March 24, 2010

Mr. Barry S. Allen
Site Vice President
FirstEnergy Nuclear Operating Company
Davis-Besse Nuclear Power Station
Mail Stop A-DB-3080
5501 North State Route 2
Oak Harbor, OH 43449-9760

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1 - ISSUANCE OF AMENDMENT RE: APPLICATION TO UPDATE THE LEAK-BEFORE-BREAK EVALUATION FOR THE REACTOR COOLANT PUMP SUCTION AND DISCHARGE NOZZLE DISSIMILAR METAL WELDS (TAC NO. ME2310)

Dear Mr. Allen:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 281 to Facility Operating License No. NPF-3 for the Davis-Besse Nuclear Power Station, Unit 1. The amendments are in response to your application dated September 28, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML092790447), as supplemented by letter dated January 20, 2010 (ADAMS Accession No. ML100250131).

The amendment approves changes to the current licensing basis for Davis-Besse Nuclear Power Station, Unit 1 (DBNPS) associated with the leak-before-break (LBB) evaluation for the reactor coolant pump suction and discharge nozzle dissimilar metal welds. By correspondence January 30, 2009 (ADAMS Accession No. ML090350070) FirstEnergy Nuclear Operating Company proposed alternatives to certain requirements associated with reactor vessel nozzle, reactor coolant pump nozzle, and reactor coolant piping weld repairs.

The Nuclear Regulatory Commission (NRC) approved alternatives (ADAMS Accession Nos. ML100271531 and ML100080573) support application of optimized weld overlays or full structural weld overlays. Applying these weld overlays on the reactor coolant pump (RCP) suction and discharge nozzle dissimilar welds requires an update to the leak-before-break evaluation. Therefore, pursuant to the requirements of General Design Criterion 4 in Appendix A of Title 10 of the *Code of Federal Regulations*, Part 50, the NRC staff approves the proposed updated leak-before-break evaluation.

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

Michael Mahoney, Project Manager
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-346

Enclosures:
1. Amendment No. 281 to NPF-3
2. Safety Evaluation

cc w/encls: Distribution via Listserv

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ADAMS Accession No. ML100640506 By Memo Dated

OFFICE	LPL3-2/PM	LPL3-2/LA	CPNB/BC	OGC	LPL3-2/BC
NAME	MMahoney	THarris (Via Email)	TLupold	DRoth(NLO)	SCampbell
DATE	03/8/10	03/18/10	03/05/10*	03/10/10	03/24/10

OFFICIAL AGENCY RECORD

FIRSTENERGY NUCLEAR OPERATING COMPANY

DOCKET NO. 50-346

DAVIS-BESSE NUCLEAR POWER STATION,

UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 281
License No. NPF-3

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by FirstEnergy Nuclear Operating Company (FENOC, the licensee), dated September 28, 2009, as supplemented by letter dated January 20, 2010, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended to authorize revision of the current licensing basis for Davis-Besse Nuclear Power Station, Unit 1, as set forth in the application for amendment by the licensee; dated September 28, 2010, as supplemented by letter dated January 20, 2010.

3. This license amendment is effective as of its date of issuance and shall be implemented within 90 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Stephen Campbell, Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Updated Final Safety Analysis Report

Date of Issuance:March 24, 2010

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

AMENDMENT NO. 281 TO FACILITY OPERATING LICENSE NO. NPF-3,

DOCKET NO. 50-346

1.0 INTRODUCTION

By letter dated September 28, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML092790447), FirstEnergy Nuclear Operating Company (FENOC, the licensee), submitted a license amendment request with an updated leak-before-break (LBB) evaluation, "Leak-Before-Break Evaluation for Reactor Coolant Pump Suction and Discharge Nozzle Weld Overlays for Davis-Besse Nuclear Power Station (DBNPS)," Revision 0, to assess the design basis of the original LBB evaluation in light of the upcoming weld overlay installation of Alloy 82/182 dissimilar metal welds (DMW) at reactor coolant pump (RCP) suction and discharge nozzles at DBNPS, Unit 1. The overlay installation is scheduled for the spring 2010, refueling outage.

By letter dated January 20, 2010 (ADAMS Accession No. ML100250131), the licensee responded to the Nuclear Regulatory Commission (NRC) staff's request for additional information and submitted Revision 1 of the updated LBB evaluation (ADAMS Accession No. ML100250132 for the non-proprietary version and ML100250133 for the proprietary version).

2.0 REGULATORY EVALUATION

Appendix 3D of the Davis-Besse Updated Final Safety Analysis Report provides details of applicability and conformance of Appendix A, "General Design Criterion" (GDC) 4, "Environmental and dynamic effects design bases," to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR 50). GDC-4 establishes the minimum design requirements for the principal design criteria of water-cooled nuclear power plants. GDC-4, states, in part, that structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with postulated accidents. However, dynamic effects associated with postulated pipe ruptures may be excluded from the design basis when analyses reviewed and approved by the NRC demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping.

The concept of LBB is based on analyses and experimental data demonstrating that certain pipe material has sufficient fracture toughness (ductility) to prevent a small through-wall flaw from propagating rapidly and uncontrollably, to catastrophic pipe rupture, and ensure the probability of pipe rupture is extremely low. The small leaking flaw is demonstrated to grow slowly, and the limited leakage would be detected by the reactor coolant system (RCS) leakage detection system early such that licensees would shutdown the plant to repair the pipe long before potential failure. The concept of LBB is permitted under 10 CFR Part 50, Appendix A, GDC-4.

