FENOC
FirstEnergy Nuclear Operating Company

Peter P. Sena III
Site Vice President

724-682-5234
Fax: 724-643-8069

August 8, 2007
L-07-095

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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
Responses to a Request for Additional Information (RAI) dated July 3, 2007 in Support of License Amendment Request Nos. 334 and 205 (TAC Nos. MD4290 MD4291)

By letter dated July 3, 2007, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) regarding License Amendment Request (LAR) Nos. 334 and 205. These LARs were submitted by FirstEnergy Nuclear Operating Company (FENOC) on February 9, 2007 by letter L-07-017 (Reference 1). The LARs propose changes that would revise the recirculation spray system pump start signal Technical Specification due to a modification to the containment sump screens. This change is needed to support modification of the containment sump. The LARs also request approval of a change to the calculation methodology used to determine aerosol removal coefficients for use in dose consequence analyses.

Attachments A through D provide the FENOC responses to the July 3, 2007 RAI questions. The RAI responses do not adversely affect the conclusions of the determination of no significant hazards consideration transmitted by Reference 1.

The response to RAI Question 13 indicates that a proposed change to Technical Specification Table 3.3.2-1 Function 7.b, as provided in Reference 1, is unnecessary. Through separate correspondence, FENOC will supplement the subject LAR to withdraw the affected portion of the proposed change, and provide corrected markups for Technical Specification Table 3.3.2-1.

A001

NRR

No new regulatory commitments are contained in this submittal. If there are 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 August 8, 2007.

Sincerely,

Peter P. Sena III

Attachments:

A. Responses to RAI dated July 3, 2007

B. Staggered Loading Calculation Excerpts

C. Draft Unit 2 Updated Final Safety Analysis Report Markups for Diesel Generator Loading Sequence

D. Sample Setpoint Methodology Calculation

Reference:

1. FENOC Letter L-07-017, License Amendment Requests Nos. 334 and 205, dated February 9, 2007.

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

Attachment A of L-07-095

REQUEST FOR ADDITIONAL INFORMATION

REGARDING THE RECIRCULATION SPRAY SYSTEM PUMP START SIGNAL

LICENSE AMENDMENT REQUEST

FIRSTENERGY NUCLEAR OPERATING COMPANY

FIRSTENERGY NUCLEAR GENERATION CORP.

OHIO EDISON COMPANY

THE TOLEDO EDISON COMPANY

BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-334 AND 50-412

By letter dated February 9, 2007, Agencywide Documents Access and Management System (ADAMS) accession number ML070440341, FirstEnergy Nuclear Operating Company (FENOC, licensee) submitted an amendment to the Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS-1 and 2) Technical Specifications (TSs). The proposed changes would be consistent with a proposed change to the Recirculation Spray System (RSS) pump start signal due to a modification to the containment sump screens. The Nuclear Regulatory Commission (NRC) staff is reviewing the submittal and has the following questions:

Safety Issues:

1. **On page 5, section "Basis for Change No. 3" of the submittal, the licensee stated, "Although the configurations of the existing trash racks and screens and the replacement sump strainer assemblies are different, they serve the same fundamental purpose...." What are the bases to conclude that the existing trash racks and screen are equivalent to the replacement strainer? How is the design function of the removed trash racks addressed in the new design?**

Response:
The overall function of the Beaver Valley Power Station (BVPS) emergency sump is to provide a long-term water source for the recirculation function of the Emergency Core Cooling and Recirculation Spray systems, including assurance of sufficient NPSH margin for the system pumps. The strainer and trash rack ensure the removal of debris that could block or degrade components downstream of the strainer. The former strainer design is a flat panel construction consisting of both a coarse and fine layer of wire mesh screen protected by vertical bars (trash rack) in front of the screen. The bars are inclined on BVPS-1 and vertical on BVPS-2.

Replacement strainers have been or are being installed at both BVPS units as a part of the resolution of GSI-191, "Assessment of Debris Accumulation on PWR Sump Performance." The replacement strainers are advanced strainer designs that use a complex strainer geometry that surpasses the performance of a typical flat plate design. The new strainers are fabricated from perforated stainless steel plate rather than the wire mesh that was used in the old screen. At BVPS-1 the strainer is designed with multiple pockets and at BVPS-2, the strainer is designed with multiple vertical cylinders. The replacement strainers do not require a vertical outer trash rack to protect the primary strainer surface.

The following regulatory positions from Regulatory Guide 1.82, Rev. 0, directly apply to the use of a trash rack:

C.3 "... At a minimum, the sump intake should be protected by two screens: (1) an outer trash rack and (2) a fine inner screen ..."

C.6 "A vertically mounted outer trash rack should be provided to prevent large debris from reaching the fine inner screen. The strength of the trash rack should be considered in protecting the inner screen from missiles and large debris."

As described above, and in the BVPS UFSARs, the function of the trash rack is to prevent large debris from reaching the fine inner screen. At BVPS, there are no missile loads applicable to the strainers due to the sump's location outside of the crane wall. Therefore, protection of the inner screen from missiles is not a design function for the trash racks.

The capture of large debris inadvertently left inside containment would be the only function of the trash racks. This type of debris could have a significant impact on the current strainer with a comparatively low strainer-to-debris surface area ratio. However, the replacement strainers have more than 22 times the surface area of the old strainers, greatly increasing the strainer-to-debris surface area ratio. Moreover, the complex strainer geometry provides a variation in surface contour such that large debris will not completely impede flow as it potentially could with the flat design of the old strainers. The large size, strainer layout, and complex geometry would make it difficult for large debris of this type to fully obstruct even a small portion of the replacement strainers.

