UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 280 TO FACILITY OPERATING LICENSE NO. DPR-66

FIRSTENERGY NUCLEAR OPERATING COMPANY

FIRSTENERGY NUCLEAR GENERATION CORP.

BEAVER VALLEY POWER STATION, UNIT NO. 1

DOCKET NO. 50-334

1.0 INTRODUCTION

By letter dated February 9, 2007 (Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML070440341), as supplemented by letters dated August 8 (ADAMS Accession No. ML072250025), August 23 (ADAMS Accession No. ML072390013), and September 13, 2007 (ADAMS Accession No. ML072600022), the FirstEnergy Nuclear Operating Company (FENOC, the licensee), submitted a request for changes to the Beaver Valley Power Station, Unit No. 1 (BVPS-1) Technical Specifications (TSs).

The supplemental letters dated August 8, August 23, and September 13, 2007, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the Nuclear Regulatory Commission (NRC) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on April 24, 2007 (72 FR 20383).

The proposed changes would address Generic Safety Issue 191 (GSI-191), "Assessment of Debris Accumulation on PWR [Pressurized-Water Reactor] Sump Performance" and Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design-Basis Accidents at Pressurized-Water Reactors" by implementing TS changes that reflect the use of a new recirculation spray system (RSS) pump start methodology and changes in the method of calculating post-accident containment temperature, pressure, and condensation rates. Specifically, the proposed changes would revise the method for starting the inside and outside containment RSS pumps in response to a design-basis accident (DBA). The licensee has proposed to change the start signal for the RSS pumps from a fixed time delay to an Engineered Safety Feature Actuation System (ESFAS) signal based on a refueling water storage tank (RWST) Level Low, coincident with a Containment Pressure High-High signal. This change to the RSS pump start methodology results from the replacement of containment sump screens. Additionally, proposed changes to the calculation methodology used to determine aerosol removal coefficients for use in dose consequence analyses, specifically the design-basis loss-of-coolant accident (LOCA) analysis, would result in the use of the Modular Accident Analysis Program-Design Basis Accident (MAAP-DBA) code instead of the LOCTIC code to

calculate containment pressure, temperature and condensation rates for input to the SWNAUA code.

Specifically, the licensee proposes to amend the following TS sections to reflect implementation of the new RSS pump start methodology:

- TS 3.3.2, "ESFAS Instrumentation," Table 3.3.2-1, Function 2, Containment Spray.
- TS 3.3.2, "ESFAS Instrumentation," Table 3.3.2-1, Function 7, Automatic Switchover to Containment Sump.
- TS 3.5.2, "ECCS [emergency core cooling system]-Operating."
- TS 3.6.5, "Containment Air Temperature."
- TS 5.5.12, "Containment Leakage Rate Testing Program."

2.0 REGULATORY EVALUATION

The General Design Criteria (GDC) included in Appendix A to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, did not become effective until May 21, 1971. The Construction Permit for BVPS-1 was issued in June 1970; consequently, this unit was not subject to GDC requirements (Ref. SECY-92-223, dated September 18, 1992). The updated final safety analysis report (UFSAR) states that BVPS-1 has been designed and constructed to comply with the "General Design Criteria for Nuclear Power Plant Construction," published in July 1967 by the AEC. However, Appendix 1A of the UFSAR provides a discussion of the degree of conformance to the AEC GDC published as Appendix A to 10 CFR Part 50 in July 1971, which indicates that it meets the intent of the GDC.

- Criterion 16-*Containment design* which states, "Reactor containment and associated systems shall be provided to establish an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require."

- Criterion 38-*Containment heat removal* which states, in part, "A system to remove heat from the reactor containment shall be provided. The system safety function shall be to reduce rapidly, consistent with the functioning of other associated systems, the containment pressure and temperature following any loss-of-coolant accident, and maintain them at acceptably low levels."

- Criterion 50-*Containment design basis* which states, "The reactor containment structure, including access openings, penetrations, and the containment heat removal system shall be designed so that the containment structure and its internal compartments can accommodate, without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from any loss-of-coolant accident. This margin shall reflect consideration of (1) the effects of potential energy sources which have not been included in the determination of the peak conditions, such as energy in steam generators and as required by [10 CFR] 50.44 energy from metal-water and other chemical reactions that may result from degradation but not total failure of emergency core cooling functioning, (2) the limited experience and experimental data

- 10 CFR 50.36, "Technical specifications," requires a licensee's TS to establish LCOs and SRs for equipment that is required for safe operation of the facility. Specifically, Section 50.36(c)(2)(ii) stipulates the LCO requirements.

- 10 CFR 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants," requires licensees to establish programs to qualify electric equipment important to safety.

- RG 1.9, Revision 2, "Selection, Design, Qualification and Testing of Emergency Diesel Generator Units used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants."

The area of human factors deals with programs, procedures, training, and plant design features related to operator performance during normal and accident conditions. The NRC staff's review covered changes to operator actions, human-system interfaces, procedures, and training needed for the proposed TS modifications. The NRC staff's evaluation for human factors was based on the following documents: GDC-19; 10 CFR 50.120; 10 CFR Part 55; American National Standards Institute and American Nuclear Society Standard 58.8 1994, "Time Response Design Criteria for Safety-Related Operator Actions;" and the guidance in GL 82-33. Specific review criteria are contained in SRP 13.2.1, 13.2.2, 13.5.2.1, and Chapter 18.0.

3.0 TECHNICAL EVALUATION

3.1 Containment and Net Positive Suction Head (NPSH) Analysis

BVPS-1 is a three-loop Westinghouse PWR originally licensed with a subatmospheric containment design. However, by letter dated February 6, 2006 (ADAMS accession number ML060100325), the Commission approved conversion of the BVPS-1 containment from subatmospheric to atmospheric operating conditions. The engineered safeguards features that mitigate a LOCA or main steamline break accident (MSLB) event include the following (Chapter 6 of the UFSAR):

- A safety injection (SI) system that injects borated water into the cold legs of all three reactor coolant loops.