NRC Standard Review Plan (SRP) Section 3.6.3, "Leak-Before-Break Evaluation Procedures," Revision 1, and NUREG-1061, Volume 3, "Report of the U.S. Nuclear Regulatory Commission Piping Review Committee, Evaluation of potential for Pipe Breaks," dated November 1984, provides screening criteria, safety margins, and an analytical method for the piping systems to be qualified for LBB. A LBB evaluation of specific piping configuration based on fracture mechanics is required to meet the requirements of GDC-4.

3.0 TECHNICAL EVALUATION

3.1 Background

Appendix 3D of the Davis-Besse Updated Final Safety Analysis Report provides details of applicability and conformance of GDC-4.

In the early 1980's, Babcox and Wilcox (B&W) performed a generic LBB evaluation for the B&W nuclear plants as documented in topical report BAW-1847, "The BAW Owners Group Leak-Before-Break Evaluation of Margins Against Full Break for the RCS [reactor coolant system] Primary Piping of the B&W Designed NSS [Nuclear Steam Supply]," Revision 1. The topical report is applicable to the RCS piping at DBNPS. The RCP discharge and suction nozzles and associated piping are part of the RCS primary piping.

By letter dated February 18, 1986, the NRC approved the topical report, BAW-1847, based on the conditions that (1) LBB provisions are incorporated into GDC-4 of 10 CFR Part 50, Appendix A, and (2) submission of an acceptable RCS leakage detection systems per NRC Regulatory Guide (RG) 1.45, "Guidance on Monitoring and Respondong to Reactor Coolant System Leakage." GDC-4 was modified in April 1986, and October 1987, through the rulemaking process. By letter dated November 6, 1990, the licensee provided information regarding the RCS leakage detection systems and subsequently implemented LBB for the RCS piping at DBNPS.

Many pressurized-water reactor (PWR) plants use nickel-based Alloy 82/182 weld metal in the DMW in their RCS piping. Operating experience has shown that Alloy 82/182 weld metal is susceptible to primary water stress-corrosion cracking (PWSCC) in the PWR environment. The screening criteria in SRP Section 3.6.3 do not accept the application of LBB on piping systems susceptible to active degradation mechanisms such as PWSCC. However, at the time of LBB evaluations performed in the 1980's and 1990's, degradation of Alloy 82/182 DMW from PWSCC had not been identified.

To mitigate potential PWSCC in DMW, the licensee proposed to apply full structural weld overlays (FSWOL) or optimized weld overlay (OWOL) on the RCP nozzles, which requires several layers of weld metal to be deposited on the outside surface of the DMW. The FSWOL has more weld layers than the OWOL. The weld overlays generate compressive stresses on the inner wall region of the DMW to mitigate initiation and growth of potential PWSCC. For the RCP discharge nozzle, the licensee will install either FSWOLs or OWOL on the DMW depending on the flaw size detected in the original DMW. For the RCP suction nozzle, the licensee will install only the FSWOL on the DMW. For overlay installation, the licensee will use Alloy 52 or 52M weld material which has been shown to be less susceptible to PWSCC than Alloy 82/182 weld material. The weld overlays are designed in accordance with the requirements for weld metal specifications, crack growth calculations, non-destructive examination (NDE) and pressure tests. Additional description of the weld overlay design is discussed below. The NRC approves LBB evaluations based on specific pipe system with specific pipe geometry and configuration. The weld overlay installation on the LBB-approved RCP piping changes, the piping geometry, and the design basis of the original LBB evaluation. SRP Section 3.6.3 specifies that the worst loads should be applied to the worst pipe location(s) to demonstrate that safety margins in SRP Section 3.6.3 are satisfied. Normally, a LBB evaluation analyzes several pipe locations with the worst load combinations to ensure that all possible worst-case scenarios have been addressed. However, when a weld overlay is installed on a DMW, it is not clear whether the worst-case location with the worst-case load combination in the original LBB evaluation would bound the overlaid DMW. Therefore, licensees will update their original LBB evaluation to show that the design basis is maintained after weld overlay installation (i.e., demonstrate the overlaid DMW satisfies the safety margins). Licensees will revise their Updated Final Safety Analysis Report after receipt of the safety evaluation to document the resolution of this issue.

The RCP suction nozzle is directly welded to a pipe elbow with a DMW without a safe-end. The RCP suction nozzle is made of cast austenitic stainless steel (CASS) with a nominal inside diameter of 28 inches. The elbow is made of carbon steel and its inside surface is clad with stainless steel. The licensee will apply a FSWOL to a portion of the suction nozzle, DMW, and a portion of the elbow.

The RCP discharge nozzle is welded to a stainless steel safe-end with a stainless steel weld. The downstream of the safe-end is welded to the carbon steel pipe elbow with a DMW. The licensee proposed to apply either a FSWOL or OWOL on a portion of the safe-end, DMW and a portion of the elbow. The discharge nozzle will not be covered with the weld overlay.

3.2 Weld Overlay Design

By letter dated January 30, 2009 (ADAMS Accession No. ML090350070), with supplements dated July 13, 2009 (ADAMS Accession No. ML091950627), November 23, 2009 (ADAMS Accession No. ML093360333), and December 15, 2009 (ADAMS Accession No. ML100040016), the licensee submitted Relief Requests RR-A32 and RR-A33 for the OWOL and FSWOL designs, respectively, to be applied on the DMWs of the RCP suction and discharge nozzles.