Regulatory Position C.6 states that the strength of the trash rack should be considered for protection of the fine inner screen from large debris. The existing BVPS-1 inner screen is a fine wire mesh that could be damaged by large debris, specifically sharp debris that could puncture or cut the mesh with a differential pressure loading applied, thus the need for the trash racks. However, the replacement sump strainers are robust components made of stainless steel perforated plate that cannot be punctured or cut by sharp debris. Therefore, the trash rack surrounding the replacement sump strainer is no longer required to protect the strainer from being punctured or cut.

The functional requirements described in regulatory position C.6 are accomplished in the replacement strainer design through increased surface area, complex strainer geometry, and

robust design. Regulatory Guide 1.82, Rev. 0, was meant to be a guide for the early strainer designs of the time. The replacement strainer design meets and exceeds the functional requirements behind the regulatory positions of Regulatory Guide 1.82.

2. **On page 9 and 25 of the submittal, the licensee stated, "....the sump strainer is a combined header for both ECCS [emergency core cooling system] trains....," but the BVPS-2 Updated Final Safety Analysis Report (UFSAR), Revision 16, page 6.2-49, states, "Train separation between the redundant RSS trains is maintained." Does the strainer replacement represent a change from two independent sumps to a shared sump? If so, justify the change.**

Response:
No, for BVPS-2, the strainer replacement does not result in a change from two independent sumps to a shared sump. The BVPS units each have a single recirculation sump. At BVPS-2, the sump strainer is divided between the two ECCS trains by perforated plates internal to the strainer assembly to maintain train separation. The BVPS-2 UFSAR statement continues to be consistent with the new strainer design.

3. **The licensee stated that due to the size, complexity, and location of the new containment sump strainer, the strainer inspection will be limited to inspect the "accessible regions." How will BVPS-1 and 2 ensure that all parts of the strainers (including "inaccessible regions") show no evidence of structural distress or abnormal corrosion, and are not restricted by debris? How will BVPS-1 and 2 ensure that the strainers will not incur any undetected latent damage (e.g., from maintenance or operations activities on or in the vicinity of the strainers) that could adversely impact the strainer's performance?**

Response:
Accessible regions of the strainers will be inspected each outage for evidence of structural distress, abnormal corrosion, and debris, as required by the proposed Technical Specification. The inaccessible regions of the strainers are protected by diamond checker plates over the strainer at BVPS-1 and by grating covered with stainless steel sheets over the strainers at BVPS-2.

There is no mechanism to cause structural distress or corrosion in the inaccessible regions that would not be present in the accessible regions. The protective cover keeps out any mechanism that could cause structural distress (such as inadvertent damage from other work in the vicinity). Because the inaccessible regions are in close proximity to the accessible regions and share the same materials of construction and environment, the absence of abnormal corrosion on accessible portions of the strainer provides reasonable assurance of similar conditions in inaccessible regions.

Other than the possibility of debris introduction during testing, there is no mechanism for debris introduction to the inaccessible regions. The BVPS-1 strainers are outside of the test pool;

therefore, at BVPS-1, testing does not provide a mechanism for debris transport to the strainer surfaces.

For BVPS-2, however, the RSS pump tests conducted each outage have the potential for debris transport to the inaccessible areas of the sump strainer. Precautions have been taken to ensure that this will not be a concern. First, the pump test connections have been designed so that the water circulating for the pump test bypasses the strainers and flows directly to the pump suction area. The return test flow for the pumps flows into the interior of the water box below the vertical strainers. In addition to this design feature, the pump test procedures have specific checkpoints for sump cleanliness. The pump test dike area may not be filled with water until it has been verified to be clean of any debris. The floor grating in the containment level above the strainer must be covered to prevent debris from falling into the dike pool. The area must be established as a "Restricted Area" to limit personnel entrance during the testing. These procedural check points ensure that the water in the pool is free of debris. With debris-free water and with no flow available to move any debris that might have escaped the procedural controls into the inaccessible areas, there is no mechanism for debris to be deposited in the inaccessible regions. Therefore, the inspection of the accessible areas provides assurance that the inaccessible areas are also free from debris.

The diamond checker plates over the strainers at BVPS-1, and grating covered with stainless steel sheets over the strainers at BVPS-2, make portions of the strainer inaccessible for inspection. They also ensure that the strainers will not incur any damage in the inaccessible areas. The diamond checker plates at BVPS-1 and the grating at BVPS-2 are bolted structures. They are in a radiation area and, in some cases, will require the use of rigging equipment to be removed. Removing the covers each outage would put the strainers at risk of damage and increase radiation dose to personnel. Unbolting, rigging, and lifting the plate and grating off of the strainers for inspection of the covered area increases the possibility of accidentally dropping a cover and damaging the strainers. With the covers removed, the protection they provide against debris introduction is also eliminated. The increased radiation dose and the possibility of strainer damage and debris introduction incurred by removing the covers would not offset the additional information that might be gained by doing so. The inspection of the accessible areas provides reasonable assurance that the inaccessible areas are behaving in a similar fashion.