- Two separate low-head safety injection (LHSI) subsystems, either of which provides long-term removal of decay heat from the reactor core.

- Two separate subsystems of the spray system, quench spray subsystem (QSS) and RSS, which, when operating together, reduce the containment pressure and temperature, and remove heat from the containment. The RSS transfers the heat from the containment to the service water (SW) system.

The QSS consists of two pumps which start on a Containment Pressure High-High signal and draw suction from the RWST, and spray into containment via spray headers to reduce containment temperature and pressure. The RSS system consists of four pumps. Two RSS pumps are located inside the containment (inside recirculation spray (IRS)) and take suction directly from the containment sump, while the other two RSS pumps are located outside the

To perform independent confirmatory dose calculations, the staff used the NRC-sponsored radiological consequence computer code, "RADTRAD: Simplified Model for RADionuclide Transport and Removal And Dose Estimation," Version 3.03, as described in NUREG/CR-6604, "A Simplified Model of Aerosol Removal by Containment Sprays," dated June 1993. The RADTRAD code, developed by the Sandia National Laboratories for the NRC, estimates transport and removal of radionuclides and the resulting radiological consequences at selected receptors.

3.3.1 Loss-of-Coolant Accident (LOCA)

The proposed TS changes will result in a modification of the post-LOCA RSS pump start methodology. The licensee has proposed to change the start signal for the RSS pumps from a fixed time delay from to an ESFAS signal based on an RWST Level Low, coincident with a Containment Pressure High-High signal. The licensee believes that starting the RSS pumps on this coincident signal provides better assurance of sump water level at RSS pump start over the range of potential break sizes and single failure assumptions, since a fixed amount of water will be transferred from the RWST to containment. The licensee also stated that 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.

The RSS helps mitigates activity release and draws water from the RWST, as credited in the current design-basis LOCA analysis. Therefore, with respect to evaluating LOCA dose consequences, the implications of this RSS pump start methodology change affects spray removal of aerosol iodine released into containment following the postulated LOCA, as well as the timing of activity releases from the RWST leakage pathway. The proposed method for starting RSS pumps will delay activation of the RSS, which will result in a short term increase in air leakage form the containment and a short term reduction in spray removal of airborne radioactivity from the containment atmosphere.

To reflect the implementation of the new RSS pump start methodology, the licensee proposed changes to the current design-basis LOCA dose consequence analysis. All changes to the input parameters used in calculating the radiological consequences of the DBA come as a result of the licensee implementing the use of a new code to determine post-accident containment conditions. Currently, to determine the containment diffusiophoresis-based iodine activity removal using the SWNAUA code, the input parameters of containment pressure, temperature, relative humidity and steam condensation rates are calculated using the LOCTIC code along with a NUREG-1465-based delayed ECCS scenario. The acceptability of this methodology is documented in the NRC staff's letter dated September 10, 2003. For this LAR, the licensee used the MAAP-DBA code, instead of LOCTIC, to calculate containment pressure, temperature, and condensation rates for input to the SWNAUA code. Thus, the EPRI code, MAAP-DBA, is the licensing basis code being used for BVPS-1 containment pressure and temperature calculations. When compared to the LOCTIC code calculations, the MAAP-DBA code approach is consistent with that used in LOCTIC and also calculates conservative results for containment pressure, temperature, and condensation rates.

Table 3.1 identifies the input parameter changes resulting from this implementation of the MAAP-DBA code to calculate a new containment and coolant response that reflects modified RSS pump start time.

Table 3.1
Comparison of Parameter Changes from Current to Proposed Licensing Basis

Input Parameter	Current DBA Value	Proposed DBA Value
CSS Spray Period		
Start (seconds)	720	85.4
End (days)	4	4
Aerosol Spray Removal Rates		
Containment Sprayed Region	Figure 5.3.6-1*	Figure 3.1**
Containment Unsprayed Region	Figure 5.3.6-2*	Figure 3.2**
RWST Backleakage		
Leakage Onset (seconds)	2186	1782
Activity Venting Onset (seconds)	5178	3055
Release Fractions	Figure 5.3.6-3*	Figure 3.3**
ESF Leakage		
Start (seconds)	300	1200
End (days)	30	30
Minimum Sump Volume		
5 minutes – 30 minutes (ft^3)	9800	19,111
30 minutes – 2 hours (ft^3)	28,600	25,333
2 hours – 30 days (ft^3)	65,600	43,577

* Letter dated June 5, 2002 (ADAMS accession number ML021620298)
** Reference 1

Figures E-1 and E-2, from Attachment E of the Enclosure to Reference 1, illustrate the resulting iodine removal rate profile in containment, as calculated with the SWNAUA code using the new input parameters determined by MAAP-DBA. Figure E-3, from Attachment E of the Enclosure to Reference 1, illustrates the change in the RWST iodine release fraction resulting from the RSS pump start methodology change and subsequent containment response recalculation using MAAP-DBA.

No compensatory changes were made to the design-basis LOCA analysis by the licensee to reduce the dose consequences associated with the conservative changes detailed in this LAR. Also, the licensee has not made any methodological changes to the calculation of airborne iodine activity removal in containment or to the release of activity from the RWST. As shown in Table 3.2, the newly calculated dose consequences still remain well within the regulatory limits.

3.4 Containment Sump SR

3.4.1 System and Design Description

The recirculation spray pumps take suction from the containment sump, which is enclosed by a protective screen assembly. The assembly consists of three sections, the inclined bars and two stages of screening. The inclined bars act as trash screens to prevent large pieces of debris from reaching the roughing and final screens. After the bars, there are two stages of screening, the first consisting of a coarse mesh and the second a fine mesh with an opening slightly smaller than the size of the smallest nozzle orifice in the recirculation spray header. The assembly is divided at the center line by screening so that failure of either half does not adversely affect the other half.