By letter dated January 21, 2010, the NRC approved Relief Request RR-A33 for the FSWOL design (ADAMS Accession No. ML100080573). By letter dated January 29, 2010, the NRC approved Relief Request RR-A33 for the OWOL design (ADAMS Accession No. ML100271531).

The requirements for the design, stress analyses, crack growth calculations, and examinations of the FSWOL and OWOL are discussed in detail in the above relief requests and respective NRC's safety evaluations. The weld overlay design is discussed herein briefly to demonstrate that PWSCC, an active degradation mechanism affecting the Alloy 82/182 DMW of the subject RCP piping, will be mitigated by the weld overlay and it will no longer be an active degradation mechanism; thereby, the RCP piping will continue to satisfy the screening criteria of SRP 3.6.3.

3.2.1 Weld Overlay Thickness Sizing

The weld overlay thickness affects the critical crack size and leakage calculations in the LBB evaluation. The overlay thickness is derived based on several assumptions and requirements of the American Society of Mechanical Engineers (ASME) Code. The licensee evaluates a postulated or an actual crack in the DMW in accordance with flaw evaluation rules of the ASME

Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components." These rules establish an end-of-evaluation-period allowable flaw size based on the maximum size flaw that can be sustained in the component in accordance with the ASME Code, Section XI, and without violating original design margins of the ASME Code, Section III, "Rules for Construction of Nuclear Facility Components."

The licensee assumes a design flaw size of 100 percent through-wall circumferentially and axially in the original DMW to design the FSWOL thickness. For the OWOL design, the licensee assumes a 75 percent through-wall circumferential flaw and 100 percent through-wall axial flaw to design the OWOL thickness. In the case of higher applied loads, additional overlay thickness may be required. Also, based on inspection requirements and the actual field application, the actual weld overlay thickness may be somewhat greater.

The design of the weld overlay thickness also considers the growth of a postulated or actual flaw in the DMW, depending whether a pre-installation inspection is performed. In general, for the FSWOL design, a 75 percent through-wall flaw is assumed in the DMW. For the OWOL design, the actual flaw size (or a postulated 10 percent through-wall flaw) will be used because pre-installation inspection is required for the OWOL design DMW. As a reference, the FSWOL thickness is approximately one-third of the pipe wall thickness. The OWOL thickness is less than that of the FSWOL thickness.

After installation, the FSWOL will become the new primary system pressure boundary for the DMW. The OWOL plus the outer 25 percent of the original DMW, will become the new primary system pressure boundary.

3.2.2 Residual Stress Consideration

Weld residual stresses are an integral part of the weld overlay design process to demonstrate that the weld overlay is effective in mitigating PWSCC. After installation, the weld overlay generates compressive residual stresses in the inner surface region of the DMW as a result of the weld shrinkage; thereby, minimizing PWSCC initiation and propagation. The industry has performed analytical and experimental studies on overlaid welds of various pipe sizes for the PWR plants demonstrating that the weld overlay will generate favorable compressive residual stresses. A recent weld overlay test program (Reference 1), also demonstrated that measured residual stresses in a typical PWR were highly compressive when a weld overlay was applied to a DMW with a severe inside surface repair in a mid-size diameter pipe.

The residual stress condition of the original DMW joint affects its susceptibility to PWSCC, especially as influenced by in-process repairs performed during plant construction. Thus, to demonstrate the favorable residual stress effects of a weld overlay, the NRC staff expects that licensees assume in their weld residual stress calculation a highly unfavorable, pre-overlay residual stress condition such as that which would result from an inner diameter (ID) surface weld repair of 50 percent through-wall flaw during construction. A weld overlay that can be shown to produce favorable residual stresses will most likely mitigate PWSCC in the DMW.

The NRC staff accepts residual stresses of less than 10 kilopounds per square inch (ksi) at the ID surface of the DMW, after application of the weld overlay, due to residual stresses of less than 10 ksi minimizing crack initiation and crack growth. Also, the crack tip stress intensity factor should be zero or below at the steady state, normal operating conditions. These two criteria will ensure a low probability of initiating new PWSCC cracks and to limit the potential of significant crack propagation in the DMW.

For DBNPS, the licensee performed plant-specific and nozzle-specific stress analysis for the RCP suction and discharge nozzle DMW to determine the residual stress distribution after the application of the OWOL and FSWOL. For each of the nozzle configurations, the licensee simulated a weld repair performed during initial plant construction from the ID surface for a postulated flaw within the original DMW. The as-analyzed weld overlay repair corresponds to the minimum OWOL and FSWOL design dimensions and thus, is considered to be conservative with respect to prediction of minimum compressive stresses in the underlying base material. The DBNPS results indicate that the residual stresses are less than 10 ksi at the ID surface of the DMW.

The licensee's weld residual stress analysis shows that compressive stresses exist through a significant portion of the DMW thickness, demonstrating the effectiveness of the weld overlay to significantly reduce the tensile stresses in the DMW or convert them to compressive stresses and thereby, mitigating PWSCC. The NRC safety evaluations for Relief Request RR-A32, dated January 29, 2010, and for Relief Request RR-A33, dated January 21, 2010, provide more details on the licensee's weld residual stresses.

Based on a review of the residual stress analysis results, the NRC staff finds that the licensee has demonstrated by plant-specific residual stress analysis that the FSWOL at the plant will provide stresses in the inner region on the DMW to mitigate potential PWSCC initiation and propagation.