4. **Please describe how flow tests are performed for the inside recirculation spray (IRS) pumps to satisfy TS surveillance requirements. Also, describe how debris and foreign materials are prevented from entering the sump area (downstream of the strainers or screens) during these flow tests.**

Response:
To satisfy the Technical Specification surveillance and Inservice Testing (IST) Program requirements, the BVPS-1 inside recirculation spray pumps are tested each outage in accordance with plant procedures. The pumps are aligned in the recirculation mode by installation of a blank-flange in the normal flow path. A temporary dike is constructed around the containment

sump and the dike is flooded with water to provide adequate NPSH for the test flow. The pumps are operated one at a time and flow is adjusted to the defined reference point, so that differential pressure, flow, vibration, running current, and bearing temperature data can be obtained.

The new containment sump strainers being installed at BVPS-1 have strainer units located along the containment floor and connected to the sump with a channel box (connecting duct). A portion of the channel box will be removed to allow the construction of the temporary dike. After the segment is removed from the channel box, the open end of the channel box inside of the temporary test dike will be covered with perforated plate with holes smaller than the openings in the current sump screen fine mesh wire screen in the test flow path. This protective plate will ensure that any debris that might be in the water within the test dike would not flow into the protected side of the containment strainer.

The governing procedure requires that the dike area be established as a "Restricted Area," that the area be cleaned and inspected for debris, and that the floor grating in the level of containment above the sump be covered to prevent debris from falling inside of the test dike area. Because of these controls, the water within the test dike remains free of debris and the perforated plate provides an added measure of assurance that no debris or foreign materials enter the sump area downstream of the strainers during these flow tests.

Containment and Electrical:

5. **On page 5, section "Basis for Change No. 2" of the submittal, the licensee stated, "With this change both units will automatically switchover ECCS suction to the containment sump on an RWST [refueling water storage tank] level Extreme Low signal." However, the system description (page 9 of 32) states that for BVPS-1, the low-head safety injection (LHSI) pumps automatically realign to take suction from the containment sump when RWST reaches its low-low level point. But for BVPS-2, the LHSI pumps automatically stop on the low-low RWST level signal and the high-head safety injection pumps are manually realigned to take suction from the discharge of one of the two RSS pumps on each train. Please explain the apparent discrepancy in the above statements and also explain how it can be verified that adequate water inventory is actually present in the sump to meet the various pump net positive suction head (NPSH) requirements.**

Response:
The current design is described on page 9 of the submittal. For BVPS-1, the correct terminology for the automatic switchover to containment sump is "RWST level low." For BVPS-2, the correct terminology is "RWST level extreme low" although "RWST level low low" is also used in some plant documentation for this function. Going forward, as explained in change number 2 on page 4 of the submittal, it is intended that "RWST level extreme low" will be used for both units for the automatic switchover to containment sump function. The description for BVPS-2, previously provided in the submittal, concerning the realignment of the HHSI pumps is

incorrect. The HHSI pumps are not manually aligned to take suction from the RSS pumps at BVPS-2. The HHSI pumps automatically realign to take suction from the RSS pumps.

Adequate water inventory in the sump is ensured by the system design and analysis. Starting of the RSS pumps on a water level signal from the RWST ensures that a defined volume of water will be transferred from the RWST to the containment. The NPSH analysis considers the potential water hold up locations in the containment when calculating the sump level which is used in the NPSH calculation. The other source of water in the containment sump is leakage from the RCS during a LOCA. A range of break sizes is also considered to determine the limiting cases for both NPSH and sump level. The analyses demonstrate that both NPSH and sump strainer submergence requirements are met.

In addition, the emergency operating procedures instruct the operators to monitor pump operation for signs of cavitation. If cavitation is indicated on the RSS pumps, the operators are instructed to shut the pumps down until adequate inventory in the sump is available as indicated by the sump level indicators. Sump level is also checked following transfer to recirculation mode to ensure adequate level is available to meet NPSH requirements.

6. **On page 4, section "Basis for Change No. 1" of the submittal, the licensee stated, "With the proposed change the recirculation spray pumps will start on a coincident Containment Pressure High-High/RWST Level Low signal. The change to the pump start signal will ensure that sufficient water is available for proper pump operation and that containment conditions are such that recirculation spray pump operation is required." Please explain how the automatic logic verifies that adequate water is present in the sump to meet the recirculation spray (RS) pump minimum NPSH requirement.**

Response:
The change to start the RSS pumps automatically on a RWST level coincident with Containment Pressure High-High signal ensures a defined volume of water will be transferred from the RWST to the containment. All flow from the RWST is directed to containment via the quench spray (QS) or safety injection (SI) systems. The NPSH analyses demonstrate that this volume of water, as supplemented by any other amount that arrives at the containment sump as a result of the LOCA, is sufficient to cover the replacement sump strainers and provide the required NPSH for the pumps. This is in contrast to the current system design which starts the RSS pumps based on a fixed time delay following a Containment High Pressure signal. Neither the current nor the proposed design has a direct input to the containment water level incorporated in the RSS pump start logic.

