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FirstEnergy Nuclear Operating Company

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February 14, 2008
L-08-054

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

SUBJECT:
Beaver Valley Power Station, Unit Nos. 1 and 2
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors" - Request for Extension of Completion Date for Corrective Actions (TAC Nos. MC4665 and MC4666

By letter dated December 20, 2007 (Reference 1), FirstEnergy Nuclear Operating Company (FENOC) provided an extension request for completion of certain activities related to Generic Letter (GL) 2004-02 (Reference 2) for Beaver Valley Power Station (BVPS), Unit Nos. 1 and 2. The NRC evaluated and approved the extension for completion of the requested actions to February 29, 2008, for BVPS Unit Nos. 1 and 2 in a letter dated December 27, 2007 (Reference 3). In the December 27, 2007 correspondence, the NRC stated that if corrective actions are identified as necessary beyond February 29, 2008, then an additional extension request would need to be submitted.

This submittal provides the additional extension request for completion of modifications and licensing activities that have been determined to be necessary beyond February 29, 2008, to achieve full compliance with the regulatory requirements of GL 2004-02. This extension request is being submitted using the criteria of SECY-06-0078 and the guidance provided in an NRC letter to NEI dated November 8, 2007 (Reference 4).

Attachment 1 provides the basis supporting FENOC's conclusion that it is acceptable to extend the completion dates for these corrective actions beyond February 29, 2008 for BVPS Unit Nos. 1 and 2. A risk assessment has been developed and mitigative measures to minimize the risk of degraded safety system functions are included in the attached supporting basis.

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A list of regulatory commitments made in this submittal is provided in Attachment 2. If there are any questions, or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – FENOC Fleet Licensing, at 330-761-6071.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 14, 2008.

Sincerely,

Peter P. Sena III

Attachments:
1. Justification for Additional Corrective Actions Extending Beyond February 29, 2008 for Beaver Valley Power Station Unit No. 1 (BVPS-1) and Unit No. 2 (BVPS-2)

2. List of Commitments

References:

1. FENOC Letter L-07-519 Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," – Request for Extension of Completion Date for Corrective Actions, dated December 20, 2007.

2. Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004.

3. NRC letter dated December 27, 2007, Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors" Extension Request Approval for Beaver Valley Power Station, Unit Nos. 1 and 2 (TAC Nos. MC4665 and MC4666).

4. NRC letter to NEI dated November 8, 2007, "Plant-Specific Requests for Extension of Time to Complete One or More Corrective Actions for Generic Letter 2004-02 Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors."

c: Mr. S. J. Collins, NRC Region I Administrator
Mr. D. L. Werkheiser, NRC Senior Resident Inspector
Ms. N. S. Morgan, NRR Project Manager
Mr. D. J. Allard, Director BRP/DEP
Mr. L. E. Ryan (BRP/DEP)

Background:
Generic Letter (GL) 2004-02 (Reference 1) required that addressees provide a description of and implementation schedule for all corrective actions, including any plant modifications, that are identified while responding to the GL. FirstEnergy Nuclear Operating Company (FENOC) provided the requested information for BVPS-1 and BVPS-2 in References 3, 4 and 5. In subsequent letters dated April 3, 2006 (Reference 2) and September 6, 2005 (Reference 6), FENOC requested an extension for BVPS-2 to permit the completion of the installation of the Recirculation Spray System (RSS) pumps start signal and the High Pressure Safety Injection Throttle Valve gap sizing modifications during the Spring 2008 refueling outage (2R13). The NRC approved the BVPS-2 extension request in their letter dated May 18, 2006 (Reference 7).

By letter dated December 20, 2007 (Reference 14), FirstEnergy Nuclear Operating Company (FENOC) provided an extension request for completion of certain activities relative to Generic Letter (GL) 2004-02 (Reference 1) for BVPS-1 and BVPS-2. FENOC requested time to fully assess the chemical effects testing that was recently performed and, based on the final results, develop a plan of action by February 29, 2008. The NRC evaluated and approved the extension for completion of the requested actions to February 29, 2008, for BVPS-1 and BVPS-2 in their letter dated December 27, 2007 (Reference 15).

FENOC has completed the assessment of the chemical effects testing and has developed an action plan to address the potential uncertainties related to head loss from chemical effects and identified corrective actions necessary to come into full compliance with GL 2004-02. Based on the results of the testing, corrective actions will be required in the form of additional testing for BVPS-1 and licensing changes and modifications for BVPS-2. Therefore, certain activities required to resolve the containment sump issues have been identified for BVPS-1 and BVPS-2 that will not be completed by February 29, 2008, and an additional extension request is required. The extension is needed to provide time to complete the additional testing for BVPS-1 and to acquire approval for the associated licensing changes for BVPS-2. Details of the proposed changes are provided below.

Justification is provided herein for an extension to the schedule beyond the December 31, 2007 implementation date specified in GL 2004-02 for completion of corrective actions at BVPS-1 and BVPS-2 . This extension request is being submitted using the criteria of SECY-06-0078 (Reference 9) and the guidance provided in the NRC letter to NEI dated November 8, 2007 (Reference 10). Mitigative measures to minimize the risk of degraded safety system functions are included in the supporting basis provided below. Based on the information presented within this correspondence,

FENOC has determined that overall plant safety will be maintained throughout the requested extension period for BVPS-1 and BVPS-2.