3.2.3 Crack Growth Calculations

As part of the weld overlay design, the licensee evaluated growth of a postulated flaw in the overlaid DMW caused by fatigue and PWSCC. The licensee used plant design transients, assuming that the defined number of cycles for 40 years, multiplied by a factor of 1.5 to conservatively define cycles for 60 years of operation, is uniformly distributed over the remaining plant operating life to create a history of plant cycles versus time for the fatigue crack growth analysis.

For the fatigue crack growth calculation, the licensee considered all relevant stresses that contribute to fatigue crack growth in the analysis. These stresses result from primary loads such as internal pressure and external piping loads, and secondary loads such as thermal gradient stresses (due to thermal transient events), and weld residual stresses.

For the PWSCC crack growth calculation, the licensee used crack growth equations for Alloy 600 weld metals (i.e., Alloy 82/Alloy 182) and stainless steel weld metals, each with a unique multiplier to account for crack growth in a PWR environment. PWSCC growth is determined by computing the stress intensity factor versus flaw depth curve (K-vs-a) at steady state normal operating conditions. The licensee used the PWSCC growth correlation provided in Reference 2. The licensee also considered crack growth equations for the DMW from NUREG/CR-6721, "Effects of Alloy Chemistry, Cold Work, and Water Chemistry on Corrosion Fatigue and Stress Corrosion Cracking of Nickel Alloys and Welds," U.S. Nuclear Regulatory Commission (Argonne National Laboratory), April 2001, and NUREG/CR-6907, "Crack Growth Rates of Nickel Alloy Welds in a PWR Environment," U.S. Nuclear Regulatory Commission, May 2006.

The NRC staff finds that the licensee has demonstrated by a plant-specific crack growth analysis that it would take a considerable length of time (14 to more than 30 years) for a postulated flaw (either 50 or 75 percent through-wall) in the overlaid DMW to reach the allowable flaw size (either 75 or 100 percent through-wall). During this period, the licensee is required to perform periodic examinations of the overlaid DMWs in accordance with weld overlay design requirements as specified in Relief Requests RR-A32 and RR-33 to verify the structural integrity of the overlaid DMWs.

The NRC staff finds that favorable residual stresses at the inside surface of the overlaid DMW, crack growth criteria, and required inservice inspections will provide reasonable assurance that PWSCC initiation and propagation are minimized and mitigated such that PWSCC would not be considered as an active degradation mechanism in RCP suction and discharge piping.

3.3 Updated LBB Evaluation

3.3.1 Scope of the Updated LBB Evaluation

The RCP suction and discharge nozzles and associated piping are part of the RCS piping that is within the scope of the original LBB evaluation at DBNPS. The NRC staff notes that SRP Section 3.6.3 safety margins calculated for all other RCS piping components in the original LBB evaluation are still valid. However, the configuration of the original DMW will be changed after the weld overlay (either an FSWOL or OWOL) is installed. Therefore, the scope of the updated LBB evaluation includes only the RCP suction and discharge nozzles and associated DMWs, safe-ends, and pipe elbows. The objective of the updated LBB evaluation is to demonstrate, by analysis, that the overlaid DMWs maintain the two major margins of SRP Section 3.6.3: (1) a margin of 2 between critical crack size and leakage crack size (i.e., the critical crack size should be twice as long as the leakage crack size), and (2) a margin of 10 between the leak rate and the detection capability of the RCS leakage detection systems (i.e., the leak rate from the crack should be 10 times greater than the minimum that RCS leakage detection system is capable of detecting).

3.3.2 LBB Screening Criteria

SRP Section 3.6.3, Revision 1, subsection III specifies that the NRC staff evaluate the potential for pipe degradation such as erosion, erosion/corrosion, water hammer, creep, PWSCC, fatigue, and brittle cleavage-type failure. The NRC staff also reviews the adequacy of the RCS leakage detection systems and corrosion resistance of piping.

The original LBB evaluation has addressed these potential degradation mechanisms. As stated above, PWSCC is an emergent degradation and the application of the weld overlay addresses PWSCC. The NRC staff finds that the application of the weld overlay will not affect the RCP piping in terms of the above degradation mechanisms except that PWSCC will be mitigated. The NRC staff finds further that the original LBB evaluation will not be affected by the weld overlay in terms of whether the overlaid DMW will satisfy the screening criteria of SRP Section 3.6.3. The original LBB evaluation has adequately addressed the degradation mechanisms specified in SRP Section 3.6.3.III.

3.3.3 Critical Crack Size Calculation

For the RCP suction and discharge nozzles, the licensee calculated critical crack sizes (lengths) for the OWOL and FSWOL designs based on the limit load methodology in Appendix C, "Evaluation of Flaws in Piping," to the ASME Code, Section XI. This is consistent with the approach provided in SRP Section 3.6.3 except that the licensee considers the combination of geometry and material properties for the original DMW (Alloy 82/182) and the weld overlay (Alloy 52M). The original LBB evaluation was based on elastic-plastic fracture mechanics (EPFM) methodology to calculate the critical crack size. Both methodologies are acceptable for use in the ASME Code, Section XI, and the results in crack sizes may different slightly as discussed in this safety evaluation.

In the updated LBB evaluation, the licensee assumed that the crack length (in the circumferential direction) was the same for the weld overlay and the underlying DMW, consistent with the assumption of a constant length through-wall crack in SRP Section 3.6.3. The NRC staff notes that the proposed crack model is conservative because in reality, through-wall cracks in the DMW and weld overlay may not develop with the same circumferential length.