7. **The licensee proposes to change the upper limit on containment average air temperature from 105° F to 108° F. In section "Basis for Change No. 4," the licensee stated, "This change incorporates the revised containment analysis upper limit on containment average air temperature." This has resulted in a maximum containment temperature slightly above the current equipment qualification (EQ) envelope (Section 4.1.6). On page 3 of Attachment D, it is stated that the purpose of raising the limit is to allow for an increase in the containment operating band. Section 4.1.6 provides a discussion of EQ analysis. It is stated that analysis of the impact of the increased EQ profile is ongoing and will be completed prior to approval of this license amendment request, and the subsequent operation with the proposed change to the RSS pump start signal.**

    i. **Please clarify if the higher temperature is assumed solely for the purpose of a more bounding analysis or is it because higher temperatures have actually occurred during normal operations. If it is the latter, is the existing containment ventilation system re-evaluated to verify that it has sufficient capacity to maintain the containment at or below 108° F.**

Response:
The purpose of increasing the containment high average temperature analysis limit is to provide additional operating margin. The ventilation system consists of three Containment Air Recirculation (CAR) fans. Normally two of three fans are in service and the third remains in standby. During the hottest periods of the year, three fans are required to maintain the containment temperature within limits. During these periods, no standby units are available. The higher containment temperature analysis limit was requested in order to minimize the amount of time when three fans are required. This change was requested for both BVPS-1 and BVPS-2 to maintain consistency.

Following steam generator replacement at BVPS-1 in the spring of 2006, it was noted that containment temperatures had increased slightly, however the temperature did not exceed 105° F. No changes have been noted at BVPS-2, although the full extended power uprate has not yet been implemented. Evaluations of the containment ventilation system to determine the impact of steam generator replacement (BVPS-1) and the extended power uprate (BVPS-1 and BVPS-2) demonstrated that the systems were capable of handling the anticipated increase in heat load to maintain the containment at or below 108° F.

    ii. **Please provide the impact of the higher temperature on the qualified lives of the equipment. Identify equipment that need to be replaced or re-qualified, if any, in accordance with 10 CFR 50.49 due to the impact of the higher containment temperature.**

Response:
In general, the qualified life calculations are based on empirically determined temperatures based

on plant operation over a period of time. A review of actual operating temperature data over the last several years indicates that temperatures in the containment locations containing EQ equipment have not approached 105° F. Therefore, the proposed technical specification limit bounds actual operating conditions. Based on the above, it is not expected that the qualified life of equipment located in containment will be impacted by the higher temperature limits and no equipment replacements will be considered necessary.

iii. Please provide the results of the analysis due to the increased EQ profile.

Response:
As stated in Attachment D of Reference 1, the EQ profiles in certain areas will increase by less than 2°F for short periods of time. While the EQ analysis is not yet complete, no component qualification issues have been identified based on the revised profiles. In Reference 1, FENOC has committed to completing the analysis of the impact of the increased EQ profile and replacement or re-qualification of equipment as necessary prior to implementation of this amendment.

8. Sections 4.1.7 and 5.1 addressed emergency diesel generator (EDG) loading. It is stated that the inside containment RSS pumps at BVPS-1 will be started immediately following receipt of an RWST Level low signal coincident with a Containment Pressure High-High signal. The BVPS-1 outside containment RSS pumps will be started following a 15-second delay after receiving the coincident signal. The 15-second delay limits the starting load on the EDG and maintains staggered pump start timing. The maximum load on the BVPS-1 EDG will not increase as a result of this modification, but will occur at a later time due to the delay in starting the RSS pumps. It is further stated that staggered loading of the RSS pumps is not required for BVPS-2.

i. Please confirm that the revised loading sequence has been re-evaluated to verify that it meets Regulatory Guide 1.9, as it pertains to its load accepting capability of the RSS motor loads in conjunction with other Engineered Safety Features (ESF) step loads with which the system is loaded.

Response:
For BVPS-1:
The revised loading sequence has been re-evaluated for BVPS-1 to verify that it meets Regulatory Guide 1.9, as it pertains to its load accepting capability of the RSS motor loads in conjunction with other Engineered Safety Features step loads with which the system is loaded.

The BVPS-1 EDGs have a Regulatory Guide 1.9 and a UFSAR loading limit of 2745 KW. The RSS pumps were designed to start at 210 seconds and 225 seconds on each EDG using a timer after the receipt of a Containment Pressure High-High Signal. The maximum coincident loading occurs on the "A" EDG at 15 minutes (2713.6 KW with a margin of 31 KW) and on the "B"

EDG at 30 minutes (2682.9 KW with a margin of 62 KW). These loads are less than the Regulatory Guide 1.9 limits.

In the proposed design, the RWST Low Level will initiate a RSS pump start signal (inside containment) coincident with Containment Pressure High-High. The RSS pumps starting times on the same EDG are shifted from the existing 210 seconds to 225 seconds, to 19.4 minutes (1163.7 seconds) to 19.4 minutes plus 15 seconds. Each pump takes approximately 2 seconds to come to full speed. The original starting method (using a 15 second start delay for the second pump) did not change except that the starting time shifted to 19.4 minutes for the first pump (inside containment) and to 19.4 plus 15 seconds for the second pump (outside containment). There is no impact to the performance of the RSS pumps or EDG load limits and they continue to meet Regulatory Guide 1.9 requirements.

The containment analyses determine the time required for the RWST level to reach the low level setpoint that provides the RSS pump start permissive. For large LOCA events, depending on the number of pumps operating and taking suction from the RWST, the time for the RWST level to reach the low level setpoint can vary from 1163.7 seconds (19.4 minutes) to 1966.9 seconds (32.78 minutes).