Summary of Chemical Effects Testing Program:
A summary of the chemical effects testing is provided below:

Chemical effects testing for both BVPS-1 and BVPS-2 was completed by Alion in November 2007. BVPS had contracted with Alion to perform four separate chemical effects tests. Two of the tests were performed based on a sodium hydroxide buffer and the other two were based on sodium tetraborate. One set of tests was performed using a high fiber load while the other set was performed using a high cal-sil load. The high fiber load tests were representative of the predicted BVPS-2 debris mix and bounding for BVPS-1. The cal-sil tests were representative of a high particulate, low fiber debris mix for both units and bounded the BVPS-1 debris head loss. The following provides a summary of the results of the four chemical effects tests.

High Fiber - Sodium Hydroxide Buffer:
The test results for the high fiber mix using sodium hydroxide resulted in a challenge to maintaining adequate NPSH for BVPS-2. The fiber content used under this test was higher than that predicted for BVPS-1 and therefore has been determined to be inconclusive for BVPS-1.

High Fiber - Sodium Tetraborate Buffer:
The test shows favorable results. The use of this test as the basis for BVPS-2 head loss from chemical effects coupled with crediting containment overpressure in the calculation of available NPSH will result in acceptable results and full compliance with GL 2004-02. The BVPS-2 buffer will be required to be changed from sodium hydroxide to sodium tetraborate.

High Cal-Sil - Sodium Hydroxide Buffer:
The high cal-sil debris mix is equivalent to a high particulate, low fiber debris mix and is representative for both units. The results of the chemical effects test based on the present sodium hydroxide buffer yielded inconclusive results. The debris did not form a closed surface over the screen during the test leaving areas of clean screen.

High Cal-Sil - Sodium Tetraborate Buffer:
The high cal-sil debris mix is equivalent to a high particulate, low fiber debris mix and is representative for both units. This test yielded favorable head loss results. With the BVPS-2 buffer change to sodium tetraborate this test has been determined to be an acceptable test for the BVPS-2 cal-sil debris load.

BVPS-1
Both the high fiber and high cal-sil test yielded inconclusive results for BVPS-1. It has been determined that additional testing will be required utilizing the specific debris mix for BVPS-1 based on precipitants calculated and using the existing sodium hydroxide buffer. This testing will be completed by June 30, 2008, and a follow-up supplemental response detailing the results of the testing for BVPS-1 will be transmitted to the NRC by August 30, 2008. The test results will be reviewed for meeting acceptable NPSH margins. In the event BVPS-1 testing results are unfavorable and indicate the need for corrective actions, these corrective actions will be completed during the Spring 2009 refueling outage (1R19). The details of the corrective actions, if required, would be included in the August 30, 2008 follow-up supplemental response.

BVPS-2
Based on the favorable test results with the sodium tetraborate buffer, the following corrective actions are planned:

- Installation of the baskets inside containment to support the BVPS-2 buffer change from sodium hydroxide to sodium tetraborate. The baskets are scheduled to be installed during the 2R13 refueling outage in the Spring of 2008.

- Complete supporting analyses and submit a License Amendment Request (LAR) for the replacement of the present sodium hydroxide buffer with sodium tetraborate. The analyses will be completed and the LAR submitted to the NRC by August 30, 2008.

- Develop and complete analyses required to support the use of containment overpressure to credit available NPSH. The proposed LAR that will be submitted for the buffer change will also include this change. The analyses will be completed and the LAR submitted to the NRC by August 30, 2008.

- Implementation of the buffer change and crediting NPSH with containment overpressure will be completed within 60 days from the LAR approval date or by the Spring (March 31) 2009, whichever is sooner. Implementation is contingent on NRC approval of the LAR.

In addition to the above planned changes, BVPS-2 has scheduled certain insulation replacement to be completed during the 2R13 refueling outage in Spring 2008. The scope includes replacement of Borated Temp Mat insulation encapsulated in RMI on the BVPS-2 Reactor Vessel Closure Head flange with RMI, and replacement of Min-K insulation encapsulated in RMI on portions of the Reactor Coolant System and Safety Injection System piping with Thermal Wrap insulation encapsulated in RMI.

Downstream Effects:
FENOC letter L-07-519, dated December 20, 2007 (Reference 14) stated that FENOC would provide a status of the downstream effects evaluations by February 29, 2008. The downstream analyses (ex-vessel to the requirements of WCAP-16406-P Rev 1 and in-vessel to WCAP-16793) are being developed by our vendors for BVPS-1 and BVPS 2. The effort is progressing but the documentation will not be finalized by February 29, 2008. Preliminary indications are that no additional modifications are required as a result of the downstream effects analyses. The follow-up supplemental response to address chemical effects scheduled for August 30, 2008 will also include the final results of the downstream effects analyses for BVPS-1 and BVPS-2.