In general, LBB evaluations analyze only circumferential cracks, not axial cracks, because circumferential cracks result in a worse consequence than that of axial cracks. Also, the LBB approach assumes that circumferential cracks are 100 percent through-wall. Therefore, the crack size discussed in this safety evaluation is the length of the crack in the circumferential direction, not its through-wall depth. The critical crack size is calculated based on the material properties of the pipe and weld which resist crack propagation. When an actual crack exceeds the critical crack size, the crack would propagate uncontrollably until rupture.

The licensee calculated the critical crack size based on a method (Reference 3), for a circumferential flaw in a DMW with weld overlay. The method is based on net-section-collapse analysis (a fracture mechanics methodology) with the following additional considerations for the weld overlay:

1. The effect of having two separate materials (Alloy 82/182 and Alloy 52) is considered. The limit load tensile force and bending moment can be evaluated for the circumferential cracked pipe with weld overlays.

2. The analytical model allows for the definition of the circumferential through-wall crack length for the weld overlay, while both circumferential crack length and depth (in the radial direction from the inside wall) for the base material are used.

3. The evaluation allows for a reduction in the fracture toughness to be considered. The Z-factor for the reduced toughness material (e.g., thermal aged material) can be applied to the specific material.

4. Optionally, the effect of internal pressure on the crack surface of both base material and weld overlay can be evaluated.

As identified in Item 3 above, to account for low fracture toughness material such as austenitic weldments and ferritic piping, the licensee applied a Z-factor to stresses in calculating the critical crack size in the updated LBB evaluation in accordance with the ASME Code, Section XI, Appendix C, "Evaluation of Flaws in Piping," and SRP Section 3.6.3. Z-factor is a load multiplier as defined in the ASME Code, Section XI, Appendix C, C-6330 and in SRP Section 3.6.3.III.11.C.(viii), and is applied to loads on the weld to account for stresses in the welds that may otherwise not be considered. The licensee assumed that the original DMW was fabricated by flux welding with either submerged arc welding (SAW) or shielded metal arc welding

(SMAW), which has low fracture toughness, and as such, it is appropriate to utilize a Z-factor. The licensee derived the Z-factor for the Alloy 82/182 DMW from Reference 4.

The Z-factors for ferritic (carbon steel) base metals and associated weld metals, and for austenitic weld materials fabricated using SMAW or SAW process are derived from the ASME Code, Section XI, Appendix C. For conservatism, the licensee applied the Z-factor for the SAW to the cast austenitic stainless steel RCP casing. The weld overlay is fabricated with the gas tungsten arc welding process with Alloy 52M as the weld metal. This weldment (weld overlay) has high fracture toughness and the Z-factor is 1.0 per the ASME Code, Section XI, Appendix C. The NRC staff finds that the Z-factors used in the updated LBB evaluation are acceptable because they were derived from the ASME Code, Section XI, Appendix C or recognized studies such as Reference 4.

The NRC staff questioned whether internal pressure was actually applied to the crack surface in calculating the flaw stability. In letter dated January 20, 2010, the licensee responded that although the updated LBB evaluation included the terms that could be used for evaluating crack face pressure, crack face pressure was not used in calculating flaw stability or leakage. This is consistent with the net-section-collapse analysis equations that are provided in SRP 3.6.3 and in the ASME Code, Section XI, Appendix C. The NRC staff finds that internal pressure on the crack surface of the DMW and weld overlay does not affect the result significantly. Therefore, the NRC staff does not object that the internal pressure was not applied to the crack face.

The NRC staff asked the licensee to discuss whether the saturated fracture toughness (worst case conditions) of the CASS material of the RCP nozzles was used in the updated LBB evaluation. In letter dated January 20, 2010, the licensee responded that the saturated fracture toughness of the CASS material of the RCP nozzles was used in the updated LBB evaluation in accordance with ASME Section XI Code Case N-481, "Alternative Examination Requirements for Cast Austenitic Pump Casings Section XI, Division 1." The saturated fracture toughness is determined from actual material certified material test reports (CMTRs). The licensee selected the lower bound fracture toughness of the worst DBNPS pump casing considering thermal embrittlement. Using the material properties from the CMTRs, the licensee calculated the saturation impact energy (CVsat) used in determining the J-R curve (J-Integral resistance curves for stable crack growth) and subsequently, the fracture toughness of the CASS material.

The NRC staff approved Code Case N-481 to be used in RG 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 14. ASME annulled Code Case N-481 in March 2004, and the provisions of the code case are incorpor+ated in the ASME Code. Subsequently the code case is not approved for use in RG 1.147, Revision 15. Therefore, Code Case N-481 is no longer permitted to be used. However, the licensee used the lower bound fracture toughness of the worst DBNPS pump casing material heats considering thermal embrittlement. Therefore, the NRC staff finds that the licensee has appropriately considered thermal embrittlement of the CASS RCP nozzles in the flaw stability analysis.

The licensee calculated various critical crack sizes for the FSWOL design from 45 to 58 inches in circumference. For the OWOL design, the licensee calculated various critical crack sizes from 39 inches to 52 inches.

The NRC staff noted that the critical crack sizes (lengths) for the FSWOL are comparable to the critical crack size for the OWOL design for the RCP discharge nozzle. In letter dated January 20, 2010, the licensee explained that at the RCP discharge nozzle, there is little difference in thickness between the weld overlay thicknesses evaluated with the minimum and maximum thicknesses of the overlays being 0.84 inch and 1.33 inches, respectively. Similarly, the base metal thickness is between 2.72 inches and 3.03 inches, which is significantly greater than the weld overlay thickness. Because the weld overlay is much thinner than the base metal, the critical flaw size is not changed much by the overlay thickness, and a consistent change is seen from the thinnest to the thickest overlay, where the critical flaw length increases with increasing thickness of the weld overlay.