The maximum coincident load for the "A" EDG based on the current analysis is 2713.6 KW after 15 minutes with an existing margin of about 31 KW. After implementation of the engineering change, the RSS pumps will start at approximately 19 minutes. Prior to starting RSS pumps, the "A" EDG loading would be 2260.2 KW [2713.6 KW - 233.4 KW (for 1RS-P-2A) - 220 KW (for 1RS-P-1A)]. At about 20 minutes after starting of both RSS pumps, the load would be 2713.6 KW. The maximum coincident load for "A" train EDG will remain at 2713.6 KW after 20 minutes.

The maximum coincident load for "B" train EDG based on the current analysis is 2682.9 KW after 30 minutes and there is an existing margin of about 62 KW. The existing loading at 15 minutes is 2678.2 KW. After implementation of the engineering change, the RSS pumps will start at approximately 19 minutes. Prior to starting RSS pumps, the EDG loading would be 2225.3 KW [2678.2 KW - 232.9 KW (for 1RS-P-2B) - 220 KW (for 1RS-P-1B)]. At about 20 minutes after starting of both RSS pumps, the load would be 2678.2 KW and it will remain at the value until 30 minutes. The maximum coincident load for "B" train EDG will remain at 2682.9 KW after 30 minutes.

The revised loading sequence has been re-evaluated for BVPS-1 and found to be satisfactory for both EDGs per Regulatory Guide 1.9.

For BVPS-2:

The revised loading sequence has been re-evaluated for BVPS-2 to verify that it meets Regulatory Guide 1.9, as it pertains to its load accepting capability of the RSS motor loads in conjunction with other Engineered Safety Features step loads with which the system is loaded.

The BVPS-2 EDGs have a Regulatory Guide 1.9 and a UFSAR loading limit of 4535 KW. The RSS pumps were designed to start at 10 minutes on each EDG using a timer after the receipt of a Containment Pressure High-High Signal. The maximum coincident loading occurs on the "A" EDG at 10 minutes (3689.5 KW with a margin of 845 KW) and on the "B" EDG at 10 minutes (3695.6 KW with a margin of 839 KW). These loads are less than the Regulatory Guide 1.9 limits.

In the proposed design, the RWST Level Low will initiate the RSS pump start signal coincident Containment Pressure High-High with no time delay between the RSS pumps.

The containment analysis determines the time required for the RWST level to reach the low level setpoint that provides the RSS pump start permissive. Depending on the number of pumps operating and taking suction from the RWST, the time for the RWST level to reach the low level setpoint can vary from 2248.1 seconds (37.47 minutes) to 3134.2 seconds (52.24 minutes).

The maximum coincident load for the "A" train EDG based on the current analysis is 3689.5 KW after 10 minutes and there is an existing margin of about 845 KW. The current loading at 30 minutes is 3663.7 KW. After implementation of the engineering change, the RSS pumps will start at approximately 37 minutes. Prior to starting RSS pumps, the EDG loading would be 3119.1 KW [3663.7 KW - 272.3 KW (for 2RSS*P21A) - 272.3 KW (for 2RSS*P21C)]. At about 38 minutes after starting of both RSS pumps, the load would be 3663.7 KW. The maximum coincident load for "A" train EDG will remain at 3663.7 KW after 38 minutes.

The maximum coincident load for "B" train EDG based on the current analysis is 3695.6 KW after 10 minutes and there is an existing margin of about 839.4 KW. The current loading at 30 minutes is 3669.4 KW. After implementation of the engineering change, the RSS pumps will start at approximately 37 minutes. Prior to starting RSS pumps, the EDG loading would be 3124.8 KW [3669.4 KW - 272.3 KW (for 2RSS*P21B) - 272.3 KW (for 2RSS*P21D)]. At about 38 minutes after starting of both RSS pumps, the load would be 3669.4 KW. The maximum coincident load for "B" train EDG will remain at 3669.4 KW after 38 minutes.

Reduction in the maximum coincident load at 38 minutes will be due to change in starting time of the RSS pumps from 10 minutes to 37 minutes. Based on the existing analysis, there is a reduction of loading between the 10 minute and 30 minute time periods. The impact of the reduction in loading between the 10 minute and 30 minute time periods translates to a reduction in the maximum coincident loading.

The EDG maximum coincident loading will be reduced by approximately 26 KW due to the proposed change. The revised loading sequence has been re-evaluated for BVPS-2 and found to be satisfactory for both EDGs per Regulatory Guide 1.9.

ii. Please explain why staggered loading of EDG is not required for BVPS-2.

Response:
Staggered loading of EDG is not required for BVPS-2 due to the EDG capacity and available margin. The proposed configuration meets Regulatory Guide 1.9. The BVPS-2 response to Question 8.i provided more details.

iii. Please provide affected calculations in support of above statement.

Response:
An excerpt from the current BVPS-2 calculation is provided in Attachment B of this letter.

iv. Please provide revised final safety analysis report (FSAR) pages for this design change.

Response:
Draft BVPS-2 UFSAR markups are provided in Attachment C of this letter. The markups are provided for information only, and approval is not requested as these changes are controlled by the licensee under 10 CFR 50.59. For BVPS-1, the EDG load sequence changes do not impact the UFSAR because the UFSAR does not contain the same level of detail as the BVPS-2 UFSAR.