Requested Extension:
In summary, FENOC will submit a follow-up supplemental response by August 30, 2008, that will address chemical effects for BVPS-1 and downstream effects for BVPS-1 and BVPS-2. The follow-up supplemental response will include the results of BVPS-1 chemical effects testing and, if required, any additional corrective actions to be implemented during the Spring of 2009 refueling outage (1R19) which commences in April 2009. A LAR for the proposed BVPS-2 buffer change and the use of containment overpressure to credit NPSH margin will also be provided by August 30, 2008. The BVPS-2 buffer change will be implemented within 60 days of the approval of the LAR or by the Spring (March 31) of 2009, whichever is sooner.

FENOC is therefore requesting an extension for BVPS-1 to the 1R19 refueling outage scheduled for the Spring 2009 refueling outage (1R19), and an extension for BVPS-2 to 60 days from approval of the LAR or the Spring (March 31) of 2009, whichever is sooner, to complete GL 2004-02 required actions. Implementation for BVPS-2 is contingent on NRC approval of the LAR. To provide efficiency in the review process for the proposed LAR, FENOC intends to facilitate communications with the NRC including a pre-submittal meeting to resolve any potential issues with the staff.

This extension request is being submitted using the criteria of SECY-06-0078 and the guidance provided in NRC letter dated November 8, 2007 (Reference 10).

Justification for Proposed Extension:

The NRC staff provided a justification for continued operation (JCO) in GL 2004-02 that justifies continued operation of pressurized water reactors through December 31, 2007. Elements of the JCO that are applicable to BVPS-1 and BVPS-2 are summarized below:

- The BVPS containments are compartmentalized making transport of debris to the sump difficult.

- BVPS does not require switchover to recirculation from the sump during a large-break loss-of-coolant accident (LOCA) until 20 to 30 minutes after accident initiation, allowing time for much of the debris to settle in other places within containment.

- The probability of the initiating event (i.e., large and intermediate-break LOCAs) is extremely low.

- Leak-before-break (LBB) qualified piping is of sufficient toughness that it will most likely leak (even under safe shutdown earthquake conditions) rather than rupture.

- The current industry issue regarding primary water stress corrosion cracking (PWSCC) associated with pressurizer Alloy 600/82/182 dissimilar metal welds at both BVPS-1 and BVPS-2 has been addressed. Full structural weld overlays on the BVPS-2 pressurizer spray, safety, relief and surge line nozzles were completed during the Fall 2006 refueling outage (2R12). Similarly, full structural weld overlays were applied to the BVPS-1 pressurizer spray, safety, and relief nozzles during the Fall 2007 refueling outage (1R18).

- The impact on risk for the requested extension period for actions to address chemical effects beyond the December 31, 2007 implementation date specified in GL 2004-02 is low based on the mitigative measures identified in this supporting document.

These elements will remain valid during the extension period requested by this submittal.

FENOC considers that the conditions at BVPS-1 and BVPS-2 meet the criteria identified in SECY-06-0078 (Reference 9) for extension beyond the completion date specified in GL 2004-02, as identified in the following sections.

Compliance with SECY-06-0078 Criteria

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.

FENOC Response:
In References 5 and 6, FENOC provided a description of the actions being taken to address GL 2004-02 and updated the responses in References 2, 3, 4, and 14. The key actions are summarized below:

BVPS has replaced the sump strainers for both units as follows:

- BVPS-2: Replaced during the 2R12 Refueling Outage (Fall 2006)
- BVPS-1: Replaced during the 1R18 Refueling Outage (Fall 2007)

The new strainers are a significant improvement over the original screen design. The new BVPS-1 strainer increases the surface area from 130 ft^2 to 3400 ft^2. The new BVPS-2 strainer increases the surface area from 150 ft^2 to 3300 ft^2.

In addition to the replacement of the strainers, a modification was completed for BVPS-1 during the Fall 2007 refueling outage (1R18) that would allow sufficient pool depth to cover the sump strainers before initiating recirculation flow. The modification changed the BVPS-1 start signal for the RSS pumps from a fixed time delay to an ESFAS signal based on a RWST Level Low coincident with a Containment Pressure High-High signal. For BVPS-1, an operating strategy that directs securing of two of four RSS pumps upon transfer to cold leg recirculation has been implemented. This will reduce the velocity through the emergency sump strainer. At BVPS-2, the modification is scheduled to be completed during the Spring 2008 refueling outage (2R13). The schedule extension for implementation of this modification beyond December 31, 2007 at BVPS-2 was approved by the staff via letter dated May 18, 2006 (Reference 7).

Mitigation efforts at BVPS-1 and BVPS-2 have been completed for addressing the issue associated with PWSCC and the pressurizer alloy 600/82/182 dissimilar metal welds. PWSCC was addressed during the BVPS-2 Fall 2006 refueling outage (2R12) through the application of full structural weld overlays on the pressurizer spray, safety, relief and surge line nozzles. Similarly, full structural weld overlays were applied to the BVPS-1 pressurizer spray, safety, and relief nozzles during the BVPS-1 Fall 2007 refueling outage (1R18).