A new multi-strainer installation is planned for BVPS-1 in the fall 2007 refueling outage. The strainer is designed with multiple pockets. The new strainer is fabricated from perforated stainless steel plate. The perforated plate has a 3/32 inch opening size, which is slightly smaller than the size of the smallest coolant passage in the reactor core and the orifice size of the spray nozzles. The licensee stated that the replacement strainers do not require a vertical outer trash rack to protect the primary strainer surface.

3.4.2 Proposed TS Change

Currently, TS SR 3.5.2.7 reads as follows:

> Verify, by visual inspection, each ECCS train containment sump suction inlet is not restricted by debris and the suction inlet trash racks and screens show no evidence of structural distress or abnormal corrosion.

The licensee has proposed the following revision to SR 3.5.2.7:

> Verify, by visual inspection, that accessible regions of the ECCS containment sump suction inlet are not restricted by debris and that the accessible regions of the strainers show no evidence of structural distress or abnormal corrosion.

The licensee indicated that the proposed revisions would not fundamentally alter the current inspection practice required by SR 3.5.2.7. Specifically, the licensee will continue to be required to visually inspect the containment sump suction inlet to verify that it is not restricted by debris and that its debris filters show no evidence of structural distress or abnormal corrosion.

3.4.3 Licensee Justification for Proposed TS Change

The proposed changes modify the requirements of SR 3.5.2.7 by removal of the word "train," changing the terminology of "trash racks and screens" to "strainers," and adding the wording "accessible regions" to describe the extent of the visual inspection.

The licensee indicated that the replacement of "trash racks and screens" with "strainers" in SR 3.5.2.7 provides a more appropriate description of the sump configuration after the installation of a larger strainer assembly to address GL 2004-02 is completed. The licensee considers the

removal of the word "train" to be a clarification of the current SR because the sump strainer is a combined header for both ECCS trains, and the word "train" is not needed. The addition of the words "accessible regions" to the SR is due to the size, complexity and location of the new containment sump strainers that limit the extent of the visual inspection. The accessible regions of the strainers are those areas that can be accessed by an inspector without disassembling the strainer unit or the protective grating and plates over the strainers.

3.4.4 NRC Staff's Evaluation

In determining the adequacy of the licensee's proposed TS change, the NRC staff considered whether the planned replacement strainer assembly is capable of fulfilling the design functions of the existing screen and trash rack configuration under the current licensing basis. The design basis function of the emergency sump is to provide a long-term water source for the recirculation function of the ECCS and RSS. The containment depressurization system is designed in accordance with RG 1.82, Rev. 0, "Water Sources for Long Term Recirculation Cooling Following a Loss of Coolant Accident," as it relates to the design of sumps for ECCS and CSS.

3.4.4.1 Changing of the Terminology "trash racks and screens" to "strainers"

As described in the BVPS-1 UFSAR, the function of the trash rack is to prevent large debris from reaching the fine inner screen. This debris could have a significant impact on the current strainer with a comparatively low strainer-to-debris surface area ratio. The replacement strainers have more than 22 times the surface area of the old screens, increasing the strainer-to-debris surface area ratio. The licensee stated that the complex strainer geometry provides a variation in surface contour such that large debris will not completely impede flow. BVPS-1 concluded that the large size, strainer layout, and complex geometry would make it difficult for large debris to fully obstruct the strainers. The NRC staff agrees with this conclusion.

Regulatory Position C.6 in RG 1.82 states that the strength of the trash rack should be considered for protection of the fine inner screen from large debris. The licensee stated that the new sump strainers are robust components made of stainless steel perforated plate that cannot be punctured or cut by sharp debris. Therefore, the licensee concluded that the trash rack surrounding the replacement sump strainers is no longer required to protect the strainers from being punctured or cut.

The NRC staff concludes, based on the information provided by the licensee and the robust construction of the new strainers that trash racks are not needed to protect the strainers from impingement by large debris.

3.4.4.2 Removal of the word “train”

By letter dated August 8, 2007, the licensee provided clarification of whether the strainer replacement represents a change from two independent sumps to a shared sump. The BVPS-1 has a single recirculation sump. In response to an NRC staff question, the licensee provided a copy of its 10 CFR 50.59 evaluation for BVPS-1, entitled "Containment Sump Strainer," dated June 29, 2007. This evaluation notes that, the existing strainer has a screen separating one half of the strainer from the other, such that a failure of one strainer will not have an impact on the

4.0 LICENSEE COMMITMENT

The licensee stated that a new operator action will be incorporated as part of the overall sump modifications. The operator action is not directly required to support the proposed modification to the RSS start signal, but has been incorporated into the associated analysis.

A new operator action will be added to BVPS-1 EOPs to direct the operators to shut down two of the four operating pumps after reaching transfer to SI recirculation mode. No action is required in the event only a single train is operating. The licensee stated that this action will limit the maximum flow through the sump strainer, which helps to minimize the strainer head loss.

The licensee stated that the new operator actions will be verified during operator training prior to implementation.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendment. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (72 FR 20383). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

8.0 REFERENCES

1. FirstEnergy Nuclear Operating Company letter L-07-017, "Beaver Valley Power Station, Unit Nos. 1 and 2, Licensing Amendment Requests Nos. 334 and 205," dated February 9, 2007.

2. FirstEnergy Nuclear Operating Company letter L-07-095, "Beaver Valley Power Station, Unit Nos. 1 and 2, Responses to a Request for Additional Information (RAI) dated July 3, 2007, in Support of Licensing Amendment Request Nos. 334 and 205 (TAC Nos. MD4290, MD4291," dated August 8, 2007.

3. FirstEnergy Nuclear Operating Company Letter L-07-105, "Beaver Valley Power Station, Unit Nos. 1 and 2, Supplemental Information for Licensing Amendment Request Nos. 334 and 205 (TAC Nos. MD4290 and MD4291)," dated August 23, 2007.

