed strainer head loss. Strainer performance testing and calculations using NUREG/CR-6224 show greater margin is available.

3.0 Reason for the Proposed Extension

DEK is requesting an extension to the current December 31, 2007 due date for resolution of GSI-191. The extension will allow DEK to update strainer performance documentation to support resolution of chemical effects and to revise downstream effects evaluations.

The following activities have been completed and are explained in further detail in Sections 4.1 and 4.2 below:

- Physical modifications identified to date, including replacement of the ECCS recirculation strainer, are complete,
- Strainer flume testing is complete,
- Chemical effects evaluations are complete, and
- Evaluations for downstream effects using WCAP-16406-P, Evaluation of Downstream Sump Debris Effects in Support of GSI-191, Revision 0, are complete.

As stated in Section 4.1 below, Kewaunee is currently in the process of updating its strainer performance documentation to reflect the results of recent flume testing and recently updated chemical precipitation analyses. Additionally, existing downstream effects evaluations will be revised in accordance with the latest industry guidance. The revisions to Kewaunee's downstream effects evaluations are expected to reconfirm that no additional modifications are required for resolution of GSI-191.

4.0 Compliance with SECY-06-0078 Criteria

SECY-06-0078 specifies two criteria for short duration GL-2004-02 extensions, limited to several months and a third criterion for extensions beyond several months. The first two criteria are applicable to Kewaunee and the associated responses are provided in detail below.

4.1 SECY-06-0078 Criterion No. 1:

The licensee has a plant-specific technical/experimental plan with milestones and schedule to address outstanding technical issues with enough margin to account for uncertainties.

<u>DEK Response</u>

The following is DEK's plan for completing final GSI-191 resolution activities for Kewaunee. No additional physical modifications are anticipated as a result of the remaining activities.

KEWAUNEE PLANT SPECIFIC TECHNICAL/EXPERIMENTAL PLAN

- Chemical Effects and Strainer Performance

DEK has completed an evaluation to determine the type and quantity of chemical precipitates that can form in the Kewaunee containment sump pool post-accident. The analysis was performed in accordance with the evaluation guidance provided in WCAP-16530-NP, "Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support GSI-191," and its associated chemical model spreadsheet, and WCAP-16785-P, "Evaluation of Additional Inputs to the WCAP-16530-NP Chemical Model." Kewaunee uses sodium hydroxide (NaOH) as a buffer. The analysis determined that only sodium aluminum silicate ($NaAlSi_3O_8$) will precipitate in Kewaunee's sump pool due to Kewaunee's low quantity of silicon-containing insulations. Consequently, Kewaunee has a very low quantity of precipitate that will form in the sump pool post-accident. Several plant-specific cases were analyzed. For the case representing Kewaunee's design parameters, the quantity of precipitate generated was determined to be 5.674 kg (8.286 mg/L).

In June 2007, DEK performed additional flume tests at Alden Research Laboratories (ARL). The purpose of the June 2007 testing was to include the strainer's debris interceptor in the flume, model the flow rate over the debris interceptor and determine the quantity of fiber that is retained behind the debris interceptor. This was a safety related test conducted and witnessed by ARL and AREVA NP, Inc. The purpose of the tests was to determine the quantity of fiber downstream of the debris interceptor that is available to potentially collect on the recirculation sump strainer. Unlike past tests, this test did not artificially place the debris directly on the strainer. The use of overhead sprays provided sump mixing by simulating drainage and Reactor Coolant System (RCS) break flows in containment. The testing proved that an extremely small quantity of fibrous debris transports to the strainer area. Kewaunee's insulation in containment is primarily reflective metal insulation; therefore, Kewaunee has a low fibrous debris quantity in its design basis debris load (45 ft^3, including margin), which includes latent fibrous debris and other fiber sources. DEK also conducted a fiber erosion test at an Alion Science and Technology laboratory. The fiber erosion test was used to confirm the quantity of fine fiber used in the June 2007 flume tests was conservative.

Kewaunee has retained Performance Contracting, Inc. (PCI) to integrate the results of the June 2007 flume tests and provide an updated strainer performance document. Based on the flume tests performed in June 2007, and the behavior of Kewaunee's coatings post-accident, the documentation is expected to show that Kewaunee's sump pool velocities and the presence of debris interceptors will not result in the formation of a complete thin or thick debris bed on the ECCS recirculation strainer. Consequently, the strainer surface will remain clean. With a

clean strainer surface in conjunction with extremely low chemical precipitation, no increased strainer head loss due to chemical effects is expected.

The results of the June 2007 flume tests at ARL have been received and approved by DEK. The chemical precipitation analysis for Kewaunee is complete.

The timeline for the remaining activities to document overall strainer performance is as follows:

December 2007	Receive and approve fiber erosion test results
April 2008	Receive and approve updated strainer performance documentation

It should be noted that Kewaunee's current ECCS recirculation strainer design contains adequate margin for the design basis debris load, including chemical effects. Furthermore, the updated strainer performance documents are expected to conclude that greater margin exists due to the results of recent testing.

- Downstream Effects

  Kewaunee has completed several downstream effects evaluations including the following:

  - GSI-191 Downstream Effects - Flow Clearances

    This evaluation documents internal clearances downstream of the ECCS recirculation strainer, not including the reactor vessel or fuel. Internal clearances were determined for items such as, but not limited to, valves, heat exchangers, instruments and pumps. The components were identified by reviewing piping and instrument diagram drawings and plant procedures.

  - Phase II Downstream Evaluation for Resolution of GSI-191

    This evaluation determines the wear on components downstream of the recirculation strainer in the Safety Injection (SI), RHR and Internal Containment Spray (ICS) systems, not including the system pumps. This evaluation was performed using the methodology provided in WCAP-16406-P, Rev. 0.

  - Kewaunee RHR, SI and ICS Pump Evaluation for GSI-191 Downstream Effects

    This evaluation determines the wear on the RHR, SI and ICS pumps and the impact on the pumps' performance. This evaluation was performed using the methodology provided in WCAP-16406-P, Rev. 0.

- Downstream Effects Evaluation to Support the Resolution of GSI-191 for Kewaunee Power Station

  This evaluation reviews the effect of downstream effects on the reactor vessel internal clearances and the potential for a fiber bed to form on the nuclear fuel support grids. The evaluation used the methodology presented in WCAP-16406-P, Rev. 0.

Kewaunee's downstream effects evaluations are approved and do not result in the need for additional modifications. However, subsequently, in 2007, the Westinghouse Pressurized Water Reactors Owner's Group (PWROG) issued WCAP-16406-P, Rev. 1, and WCAP-16793-NP, "Evaluation of Long term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculation Fluid," Rev. 0. Consequently, DEK is working with its vendors to update our existing downstream effects evaluations to reconfirm that no additional physical modifications are required as a result of the recent methodology revisions.

The anticipated schedule for completing these evaluation updates is as follows:

June 2008 Receive and approve revised downstream effects evaluations.

Based on the above discussion, Kewaunee meets the requirements of SECY-06-0078 Criterion 1.

4.2 SECY-06-0078 Criterion No. 2:

The licensee identifies mitigative measures to be in place prior to December 31, 2007, and adequately describes how these mitigative measures will minimize the risk of degraded ECCS [emergency core cooling system] functions during the extension period.

DEK Response

The following mitigative measures have already been implemented to minimize the risk of degraded ECCS and RS functions during the requested extension period.

4.2.1 Mitigative Measures

DEK is fully committed to resolving the issues associated with GSI-191 and is continuing efforts to complete the corrective actions committed to in our September 1, 2005 response to GL 2004-02. The identified physical modifications to date are complete.

1. Physical Modifications

Kewaunee's hardware modifications include:

- Installation of a replacement ECCS recirculation strainer,
- Installation of debris interceptors, and
- Modification of the containment sump narrow range level indicators.

The previous ECCS recirculation strainer consisted of two strainer elements with a combined screen surface area of approximately 39 ft^2, and was constructed of Johnson Screen material with a perforation size of 1/8 inch x 15/32 inch. In October 2006, Kewaunee completed installation of a new Sure-Flow strainer arrangement designed by PCI. The replacement strainer consists of fourteen (14) strainer elements with a total strainer surface area of 768.7 ft^2 and is sized for the design basis debris load. The maximum strainer head loss specified is 10 feet of water, with margin retained for debris load changes. The new design retains 5.8 feet of NPSH margin for operation of the RHR pumps in the recirculation mode:

23.813 ft	NPSH Available (water height minus piping friction losses)
- 10.0	Maximum debris-laden strainer head loss*
- 8.0	NPSH Required
5.813 ft	NPSH Margin

*The ECCS recirculation strainer is limited to 10 ft head loss unless the structural integrity of the strainer is analyzed to exceed that value (see Section 2.0).