Summary of Activities Already Completed:

- Strainer replacements have been installed at both units. At BVPS-2, the new replacement strainer was installed during the Fall 2006 refueling outage (2R12) which increased the available surface area from approximately 150 sq. ft. to 3300 sq. ft. At BVPS-1, the new replacement strainer was installed during the Fall 2007 refueling outage (1R18) which increased the available surface area from approximately 130 sq. ft. to 3400 sq. ft.
- Replacement of BVPS-1 High Pressure Safety Injection Cold Leg Throttle Valves to increase the throttle valve gap.
- Changing the BVPS-1 start signal for the RSS pumps from a fixed time delay to an Engineered Safety Features Actuation System (ESFAS) signal based on a Refueling Water Storage Tank (RWST) Level Low coincident with a Containment Pressure High-High signal to allow sufficient pool depth to cover the sump strainer before initiating recirculation flow.

- Replacement of Borated Temp Mat insulation encapsulated in Reflective Metal Insulation (RMI) on the BVPS-1 Reactor Vessel Closure Head with RMI during the Spring 2006 refueling outage (1R17) to reduce particulate loading on the sump strainer.
- New RMI was installed on the BVPS-1 Replacement Steam Generators (RSGs) and associated piping in the vicinity of the RSG during the Spring 2006 refueling outage (1R17).
- Prototype testing of the new strainer design was completed for BVPS-1 and BVPS-2.

Summary of Activities to be Completed During the BVPS-2 Spring 2008 Refueling Outage (2R13):

- Modification of the BVPS-2 High Pressure Safety Injection Throttle Valves to increase the throttle valve gap.
- Changing the BVPS-2 start signal for the RSS pumps from a fixed time delay to an ESFAS signal based on a RWST Level Low coincident with a Containment Pressure High-High signal to allow sufficient pool depth to cover the sump strainer before initiating recirculation flow.
- Replacement of Borated Temp Mat insulation encapsulated in RMI on the BVPS-2 Reactor Vessel Closure Head flange with RMI, and replacement of Min-K insulation encapsulated in RMI on portions of the Reactor Coolant System and Safety Injection System piping with Thermal Wrap insulation encapsulated in RMI.
- A containment coatings inspection and evaluation program will be implemented starting with the BVPS-2 Spring 2008 refueling outage (2R13).
- Installation of baskets to support the BVPS-2 buffer change from sodium hydroxide to sodium tetraborate.

Summary of Activities to be Completed for BVPS-1 and BVPS-2 by August 30, 2008:

- BVPS-1 chemical effects testing will be performed using the BVPS-1 specific debris mix and the results will be provided by August 30, 2008.
- At BVPS-2, develop and complete analyses required to support the buffer replacement, presently sodium hydroxide buffer with sodium tetraborate. This buffer change will require physical configuration changes as well as supporting analyses. A License Amendment Request (LAR) will be submitted to the NRC for this change by August 30, 2008.
- At BVPS-2, develop and complete analyses required to support the use of containment overpressure to credit available NPSH. The proposed LAR submitted for the buffer change will also include this change and be submitted by August 30, 2008.

- The downstream effects analyses (both in-vessel and ex-vessel) are being developed by our vendors for BVPS-1 and BVPS-2. The documentation is progressing but will not be finalized by February 29, 2008. The downstream effects analyses will be completed with results provided in the follow-up supplemental response by August 30, 2008.

Additional Planned Actions for BVPS-1 and BVPS-2:

- Based on the results of the BVPS-1 chemical effects testing, any additional required corrective actions that are deemed necessary would be implemented during the Spring of 2009 refueling outage (1R19) which commences in April 2009.

- The BVPS-2 buffer change will be implemented within 60 days from receipt of NRC approval of the LAR or by Spring (March 31) 2009, whichever is sooner. Implementation is contingent on NRC approval of the LAR.

SECY-06-0078 Criterion No. 2:
The licensee identifies mitigative measures to be put 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] and CSS *[containment spray system] functions during the extension period.*

Response:
FENOC has installed replacement strainers and implemented other significant mitigative measures that are described above under Criterion No. 1 of SECY-06-0078. Additional mitigative measures that have been or will be implemented to minimize the risk of degraded ECCS and CSS functions during the extension period are provided below.

Mitigative Measures to be implemented:

<u>BVPS-2 Insulation Remediation:</u>
Insulation replacement inside the BVPS-2 containment is scheduled for the Spring 2008 refueling outage (2R13). Borated Temp Mat insulation encapsulated in RMI on the RVCH flange will be replaced with RMI. Min-K insulation encapsulated in RMI on portions of Reactor Coolant System and Safety Injection System piping located inside the steam generator cubicles will be replaced with Thermal Wrap insulation encapsulated in RMI.

Mitigative Measures Implemented:

Modifications to the Sump Screen Configuration at BVPS-1 and BVPS-2

During the BVPS-1 Fall 2007 refueling outage (1R18), BVPS-1 installed new sump strainers that increased the available surface area from approximately 130 sq. ft. to 3400 sq. ft., to improve existing margins.

During the BVPS-2 Fall 2006 refueling outage (2R12), BVPS-2 installed new sump strainers that increased the available surface area from approximately 150 sq. ft. to 3300 sq. ft., to improve existing margins.