The NRC staff noted that the original LBB evaluation showed that the critical crack size of the base metal (20.36 inches) is substantially different than the critical crack size of the weld metal (37.08 inches). However, the updated LBB evaluation does not show that the critical crack sizes of the weld overlay are substantially different than the critical crack sizes in the base metal. In letter dated January 20, 2010, the licensee responded that in the original LBB evaluation, the large difference between the critical crack sizes of the base metal and the weld metal was due to the differences between the material properties of the base and weld metals. The flow stress of the base metal (RCP) is 43.24 ksi, while the flow stress of the weld metal is 55.04 ksi. In the updated LBB evaluation, the flow stress of the weld overlay (WOL) material is 54.08 ksi and this WOL material is applied over both the carbon steel or stainless steel base materials and the DMW weld metal. The impact of the difference between the two materials is greatly reduced by the applied WOL material, leading to a smaller difference between critical flaw sizes in the current LBB evaluation.

The NRC staff noted that the critical crack sizes (lengths) calculated in the updated LBB evaluation are much larger (35 percent to 60 percent) than the critical crack sizes calculated in the original LBB evaluation. In letter dated January 20, 2010, the licensee explained that the critical crack size increases are due to the application of the WOL. The WOL material has high material toughness and does not require use of a Z-factor, whereas the base/weld metals require use of the Z-factor. The WOL material also has a slightly higher flow stress, and is applied at a slightly larger radius than exists for the base materials. Thus, the increment of the critical crack size would not be expected to be linearly proportional to the increment of the thickness. As shown in Appendix A to the ASME Code, Section XI, the equations related to critical crack size calculation contain higher order terms of t (thickness), and treats the radius of the base metal and the WOL separately. Hence, the percent increase in critical crack size is higher than the percent increase in thickness.

The licensee verified its limit load methodology used in the updated LBB evaluation against the EPFM methodology used in original LBB evaluation by calculating the critical crack size of a straight segment of pipe as performed in the original LBB evaluation. The updated LBB evaluation obtained a similar, but slightly conservative, critical crack size as compared to the original LBB evaluation. This confirms that two different methodologies, the limit load methodology of the updated LBB evaluation and EPFM methodology of the original LBB evaluation, provide similar critical crack sizes and that the limit load methodology used in the updated LBB evaluation is acceptable.

The NRC staff finds that the conservative crack model that the licensee assumed considered the effects of different material properties of the weld overlay and DMW. Therefore, the NRC staff finds that the critical crack calculation is acceptable.

3.3.4 Leakage Calculations

For leakage calculations, the licensee derived various leakage crack sizes and leak rates using the Pipe Crack Evaluation Program (PICEP) computer program (Reference 5). In the 1980’s, the Electric Power Research Institute (EPRI) developed the PICEP program to support the leak-before-break application effort. PICEP calculates crack opening area, the critical crack length, and the leak rate. PICEP uses pipe loads, material, crack length and pipe geometry to derive leakage crack size and leak rate for piping fabricated with a single metal. In PICEP, the crack opening area is based on EPFM methods. The EPFM solutions consider the crack opening from remotely applied loads either due to tension or bending. PICEP provides guidance on how to combine tension and bending loads. To perform leakage calculations for cracks in the overlaid DMW with properties of two different types of metals, the licensee derived equivalent parameters such as material properties and friction factors based on the data of the original DMW and weld overlay.

Leakage calculations in traditional LBB evaluations are based on the crack morphology of the fatigue degradation mechanism only. However, to analyze a through-wall circumferential leakage crack in the overlaid DMW, the licensee assumed fatigue crack morphology for the portion of the crack in the weld overlay and PWSCC crack morphology for the portion of the crack in the DMW. The portion of the crack in the WOL would grow based on the fatigue degradation mechanism and the portion of the crack in the DMW would grow based on the PWSCC degradation mechanism.

Because the leakage model is based on a composite material model to run PICEP, the licensee assumed that the crack opening displacement in the base material (DMW) and the weld overlay is the same. As discussed above, the crack morphology parameters for the fatigue crack in the WOL and PWSCC crack in the DMW and the material property parameters for the Alloy 82/182 and Alloy 52 need to be combined into a single set of parameters to simulate fluid flow in a single leaking crack in the overlaid DMW.

Battelle Memorial Institute and Engineering Mechanics Corporation of Columbus (Battelle) have conducted research to assess the technology used in determining leakage through cracked piping with stress-corrosion cracking morphology such as PWSCC. Battelle has determined that the crack morphology, characterized by the local roughness, number of flow path turns, and total leakage path length, is significantly different between fatigue cracking and stress-corrosion cracking. For fatigue cracks, the flow path is relatively smooth and straight, whereas for stress-corrosion cracking, the flow path is relatively rough and consists of many turns.

NUREG/CR-6300, “Refinement and Evaluation of Crack-Opening Analyses for Short Circumferential Through-Wall Cracks in Pipes," NRC, April 1995, has proposed a procedure that defines the surface roughness, effective flow path length, and number of flow path turns as a function of the ratio of the crack opening displacement to the global roughness of the flow path. For very tight cracks, there is a relatively longer flow path with many local turns, but the local roughness is relatively low. For cracks with a much larger opening, the roughness is better represented by the global roughness but the number of turns and effective flow path length decrease. Both global roughness and the local roughness of the crack are combined with crack opening displacement to develop an effective roughness. The licensee stated that although not confirmed by testing or detailed fluid mechanics analysis, this model is a reasonable representation of the morphology effects due to stress-corrosion cracking on leakage flow.