4. Technical Report NEI-04-07, Revision 0, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volumes 1 and 2 (Safety Evaluation Report), December 2004.

5. NRC letter dated February 6, 2006, "Beaver Valley Station, Unit Nos. 1 and 2 (BVPS-1 and 2) - Issuance of Amendments Re: Containment Conversion from Subatmospheric Operating Conditions (TAC Nos. MC3394 and MC3395)," Amendment Nos. 271 and 153.

6. FirstEnergy Nuclear Operating Company Letter L-07-126, "Beaver Valley Power Station, Unit Nos. 1 and 2, Supplemental Information in Support of Licensing Amendment Request Nos. 334 and 205 (TAC Nos. MD4290 and MD4291)," dated September 13, 2007.

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3.1.4 TS Changes

The proposed TS changes to TS 3.3.2, reflecting the changes to the RSS pump start signal are appropriately modeled and reflected in the licensee's submittals. The licensee provided reasons and the basis for the proposed change to TS 3.6.5 to increase the upper limit on containment air temperature. The change was appropriately included in the licensee's containment analysis. The proposed TS change to TS 5.5.12 appropriately incorporated the calculated containment internal pressure from the revised containment analysis. Therefore, the NRC staff finds the above referenced TS changes, as described in the References 1 and 3 are acceptable with respect to the containment and NPSH consequences of DBA.

3.2 Containment Spray System ESFAS Instrumentation

The current TS ESFAS instrumentation LCO Table 3.3.2-1 does not indicate that the Containment Spray function is provided by two spray systems; Quench Spray and Recirculation Spray. The current TS table indicates that the Containment Spray function is initiated either manually, by Automatic Actuation Logic and Actuation Relays, or by Containment Pressure-High High signals. The proposed changes divide the Containment Spray system function into Quench Spray and Recirculation Spray functions; each with its own initiation signals, and the respective requirements for applicable modes, required channels, operating conditions, SRs, and the setpoint allowable values. Containment Spray system initiation signals and the LCO requirements in the current TSs will become applicable to the Quench Spray function. The Recirculation Spray function, with its initiation signals, and the LCO requirements will be added in the proposed TSs.

The bases for these TS changes were provided in the LAR, which justified each of the initiation signals and their instrumentation LCO requirements. Recirculation spray will be initiated by Automatic Actuation Logic and also by RWST Level Low coincident with Containment Pressure High-High signals. The licensee proposed allowable values (AVs) for both RWST level and containment pressure instrumentation setpoints. The RWST Level Low allowable value has both upper and lower limits. The AV lower limit is selected to ensure that containment temperatures remain within safety analysis limits. The AV upper limit ensures adequate NPSH to the Recirculation Spray pumps. The licensee stated that the RWST Level Low and Containment Pressure High-High instrumentation setpoint uncertainties were developed in accordance with Westinghouse Setpoint Methodology for Protection Systems, WCAP-11366, Rev. 7, which the NRC staff has previously reviewed and approved as documented in the NRC staff's safety evaluation dated January 11, 2006 (ADAMS accession number ML053530143). By letter dated August 8, 2007, the licensee provided a sample setpoint calculation which the NRC staff has reviewed and found acceptable.

The NRC staff found that the proposed applicable modes, required number of instrumentation channels, operating conditions, and the SRs for each of the three instrumentation signals for the start of RSS pump are acceptable. The NRC staff also found that the proposed instrumentation setpoint AVs for the RWST Level Low and Containment Pressure High-High instrumentation, to automatically start Recirculation Spray of the containment, are acceptable.

3.3 Radiological Consequences of the Design-Basis LOCA

The NRC staff reviewed the regulatory and technical analyses performed by the licensee in support of its proposed LAR, as they relate to the radiological consequences of the design-basis LOCA. Information regarding this analysis was provided in Attachment E to the Enclosure of Reference 1. The licensee's evaluation verified that the offsite, control room, and emergency response facility (ESF) dose consequences remained within limits after implementation of the proposed changes. The current design-basis LOCA analysis was reviewed and approved by the NRC staff, by letter dated September 10, 2003 (ADAMS accession number ML032530204); this current design-basis LOCA analysis remains largely unchanged by this LAR. Therefore, the NRC staff's review is limited to the changes to the existing design-basis LOCA analysis, which includes all new assumptions, inputs, and methods used by the licensee to assess the impacts of the LAR. Where necessary, the NRC staff performed independent calculations to confirm the conservatism of the licensee's analyses.

To perform independent confirmatory dose calculations, the staff used the NRC-sponsored radiological consequence computer code, "RADTRAD: Simplified Model for RADionuclide Transport and Removal And Dose Estimation," Version 3.03, as described in NUREG/CR-6604, "A Simplified Model of Aerosol Removal by Containment Sprays," dated June 1993. The RADTRAD code, developed by the Sandia National Laboratories for the NRC, estimates transport and removal of radionuclides and the resulting radiological consequences at selected receptors.

3.3.1 Loss-of-Coolant Accident (LOCA)

The proposed TS changes will result in a modification of the post-LOCA RSS pump start methodology. The licensee has proposed to change the start signal for the RSS pumps from a fixed time delay to an ESFAS signal based on an RWST Level Low, coincident with a Containment Pressure High-High signal. The licensee believes that starting the RSS pumps on this coincident signal provides better assurance of sump water level at RSS pump start over the range of potential break sizes and single failure assumptions, since a fixed amount of water will be transferred from the RWST to containment. The licensee also stated that 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.

The RSS helps mitigates activity release, as credited in the current design-basis LOCA analysis. Therefore, with respect to evaluating LOCA dose consequences, the implications of this RSS pump start methodology change affects spray removal of aerosol iodine released into containment following the postulated LOCA, as well as the timing of activity releases from the RWST leakage pathway. The proposed method for starting RSS pumps will delay activation of the RSS, which will result in a short term increase in air leakage from the containment and a longer spray removal as shown in Table 3.1 under CSS spray period.