For both units, the new strainer design was chosen based on the largest available sump strainer that would fit within the bounds of the existing sump area and be compatible with the anticipated water level. The new sump strainer is designed to reduce both head loss and the ingestion of debris, which could affect safety-related downstream components. The strainers are sized to preclude the passage of debris large enough to cause loss-of-function of downstream components.

Containment Spray System Design

As noted above, a modification to the containment sump was identified in the FENOC supplemental response to Generic Letter 2004-02 in FENOC letter L-06-020 dated April 3, 2006. Since the adoption of a licensing basis consistent with Generic Letter 2004-02 will result in an increase in the containment sump strainer head loss, it is necessary to increase the static height of water in the containment sump at both units in order to increase NPSH margin available. This is accomplished by changing the start signal for the RSS pumps from a fixed time delay to an ESFAS signal based on a RWST Level Low coincident with a Containment Pressure High-High signal. Starting the RSS pumps on this coincident signal provides assurance of adequate sump water level at RSS pump start over the range of potential break sizes and single failure assumptions. The higher water level will also ensure that the new containment sump strainers will be submerged while accommodating a substantial increase in available surface area.

BVPS-1 completed the modifications associated with the RSS pump start signal during the Fall 2007 refueling outage (1R18). For BVPS-2, a schedule extension for completion of the change associated with the RSS pump start signal during the Spring 2008 refueling outage (2R13) was granted by NRC via letter dated May 18, 2006 (Reference 7).

Insulation Remediation

BVPS-1:
New RMI was installed on the BVPS-1 RSGs and associated piping in the vicinity of the RSGs during the Spring 2006 refueling outage (1R17). The associated piping includes the Reactor Coolant System crossover leg elbow, the main steam piping between the RSG main steam nozzle and first pipe rupture restraint, feedwater piping between the RSG feedwater nozzle and the first pipe rupture restraint, and the existing blowdown and shell drain piping between the RSG nozzles to the point where the two blowdown lines and the shell drain merge into a common header.

New RMI was also installed on the new BVPS-1 Reactor Vessel Closure Head (RVCH) during the Spring 2006 refueling outage (1R17) to reduce debris loading on the sump strainer.

Debris Generation

The debris generation and transport analyses have been performed by Alion Science and Technology. The analyses were conducted using the methodology described in NEI 04-07, Sections 3.3 and 3.4, and refined as described in Section 4.2, as modified by NRC staff comments in the SER. BVPS-1 analysis has been completed and was used as input for the design of the new containment sump strainers. BVPS-2 analysis is in the process of being revised to account for the insulation changes to be implemented during the Spring 2008 refueling outage (2R13).

Periodic containment walkdowns are conducted using procedures which focus on sources, types and locations of items or conditions having the potential to become debris following a LOCA. Noted discrepancies are addressed via the BVPS corrective action program.

Leak-Before-Break

Postulated breaks in the reactor coolant loop and the pressurizer surge line have been evaluated for both BVPS-1 and BVPS-2 by application of leak-before-break (LBB) technology.

While LBB is not being used to establish the design basis debris load on the new sump strainers, the use of LBB would result in a substantial reduction in the zone of influence, and thus a significant reduction in the postulated debris generation, loading on the sump strainers, and potential clogging and wear of downstream components. With the installation of the additional sump strainer area, the possibility of clogging due to debris is greatly reduced.

Implementation of Mitigative Measures in Response to Bulletin 2003-01

In addition to the plant modifications and mitigative measures described above, current mitigative measures in response to Bulletin 2003-01 "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors" (Reference 11) are in place and continue to be current. FENOC's response is documented in Reference 12 for BVPS-1 and BVPS-2. By letter dated September 6, 2005 (Reference 13), the NRC staff concluded that the compensatory measures that have been implemented to reduce the interim risk associated with the potentially degraded or nonconforming emergency core cooling system and containment spray system recirculation function are responsive to and meet the intent of Bulletin 2003-01.

In summary, these mitigative measures include:

1. Provisions of procedural guidance and operator training on indications of and responses to sump clogging. The guidelines contain instructions to establish flow to the reactor if symptoms of containment sump blockage are present.

2. Procedural guidance to minimize RWST inventory depletion in the event of loss of sump recirculation capability. Procedural guidance is also provided to refill the RWST when SI recirculation flow is reduced or lost when symptoms of containment sump blockage are present.

3. Procedural guidance to refill the RWST through the normal makeup path and other alternate sources in the event containment sump blockage is a concern.

4. Implementation of mitigative measures that assure containment cleanliness and foreign material exclusion:

    a) Foreign material exclusion (FME) is assured by procedural controls at BVPS-1 and BVPS-2, which applies to inspection, operation, maintenance and outage activities.

    b) Ensuring sump strainers are free of adverse gaps and breaches, and verifying each refueling outage that the sumps are free of debris in accordance with surveillance requirements of the Technical Specifications at each unit.

    c) Procedures require the use of the recirculation spray pumps at BVPS-1 and BVPS-2 to circulate water through the sump after installing a temporary dike around the sump. Although this test is intended to confirm pump performance, it also provides confidence of sump function, and is performed each refueling outage.

d) Other procedures which focus on sources, types and locations of items or conditions having potential to become debris following a LOCA are also utilized. These procedures specifically identify examples of items to look for that may have the potential to be transported to the containment sump under accident conditions. Noted discrepancies are addressed via the BVPS corrective action program.

e) New labels, signs, and placards to be installed inside containment at BVPS-1 and BVPS-2 are required to meet the post-LOCA environment requirements.