The new strainer arrangement includes debris interceptors installed around the strainer arrangement at the containment basement floor elevation. The interceptors will prevent debris traveling along the containment basement floor from reaching the strainer's perforated material. The debris interceptors are constructed from eight-inch stainless steel channel.

Also, the existing narrow range containment sump level indicators were modified. The float columns for the level indicators/switches are an entry point into the recirculation sump pit. The perforated float column end plates were modified to result in openings into the sump pit that are smaller than the new sump strainer's perforation size to prevent bypassing debris that is larger than the size of debris that could be passed through the recirculation strainer.

Furthermore, as committed to in our September 1, 2005 Generic Letter response, insulation repairs were made to improve the material condition of service water piping subject to containment spray impingement and steam generator blowdown

piping submerged post-accident. This work was completed during the fall 2006 refueling outage. In addition, the wooden reactor vessel o-ring storage container was removed from the reactor containment building, and several equipment labels in containment were upgraded with acceptable materials during the 2006 refueling outage.

2. Containment Cleanliness

DEK has detailed containment cleanliness procedural requirements for restart readiness following a refueling outage. The procedure minimizes miscellaneous debris sources within the containment. Specifically, the procedural requirements ensure that each major containment elevation is inspected and any loose debris (e.g., rags, trash, clothing, etc.) that could be transported to the containment recirculation sump is removed. Kewaunee's procedure also ensures that portable equipment is seismically restrained, the north stairway gate is secured to prevent debris from traveling down the stairwell nearest the ECCS recirculation strainer, and the removable sections of the ECCS recirculation strainer debris interceptors are installed.

3. Procedural Guidance, Training, and Actions

As discussed in the response to NRC Bulletin 2003-01, DEK has implemented a number of interim compensatory actions at Kewaunee to assure core cooling and containment integrity. In a letter dated December 15, 2005, the NRC staff concluded that DEK was responsive to, and met the intent of, Bulletin 2003-01 for Kewaunee.

In response to Bulletin 2003-01, Kewaunee implemented a new emergency operating procedure, ECA-1.3, Containment Sump Blockage, and provided operator training on indications of and responses to sump clogging. The procedure follows the guidance provided by the Westinghouse Owner's Group. Subsequently, the ECCS recirculation strainer was replaced; however, ECA-1.3 remains in effect at this time and provides general guidance to identify and respond to a cavitating RHR pump and provides steps for establishing recirculation flow. Additional operating procedure enhancements were implemented as described in Kewaunee's responses to Bulletin 2003-01 and remain in effect.

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. Kewaunee does not have the above-described combination in its containment and, therefore, no response to IN 2005-26 was necessary for Kewaunee.

5. Risk Evaluation

With the installation of the advanced sump strainer and other associated changes and evaluations, there has been a significant reduction in the vulnerability to debris blockage and component wear in the recirculation system when mitigating a LOCA. For the remaining outstanding issues of downstream and chemical effects, the vulnerability is limited to large break LOCAs only. For small and intermediate break LOCAs, it is expected that there will be a significant reduction in debris generation, as much as one to two orders of magnitude. With this type of reduction in the fibrous and particulate sources, core cooling will be assured for small and intermediate break LOCAs. Since the advanced strainer design is sized for a conservative estimate of the fibrous debris loading from a large break LOCA, it is expected that for fibrous debris loadings that are an order of magnitude or more lower, there will be open screen area such that any chemical precipitants that are generated will not prevent flow through the strainer and adequate NPSH will be maintained. Similarly, with an order of magnitude or more reduction in the particulate debris, the particulate debris concentration will be low enough such that wear of downstream components would be limited to the point such that there is reasonable assurance that the ECCS pumps and downstream components will continue to provide adequate core cooling. Thus, the quantitative risk evaluation addresses potential vulnerability for large break LOCAs only. The frequency of this initiating event is low (5E-6/yr).

The increase in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) is determined from the initiating event frequency for a large break LOCA. Integrating the initiating event frequency over the period of the proposed six months extension determines the Core Damage Probability (CDP) and the Large, Early Release Probability (LERP). As noted above, the initiating event frequency for a LBLOCA is equal to 5E-6/yr. Therefore, for a six months extension to complete GL 2004-02 corrective actions, the CDP is calculated as follows:

CDP = (5E-6/yr)*(0.5 years)
CDP = 2.5E-6

The LERP is negligible based on the Level 2 Probability Risk Assessment (PRA) model.

No credit is taken for recovery actions, which Kewaunee would normally use, to ensure continued supply from the sumps. The base CDF and base LERF values for Kewaunee are shown below along with the CDP and LERP values that were calculated for the proposed six months extension.

Base CDF (internal events)	CDP for 6 months extension	Base LERF (internal events)	LERP for 6 months extension
7.6E-5/yr	2.5E-6	9.8E-6/yr	negligible

Regulatory Guide (RG) 1.174 states that, when calculated changes in risk are in the range of 1E-6/yr to 1E-5/yr, a permanent change is "small" if the total plant CDF is less than 1E-4/yr. For LERF, a "small" change is a calculated risk increase in the range of 1E-7/yr to 1E-6/yr if the total LERF is less than 1E-5/yr. This RG sets criteria for permanent plant changes with associated risk increases. In this case, it may be conservatively used to evaluate the risk impact of the six months extension to complete the GL 2004-02 corrective actions. The assumption that the sump is 100% unavailable is additionally conservative. Therefore, based on RG 1.174, the risk associated with proposed six months extension to complete the GL 2004-02 corrective actions for Kewaunee is not considered to be significant.

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

In addition to the measures described above, there are design features that would facilitate mitigation of this issue. DEK has previously received NRC approval to invoke the leak-before-break methodology to eliminate the dynamic effects (pipe whip and jet impingement) of a postulated rupture of the RCS piping (hot leg, cold leg, crossover piping, pressurizer surge piping and piping connected to the RCS) from the design basis of the plant. The approval was based on the conclusion that the probability is low that a pipe failure occurs before noticeable leakage could be detected, and the plant can be brought to a safe shutdown condition. While leak-before-break is not being used to establish the design basis debris load on the ECCS recirculation strainer, it does provide a basis for safe continued operation until the completion of the GL 2004-02 corrective actions.

Based on the above discussion, Kewaunee meets the requirements of SECY-06-0078 Criterion 2.

4.3 SECY-06-0078 Criterion 3:

For proposed extensions beyond several months, a licensee's request will more likely be accepted if the proposed mitigative measures include temporary physical improvements to the ECCS sump or materials inside containment to better ensure a high level of ECCS performance.

DEK Response

As noted in Section 4.2.1 above, identified permanent hardware modifications including a new recently installed ECCS recirculation strainer design, which contains adequate margin for the design basis debris load including chemical effects, have already been

implemented. Therefore, temporary physical improvements to the ECCS sump or materials inside containment are not necessary. The extension request will permit the update of strainer performance documentation to support resolution of chemical effects and to revise downstream effects evaluations.

Based on the above discussion, Kewaunee meets the requirements of SECY-06-0078 Criterion 3.

5.0 Conclusion

An extension of the Kewaunee completion date from December 31, 2007 to June 30, 2008 for corrective actions required by GL 2004-02 is acceptable because:

- The core damage and large, early release probabilities for Kewaunee associated with the six months extension are 2.5E-6 and negligible, respectively. This risk impact is characterized as "small" per NRC Regulatory Guide 1.174.

- DEK has completed: 1) required physical modifications identified to date, 2) analyses for chemical effects and 3) analyses for downstream effects using WCAP-16406-P, Rev. 0.

- DEK is implementing a plant-specific plan with milestones and a schedule to address the outstanding technical issues with sufficient design margin to address uncertainties.

- Analyses performed to date do not indicate the need for additional physical modifications for resolution of GSI-191.

Therefore, per the criteria included in SECY-06-0078, DEK has established that the risk of degraded ECCS function for Kewaunee during the request extension period is considered not to be risk significant.

ATTACHMENT 2

NRC GENERIC LETTER 2004-02 POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS

REQUEST FOR AN EXTENSION OF THE COMPLETION DATE FOR CORRECTIVE ACTIONS

DOMINION NUCLEAR CONNECTICUT, INC.
(DNC)
MILLSTONE POWER STATION UNITS 2 AND 3

Request for an Extension of the Completion Date for Corrective Actions
Millstone Power Station Units 2 and 3

1.0 Background

In Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," 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 a letter dated September 1, 2005 (Serial No. 05-212), Dominion Nuclear Connecticut, Inc. (DNC) submitted a response to GL 2004-02. In that letter, DNC committed to completing the corrective actions required by GL 2004-02 by December 31, 2007 for Millstone Power Station Units 2 and 3 (MPS2 and MPS3).