To reflect the implementation of the new RSS pump start methodology, the licensee proposed changes to the current design-basis LOCA dose consequence analysis. Some changes to the input parameters used in calculating the radiological consequences of the DBA come as a result of the licensee implementing the use of a new code to determine post-accident containment conditions. Currently, to determine the containment diffusiophoresis-based iodine activity removal using the SWNAUA code, the input parameters of containment pressure, temperature,

relative humidity and steam condensation rates are calculated using the LOCTIC code along with a NUREG-1465-based delayed ECCS scenario. The acceptability of this methodology is documented in the NRC staff's letter dated September 10, 2003. For this LAR, the licensee used the MAAP-DBA code, instead of LOCTIC, to calculate containment pressure, temperature, and condensation rates for input to the SWNAUA code. Thus, the Electric Power Research Institute (EPRI) code, MAAP-DBA, is the licensing basis code being used for BVPS-2 containment pressure and temperature calculations. When compared to the LOCTIC code calculations, the MAAP-DBA code approach is consistent with that used in LOCTIC and also calculates conservative results for containment pressure, temperature, and condensation rates.

Table 3.1 identifies the input parameter changes resulting from this implementation of the MAAP-DBA code to calculate a new containment and coolant response that reflects modified RSS pump start time.

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Comparison of Parameter Changes from Current to Proposed Licensing Basis

Input Parameter	Current DBA Value	Proposed DBA Value
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RWST Backleakage		
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* Letter dated June 5, 2002 (ADAMS accession number ML021620298)
** Reference 1

Figures E-1 and E-2, from Attachment E of the Enclosure to Reference 1, illustrate the resulting iodine removal rate profile in containment, as calculated with the SWNAUA code using the new input parameters determined by MAAP-DBA. Figure E-3, from Attachment E of the Enclosure to Reference 1, illustrates the change in the RWST iodine release fraction resulting from the RSS

which 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, and the area must be established as a "Restricted Area" to limit personnel entrance during the testing. The NRC staff finds that the licensee's measures to prevent and/or detect functional damage to the new strainers and inadvertent introduction of debris are adequate.

Based upon the information described above, the NRC staff considers the replacement strainer configuration as meeting the intent of the current sump performance licensing basis because the filtration capacity associated with the replacement strainers' large, complex surface is significantly in excess of the filtration capacity associated with the existing screen. Under the current licensing basis, BVPS-2 demonstrates adequate sump functionality based on an assumption, from RG 1.82, Revision 0, that half the area of each of the existing sump screens is covered with debris such that water cannot flow through the blocked portion of the screen, while the other 50% is assumed to remain completely unblocked. Therefore, the NRC staff considers the replacement strainers to be functionally equivalent to (or better than) the existing screens under the non-mechanistic current licensing basis for satisfying the requirements of 10 CFR 50.46(b)(5) for long-term reactor core cooling.

Consistent with the intent of GL 2004-02, current licensing basis compliance is sufficient until December 31, 2007, or until expiration of any extensions to that due date approved by the NRC staff. No later than this date, the NRC staff has requested that licensees complete modifications to their licensing bases for containment recirculation sump performance to ensure consistency with the mechanistic methodology associated with GSI-191. Assurance that the licensee's replacement strainer design is adequate for satisfying the intent of GL 2004-02 will be reviewed by the NRC staff as part of its regulatory activities regarding GL 2004-02 and GSI-191, including reviews of licensees' supplemental responses to GL 2004-02, sample audits of licensees' sump performance calculations, and reviews of generic industry guidance and practices.

3.4.4.4.1 Pipe Whip, Jet Impingement, and Missile Impact

The NRC staff review focused on whether the planned replacement strainer evaluation has adequately considered potential dynamic effects of jet impingement, missile impact, and pipe whip. The NRC staff requested that the licensee provide additional information to ensure the structural integrity of the new passive strainer assemblies. The licensee provided a sketch showing the general arrangement of BVPS-2 containment sump strainer assembly. The new sump strainer will be located at elevation (El) 692-11" of the containment; on the bottom floor of the containment and entirely outside of the crane wall. High energy systems such as Feedwater, Main Steam, Steam Generator Blowdown and Reactor Coolant piping, are isolated from the sump by major structural features, such as walls and floors. The new containment sump strainer will be located adjacent to the containment liner at El 692'-11". The BVPS-2 design is such that the polar crane wall serves as a barrier between the reactor coolant loops and the containment liner. In addition, the refueling cavity walls, various structural beams, the operating floor, and the crane wall, enclose each reactor coolant loop into a separate compartment, thereby preventing an accident which may occur in any loop from affecting another loop or the containment liner. The portions of the steam and feedwater lines within the containment have been routed behind barriers which separate these lines from all reactor coolant piping. The barriers described above will withstand loadings caused by jet forces and pipe whip impact forces. This protection from the dynamic effects of pipe breaks is included in Sections 3.6B.1, 3.6B.2.1.1, "Criteria for Inside

the Containment," and 3.6N.2.2.3 of the BVPS-2 UFSAR.
The existing compartments and the crane wall provide protection from high energy line break effects for the new containment sump strainer assembly.

Components which are considered to have a potential for missile generation inside the reactor containment are the following:

- Control rod drive shaft, and the drive shaft and drive mechanism latched together
- Certain valves
- Temperature and pressure assemblies.

Due to the location and existing protection, a missile from the control rod drive shaft cannot impact the new strainer.

The design and licensing basis for valve stems as potential missiles include only those valves in the region where the pressurizer extends above the operating deck. Valves in this region are the pressurizer safety valves, the motor operated isolation valves in the relief line, the air-operated relief valves, and the air-operated spray valves. Due to their location, these valve stems cannot impact the new strainer assembly.

Temperature elements are installed on the reactor coolant pumps, close to the radial bearing assembly. Based on the locations of these assemblies, a postulated missile cannot impact the new strainer.

The new BVPS-2 containment sump strainer design did not result in piping rerouting in the vicinity of the sump strainer.