These mitigative measures are already in place to minimize the risk of degraded ECCS and CSS functions during the requested extension period.

In addition, a containment coatings inspection and evaluation program is scheduled to be implemented starting with the BVPS-2 Spring 2008 refueling outage (2R13). Containment coatings inspections will be a scheduled activity for the refueling outages at both BVPS-1 and BVPS-2. This commitment was identified in Attachment 2 of FENOC letter L-07-519 (Reference 14).

SECY-06-0078 Criterion No. 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 sump performance.

FENOC Response:
Physical mitigative measures in place at BVPS-1 and BVPS-2 are described in detail in Section SECY-06-0078 Criterion 2 of this extension request. A risk assessment has been performed for both BVPS-1 and BVPS-2 to assess the risk for the requested extension period.

Risk Assessment:

Downstream Effects Ex-Vessel
Downstream effects evaluations have been performed for BVPS-1 and BVPS-2 to the requirements of Revision 0 of WCAP-16406-P. The High Pressure Safety Injection Cold Leg Throttle valves have been replaced at BVPS-1 and are scheduled to be modified at BVPS-2 during 2R13 in the Spring of 2008 as a result of the evaluations.

Based on the margins for plugging and wear, the completion of this evaluation to Revision 1 of the WCAP is not expected to result in a change of conclusions. Preliminary evaluations for plugging and wear using the criteria in WCAP-16406-P Revision 1 have been performed which substantiate this assessment. All components

with the exception of the High Pressure Safety Injection Throttle valves and the High Head Safety Injection (HHSI) pumps were found acceptable when evaluated under the WCAP methodology. Preliminary evaluations indicate that the HHSI pumps at BVPS-1 and BVPS-2 will maintain adequate hydraulic performance for their 30 day mission time. The potential for mechanical seal failure due to debris blocking axial movement of the rotating seal face, or due to debris blocking the seal injection flow line, is considered low. There is little potential for significant debris-induced wear of the seal faces due to the tight running gap, which matches the conclusion given in WCAP-16406-P regarding the potential for seal face degradation.

Detailed evaluations and final documentation are continuing; however, based on the preliminary results it is expected that the HHSI pumps will yield acceptable results and the increase in risk for the duration of the requested extension is negligible.

Downstream Effects In-Vessel

The BVPS-1 and BVPS-2 site-specific in-vessel downstream analysis has not been finalized; however, based on evaluations performed to date, the increase in risk is low for the duration of the extension period requested.

Westinghouse has developed preliminary evaluations for both BVPS-1 and BVPS-2 for in-vessel downstream effects. These evaluations have identified flow paths and have evaluated the potential for blockage of these flow paths by both particulate and fibrous debris. The review concluded that, based on the containment sump strainer sizes at both BVPS-1 and BVPS-2, the points of interest are sufficiently large to preclude plugging during hot leg or cold leg recirculation.

Strainer debris bypass test results for BVPS-1 and BVPS-2 have been reviewed by Westinghouse and preliminary conclusions indicate that the predicted in-vessel debris will not result in a thin bed effect.

WCAP-16793-NP (under NRC review) demonstrates that, for PWR's, in-vessel post-accident effects still allow core cooling to be maintained. With the exception of the chemical precipitate evaluation in section 5 of the WCAP, the study is generically applicable.

Section 5 of the WCAP develops the LOCADM chemical precipitation model. This is to be run with plant-specific inputs. Section 5.7 shows the results of the core chemistry effects analysis done with input conditions simulating a 3,188 MW thermal PWR with both a high fiberglass debris loading (7,000 ft3) and a large quantity of calcium silicate debris (80 ft3). Sodium hydroxide was present for pH control and there were 15,189 square feet of un-submerged aluminum and 799 square feet of submerged aluminum. For these cases, the long term core cooling was shown not to be compromised.

The debris input values for BVPS-1 and BVPS-2 were compared with the debris inputs used in the WCAP analysis. With the exception of un-submerged aluminum, the BVPS-1 and BVPS-2 debris input values are much smaller than those used in the demonstration cases. This indicates that the WCAP analysis bounds the quantity of debris predicted at both BVPS-1 and BVPS-2.
Based upon this initial review, the conclusions of the WCAP are applicable to BVPS-1 and BVPS-2:

- Adequate flow to remove decay heat will continue to reach the core even with debris from the sump reaching the RCS and core.
- Decay heat will continue to be removed even with debris collection at the fuel assembly spacer grids.
- Fibrous debris, should it enter the core region, will not tightly adhere to the surface of fuel cladding.
- An extension of the chemical effects method developed in WCAP-16530-NP demonstrates that decay heat would be removed and acceptable fuel clad temperatures would be maintained.
- The current analysis that demonstrates appropriate boric acid dilution to preclude boric acid precipitation remains valid.