During the ensuing work to complete the GL 2004-02 corrective actions, it has become apparent that certain activities required to resolve the containment sump issues cannot be completed within the current schedules, and, therefore, extensions to complete the corrective actions are necessary. DNC is performing a mechanistic analysis of the potential for adverse effects of post-accident debris blockage and of the potential for debris-laden fluids to affect the recirculation functions of the Emergency Core Cooling System (ECCS) and Recirculation Spray System following postulated design basis accidents for which the recirculation of these systems is required. However, certain activities have been identified for MPS2 and MPS3 that will not be completed by December 31, 2007; specifically, the downstream effects evaluations for components, including the reactor vessel and nuclear fuel, the chemical effects testing and evaluation, and the associated acceptance reviews. Furthermore, the results of the evaluations and testing may indicate the need for additional plant or procedure modifications to fully resolve open issues associated with GSI-191. These items are discussed in greater detail in Section 3.0 below.

Therefore, DNC is requesting a schedule extension for MPS2 and MPS3 to complete the remaining technical evaluations and testing, as well as to determine whether any additional actions may be required based on the results of the technical evaluations and testing. The following information provides the basis for the MPS2 and MPS3 extension request. Specifically, in the following discussion, DNC has addressed the "Criteria for Evaluating Delay of Hardware Changes," as described in SECY-06-0078 dated March 31, 2006. This discussion supports DNC's request for an extension of the completion date to ensure that the necessary technical evaluations and testing have been completed to facilitate resolution of GSI-191 issues. An extension is requested until November 30, 2008 to complete the required actions noted above. The proposed extension for MPS2 and MPS3 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 of sufficiently low plant risk.

2.0 Justification for the Proposed Extension

The NRC provided a justification for continued operation (JCO) in the "Summary of July 26-27, 2001 Meeting with Nuclear Energy Institute and Industry on ECCS Strainer Blockage in PWRs" dated August 14, 2001, that supports continued operation through December 31, 2007. Elements of the JCO that continue to be applicable to MPS2 and MPS3 include:

- The MPS2 and MPS3 containments are compartmentalized making transport of debris to the sump difficult.
- The probability of the initiating event (i.e., large break LOCA) is extremely low.
- Leak-Before-Break (LBB) qualified piping is of sufficient toughness that it will most likely leak (even under safe shutdown conditions) rather than rupture.
- The time to switchover to recirculation from the sump after accident initiation allows for debris settling.

3.0 Reason for the Proposed Extension

DNC is requesting an extension until November 30, 2008 for the completion of the following activities: 1) downstream effects evaluations for components, including the reactor vessel and nuclear fuel, 2) chemical effects testing and evaluation, and 3) determination of any additional actions that may be required based on the results of the evaluations and testing.

An evaluation of downstream clogging and wear was completed for MPS2 and MPS3 in accordance with WCAP-16406-P Rev. 0. However, WCAP-16406-P Rev. 1 was issued in September 2007 and includes revised guidance for the performance of downstream effects evaluations for components, including the reactor vessel and nuclear fuel. Also, WCAP-16793-NP Rev. 0, issued in May 2007, provides guidance on evaluation of blockage and chemical precipitant plateout in the reactor core and fuel and is currently undergoing NRC review and Safety Evaluation Report preparation. Consequently, revised downstream effects evaluations must be performed in accordance with the most recent WCAP guidance. The revised downstream effects evaluations are scheduled to be completed for MPS2 and MPS3 by the end of the first quarter of 2008.

Also, a chemical effects evaluation is currently being performed for MPS2 and MPS3 by Atomic Energy of Canada Limited (AECL – the strainer vendor) to determine the potential for chemical precipitate formation. Benchtop testing is being performed to validate evaluation assumptions. Reduced scale testing for chemical effects may also be necessary based on the results of the benchtop testing and/or other industry/regulatory testing results. Completion of the required chemical effects

evaluation and testing is required to confirm that the replacement strainers installed at MPS2 and MPS3 are adequate to maintain NPSH margin for the ECCS pumps during long-term core cooling and to confirm that no further physical modifications are required. Completion of the chemical effects evaluation and testing and issuance of the technical reports will not be completed until the third quarter of 2008 for MPS2 and MPS3.

4.0 Compliance with SECY-06-0078 Criteria

SECY-06-0078 specifies two criteria for short duration GL 2004-02 extensions, limited to several months and a third criterion for extensions beyond several months. These three criteria and the associated responses for MPS2 and MPS3 are provided in detail below.

4.1 SECY-06-0078 Criterion No. 1:

The licensee has a plant-specific technical/experimental plan with milestones and schedule to address outstanding technical issues with enough margin to account for uncertainties.

DNC Response

MILLSTONE PLANT SPECIFIC TECHNICAL/EXPERIMENTAL PLAN

DNC has completed debris generation analyses, debris transport analyses, debris blockage and wear analyses for downstream components (using WCAP 16406-P, Rev. 0), strainer head loss and vortex testing for expected debris (excluding chemical precipitants), and replacement strainer design and installation for both MPS2 and MPS3.

Technical issues concerning downstream effects and the impact of chemical precipitates on strainer head loss will not be complete for MPS2 and MPS3 by December 31, 2007. To resolve these issues and adopt the mechanistic licensing basis required for long-term core cooling required for resolution of GSI-191 at both MPS2 and MPS3, the following milestones have been established:

- Downstream Effects Evaluations for Components, including Reactor Vessel and Nuclear Fuel

March 31, 2008	Completion of revised downstream effects evaluations for components, including reactor vessel and nuclear fuel, for incorporation into the MPS2 and MPS3 licensing basis.
June 30, 2008	Determination of, and schedule for, hardware and/or procedural modifications (if any) needed as a result of the

completion of the downstream effects evaluations for components, including reactor vessel and nuclear fuel.

- Chemical Effects Testing and Evaluation

March 31, 2008	Completion of chemical effects evaluation and benchtop testing to determine likely precipitate formation and bounding quantities of precipitates for use in reduced scale testing.
September 30, 2008	Completion of reduced scale testing to determine impact of chemical precipitate formation, if required.
November 30, 2008	Determination of, and schedule for, hardware and/or procedural modifications (if any) needed as a result of the completion of the chemical precipitate head loss testing.

Based on the above discussion, MPS2 and MPS3 meet the requirements of SECY-06-0078 Criterion 1.

4.2 SECY-06-0078 Criterion No. 2:

The licensee identifies mitigative measures to be in place prior to December 31, 2007, and adequately describes how these mitigative measures will minimize the risk of degraded ECCS [emergency core cooling system] functions during the extension period.

DNC Response

The following mitigative measures have already been implemented to minimize the risk of degraded ECCS and Recirculation Spray functions during the requested extension period.

4.2.1 Mitigative Measures

DNC is fully committed to resolving the issues associated with GSI-191 and is continuing efforts to complete the corrective actions committed to in the September 1, 2005 response to GL 2004-02. DNC will have implemented the physical modifications identified to date at MPS2 and MPS3 prior to December 31, 2007. Specifically, the following work has been completed:

1. Physical Modifications

   MPS2 - As discussed in greater detail below in Section 4.3, DNC completed the installation of an approximately 6000 ft^2 surface area replacement strainer system (which includes some margin for chemical effects), and replaced calcium silicate

insulation that could contribute to a limiting debris bed in containment during the fall 2006 refueling outage (RFO).

MPS3 - DNC completed the installation of an approximately 5000 ft^2 surface area replacement strainer system (which includes some margin for chemical effects) during the spring 2007 RFO. Additionally, DNC implemented a modification to delay the start time of the Recirculation Spray System (RSS) pumps to ensure that the replacement strainers are submerged prior to pump start. The MPS3 RSS pumps are the only pumps that take suction from the replacement strainer during recirculation and long-term cooling.

2. Containment Cleanliness

DNC has a procedure in place for each unit to ensure 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." A detailed containment inspection is performed prior to closing containment following a plant outage that requires a containment entry, or following a containment entry at power. The procedure specifically directs the inspection for, and removal of, loose debris (e.g., rags, trash, clothing, etc.) in the containment that could be transported to the containment recirculation sump or that could block containment drainage paths. Additionally, the procedure directs the removal of temporary material that is used in containment and the restraint of any temporary material that is to be left in containment. Containment sump inspections are required by the Millstone Technical Specifications.

3. Procedural Guidance, Training, and Actions

As discussed in the response to NRC Bulletin 2003-01, DNC has implemented a number of interim compensatory actions at Millstone to assure core cooling and containment integrity. In a letter dated September 26, 2005, the NRC staff concluded that Dominion was responsive to, and met the intent of, Bulletin 2003-01 for Millstone.

Operators are trained and have guidance for continuously monitoring ECCS 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 ECCS pumps in the recirculation cooling mode.

4. Information Notice 2005-26

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.