The NRC staff questioned whether experiments have been performed to verify the accuracy of the analytical method in PICEP to predict the leak rates from through-wall crack in the overlaid

DMW. In letter dated January 20, 2010, the licensee responded that PICEP is accepted for calculating leakage in through-wall cracked piping, and has been used in numerous LBB evaluations that the NRC has approved. The licensee stated further that PICEP was verified by comparison to a large number of tests for leakage through cracks. However, the licensee recognizes that neither industry nor the NRC has perform any tests to verify leak rates through weld overlaid pipe or through PWSCC cracked piping. The licensee noted that there may be uncertainties in the leakage calculations associated with LBB, thus, a factor of 10 is applied between the calculated leakage rate and the leakage detection capability in nuclear plants applying LBB.

The licensee stated that it used a crack morphology that was verified by early EPRI/Battelle work to justify the PICEP computer program. The values used provided a good mean prediction of leakage for a large number of tests. NUREG/CR-6004, "Probabilistic Pipe Fracture Evaluations for Leak-Rate Detection Applications," NRC, April 1995, provides data on microscopic measurements to quantify flow path morphology and is the basis of a modified model that is reasonable for predicting leakage for the overlaid DMW.

The original LBB evaluation assumed fatigue cracking with a crack morphology roughness of 0.000197 with no turns. However, in the updated LBB evaluation, the licensee assumed that the morphology associated with PWSCC crack propagation parallel to the long direction of the dendritic grains would be applicable. The PWSCC crack usually results in various 45 and 90 degree turns as it propagates through the pipe wall thickness. The licensee obtained the following data from the NRC-sponsored research on PWSCC (Reference 6), as input to the leakage calculation.

Local roughness, inches = .000663778
Global roughness, inches = .0044842
Number of 90 degree turns per inch = 150.87
Global flow path length to thickness ratio = 1.009
Global plus local flow path length to thickness ratio = 1.243

The average numbers of turns (reported as 90 degree turns only) for a typical PWSCC crack is 150.87. However, the licensee modified the number of turns to derive the effective (equivalent) number of turns based on the crack opening displacement and roughness to simulate the total path fluid flow resistance in the original DMW and overlay. The licensee also developed equivalent roughness and equivalent flow path length for flow through a complex crack.

The licensee stated that a series of 20 crack sizes are evaluated, so that the relationship between crack size and crack opening displacement will be determined at closely spaced sample points for more accurate interpolation over a range that bounds the crack size of interest. PICEP has a limit of 20 crack sizes maximum between zero and a maximum crack size, so the maximum number is used. The NRC staff finds it is acceptable that the licensee used the maximum number of crack size in PICEP.

Under normal operation conditions of the RCP piping, the leakage may occur in a two-phase condition (i.e., a mixture of steam and water) at the exit. The NRC staff asked the licensee to clarify whether the two-phase flow condition has been considered in the leak rate calculation. In letter dated January 20, 2010, the licensee responded that the leakage calculation in PICEP considers flashing to two-phase condition in the crack, such that a two-phase mixture will exist at the exit. In PICEP, the mass flow rate (for example lb/sec) is converted to a volumetric flow rate (gpm) and is output at 200 degrees Fahrenheit (F). The licensee stated that the fluid that leaked from the pipe is collected in the sump and its temperature is generally at 120 degrees F. Hence, the amount of water collected at the sump has to be multiplied by the ratio of the density of the water at 120 degrees F to the density of water at 200 degrees F. Therefore, to obtain 10 gpm of leakage at the sump, a leak rate of 10.264 gpm or 2.64 percent more leakage from the crack in the pipe is required. The calculated minimum leakage is 289.8 percent more than the required minimum detection rate of 10 gpm. Compared to this large margin, the difference in the minimum detectable leakage values due to different temperatures (i.e., 2.64 percent) is small. The NRC staff finds that although the amount of fluid exiting the crack is less than the amount of fluid collected in the sump to satisfy the 10 gpm allowable, the difference is insignificant when compared to the large margin that exists in the calculated leak rates.

The NRC staff questioned the impact of the weight of WOL on the RCS piping system and in terms of leakage crack size. In letter dated January 20, 2010, the licensee clarified that the maximum weight of the WOL applied at the RCP DMW is conservatively calculated as 0.45 kips (kilopounds). This weight is not significant when compared to the dead weight of 6.1 kips for the adjacent 90 degree elbow filled with water weighing another 1.47 kips. Also, the total weight of a typical RCP, including motor, casing, pump, and reactor coolant, ranges between approximately 150 kips to 340 kips. The added WOL weight is no more than 0.3 percent the weight of the RCP. The licensee stated that the effect of the additional weight due to the application of the WOL is negligible as a percentage of the existing weight.

The licensee stated further that the effect of the increased weight due to WOL material is to slightly increase the dead weight and seismic stresses. The effect of the increased dead weight and seismic stresses would be to slightly decrease the critical flaw size and to increase leakage (for a given flaw size). In light of the large margins demonstrated by the updated LBB evaluation, these effects would minimally affect the required LBB margins and consequently were not considered in the updated LBB evaluation. The NRC staff does not object that the weight of the WOL was not included in the updated LBB evaluation because it will not affect significantly the piping loads for the nozzle, DMW, and elbow.