Given the above, it is therefore concluded that BVPS-1 and BVPS-2 will maintain adequate long-term core cooling with consideration for debris and chemical products in the recirculating fluid. Based on the evaluations performed to date, the increase in risk for the duration of the requested extension period is negligible.

Based on the discussions presented within this correspondence, FENOC has determined that overall plant safety will be maintained throughout the requested extension period for BVPS-1 and BVPS-2.

FENOC is aware of the conditions and limitations of the Topical Report WCAP-16793-NP identified in NRC letter to NEI dated February 4, 2008, and intends to work with Westinghouse to address these concerns as they relate to the use of the WCAP for evaluating in-vessel downstream effects at BVPS-1 and BVPS-2.

Chemical Effects
Risk Assessment:
FENOC has requested an extension for completion of GL 2004-02 corrective actions for BVPS-1 and BVPS-2 out to the Spring of 2009; however, the following probabilistic risk assessment (PRA) was conservatively developed assuming a longer period of time [BVPS-2 out to the Fall 2009 refueling outage (2R14) commencing in October 2009 and for BVPS-1 out to the Spring 2009 refueling outage (1R19) commencing in April 2009].

The PRA reviewed the plant-specific debris generation/transport evaluations for BVPS-1 and BVPS-2 to identify break sizes and locations where satisfactory performance of the sump strainers was demonstrated due to the limited debris mass generated. The conclusion of this review determined that 6-inch line breaks and less will not generate significant quantities of fibrous material and cannot create a closed layer of debris coverage over the new containment sump strainers, with or without chemical effects. Therefore, only the large break LOCAs as modeled in the PRA (i.e., > 6 inches) were evaluated for vulnerability to sump blockage from debris.

The PRA also reviewed chemical effects testing results on chemical precipitate generation rates, which indicate that it would take more than 24 hours to result in any significant head loss due to the chemical products reacting with the sump strainer debris. Therefore, given this time margin and multiple cold or hot leg safety injection flow paths available, credit was also taken for plant operators to use existing emergency operating procedures to makeup to the RWST and to realign the safety injection system to take suction from the RWST following blockage of the containment sump due to chemical effects.

To estimate the frequency of an event capable of plugging the sump strainer the internal events large-LOCA (i.e., RCS breaks larger than 6 inches) frequencies are used as the starting point. Only internally generated large break LOCAs (i.e., a random pipe failure) are judged to be credible for this analysis. Based on a review of the BVPS PRA models, fire-induced large pipe breaks are not credible, and the frequencies of seismically-induced large pipe breaks are insignificant. The large-LOCA frequency, used in both of the BVPS PRA Models, is 7.2E-06 per year. This frequency includes pipe breaks over 6 inches in diameter and is assigned based on NUREG/CR-5750. This frequency has also been increased to include aging-related failure mechanisms based on the interim LOCA frequencies from Table 4.1 of the "Technical Work to Support Possible Rulemaking for a Risk-Informed Alternative to 10CFR 50.46 / GDC 35, Revision 1," dated July 2002.

As stated above, the extension request risk assessment takes credit for sump blockage recovery actions. The human error probabilities for these actions have previously been analyzed in Revision 4 of the BVPS-2 PRA model (BV2REV4) using the EPRI HRA Calculator; however, the baseline PRA models conservatively did not credit these actions following large break LOCAs. For the extension request risk assessment, credit

was taken for performing these sump blockage recovery actions following large LOCAs. A human error probability of 1.0E-02 was assumed for the sump blockage recovery actions following large LOCAs, which is conservative, based on the previously analyzed values and the extended time available for recovery, since the chemical effects impacting the containment sump are not expected prior to 24 hours.

The increase in Core Damage Frequency (ΔCDF) is determined from the product of the initiating event frequency for the LOCA, the postulated sump failure probability (conservatively assumed to be 1.0), and the sump blockage recovery action failure probability. Since the ΔCDF is given per year, the conservatively assumed extension periods of 16 months (for BVPS-1) and 22 months (for BVPS-2) would increase these by factors of 16/12 for BVPS-1 and 22/12 for BVPS-2, and provide the integrated risk over the extended period or Core Damage Probability (CDP) values. The table below shows the results of the extension request ΔCDF and CDP risk assessment.