MPS2 had calcium silicate insulation on some small bore piping and on the regenerative heat exchanger, which was susceptible to damage from a limiting break. In a letter dated November 29, 2005, DNC provided the results of a review of compensatory measures from NRC Bulletin 2003-01 in light of IN 2005-26. During the fall 2006 RFO, calcium silicate insulation was removed from any limiting break zone of influence (ZOI) to prevent it from being a contributing debris source for a limiting break.

MPS3 does not have calcium silicate insulation in its containment and, therefore, no response to IN 2005-26 was required for MPS3.

5. Risk Evaluation

With the installation of the advanced sump strainer and other associated changes and evaluations, there has been a significant reduction in the vulnerability to debris blockage and component wear in the recirculation system when mitigating a LOCA. For the remaining outstanding issues of downstream and chemical effects, the vulnerability is limited to large break LOCAs only. For small and intermediate break LOCAs, it is expected that there will be a significant reduction in debris generation, as much as one to two orders of magnitude. With this type of reduction in the fibrous and particulate sources, core cooling will be assured for small and intermediate break LOCAs. Since the advanced strainer design is sized for a conservative estimate of the fibrous and particulate debris loading from a large break LOCA, it is expected that for particulate debris loadings that are an order of magnitude or more lower, there will be insufficient particulate to form a thin-bed on the replacement strainer and there will potentially be open strainer area. Thus, it is likely that any chemical precipitates that are generated will not create a head loss larger than the tested thin-bed head loss for which the strainer was designed, and adequate NPSH will be maintained. Furthermore, with an order of magnitude or more reduction in the particulate debris, the particulate debris concentration should be low enough such that wear of downstream components would be limited to the point that there is reasonable assurance that the ECCS pumps and downstream components would continue to provide adequate core cooling. Thus, the quantitative risk evaluation addresses potential vulnerability for large break LOCAs only. The frequency of this initiating event is low (5E-6/yr).

The increase in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) is determined from the initiating event frequency for a large break LOCA. Integrating the initiating event frequency over the period of the proposed eleven months extension determines the Core Damage Probability (CDP) and the Large Early Release Probability (LERP). As noted above, the initiating event frequency for a LBLOCA is equal to 5E-6/yr. Therefore, for an eleven months

extension to complete GL 2004-02 corrective actions, the CDP is calculated as follows:

CDP = (5E-6/yr)*(0.92 years)
CDP = 4.6E-6

The LERP is negligible based on the Level 2 Probabilistic Risk Assessment (PRA) model.

No credit is taken for recovery actions, which MPS 2 and MPS3 would normally use, to ensure continued supply from the sumps. The base CDF and base LERF values for MPS 2 and MPS3 are shown below along with the CDP and LERP values that were calculated for the proposed eleven months extension.

Unit	Base CDF (internal events)	CDP for an 11 months extension	Base LERF (internal events)	LERP for an 11 months extension
MPS2	1.5E-5/yr	4.6E-6	6.9E-8/yr	negligible
MPS3	6.4E-6/yr	4.6E-6	5.3E-7/yr	negligible

Regulatory Guide (RG) 1.174 states that, when calculated changes in risk are in the range of 1E-6/yr to 1E-5/yr, a permanent change is "small" if the total plant CDF is less than 1E-4/yr. For LERF, a "small" change is a calculated risk increase in the range of 1E-7/yr to 1E-6/yr if the total LERF is less than 1E-5/yr. This RG sets criteria for permanent plant changes with associated risk increases. In this case, it may be conservatively used to evaluate the risk impact of the eleven months extension to complete the GL 2004-02 corrective actions. The assumption that the sump is 100% unavailable is additionally conservative. Therefore, based on RG 1.174, the risk associated with proposed eleven months extension to complete the GL 2004-02 corrective actions for MPS 2 and MPS3 is not considered to be significant.

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

In addition to the measures described above, there are design features that would facilitate mitigation of this issue. DNC has NRC approval to invoke the leak-before-break (LBB) methodology to eliminate the dynamic effects (pipe whip and jet impingement) of postulated reactor coolant piping ruptures from the design basis of the plant.

For MPS2, the licensing basis includes approved LBB analysis for the hot legs, cold legs, and crossover legs of the Reactor Coolant System (RCS), the pressurizer surge line, and portions of the Safety Injection (SI) and Shutdown Cooling lines, which are not isolable from the RCS piping.

For MPS3, the plant licensing basis includes approved partial LBB analysis for the hot legs, cold legs, and crossover legs of the RCS.

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 GL 2004-02 corrective actions.

Based on the above discussion, MPS2 and MPS3 meet the requirements of SECY-06-0078 Criterion 2.

4.3 SECY-06-0078 Criterion 3:

For proposed extensions beyond several months, a licensee's request will more likely be accepted if the proposed mitigative measures include temporary physical improvements to the ECCS sump or materials inside containment to better ensure a high level of ECCS performance.

DNC Response

DNC has implemented the following physical improvements to the containment sump to better ensure a high level of ECCS performance:

- Strainer Installation

  MPS2 – DNC completed the installation of the MPS2 replacement strainer system during the MPS2 fall 2006 RFO. The new strainer system represents a significant improvement over the previous design. The total surface area of the new strainer is approximately 6000 ft^2. This replaced the previous screen, which had a surface area of approximately 115 ft^2.

  MPS3 - DNC completed the installation of the MPS3 replacement strainer system during the MPS3 spring 2007 RFO. The new strainer system represents a significant improvement over the previous design. The total surface area of the new strainer is approximately 5000 ft^2. This replaced the previous screen, which had a surface area of approximately 240 ft^2.

- Calcium Silicate Insulation (Cal-Sil) Removal (MPS2 only)

  MPS2 removed Cal-Sil from inside the steam generator cavities within the containment. There is no longer any credible high-energy line break that can impact the remaining Cal-Sil in containment. The remaining Cal-Sil insulation is located in the containment penetration area, outside of the LOCA ZOIs. Further, metal jacketing protecting the remaining Cal-Sil insulation would prevent significant

damage due to containment spray. Finally, the remaining Cal-Sil would not become submerged.

- RSS Pump Start Time Change (MPS3 only)

  Refueling Water Storage Tank (RWST) instrumentation was modified to delay the RSS pumps' start to a Lo-Lo RWST level signal to ensure sufficient water is available to cover the ECCS strainer to meet the strainer submergence requirements. Prior to this change, the RSS pumps were started on a timer.

Based on the above discussion, MPS2 and MPS3 meet the requirements of SECY-06-0078 Criterion 3.

5.0 Conclusion

An extension of the MPS2 and MPS3 completion dates from December 31, 2007 to November 30, 2008 for corrective actions and modifications required by GL 2004-02 is acceptable because:

- The core damage and large early release probabilities associated with the eleven months extension are 4.6E-6 and negligible, respectively. This risk impact is the same at both MPS2 and MPS3 and is characterized as "small" per NRC Regulatory Guide 1.174.

- DNC has completed considerable work to further promote a high level of ECCS pump performance including replacement strainer installation (MPS2 and MPS3), Cal-Sil insulation removal (MPS2), and RSS pump start time change (MPS3).

- DNC has implemented mitigative measures to minimize the risk of degraded ECCS functions during the extension period.

- DNC has a plant-specific plan with milestones and schedule to address the outstanding technical issues with sufficient conservatism to address uncertainties.

Therefore, per the criteria included in SECY-06-0078, DNC has established that the risk of degraded ECCS and Recirculation Spray functions for MPS2 and MPS3 is not considered to be significant.

ATTACHMENT 3

NRC GENERIC LETTER 2004-02 POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS

REQUEST FOR AN EXTENSION OF THE COMPLETION DATE FOR CORRECTIVE ACTIONS

VIRGINIA ELECTRIC AND POWER COMPANY
(DOMINION)
NORTH ANNA POWER STATION UNITS 1 AND 2

Request for an Extension of the Completion Date for Corrective Actions North Anna Power Station Units 1 and 2

1.0 Background

In Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," 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 a letter dated September 1, 2005 (Serial No. 05-212), Virginia Electric and Power Company (Dominion) submitted a response to GL 2004-02, In that letter, Dominion committed to completing the corrective actions required by Generic Letter 2004-02 by December 31, 2007 for North Anna Power Station Units 1 and 2 (NAPS1 and NAPS2).

During the ensuing work to complete the GL 2004-02 corrective actions, it has become apparent that certain activities required to resolve the containment sump issues cannot be completed within the current schedules, and, therefore, extensions to complete the corrective actions are necessary. Dominion is performing a mechanistic analysis of the potential for adverse effects of post-accident debris blockage and of the potential for debris-laden fluids to affect the recirculation functions of the Emergency Core Cooling System (ECCS) and Recirculation Spray (RS) System following postulated design basis accidents for which the recirculation of these systems is required. However, certain activities have been identified for NAPS1 and NAPS2 that will not be completed by December 31, 2007; specifically, the downstream effects evaluations for components, including the reactor vessel and nuclear fuel, the chemical effects testing and evaluation, and their associated acceptance reviews. Furthermore, the results of the evaluations and testing may indicate the need for additional plant or procedure modifications to fully resolve open issues associated with GSI-191. These items are discussed in greater detail in Section 3.0 below.