3.4.4.4.2 ASME Codes

In response to the NRC staff's questions regarding the codes utilized in the structural design of the sump replacement strainer, the licensee provided the following information:

> The original containment sump screen assembly was composed of a structural steel frame that supported trash racks, two layers of vertical screening that comprised approximately 150 ft^2 of strainer surface area and anti vortex grating located inside the sump screens adjacent to the pump inlets. The top of the frame was covered with steel deck plate.
>
> The frame's vertical columns were welded to embedded plates in the floor. The trash racks were made of vertical 1" x 1/8" galvanized carbon steel grating. Inside the trash racks were vertical screens composed of outer screens with 3/4" square openings of 0.192" diameter wire, 304 stainless steel, and inner wire cloth screens, 3/32" square openings, 0.063" diameter wire, 304 stainless steel. Inside the screens, above the pump suction inlets, was a horizontal layer of 1 x 1/8 anti vortex grating. The frame members and rash racks adjacent to the screens, the vertical screens, and anti vortex grating were all removed and discarded. Original framing and decking at the normal sump area remains as originally installed, because it supports numerous pipes, pumps and equipment.

The modification installed a passive, safety-related strainer assembly engineered by Enercon and fabricated by Transco. The design does not include an active approach for the strainer. Reverse flow back flushing strategy was not used. The new containment sump strainer provides approximately 3300 ft^2 of strainer area. The flow velocity through the screens is 0.009 fps based on upon 12,600 gpm maximum flow and 3,396 ft^2 effective flow area. The strainer configuration is designed to a differential pressure of 5.0 psi.

The new strainer arrangement for BVPS-2 consists of three segments, A, B, & C, with connectors between segments. Segment A is located over the existing sump trench. Each segment has vertically orientated, cylindrical top-hat style strainer assemblies supported on structural frames. Each top-hat is approximately 3 ft long and consists of four perforated plate tubes of different diameters stacked one inside the other. The perforated plates are made from 14 gage stainless steel plates with 3/32" diameter holes. A bypass eliminator material made of woven stainless steel wire is sandwiched between the tubes. Top-hats have a square flange at the bottom for attachment to the supporting frames. A cruciform near the flange acts as a vortex suppressor. Additionally, in segment A, vortex suppression grating is installed between the top-hats and the Recirculation Spray pump inlets. There are water boxes below each of the three separate segments to collect and channel recirculated containment water to the sump trench. The modifications were installed in BVPS-2 during the 2006 refueling outage.

Strainer segment A has fifty-seven (57) of the top-hat modules which consists of an outer perforated tube with a diameter of 15 inches and inner perforated tubes with diameters of 13, 8, and 6 inches. Strainer segments B and C each have twenty-eight (28), fifty-six (56) total, of the top-hat modules which consists of an outer perforated tube with a diameter of 18 inches and inner perforated tubes with diameters of 15, 9, and 7 inches. Containment water enters the top-hats through either the inner or outer perforated tubes and then flows downward through the bypass eliminator material, in the annulus region between the tubes, into the water boxes below.

The Design Code used to design the BVPS-2 containment sump strainer assembly is the AISC Specification for the Design, Fabrication, and Erection of Structural Steel - 7th Edition. The AISC Code does not provide reduction in strength due to elevated temperatures. Therefore, the material property values used at elevated temperatures are from ASME Code Section III 1971 and 1974 Editions. Stud material properties for the Top Hats are from ASME Code Section III 1984.

The new strainer does not provide any support function for any pumps or piping. The superstructure used for the existing screens will continue to provide the pump and piping support. There is no specific method of evaluation discussed within the UFSAR on the design of the containment sump strainer assembly in regards to any design feature.

3.4.4.4.3 Loads and Load Combinations

In response to the NRC staff's questions regarding the loads, and load combinations utilized in establishing the structural integrity of the sump replacement strainer assemblies and the discharge piping, the licensee provided the following information.

The design loads used in the analyses are:

1. Dead Load (DL)
2. Faulted Seismic (SSE)
3. Live Load (LL)
4. Pressure Differential
5. Jet Impingement

The loading combination consider in the analysis include:
DL + Seismic (SSE) + Differential Pressure
DL + Seismic (SSE) + LL
DL + Jet Impingement

The combinations were computed for Normal and Faulted conditions(SSE). The Upset condition = DL + Sesimic OBE is qualified by comparison to the Faulted load case = DL + Seismic SSE + LL. The live load is considered to by 75 lb / ft2 or 734 lb / ft2 on the overhead grating.

The BVPS-2 strainer Top-Hats are bolted to supporting structures. The Top-Hats were analyzed by hand calculations. The strainer supporting structures were designed as space frames using GTSTRUDL dynamic analysis and hand calculations. Modifications to the strainer supporting structure during installation were evaluated using PC-PREPS static analyses.

3.4.4.4.4 Temperature Effect

The three strainer segments are independently supported. Segment A frame support members are welded to the existing embedded floor plates. The support frame is divided into five separate bays. The support frame members between and within the bays have slotted bolt holes to allow for thermal expansion. Strainer segments B & C are attached to the containment floor with expansion type concrete anchors. One end of segment B is fixed and is allowed to grow thermally toward Segment C. One end of segment C is fixed and is allowed to grow thermally away from Segment B. The connection between segments B & C has slotted holes to accommodate thermal expansion. The support frame members within segments B & C have slotted bolt holes to allow for thermal expansion.

3.4.4.4.5 Structural Integrity of the Strainer Components

Table 3.4.4.4.5-1 provides a listing of major components with their design margins. In some cases (e.g, anchor bolts or welds) the margin presented is the smallest margin presented in the analysis for the same type components. The majority of components have a substantial margin of safety.