Description	BVPS-1	BVPS-2
Large break LOCA Initiating Event Frequency (IE) =	7.2E-06	7.2E-06
Postulated Sump Failure Probability (SM) =	1.0	1.0
Sump Blockage Recovery Action Failure Probability (MU) =	1.0E-02	1.0E-02
Increase in Core Damage Frequency (ΔCDF per yr) = IE * SM * MU =	7.2E-08	7.2E-08
Extension Time in Months (ET) =	16	22
Extension Time Core Damage Probability (CDP) = ΔCDF * ET/12 =	9.6E-08	1.3E-07

The risk assessment estimated that the increase in CDF is 7.2E-08 per year for each unit, with a 9.6E-08 CDP due to a 16-month extension at BVPS-1 and a 1.3E-07 CDP due to a 22-month extension at BVPS-2. Regulatory Guide (RG) 1.174 states that when the calculated increase in CDF is less than 1.0E-06 per reactor year, the increase in risk is very small and that the change will be considered. For Large Early Release Frequency (LERF), RG 1.174 states that there is a very small increase in risk when the calculated increase in LERF is less than 1.0E-07 per reactor year. It is expected that any increases in the LERF due to these extension periods would be below this threshold value, since debris loading by itself cannot completely block the sump following large break LOCAs. Moreover, the formation of chemical precipitants will not affect the NPSH of the pumps for the first 24 hours following the LOCA, and hence, any large releases due to the impacts of chemical effects would no longer be considered early (i.e., not a contributor to LERF), as effective implementation of the off-site emergency response and protective actions would have occurred. Therefore, since the postulated increases in CDF and LERF are less than the threshold values as defined by RG 1.174, the increase in risk is very small.

List of References

1. NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004.

2. FENOC Letter L-06-020 Supplemental Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated April 3, 2006.

3. FENOC Letter L-06-171 "Revised Commitment Date Relevant to FirstEnergy Nuclear Operating Company Correspondence to the NRC, Dated September 29, 2006," dated December 21, 2006.

4. FENOC Letter L-05-123 Response to Request for Additional Information on Generic Letter 2004-02 (TAC Nos. MC4665 and MC4666), dated July 22, 2005.

5. FENOC Letter L-05-034 Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated March 4, 2005.

6. FENOC Letter L-05-146 Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 6, 2005.

7. NRC letter dated May 18, 2007, Beaver Valley Power Station, Unit No. 2 (BVPS-2) - Request for Schedular Extension from Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors."

8. Summary of July 26-27, 2001, Meeting with Nuclear Energy Institute and Industry on ECCS Strainer Blockage in PWRs, dated August 14, 2001.

9. SECY-06-0078, from L. A. Reyes, NRC Executive Director for Operations, to NRC Commissioners, "Status of Resolution of GSI -191, 'Assessment of [Effect of] Debris Accumulation on PWR [Pressurized Water Reactor] Sump Performance,'" dated March 31, 2006.

10. NRC letter to NEI dated November 8, 2007, "Plant-Specific Requests for Extension of Time to Complete One or More Corrective Actions for Generic Letter 2004-02 Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors."

11. NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," dated June 9, 2003.

12. FENOC Letter L-03-117, "60-Day Response to NRC Bulletin 2003-01," dated August 8, 2003.

13. NRC letter dated September 6, 2005, "Beaver Valley Power Station, Unit Nos. 1 and 2 Response to NRC Bulletin 2003-01, Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors (TAC Nos. MB9554 and MB9555).

14. FENOC Letter L-07-519 Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors" - Request for Extension of Completion Date for Corrective Actions dated December 20, 2007.

15. NRC letter dated December 27, 2007, Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors" Extension Request Approval for Beaver Valley Power Station, Unit Nos. 1 and 2 (TAC Nos. MC4665 and MC4666).

ATTACHMENT 2
L-08-054

Regulatory Commitment List

The following list identifies those actions committed to by FirstEnergy Nuclear Operating Company (FENOC) for Beaver Valley Power Station (BVPS) Unit Nos. 1 and 2 in this document. Any other actions discussed in the submittal represent intended or planned actions by FENOC. They are described only as information and are not Regulatory Commitments. Please notify Mr. Thomas A. Lentz, Manager - Licensing, at (330) 761-6071 of any questions regarding this document or associated Regulatory Commitments.

Regulatory Commitment	Due Date
1. Applicable to BVPS-1: Additional chemical effects testing will be performed for BVPS-1 using the specific BVPS-1 predicted debris mix, and a follow-up supplemental response will be provided by August 30, 2008, which will include the results of BVPS-1 chemical effects testing and the details of any corrective actions, if required.	August 30, 2008
2. Applicable to BVPS-1: Based on the results of the BVPS-1 chemical effects testing, any additional required corrective actions that are deemed necessary would be implemented during the Spring of 2009 refueling outage (1R19) which commences in April 2009.	Spring of 2009 refueling outage (1R19) which commences in April 2009
3. Applicable to BVPS-2: Complete supporting analyses and submit a License Amendment Request (LAR) for the replacement of the present sodium hydroxide buffer with sodium tetraborate and the use of containment overpressure to credit NPSH margin. The analyses will be completed and the LAR submitted to the NRC by August 30, 2008.	August 30, 2008

4. Applicable to BVPS-2: The license amendment for the buffer change and crediting NPSH with containment overpressure will be implemented within 60 days of the approval date of the LAR or by the Spring (March 31) of 2009, whichever is sooner. Implementation is contingent on NRC approval of the LAR.	Within 60 days of the approval date of the license amendment or by the Spring (March 31) of 2009, whichever is sooner.
5. Applicable to BVPS-1 and BVPS-2: Downstream effects analyses (both in-vessel and ex-vessel) will be completed for BVPS-1 and BVPS-2 with results documented and provided in the follow-up supplemental response by August 30, 2008.	August 30, 2008