Therefore, Dominion is requesting a schedule extension for NAPS1 and NAPS2 to complete the remaining technical evaluations and testing, as well as to determine whether any additional actions may be required based on the results of the technical evaluations and testing. The following information provides the basis for the NAPS1 and NAPS2 extension request. Specifically, in the following discussion, 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 to ensure that the necessary technical evaluations and testing have been completed to facilitate resolution of GSI-191 issues. An extension is requested until November 30, 2008 to complete the required actions noted above. The proposed extension for NAPS1 and NAPS2 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 of sufficiently low plant risk.

2.0 Justification for the Proposed Extension

The NRC provided a justification for continued operation (JCO) in the "Summary of July 26-27, 2001 Meeting with Nuclear Energy Institute and Industry on ECCS Strainer Blockage in PWRs" dated August 14, 2001, that supports continued operation through December 31, 2007. Elements of the JCO that continue to be applicable to NAPS1 and NAPS2 include:

- The NAPS1 and NAPS2 containments are compartmentalized thus slowing transport of debris to the sump.
- The probability of the initiating event (i.e., large break LOCA) is extremely low.
- Leak-Before-Break (LBB) qualified piping is of sufficient toughness that it will most likely leak (even under safe shutdown conditions) rather than rupture.
- The time to switchover to recirculation from the sump after accident initiation allows for debris settling.

3.0 Reason for the Proposed Extension

Dominion is requesting an extension until November 30, 2008 for completion of the following activities: 1) downstream effects evaluations for components, including the reactor vessel and nuclear fuel, 2) chemical effects testing and evaluation, and 3) determination of any additional actions that may be required based on the results of the evaluations and testing.

An evaluation of downstream clogging and wear was completed for NAPS1 and NAPS2 in accordance with WCAP-16406-P Rev. 0. However, WCAP-16406-P Rev. 1 was issued in September 2007 and includes revised guidance for the performance of downstream effects evaluations for components, including reactor vessel and nuclear fuel. Also, WCAP-16793-NP Rev. 0, issued in May 2007, provides guidance on evaluation of blockage and chemical precipitant plateout in the reactor core and fuel and is currently undergoing NRC review and Safety Evaluation Report preparation. Consequently, revised downstream effects evaluations must be performed in accordance with the most recent WCAP guidance. The revised downstream effects evaluations are scheduled to be completed for NAPS1 and NAPS2 by the end of the first quarter of 2008.

Also, a chemical effects evaluation is currently being performed for NAPS1 and NAPS2 by Atomic Energy of Canada Limited (AECL – the strainer vendor) to determine the potential for chemical precipitate formation, and benchtop testing is being performed to validate evaluation assumptions. Reduced scale testing for chemical effects may also

be necessary based on the results of the benchtop testing and/or other industry/regulatory testing results. Completion of the required chemical effects evaluation and testing is required to confirm that the replacement strainers installed at NAPS1 and NAPS2 are adequate to maintain NPSH margin for the ECCS pumps during long-term core cooling and to confirm that no further physical modifications are required. Completion of the chemical effects evaluation and testing and issuance of the technical report will not be completed until the third quarter of 2008 for NAPS1 and NAPS2.

4.0 Compliance with SECY-06-0078 Criteria

SECY-06-0078 specifies two criteria for short duration GL 2004-02 extensions, limited to several months and a third criterion for extensions beyond several months. These three criteria and the associated responses for NAPS1 and NAPS2 are provided in detail below.

4.1 SECY-06-0078 Criterion No. 1:

The licensee has a plant-specific technical/experimental plan with milestones and schedule to address outstanding technical issues with enough margin to account for uncertainties.

Dominion Response

NORTH ANNA PLANT SPECIFIC TECHNICAL/EXPERIMENTAL PLAN

Dominion has completed debris generation analyses, debris transport analyses, debris blockage and wear analyses for downstream components (using WCAP 16406-P, Rev. 0), strainer head loss and vortex testing for expected debris (excluding chemical precipitants), and replacement strainer design and installation for both NAPS1 and NAPS2.

Technical issues concerning downstream effects and the impact of chemical precipitates on strainer head loss are expected to remain unresolved for both NAPS1 and NAPS2 on December 31, 2007. To resolve these issues and adopt the mechanistic licensing basis required for long-term core cooling required for resolution of GSI-191 at both NAPS1 and NAPS2, the following milestones are to be met:

- Downstream Effects Evaluations for Components, Including Reactor Vessel and Nuclear Fuel

  March 31, 2008: Completion of revised downstream effects evaluations for components, including reactor vessel and nuclear fuel, for incorporation into NAPS1 and NAPS2 licensing basis.

June 30, 2008: Determination of, and schedule for, hardware and/or procedural modifications (if any) needed as a result of the completion of the downstream effects evaluations for components, including reactor vessel and nuclear fuel.

- Chemical Effects Testing and Evaluation

March 31, 2008: Completion of analysis and bench-top testing to determine likely precipitate formation and bounding quantities of precipitates to use in reduced scale testing.

September 30, 2008 Completion of reduced scale testing to determine impact of chemical precipitate formation, if required.

November 30, 2008 Determination of, and schedule for, hardware and/or procedural modifications (if any) needed as a result of the completion of the chemical precipitate head loss testing.

Based on the above discussion, NAPS1 and NAPS2 meet the requirements of SECY-06-0078 Criterion 1.

4.2 SECY-06-0078 Criterion No. 2:

The licensee identifies mitigative measures to be out in place prior to December 31, 2007, and adequately describes how these mitigative measures will minimize the risk of degraded ECCS [emergency core cooling system] functions during the extension period.

Dominion Response

The following mitigative measures have already been implemented to minimize the risk of degraded ECCS and RS functions during the requested extension period.

4.2.1 Mitigative Measures

Dominion is fully committed to resolving the issues associated with GSI-191 and is continuing efforts to complete the corrective actions committed to in our September 1, 2005 response to GL 2004-02. We have implemented the physical modifications identified to date at NAPS1 and NAPS2. Specifically, the following work has been completed:

1. Physical Modifications

As discussed in greater detail in Section 4.3 below, Dominion completed the installation of the NAPS2 and NAPS1 replacement strainer systems during the spring and fall 2007 refueling outages (RFO), respectively.

Also, an evaluation was performed to identify the amount of Cal-Sil and MicroTherm insulation inside the containments at NAPS1 and NAPS2. The MicroTherm insulation within the containment (NAPS2 only) and the Cal-Sil insulation in the steam generator and pressurizer rooms were either removed or replaced during the spring and fall 2007 RFOs for NAPS2 and NAPS1, respectively. Removal of Cal-Sil and Microtherm insulation was required to achieve the specified strainer head loss and to help reduce component wear.

Dominion has also modified the Refueling Water Storage Tank (RWST) level instrumentation to accomplish the following:

- The Outside Recirculation Spray (ORS) pumps will start on a Hi-Hi containment pressure signal coincident with a 60% RWST wide range level signal to ensure sufficient water is available to meet strainer submergence requirements.
- A 120-second time delay was added for the start of the Inside Recirculation Spray (IRS) pumps. This reduces the load impact on the Emergency Diesel Generators and allows sufficient time for the IRS pumps to fill its piping and attain stable operation prior to the start of the ORS pumps.
- The Safety Injection automatic Recirculation Mode Transfer (RMT) setpoint was also changed from 19.4 % to 16.0 % RWST wide range level to ensure sufficient water is available to meet strainer submergence requirements.

A 12-inch hole was also core bored in the primary shield wall plug at both NAPS1 and NAPS2 to allow water held-up in the reactor cavity to drain from the in-core sump (ICS) room into the containment sump. This modification facilitates the transfer of additional water to the containment floor to ensure full submergence of the new containment sump strainers.

2. Containment Cleanliness

Dominion has procedures in place to ensure 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. Specifically, the procedures require that no loose debris (rags, trash, clothing, etc.) is present in the containment that could be transported to the containment recirculation sumps or that could block drainage paths. In support of these cleanliness standards, walkdowns of the containment are required by

procedure after work has been completed prior to the restart from an outage. In addition, containment sump strainer inspections are required by the NAPS Technical Specifications and are performed on a once per 18 months frequency.

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 NAPS to assure core cooling and containment integrity. In a letter dated September 26, 2005, the NRC staff concluded that Dominion was responsive to, and met the intent of, Bulletin 2003-01 for NAPS.

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

4. Information Notice 2005-26

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. NAPS1 and NAPS2 were not units listed in this document as having the above-described combination in its containment and, therefore, no response to IN 2005-26 was required for NAPS1 and NAPS2.