9. **Section 4.1.2 provides a discussion of NPSH analysis. It is stated that the available NPSH for outside recirculation spray (ORS) pumps increased from 11.8 feet to 14.7 feet. What is the reason for this increase in available NPSH? Please clarify if any portion of this gain in NPSH is from reapportioning the quench spray system (QSS) pump flow from equal division to the IRS and ORS pumps to one third to IRS and two thirds to ORS. If there is, in fact, a gain in NPSH, please further explain the flow model and show that the conservatism in the analysis is not compromised.**

Response:
The available NPSH for the ORS pumps at BVPS-1 increases for several reasons. The static height of the water in the sump is increased due to the later starting time. The temperature of the water in the sump is lower due to the later starting time. The increase in the QSS flow to the ORS pump suction also increases the available NPSH for the ORS pumps. The QSS system provides a total of 450 gpm (nominally) to the pump suctions for each train of RSS (one IRS and one ORS pump). This piping as currently installed was designed to provide one third (150 gpm) of the flow to the IRS pumps and two thirds (300 gpm) to the ORS pumps. This was required since the ORS pumps have a higher suction loss due to the additional piping. Restriction orifices in the system control the flow distribution. System hydraulic flow models are used to calculate the total flow and distribution under various conditions of RWST level, containment pressure, pump performance, etc. This performance is then used in the integrated containment MAAP-DBA model. The current analysis made a simplification and used equal flow to both IRS and ORS pumps. The revised analysis which models the actual flow distribution represents a more detailed approach and does not compromise the overall conservatism.

10. In section 4.1.4 "Dose Analyses," it is stated that the dose consequences analyses for the loss-of-coolant accident are impacted by the proposed RSS modifications, and the results of the analyses show small increases in all reported doses. Please provide the impact of the above analyses on the EQ program.

Response:
Analysis of changes to doses in plant areas which contain EQ components is not yet complete. However, preliminary results indicate that the dose increase is small and no impact on equipment qualification is expected. As committed in Reference 1, the analyses will be completed prior to implementation of the amendment.

Instrumentation and Controls: Table 3.3.2-1, "ESF Actuation System Instrumentation"

11. In the Containment Spray System section, the Automatic Actuation logic function for starting quench spray (QS) pumps is required to be operable in Modes 1, 2, 3, and 4, while the same instrumentation function for starting RS pumps is not required to be operable in Mode 4. Please explain the reason for this change.

Response:
As shown in LAR 334/205 Attachment B (proposed Technical Specification Bases changes) page B 3.3.2-15, manual initiation of the quench spray (QS) system is required to be operable during Mode 4. However, automatic initiation of QS is not required during Mode 4 for design basis accident (DBA) mitigation because adequate time is available to manually actuate required components in the event of a DBA.

As shown in LAR 334/205 Attachment A, Table 3.3.2-1 Function 2.a.1 and 2.a.2, Engineered Safeguards (ESF) instrumentation required to support the QS manual initiation function in Mode 4 includes:

manual initiation switches	Modes 1, 2, 3, 4 (SR 3.3.2.7 – perform TADOT)
master relays	Modes 1, 2, 3, 4 (SR 3.3.2.3 – perform Master Relay Test)
slave relays	Modes 1, 2, 3, 4 (SR 3.3.2.6 – perform Slave Relay Test)

Additionally, Technical Specification 3.6.6 requires two operable trains of QS System in Mode 4. The ESF instrumentation listed above in combination with two operable trains of QS ensure all equipment required for manual initiation in Mode 4 is operable.

Similar to the QS system, automatic initiation of the RS system is not required in Mode 4 for DBA mitigation. However, manual initiation of the RS system is required. Technical Specification Section 3.6.7 requires two trains of RS operable during Modes 1, 2, 3, and 4. The manual initiation of RS can be initiated using the manual pump switches. This physical configuration is reflected in the proposed Technical Specification Bases changes shown on Attachment B page B 3.3.2-15. Manual operation of the Quench Spray and Recirculation Spray

Systems is required in Mode 4. The difference between the manual modes for each system is the Quench Spray design requires ESFAS instrumentation (manual initiation switches and actuation relays) while the Recirculation Spray design does not require ESFAS instrumentation since the Recirculation Spray pump switches are used for manual initiation.

12. Condition "C" is the applicable action statement for an inoperable Automatic Actuation Logic for starting QS pumps with a Completion Time of 6 hours. Please justify using Condition "F" for an inoperable Automatic Actuation Logic for starting RS pumps with a Completion Time of 48 - 60 hours.

Response:
In the event of one inoperable RS Automatic Actuation Logic Train, Condition F requires restoration of the Automatic Actuation Logic function within 48 hours or being in Mode 4 within the 60 hours. Note that under this scenario, there are two operable RS trains available for manual initiation during all plant modes. The response to Question 11 states that manual initiation of RS in Mode 4 provides DBA mitigation.

If an RS train is unavailable (two RS pumps in a single train failed), LCO 3.6.7 Conditions B and C, depending on the unit, requires restoration of the train within 72 hours or being within Mode 5 within 84 hours. The required actions of Limiting Condition for Operation (LCO) 3.3.2, Condition F is more restrictive than the required actions performed under LCO 3.6.7, Conditions B or C. LCO 3.3.2, Condition C for the RS Automatic Actuation Logic was not selected because this action requires entry into Mode 5. As noted in the response to Question 11, automatic initiation of RS is not required in Mode 4.