Table 3.4.4.4.5-1

Component	Actual Value	Allowable Value	Margin (%)
Main Frame			
Member	0.83	1.0	17
Cover Plate	7149 psi	17250 psi	59
Vertical Plate	3488 psi	3974 psi	12

Horizontal Plate	8843 psi	17250 psi	49
Component	**Actual Value**	**Allowable Value**	**Margin (%)**
Connection Plate	13521 psi	17250 psi	22
Embedment Plate (studs)	0.99	1.0	1
Weld	0.97	1.0	3
Extension Frame			
Member	0.77	1.0	23
Base Plate (Anchor Bolt)	1.015	1.0	*
Weld	0.85	1.0	15
Side Seal Plate	9038 psi	17250 psi	48
Connector Plates	18070 psi	20700 psi	13
Top Hats			
Top Hat	600 psi	1498 psi	60
Studs	0.2	1.0	80
Cover Plate	8019 psi	16875 psi	52
Welds	202 lb/in	563 lb/in	64

* Margin is not quantified due to use of engineering judgment.

The computed stresses in the various structural components of the strainer assembly are within their allowable stress limits. The margin for each strainer component was determined. Most components were determined to have significant margin, and every analyzed strainer component was determined to be within its allowable stress limits.

3.5 Equipment Qualification Analysis and Emergency Diesel Generator (EDG) Loading Impact

3.5.1 EQ Analysis

The licensee proposed to change the upper limit on containment average air temperature from 105 °F to 108 °F. The licensee stated, "This change incorporates the revised containment analysis upper limit on containment average air temperature." This resulted in a maximum containment temperature slightly above the current EQ envelope. On Page 3 of Attachment D to the letter dated February 9, 2007, 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 of the enclosure to Reference 1 provides a discussion of EQ analysis and states that analysis of the impact of the increased equipment qualification profile is ongoing and will be completed prior to approval of this LAR, and the subsequent operation with the proposed change to the RSS pump start signal.

The NRC staff requested the licensee provide any impact on its EQ program due to increase in the normal ambient temperature and radiation doses due to the proposed LAR. By letters dated August 8, 2007, and January 25, 2008, the licensee provided the EQ analysis and calculation summary.

The licensee provided the BVPS-2 EQ calculation summary and the accident analysis temperature results for various LOCA and MSLB cases in support to this LAR. The licensee established a new composite temperature profile by bounding the accident analysis temperature overall peak and duration results. The licensee performed EQ evaluations for all EQ equipment inside containment using this composite EQ temperature profile. The licensee, in its letter dated January 25, 2008, stated that (1) the pressure profile did not change due to this LAR and (2) the equipment in the areas that experienced dose increases remained qualifed and no area became a harsh environment as a result of the dose increase. Based on the above analysis and EQ calculations, the licensee concluded that EQ equipment both inside and outside containment remains qualified for the proposed LAR and it was not necessary to replace or re-qualify any equipment as a result of this LAR.

Based on its review of the licensee's submittals, the NRC staff finds that the licensee's EQ analysis is in compliance with 10 CFR 50.49 for BVPS-2.

3.5.2 EDG Loading

In Section 4.1.7, of the enclosure to the letter dated February 9, 2007, the licensee addressed EDG loading. It stated that with the proposed RSS pump start change, all four RSS pumps will start immediately following receipt of an RWST Level Low signal coincident with a Containment Pressure High-High signal. The maximum load on the 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.

The NRC staff requested the licensee to confirm that the revised loading sequence has been re-evaluated to verify that it meets RG 1.9, as it pertains to its load accepting capability. The licensee provided an evaluation of the impact on the EDG due to this LAR. The revised loading sequence has been re-evaluated to verify that it meets RG 1.9, as it pertains to its load accepting capability of RSS motor loads in conjunction with other ESF step loads.

The BVPS Unit 2 EDGs have 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).

Based on its review of the licensee's submittal, the NRC staff finds that the revised loading sequence for BVPS-2 EDGs is consistent with the guidance of RG 1.9 and the existing EDG loading capacity bounds the revised loading for the proposed design change. Based on this information, the NRC staff concludes that the proposed design change is acceptable.

3.6 Human Factors

3.6.1 Operator Actions Affected

The licensee requested TS changes related to the modification of the RSS pumps start signal initiation. The proposed chance requires a coincident Containment Pressure High-High/ RWST Level Low ESFAS signal instead of a fixed time delay signal. This results in the RSS pump to start automatically as driven by plant conditions. This section evaluates the modified or

additional operator manual actions proposed for addition to the Emergency Operating Procedures (EOPs) and Abnormal Operating Procedures (AOPs), the effect on existing operator action times, and any impacts to the control room environment.

3.6.2 New and Modified Operator Actions in EOPs and AOPs

The licensee will also add a new operator manual action to the EOPs to shut down an RSS pump or train, if service water is unavailable to the RSS heat exchanger. The purpose of this new operator manual action is to limit the heat input into containment and to assure that un-cooled containment sump water is not directed to SI piping. The operators complete these actions from the control room. These new operator actions will be validated using both classroom and simulator training.

Currently, the EOPs instruct the operators to monitor pump operation for signs of cavitation. If the RSS pumps are cavitating, procedures provide instructions for the operators to shut the pumps down until adequate inventory in the sump is available as indicated by the sump level indicators.

The licensee process requires that LARs are reviewed to determine what procedure changes are required including operator actions in the EOPs or by reference to other operating procedures. The associated Engineering Change Packages (ECPs) have similar requirements in the form of a Design Interface Evaluation (DIE). Procedure changes associated with the proposed RSS pump start signal modification have been identified and are scheduled for completion prior to amendment implementation. Procedure changes are currently evaluated under 10 CFR 50.59 to ensure consistency with the UFSAR and verify that the procedure changes can be made without NRC approval.

The NRC staff has reviewed the proposed new manual actions for the EOPs to support the LAR. The NRC staff determined that the new operator manual actions do not result in changes in either the operating or accident mitigation philosophies. Based on the licensee's description of the actions to be credited in the UFSAR, the licensee's commitment to using a tabletop approach to validate the procedure changes associated with the new operator actions and a technical verification performed on the changes as part of the validation process, the NRC staff finds the new operator manual actions acceptable.