5. Risk Evaluation

With the installation of the advanced sump strainer and other associated changes and evaluations, there has been a significant reduction in the vulnerability to debris blockage and component wear in the recirculation system when mitigating a LOCA. For the remaining outstanding issues of downstream and chemical effects, the vulnerability is limited to large break LOCAs only. For small and intermediate break LOCAs, it is expected that there will be a significant reduction in debris generation, as much as one to two orders of magnitude. With this type of reduction in the fibrous and particulate sources, core cooling will be assured for small and intermediate break LOCAs. Since the advanced strainer design is sized for a conservative estimate of the fibrous and particulate debris loading from a large break LOCA, it is expected that for particulate debris loadings that are an order of magnitude or more lower, there will be insufficient particulate to form a thin-bed on the replacement strainer and there will potentially be open strainer area. Thus, it is likely that any chemical precipitates that are generated will not create a head loss larger than the tested thin-bed head loss for which the strainer was designed, and adequate NPSH will be maintained. Furthermore, with an order of magnitude or

more reduction in the particulate debris, the particulate debris concentration should be low enough such that wear of downstream components would be limited to the point that there is reasonable assurance that the ECCS pumps and downstream components would continue to provide adequate core cooling. Thus, the quantitative risk evaluation addresses potential vulnerability for large break LOCAs only. The frequency of this initiating event is low (5E-6/yr).

The increase in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) is determined from the initiating event frequency for a large break LOCA. Integrating the initiating event frequency over the period of the proposed eleven months extension determines the Core Damage Probability (CDP) and the Large Early Release Probability (LERP). As noted above, the initiating event frequency for a LBLOCA is equal to 5E-6/yr. Therefore, for an eleven months extension to complete GL 2004-02 corrective actions, the CDP is calculated as follows:

CDP = (5E-6/yr)*(0.92 years)
CDP = 4.6E-6

The LERP is negligible based on the Level 2 Probabilistic Risk Assessment (PRA) model.

No credit is taken for recovery actions, which NAPS1 and NAPS2 would normally use, to ensure continued supply from the sumps. The base CDF and base LERF values for NAPS1 and NAPS2 are shown below along with the CDP and LERP values that were calculated for the proposed eleven months.

Base CDF (internal events)	**CDP for 11 months extension**	**Base LERF (internal events)**	**LERP for 11 months extension**
5.4E-6/yr	4.6E-6	8.2E-7/yr	negligible

Regulatory Guide (RG) 1.174 states that, when calculated changes in risk are in the range of 1E-6/yr to 1E-5/yr, a permanent change is "small" if the total plant CDF is less than 1E-4/yr. For LERF, a "small" change is a calculated risk increase in the range of 1E-7/yr to 1E-6/yr if the total LERF is less than 1E-5/yr. This RG sets criteria for permanent plant changes with associated risk increases. In this case, it may be conservatively used to evaluate the risk impact of the eleven months extension to complete the GL 2004-02 corrective actions. The assumption that the sump is 100% unavailable is additionally conservative. Therefore, based on RG 1.174, the risk associated with the proposed eleven months extension to complete the GL 2004-02 corrective actions for NAPS1 and NAPS 2 is not considered to be significant.

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

   In addition to the measures described above, there are design features that would facilitate mitigation of this issue. Dominion has NRC approval to invoke the leak-before-break (LBB) methodology to eliminate the dynamic effects (pipe whip and jet impingement) of postulated primary coolant piping ruptures from the design basis of the plant.

   For NAPS1 and NAPS2, the licensing basis includes approved LBB analysis for the Reactor Coolant System (RCS) primary loop piping.

   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 GL 2004-02 corrective actions.

Based on the above discussion, NAPS1 and NAPS2 meet the requirements of SECY-06-0078 Criterion 2.

4.3 SECY-06-0078 Criterion 3:

For proposed extensions beyond several months, a licensee's request will more likely be accepted if the proposed mitigative measures include temporary physical improvements to the ECCS sump or materials inside containment to better ensure a high level of ECCS performance.

Dominion Response

As noted above, Dominion has implemented the following physical improvements to the containment sump to better ensure a high level of ECCS and RS sump performance.

- Strainer Installation

  NAPS1 – Dominion completed the installation of the NAPS1 replacement strainer system during the fall 2007 RFO. The new strainer system represents a significant improvement over the previous design. The total surface area of the new RS strainer is approximately 4400 ft^2, and the total surface area of the Low Head Safety Injection (LHSI) strainer is approximately 2000 ft^2. This replaces the previous screens which had a total surface area of approximately 168 ft^2 each.

  NAPS2 – Dominion completed the installation of the NAPS2 replacement strainer system during the spring 2007 RFO. The new strainer system represents a significant improvement over the previous design. The total surface area of the new RS strainer is approximately 4400 ft^2, and the total surface area of the LHSI strainer

is approximately 1900 ft^2. This replaces the previous screens which had a total surface area of approximately 168 ft^2 each.

- RS Pump Start Time Change

  The RWST instrumentation was modified at NAPS1 and NAPS2 during the NAPS1 fall 2007 RFO and the NAPS 2 spring 2007 RFO to change the start signals for the RS pumps. This change allows the ORS pumps to start on a Hi-Hi containment pressure signal coincident with a 60% RWST wide range level signal to ensure sufficient water is available to meet strainer submergence requirements. A 120-second time delay was also added for the start of the IRS pumps. This reduces the load impact on the Emergency Diesel Generators and allows sufficient time for the ORS pumps to fill its piping and attain stable operation prior to the start of the IRS pumps.

- LHSI Pump Recirculation Mode Transfer (RMT) Change

  The RWST instrumentation has been modified at NAPS1 and NAPS2 during the NAPS1 fall 2007 RFO and the NAPS 2 spring 2007 RFO to change the Safety Injection RMT setpoint from 19.4% to 16.0% RWST wide range level. This allows more energy to be removed from the containment and lowers the sump temperature prior to swapping the Low Head Safety Injection (LHSI) pump suction from the RWST to the containment sump. This change also provides a higher water level in the containment prior to LHSI suction swap to the containment sump. The combination of lower temperature and higher water level provides more NPSH to the LHSI pumps and provides the required volume of water to maintain strainer submergence.

- Insulation Replacement/Removal

  NAPS1 – An evaluation was performed at NAPS1 to identify lines within the containment that required insulation removal/replacement to minimize the ZOI generated particulate during a critical pipe break. Cal-Sil insulation located within the steam generator (SG) cubicles and pressurizer room was removed/replaced during the NAPS1 fall 2007 RFO. Removal of Cal-Sil insulation was required to achieve the specified strainer head loss and to help reduce component wear.

  NAPS2 – An evaluation was performed at NAPS2 to identify lines within the containment that required insulation removal/replacement to minimize the ZOI generated particulate during a critical pipe break. Cal-Sil insulation located within the SG cubicles and pressurizer room, and the Microtherm insulation within the containment was removed/replaced during the NAPS2 spring 2007 RFO. Removal of Cal-Sil and Microtherm insulation was required to achieve the specified strainer head loss and to help reduce component wear.

- Incore Sump (ICS) Room Drain

  An ICS room drain was installed in the primary shield wall plug at NAPS2 during the spring 2007 RFO and at NAPS1 during the fall 2007 RFO. This modification allows water held up in the reactor cavity to drain to the containment sump from the ICS room. This facilitates the transfer of additional water to the containment floor at elevation 216"-11" to facilitate full submergence of the new containment sump strainers.

Based on the above discussion, NAPS1 and NAPS2 meet the requirements of SECY-06-0078 Criterion 3.

5.0 Conclusion

An extension of the NAPS1 and NAPS2 completion dates from December 31, 2007 to November 30, 2008 to complete the corrective actions required by GL 2004-02 is acceptable because:

- The core damage and large early release probabilities for NAPS1 and NAPS2 associated with the eleven months extension are 4.6E-6 and negligible, respectively. This risk impact is characterized as "small" per NRC Regulatory Guide 1.174.

- Dominion has completed considerable work to further promote a high level of ECCS and RS pump performance including replacement strainer installation at both NAPS1 and NAPS2.

- Dominion has implemented mitigative measures to minimize the risk of degraded ECCS and RS functions during the extension period.

- Dominion has a plant-specific plan with milestones and schedules to address the outstanding technical issues with sufficient conservatism to address uncertainties.

Therefore, per the criteria included in SECY-06-0078, Dominion has established that the risk of degraded ECCS and RS functions for NAPS1 and NAPS2 is not considered to be significant.