LCO 3.3.2, Condition C for QS was selected because the function includes both Automatic Actuation Logic and Actuation Relays. The response to Question 11 describes how the Actuation Relays are needed for both automatic initiation and manual initiation of QS. If one train of QS Actuation Relays is not available, then entry in Mode 5 is required (below the Mode of applicability for the QS system to perform DBA mitigation).

13. The TS Bases indicates that RWST Level Extreme Low instrumentation has four transmitters (required channels). In the revised Table 3.3.2-1, under "Required Channels," the number of trains is not clear. Please explain the reason for adding two trains next to the existing entry of four channels.

Response:
For Technical Specification Table 3.3.2-1 Function 7.b, the Required Channels column should indicate "4" (there are 4 RWST Level Channels for this function) instead of "2 trains" provided in the original submittal. The change to Technical Specification Table 3.3.2-1 Function 7.b, as proposed in the License Amendment Request, was inappropriately introduced during the review process. Further evaluation demonstrates that this change is not required. Through separate correspondence, FENOC will supplement the subject LAR to withdraw the affected portion of the proposed change, and provide corrected markups for Technical Specification Table 3.3.2-1.

14. Provide documentation (including sample calculations) of the methodology used for establishing the limiting setpoint (or Nominal Trip Setpoint) and the limiting acceptable values for the as-found and as-left setpoints, as measured in periodic surveillance testing. If the NRC staff has previously reviewed this methodology, please provide the reference for the safety evaluation. Also, indicate the related analytical limits and other limiting design values (and the source of these values) for the instrument setpoint of the RWST Level Low.

Response:
The methodology used for establishing the limiting setpoint and the limiting acceptable values for the as-found and as-left setpoints, as measured in periodic surveillance testing for the new RWST Level Low function, continues to utilize the Westinghouse setpoint methodology defined in WCAP-11419 for BVPS-1 and WCAP-11366 for BVPS-2.

The NRC has previously reviewed this methodology as documented in the Safety Evaluation for Amendment Nos. 270 and 152 (TAC Nos. MC4649 and MC4650) dated January 11, 2006.

A sample setpoint methodology calculation has been provided as Attachment D of this letter.

The safety analysis limits for RWST Level Low are:

BVPS-1 RWST Level Low (Referenced from 12 inches from tank bottom)

Safety Analysis Limit High	29 feet 3.5 inches
Safety Analysis Limit Low	25 feet 11.5 inches

BVPS-2 RWST Level Low (Referenced from the bottom of the tank)

Safety Analysis Limit High	35 feet 7 inches
Safety Analysis Limit Low	29 feet 10 inches

The safety analysis limits are based on meeting the submergence requirements for the replacement containment sump strainers and the NPSH requirements for the RS and SI pumps. The safety analysis limits were determined in the containment response calculations. No other relevant limiting design values are applicable.

Human Performance:

15. Will the operator align the two internal RSS pumps (one on each train) respectively to one high head safety injection pump and one LHSI pump to transfer suction from the RWST to the containment sump upon receipt of the RWST Level Low signal in BVPS-2?

Response:
As noted in the response to Question 5, the transfer of the HHSI suction from the RWST to the RSS pumps is automatic. No manual operator actions are required to accomplish this. The sequence is described in section 6.3.2.1 of the BVPS-2 UFSAR and is summarized below:

On receipt of the RWST extreme low level signal:

- The RSS pump discharge valves to the LHSI header open
- The RSS spray header isolation valves close
- The LHSI pumps stop when the RSS pump discharge valves are fully open
- The HHSI pump suction valves from the LHSI header open
- The HHSI suction valves to the RWST close
- The LHSI pump suction isolation valves from the RWST close

16. Has an evaluation of the manual actions been performed to determine the change in the environment in which the operator is expected to perform the actions effected by the license amendment request (LAR)? Does this affect the ability of the operator to successfully complete the manual actions necessary to manually re-align the two internal RSS pumps in BVPS-2, and as well as, stop the QSS pumps for BVPS-1 and 2 when the RWST Level Low alarm is received?

Response:
Based on preliminary dose assessments for plant vital areas, the dose increases are minimal and not expected to impact the ability of operators to safely complete such actions. As described above, the transfer of the BVPS-2 HHSI suction from the RWST to the RSS pumps is automatic and no manual operator actions are required to accomplish this. There will be no effect on the ability of the operator to stop the QSS pumps when the RWST alarm is received indicating the tank is nearing empty. The timing of RWST drawdown is not impacted by the change in the start time of the RSS pumps since these pumps do not draw from the RWST. This action is taken in the control room and the environment is essentially unchanged.

17. How will the proposed LAR affect the times associated with the manual actions required for the operators to perform their tasks?

a. What is the current available response time for operators to manually re-align the two internal RSS pumps at BVPS-2?

Response:
As stated in the response to question 5, the RSS pumps are automatically realigned and no manual operator actions are required to accomplish the realignment.

b. If the operator response times were affected by the proposed LAR, indicate how the response times have changed, and as well as, how they will be validated.

Response:
No operator response times are affected by the proposed LAR.

c. How will the current operator response times be affected by the proposed signal delay to the RSS pumps? What is the expected time frame in which the RSS pumps for both Units initiate upon receipt of the RWST Level Low signal?