3.6.3 Impact on Existing Operator Action Times

In response to the NRC staff's RAI, the licensee stated that operator response times will remain unaffected by the proposed LAR. The RSS pumps will start automatically upon receipt of the RWST level low signal as long as a Containment Pressure High-High signal is present.
The new operator to shut down RSS pumps, if the associated heat exchanger does not have service water flow, can be completed any time between the actuation of the containment high pressure signal and the transfer to SI recirculation. This provides a minimum time of approximately 40 minutes to complete this action. Currently, the EOPs require operators to check the status of the RSS pumps continuously. The licensee stated given the time available, the steps to shut down the RSS pumps will not alter the timeline associated with the accident scenario.

3.6.4 Changes to Environments in which the Operators Complete Actions

The licensee stated that starting the RSS pumps on a coincident Containment Pressure High-High/RWST Level Low Engineered ESFAS signal would not involve a new operator manual action due to the RSS pump start function being automatic. The transfer of the HHSI pump suction from the RWST to the RSS pumps is also automatic and no additional operator manual actions are required. The automatic function of the RSS pump start signal will not affect the operators' ability to stop the QSS pumps upon receipt of the RWST alarm, which indicates that the RWST 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 takes place in the control room and the environment will be unchanged.

Based on preliminary dose assessments conducted by the licensee, the NRC staff observed that the dose increases are minimal and are not expected to impact the ability of operators to safely complete the existing and new operator manual actions. The licensee also stated that the proposed RSS pump start modification should not adversely affect the habitability of the control room or result in additional heat concerns, smoke, toxic gases, effects of ventilation shutdown or impact the operator manual actions in the locations where the actions are to be taken and along access and egress routes.

3.6.5 Changes to Control Room Controls, Displays and Alarms

In response to the NRC staff's RAI, the licensee provided a list of changes to the control room including the addition of new status lights, updating annunciator windows, updating computer points, relocating status lights based on human factors, addition of status panel lights, and renaming status lights. These changes to the control room will notify the operators of the status of the RWST and other supporting equipment involved in the proposed LAR. The NRC staff reviewed the proposed changes to the control room and concluded that the changes reflect the equipment and logic changes made in the plant in support of the proposed LAR.

3.6.6 Changes to the Operator Training Program

In response to the NRC staff's RAI, the licensee stated that its training department completed a Design Interface Evaluation as part of the ECP program and identified Operations and Instrument and Controls (I&C) Maintenance as areas requiring training. Lesson plans will be updated to incorporate the appropriate subject matter. The training 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 pump start signal.

The NRC staff has reviewed the proposed changes to the operator training program. The NRC staff determines that the changes do not result in changes to the operating or accident mitigation philosophies.

4.0 LICENSEE COMMITMENT

A new operator action will be incorporated as part of the overall sump modifications. The operator action is not directly required to support the proposed modification to the RSS start signal, but has been incorporated into the associated analysis.

The new operator action will be added to the EOPs to shut down an RSS train or pump if that train or pump does not have service water available to the associated RSS heat exchanger. After reaching transfer to recirculation, two of the four RSS pumps (one on each train) re-align to provide flow to the SI header and the HHSI pumps. The RSS heat exchangers are located in the flow path from the RSS pumps to the SI header, thus cooling the water prior to entering the SI system. The current piping analysis is based on a failure of service water to one train of RSS heat exchangers. The sump temperatures at transfer to cold leg recirculation increased by approximately 40 °F due to the additional delay in RSS pump start. The reduced time between RSS pump start and switchover results in less heat removal from the containment sump during this period. The licensee stated that the effects of the delayed start of the RSS pumps together with the assumption of loss of service water on the piping analysis will be alleviated by revising procedures to instruct the operators to secure a RSS train or pump if no service water is available to that train or pump. The licensee further stated that this action will limit the heat input into containment and will ensure that un-cooled sump water is not directed to SI piping.

With the proposed change, the earliest the RSS pumps would start is approximately 40 minutes after the event, where as service water flow to RSS heat exchangers initiates much earlier. The licensee believes that there is adequate time to secure the RSS train without service water. The licensee stated that the new operator action will be validated during operator training prior to implementation.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendment. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (72 FR 20383). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

8.0 REFERENCES

1. FirstEnergy Nuclear Operating Company letter L-07-017, "Beaver Valley Power Station, Unit Nos. 1 and 2, Licensing Amendment Requests Nos. 334 and 205," dated February 9, 2007.

2. FirstEnergy Nuclear Operating Company letter L-07-095, "Beaver Valley Power Station, Unit Nos. 1 and 2, Responses to a Request for Additional Information (RAI) dated July 3, 2007, in Support of Licensing Amendment Request Nos. 334 and 205 (TAC Nos. MD4290, MD4291," dated August 8, 2007.

3. FirstEnergy Nuclear Operating Company Letter L-07-105, "Beaver Valley Power Station, Unit Nos. 1 and 2, Supplemental Information for Licensing Amendment Request Nos. 334 and 205 (TAC Nos. MD4290 and MD4291)," dated August 23, 2007.

4. Technical Report NEI-04-07, Revision 0, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volumes 1 and 2 (Safety Evaluation Report), December 2004.

5. NRC letter dated February 6, 2006, "Beaver Valley Station, Unit Nos. 1 and 2 (BVPS-1 and 2) - Issuance of Amendments Re: Containment Conversion from Subatmospheric Operating Conditions (TAC Nos. MC3394 and MC3395)," Amendment Nos. 271 and 153.

6. FirstEnergy Nuclear Operating Company Letter L-07-126, "Beaver Valley Power Station, Unit Nos. 1 and 2, Supplemental Information in Support of Amendment Request Nos. 334 and 205 (TAC Nos. MD4290 and MD4291)," dated September 13, 2007.

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