ATTACHMENT 4

NRC GENERIC LETTER 2004-02 POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS

REQUEST FOR AN EXTENSION OF THE COMPLETION DATE FOR CORRECTIVE ACTIONS

VIRGINIA ELECTRIC AND POWER COMPANY
(DOMINION)
SURRY POWER STATION UNITS 1 AND 2

Request for an Extension of the Completion Date for Corrective Actions
Surry Power Station Units 1 and 2

1.0 Background

In Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," 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 a letter dated September 1, 2005 (Serial No. 05-212), Virginia Electric and Power Company (Dominion) submitted a response to GL 2004-02. In that letter, Dominion committed to completing the corrective actions required by Generic Letter 2004-02 by December 31, 2007 for Surry Power Station Units 1 and 2 (SPS1 and SPS2). Subsequently, in a letter dated March 8, 2007, the NRC approved an extension for SPS2 to complete the remaining portion of the Unit 2 strainer installation during the spring 2008 RFO.

During the ensuing work to complete the GL 2004-02 corrective actions, it has become apparent that certain activities required to resolve the containment sump issues cannot be completed within the current schedules, and, therefore, extensions to complete the corrective actions are necessary. Dominion is performing a mechanistic analysis of the potential for adverse effects of post-accident debris blockage and of the potential for debris-laden fluids to affect the recirculation functions of the Emergency Core Cooling System (ECCS) and Recirculation Spray (RS) System following postulated design basis accidents for which the recirculation of these systems is required. However, certain activities have been identified for SPS1 and SPS2 that will not be completed by December 31, 2007; specifically, the downstream effects evaluations for components, including reactor vessel and nuclear fuel, the chemical effects testing and evaluation, and their associated acceptance reviews. Furthermore, the results of the evaluations and testing may indicate the need for additional plant or procedure modifications to fully resolve open issues associated with GSI-191. These items are discussed in greater detail in Section 3.0 below.

Therefore, Dominion is requesting a schedule extension for SPS1 and SPS2 to complete the remaining technical evaluations and testing, as well as to determine whether any additional actions may be required based on the results of the technical evaluations and testing. The following information provides the basis for the SPS1 and SPS2 extension request. Specifically, in the following discussion, 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 to ensure that the necessary technical evaluations and testing have been completed to facilitate resolution of GSI-191 issues. An extension is requested until November 30, 2008 to complete the required actions noted

above. The proposed extension for SPS1 and 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 of sufficiently low plant risk.

2.0 Justification for the Proposed Extension

The NRC provided a justification for continued operation (JCO) in the "Summary of July 26-27, 2001 Meeting with Nuclear Energy Institute and Industry on ECCS Strainer Blockage in PWRs" dated August 14, 2001, that supports continued operation through December 31, 2007. Elements of the JCO that continue to be applicable to SPS1 and SPS2 include:

- The SPS1 and SPS2 containments are compartmentalized thus slowing transport of debris to the sump.
- The probability of the initiating event (i.e., large break LOCA) is extremely low.
- Leak-Before-Break (LBB) qualified piping is of sufficient toughness that it will most likely leak (even under safe shutdown conditions) rather than rupture.
- The time to switchover to recirculation from the sump after accident initiation allows for debris settling.

3.0 Reason for the Proposed Extension

Dominion is requesting an extension until November 30, 2008 for completion of the following activities: 1) downstream effects evaluations for components, including the reactor vessel and nuclear fuel, 2) chemical effects testing and evaluation, and 3) determination of any additional actions that may be required based on the results of the evaluations and testing.

An evaluation of downstream clogging and wear was completed for SPS1 and SPS2 in accordance with WCAP-16406-P Rev. 0. However, WCAP-16406-P Rev. 1 was issued in September 2007 and includes revised guidance for the performance of downstream effects evaluations for components, including reactor vessel and nuclear fuel. Also, WCAP-16793-NP Rev. 0, issued in May 2007, provides guidance on evaluation of blockage and chemical precipitant plateout in the reactor core and fuel and is currently undergoing NRC review and Safety Evaluation Report preparation. Consequently, revised downstream effects evaluations must be performed in accordance with the most recent WCAP guidance. The revised downstream effects evaluations are scheduled to be completed for SPS1 and SPS2 by the end of the first quarter of 2008.

Also, a chemical effects evaluation is currently being performed for SPS1 and SPS2 by Atomic Energy of Canada Limited (AECL – the strainer vendor) to determine the

potential for chemical precipitate formation. Benchtop testing is being performed to validate evaluation assumptions. Reduced scale testing for chemical effects may also be necessary based on the results of the benchtop testing and/or other industry/regulatory testing results. Completion of the required chemical effects evaluation and testing is required to confirm that the replacement strainers installed at SPS1 and SPS2 are adequate to maintain NPSH margin for the ECCS pumps during long-term core cooling and to confirm that no further physical modifications are required. Completion of the chemical effects evaluation and testing and issuance of the technical report will not be completed until the third quarter of 2008 for SPS1 and SPS2.

4.0 Compliance with SECY-06-0078 Criteria

SECY-06-0078 specifies two criteria for short duration GL 2004-02 extensions, limited to several months and a third criterion for extensions beyond several months. These three criteria and the associated responses for SPS1 and SPS2 are provided in detail below.

4.1 SECY-06-0078 Criterion No. 1:

The licensee has a plant-specific technical/experimental plan with milestones and schedule to address outstanding technical issues with enough margin to account for uncertainties.

Dominion Response

SURRY PLANT SPECIFIC TECHNICAL/EXPERIMENTAL PLAN

Dominion has completed debris generation analyses, debris transport analyses, debris blockage and wear analyses for downstream components (using WCAP 16406-P, Rev. 0), strainer head loss and vortex testing for expected debris (excluding chemical precipitants), and replacement strainer design and installation for both SPS1 and SPS2.

Technical issues concerning downstream effects and the impact of chemical precipitates on strainer head loss are expected to remain unresolved for both SPS1 and SPS2 on December 31, 2007. To resolve these issues and adopt the mechanistic licensing basis required for long-term core cooling required for resolution of GSI-191 at both SPS1 and SPS2, the following milestones are to be met:

- Downstream Effects Evaluations for Components, Including Reactor Vessel and Nuclear Fuel

  March 31, 2008: Completion of revised downstream effects evaluations for components, including reactor vessel and nuclear fuel, for incorporation into SPS1 and SPS2 licensing basis.

June 30, 2008: Determination of, and schedule for, hardware and/or procedural modifications (if any) needed as a result of the completion of the downstream effects evaluations for components, including reactor vessel and nuclear fuel.

- Chemical Effects Testing and Evaluation

March 31, 2008: Completion of analysis and bench-top testing to determine likely precipitate formation and bounding quantities of precipitates to use in reduced scale testing.

September 30, 2008 Completion of reduced scale testing to determine impact of chemical precipitate formation, if required.

November 30, 2008 Determination of, and schedule for, hardware and/or procedural modifications (if any) needed as a result of the completion of the chemical precipitate head loss testing.

Based on the above discussion, SPS1 and SPS2 meet the requirements of SECY-06-0078 Criterion 1.

4.2 SECY-06-0078 Criterion No. 2:

The licensee identifies mitigative measures to be out in place prior to December 31, 2007, and adequately describes how these mitigative measures will minimize the risk of degraded ECCS [emergency core cooling system] functions during the extension period.

Dominion Response

The following mitigative measures have already been implemented to minimize the risk of degraded ECCS and RS functions during the requested extension period.

4.2.1 Mitigative Measures

Dominion is fully committed to resolving the issues associated with GSI-191 and is continuing efforts to complete the corrective actions committed to in our September 1, 2005 response to GL 2004-02. We have implemented a significant portion of the physical modifications at SPS1 and SPS2 prior to the committed completion dates for SPS1 and SPS2. In a letter dated March 8, 2007, the NRC approved an extension for SPS2 to complete the remaining portion of the Unit 2 strainer installation during the spring 2008 RFO. Specifically, the following work has been completed or is currently underway:

1. Physical Modifications

As discussed in greater detail in Section 4.3 below, Dominion is completing the installation of the SPS1 replacement strainer system and jacketing insulation that has damaged or unqualified coating during the SPS1 fall 2007 refueling outage (RFO).

Dominion completed a partial installation of the SPS2 replacement strainer system during the SPS2 fall 2006 RFO. Approximately 3500 ft^2 of the new passive strainers was installed. Dominion will complete the full installation of the SPS2 replacement strainer system during the SPS2 spring 2008 RFO. SPS2 insulation with damaged or unqualified coatings will also be jacketed or replaced during the 2008 RFO.

Additionally, Dominion modified the SPS2 Refueling Water Storage Tank (RWST) instrumentation during the fall 2006 RFO to allow the Inside Recirculation Spray (IRS) pumps to start on a Hi-Hi containment pressure signal coincident with a 60% RWST wide range level signal to ensure sufficient water is available to meet strainer submergence requirements. A 120-second time delay was also added for the start of the Outside Recirculation Spray (ORS) pumps. This reduces the load impact on the Emergency Diesel Generators and allows sufficient time for the IRS pumps to fill its piping and attain stable operation prior to the start of the ORS pumps. The same modification is being made on SPS1 during the fall 2007 RFO.