Response:
No operator response times are affected by the proposed signal delay to the RSS pumps. The RSS pumps start immediately upon receipt of the RWST level low signal as long as a Containment Pressure High-High signal is present (except for a 15 second delay for the ORS pumps at BVPS-1 for emergency diesel generator loading considerations). For BVPS-1, the minimum calculated RSS pump start time is approximately 20 minutes following initiation of a large LOCA. For BVPS-2, the minimum calculated start time is approximately 37 minutes. The BVPS-2 start times are longer due to the larger volume of the RWST. The maximum start time is approximately 3 hours which occurs for very small break sizes (~1 inch).

18. Are the manual actions included in the Emergency Operating Procedures, Abnormal Operating Procedures, or normal operating procedures as a part of the BVPS-1 and 2 UFSAR? If so, how will the procedures be changed due to the proposed LAR?

Response:
Any required manual actions are or will be included in the Emergency Operating Procedures or by reference to other operating procedures. The FENOC process requires that LARs be reviewed by the station to determine what procedure changes are required. The associated Engineering Change Packages (ECPs) have similar requirements in the form of a Design Interface Evaluation (DIE). Procedure changes associated with the proposed modifications have been identified and are scheduled for completion prior to amendment implementation. Procedure changes are evaluated under 10 CFR 50.59 to ensure consistency with the UFSAR and to verify the changes can be made without NRC approval.

19. Indicate how the operators will be informed of the change to the usage of RSS pumps with the delayed signal. Describe all changes to operator actions, control

room modifications (displays, controls, alarms, etc.), and operator training methods that will be affected by this proposed change to the RSS.

Response:
Two new operator actions will be incorporated as part of the overall sump modifications. These operator actions are not directly required to support the proposed modification to the RSS start signal but have been incorporated into the associated analyses. At BVPS-1, a new operator action will be added to the emergency operating procedures to direct the operators to shut down two of the four operating RSS pumps after reaching transfer to safety injection recirculation mode (RWST Level Extreme Low). No action is required in the event only a single train is operating. The purpose of this action is to limit the maximum flow through the containment sump strainer. This helps to minimize the strainer head loss. At BVPS-2, a new operator action will be added to the emergency operating procedures to shut down a RSS train or pump if that train or pump does not have service water available to the RSS heat exchanger. The purpose of this action is to limit the heat input into containment and to assure that un-cooled containment sump water is not directed to Safety Injection piping. These actions will be validated during operator training prior to implementation.

BVPS-1 Control Room Modifications include:

1. New Status Lights:
    a. Add 22A - "RWST LOW LEVEL" (Red light) for Channel I
    b. Add 22C - "RWST LOW LEVEL" (Blue light) for Channel III
    c. Add 22D - "RWST LOW LEVEL" (Yellow light) for Channel IV

2. Annunciator Windows:
    a. Rename existing window A1-26 to read, "1/4 REFUELING WATER STORAGE TANK LEVEL EXT LOW".
    b. Rename existing window A1-25 to read, "2/4 RWST EXT LOW LEVEL & SI AUTO XFR SI INJ TO RECIRC INITIATED".
    c. Add new window A1-99 "1/3 REFUELING WATER STORAGE TANK LEVEL LOW" actuates on any Channel I, III, or IV RWST Low Level signal.

3. Computer Points
    a. Add Sequence of Events Point 63, 1/3 RWST Level Low
    b. Add In-Plant Computer Point, Y9032D RWST Level Low Channel I
    c. Add In-Plant Computer Point, Y9033D RWST Level Low Channel III
    d. Add In-Plant Computer Point, Y9034D RWST Level Low Channel IV

BVPS-2 Control Room Modifications include:

1. Relocate status lights based on human factors
   a. 8A, PRI PROT RACK DOOR OPEN (Red Light)
   b. 8B, PRI PROT RACK DOOR OPEN (White Light)
   c. 8C, PRI PROT RACK DOOR OPEN (Blue Light)
   d. 8D, PRI PROT RACK DOOR OPEN (Yellow Light)

2. Add Status Panel Lights
   a. 23A, RWST LO LEVEL CHAN I (Red Light)
   b. 23C, RWST LO LEVEL CHAN III (Blue Light)
   c. 23D, RWST LO LEVEL CHAN IV (Yellow Light)

3. Rename Status Lights
   a. 24A, RWST EXT-LO LEVEL CHAN I (Red Light)
   b. 24B, RWST EXT-LO LEVEL CHAN II (White Light)
   c. 24C, RWST EXT-LO LEVEL CHAN III (Blue Light)
   d. 24D, RWST EXT-LO LEVEL CHAN IV (Yellow Light)

4. Rename Bypass Status Lights
   a. 4A, RWST EXT-LO LEVEL CHAN I TEST (Red Light)
   b. 4B, RWST EXT-LO LEVEL CHAN II TEST (White Light)
   c. 4C, RWST EXT-LO LEVEL CHAN III TEST (Blue Light)
   d. 4D, RWST EXT-LO LEVEL CHAN IV TEST (Yellow Light)

Training:

The Training Department has completed a Design Interface Evaluation as part of the Engineering Change Package (ECP) program and has identified Operations and I&C Maintenance as requiring training for both Units. Lesson plans will be updated to incorporate the appropriate subject matter. The simulator will be modified and applicable training will be conducted for the required operations personnel. The training documentation has been identified for update and is being tracked as part of the ECP process. Existing operator training methods will not be affected by the proposed changes to the RSS.