An in-core sump room drain was installed in SPS2 during the fall 2006 RFO. A 12-inch hole was core bored in the primary shield wall plug at SPS2 to allow water held-up in the reactor cavity to drain from the in-core sump room into the containment sump. This modification facilitates the transfer of additional water to the containment floor to ensure full submergence of the new containment sump strainers. The same modification is being made for SPS1 during the fall 2007 RFO.

2. Containment Cleanliness

Dominion has procedures in place to ensure 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. Specifically, the procedures require that no loose debris (rags, trash, clothing, etc.) is present in the containment that could be transported to the containment recirculation sumps or that could block drainage paths. In support of these cleanliness standards, walkdowns of the containment are required by procedure after work has been completed prior to the restart from an outage. In addition, containment sump strainer inspections are required by the SPS Technical Specifications and are performed on a once per 18 months frequency.

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 September 26, 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 ECCS pump parameters including loss of NPSH as indicated by erratic pump current or discharge flow. Training briefs presented during operator re-qualification training have increased operations personnel awareness of the potential for the containment recirculation sump to become clogged during operation of the ECCS pumps in the recirculation cooling mode.

4. Information Notice 2005-26

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. SPS1 and SPS2 were not units listed as having the above-described combination in its containment and, therefore, no response to IN 2005-26 was required for SPS1 and SPS2.

5. Risk Evaluation

With the installation of the advanced sump strainer and other associated changes and evaluations, there has been a significant reduction in the vulnerability to debris blockage and component wear in the recirculation system when mitigating a LOCA. For the remaining outstanding issues of downstream and chemical effects, the vulnerability is limited to large break LOCAs only. For small and intermediate break LOCAs, it is expected that there will be a significant reduction in debris generation, as much as one to two orders of magnitude. With this type of reduction in the fibrous and particulate sources, core cooling will be assured for small and intermediate break LOCAs. Since the advanced strainer design is sized for a conservative estimate of the fibrous and particulate debris loading from a large break LOCA, it is expected that for particulate debris loadings that are an order of magnitude or more lower, there will be insufficient particulate to form a thin-bed on the replacement strainer and there will potentially be open strainer area. Thus, it is likely that any chemical precipitates that are generated will not create a head loss larger than the tested thin-bed head loss for which the strainer was designed, and adequate NPSH will be maintained. Furthermore, with an order of magnitude or more reduction in the particulate debris, the particulate debris concentration should be low enough such that wear of downstream components would be limited to the point that there is reasonable assurance that the ECCS pumps and downstream components would continue to provide adequate core cooling. Thus, the

quantitative risk evaluation addresses potential vulnerability for large break LOCAs only. The frequency of this initiating event is low (5E-6/yr).

The increase in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) is determined from the initiating event frequency for a large break LOCA. Integrating the initiating event frequency over the period of the proposed eleven months extension determines the Core Damage Probability (CDP) and the Large Early Release Probability (LERP). As noted above, the initiating event frequency for a LBLOCA is equal to 5E-6/yr. Therefore, for an eleven months extension to complete GL 2004-02 corrective actions, the CDP is calculated as follows:

CDP = (5E-6/yr)*(0.92 years)
CDP = 4.6E-6

The LERP is negligible based on the Level 2 Probabilistic Risk Assessment (PRA) model.

No credit is taken for recovery actions, which SPS1 and SPS 2 would normally use, to ensure continued supply from the sumps. The base CDF and base LERF values for SPS1 and SPS2 are shown below along with the CDP and LERP values that were calculated for the proposed eleven months extension.

Base CDF (internal events)	**CDP for 11 months extension**	**Base LERF (internal events)**	**LERP for 11 months extension**
1.8E-5/yr	4.6E-6	6.62E-7/yr	negligible

Regulatory Guide (RG) 1.174 states that, when calculated changes in risk are in the range of 1E-6/yr to 1E-5/yr, a permanent change is "small" if the total plant CDF is less than 1E-4/yr. For LERF, a "small" change is a calculated risk increase in the range of 1E-7/yr to 1E-6/yr if the total LERF is less than 1E-5/yr. This RG sets criteria for permanent plant changes with associated risk increases. In this case, it may be conservatively used to evaluate the risk impact of the eleven months extension to complete the GL 2004-02 corrective actions. The assumption that the sump is 100% unavailable is additionally conservative. Therefore, based on RG 1.174, the risk associated with the proposed eleven months extension to complete the GL 2004-02 corrective actions for SPS1 and SPS 2 is not considered not to be significant.

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

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

For SPS1 and SPS2, the licensing basis includes approved LBB analysis for the Reactor Coolant System (RCS) primary loop, the pressurizer surge line, and portions of the Feedwater and Main Steam lines.

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 GL 2004-02 corrective actions.

Based on the above discussion, SPS1 and SPS2 meet the requirements of SECY-06-0078 Criterion 2.

4.3 SECY-06-0078 Criterion 3:

For proposed extensions beyond several months, a licensee's request will more likely be accepted if the proposed mitigative measures include temporary physical improvements to the ECCS sump or materials inside containment to better ensure a high level of ECCS performance.

Dominion Response

Dominion has implemented the following physical improvements to the containment sump to better ensure a high level of ECCS performance.

- Strainer Installation

  SPS1 – Dominion is completing the installation of the SPS1 replacement strainer system during the SPS1 fall 2007 RFO. The new strainer system represents a significant improvement over the previous design. The total surface area of the new RS strainer is approximately 6220 ft^2, and the total surface area of the LHSI strainer is approximately 2180 ft^2. This replaces the previous screens, which had a total surface area of approximately 158 ft^2 each.

  SPS2 - Dominion completed a partial installation of the SPS2 replacement strainer system during the SPS2 fall 2006 RFO. Approximately 3500 ft^2 of the new passive strainers was installed. Dominion will complete the full installation of the SPS2 replacement strainer system during the SPS2 spring 2008 RFO. The new strainer system represents a significant improvement over the previous design. The total surface area of the new RS strainer is approximately 6258 ft^2, and the total surface area of the LHSI strainer is approximately 2230 ft^2. This replaces the previous screens, which had a total surface area of approximately 158 ft^2 each.

- RSS Pump Start Time Change

  The SPS2 Refueling Water Storage Tank (RWST) instrumentation was modified during the fall 2006 RFO to allow the IRS Pumps to start on a Hi-Hi containment pressure signal coincidental with 60% RWST wide range level signal, to ensure sufficient water is available to meet the strainer submergence requirements. A 120-second time delay was also added for the start of the ORS pumps. This minimizes the impact on the Emergency Diesel Generators, and allows sufficient time for the IRS pumps to fill its piping and attain stable operation prior to the start of the ORS pumps. The same modification is being implemented for SPS1 during the fall 2007 RFO.

- Insulation Jacketing

  SPS1 – Insulation at SPS1 that was damaged or had unqualified coating is either being removed from containment or jacketed with a qualified jacketing system during the fall 2007 RFO. This modification will help to minimize the amount of spray and submergence generated debris at SPS1.

  SPS2 – Insulation at SPS2 that is found to be damaged or have unqualified coating will either be removed from containment, or jacketed with a qualified jacketing system during the spring 2008 RFO. This will minimize the amount of spray and submergence generated debris at SPS2.

- Incore Sump (ICS) Room Drain

  An ICS room drain was installed in the primary shield wall plug at SPS2 during the fall 2006 RFO and is being installed at SPS1 during the fall 2007 RFO. This modification allows water held up in the reactor cavity to drain to the containment sump from the ICS room. This facilitates the transfer of additional water to the containment floor at elevation (-)27'-7" to facilitate full submergence of the new containment sump strainers.

Based on the above discussion, SPS1 and SPS2 meet the requirements of SECY-06-0078 Criterion 3.

5.0 Conclusion

An extension of the SPS1 and SPS2 completion dates from December 31, 2007 to November 30, 2008 for corrective actions and modifications required by GL 2004-02 is acceptable because:

- The core damage and large early release probabilities for SPS1 and SPS2 associated with the eleven months extension are 4.6E-6 and negligible, respectively. This risk impact is characterized as "small" per NRC Regulatory Guide 1.174.

- Dominion has completed considerable work to further promote a high level of ECCS and RS pump performance including replacement strainer installation at SPS1 and partial strainer installation at SPS2.

- Dominion has implemented mitigative measures to minimize the risk of degraded ECCS and RS functions during the extension period.

- Dominion has a plant-specific plan with milestones and schedules to address the outstanding technical issues with sufficient conservatism to address uncertainties.

Therefore, per the criteria included in SECY-06-0078, Dominion has established that the risk of degraded ECCS and RS functions for SPS1 and SPS2 is not considered to be significant.