The licensee calculated leakage flaw sizes for various FSWOL and OWOL thickness that would yield a leak rate of 10 gpm (to demonstrate the margin of 10 on leakage). Comparing the leakage crack sizes (with a 10 gpm leak rate) to the critical crack sizes, the licensee derived the minimum margins of 2.8 and 2.81 for the OWOL and FSWOL designs, respectively. That is, the critical crack size is at least 2.8 times longer than the leakage crack size that generates a leak rate of 10 gpm. Therefore, the overlaid DMWs satisfy the margin of 2 on crack size as specified in SRP Section 3.6.3.

The licensee also calculated leak rates given a leakage crack that is half of the critical crack size (to satisfy the margin of 2 on crack size) for various FSWOL and OWOL thickness. For the RCP suction nozzle, the licensee calculated the leakage from a crack that is half of the critical crack size to be 34.52 gpm and 153.61 gpm for the minimum and maximum FWSOL thickness, respectively. For the RCP discharge nozzle, the licensee calculated the leakage from a crack that is half of the critical crack size to be 30.25 gpm and 246 gpm for the minimum and maximum FWSOL thickness and 30 gpm and 254 gpm for the minimum and maximum OWOL thickness. The licensee showed that its calculated leak rates are significantly above the allowable 10 gpm (i.e., a margin of 10 to the 1 gpm of the RCS leakage detection system capability) generated from a crack that is half of the critical crack size. Therefore, the leak rates satisfy the required margin of 10 in SRP Section 3.6.3.

The NRC staff finds that the leakage methodology in the updated LBB evaluation is more up-to-date in its prediction than the leakage methodology used in the original LBB evaluation because of the research that has been performed since the 1980's. PICEP does not provide for leakage through a composite flow path such as flow through the Alloy 82/182 base material and Alloy 52 weld overlay. To address this consideration, the licensee derived a set of input parameters to simulate the composite flow path through the PWSCC portion of the assumed through wall crack in the base metal and fatigue portion of the crack in the weld overlay.

In the 1980's, the NRC staff specified a margin of 10 for leak rates recognizing the uncertainties in the leakage prediction. At present, the NRC staff finds that PICEP is acceptable for the analysis of the overlaid DMW when appropriate crack modeling and conservative input parameters for the crack morphology are used. The NRC staff finds further that the licensee's PICEP input parameters provide a reasonable simulation of flow through the composite flow path assumed for the leakage calculation and are, therefore, acceptable.

3.3.5 Comparison of LBB Evaluations

The licensee compared the leakage flaw sizes calculated by the methodology in the updated LBB evaluation with the leakage flaw sizes calculated in the original LBB evaluation to determine any significant deviations between the two methodologies. The licensee used the method in the updated LBB evaluation to calculate the leakage flaws for the same straight pipe and elbow locations that were the subject of investigation in the original LBB evaluation. The results show that the leakage flaw sizes calculated by the updated LBB methodology are consistently smaller than the leakage flaw size calculated in the original LBB evaluation by approximately 15 percent. The licensee explained that the differences may be attributed to the Ramberg-Osgood parameters used in the updated LBB evaluation, which were not used in the original LBB evaluation. The licensee concludes that the results suggest that the methodology used in the updated LBB evaluation is comparable to the methodology used in the original LBB evaluation. The NRC staff finds that the differences in leakage flaw sizes between the two methodologies are not unexpected considering the differences in input parameters (use of Ramberg-Osgood parameters) and methodology (EPFM vs. limit load).

In terms of critical flaw size methodology, the original LBB evaluation determined critical flaw sizes based on the EPFM method. The updated LBB evaluation used a modified limit load methodology (two different materials) with the application of Z-factors in accordance with the ASME Code, Section XI, Appendix C. The NRC staff finds that the methodology in the updated LBB evaluation has used appropriate input parameters such as material properties and configurations and applied them to an appropriate model. Although uncertainties exist in the leak rate analysis of a composite overlaid DMW configuration, the margin available on leakage compensates for these uncertainties.

3.3.6 Summary

The NRC staff finds the updated DBNPS LBB evaluation acceptable because:

(1) The licensee demonstrated by weld residual stress analysis that the weld overlay will mitigate PWSCC in the DMW. This satisfied the screening criteria of SPR Section 3.6.3.

(2) The critical crack size is more than twice the leakage crack size of the overlaid DMW; therefore, the safety margin of 2 specified by SRP 3.6.3 is satisfied.

(3) The leak rate from the leakage crack size is more than 10 times of the RCS leakage detection system capability of 1 gpm; therefore, the safety margin of 10 on leakage specified by SRP 3.6.3 is satisfied.

(4) The licensee performed a plant-specific and component-specific LBB evaluation and used appropriate input parameters and methodology.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to installation or use of a facility's components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve 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 amendments involve no significant hazards consideration, and there has been no public comment on such finding. Accordingly, the amendments meet 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 amendments.

6.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION (NSHCD)

The commission may issue the license amendment before the expiration of the 60-day period provided that its final determination is that the amendment involves no significant hazards consideration. This amendment is being issued prior to the expiration of the 60-day period. Therefore, a final finding of no significant hazards consideration follows.

The Commission has made a proposed determination that the amendment request involves no significant hazards consideration. Under the Commission's regulations in 10 CFR 50.92, this means that operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. As required by 10 CFR 50.91(a), the licensee has provided its analysis of the issue of no significant hazards consideration which is presented below.

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

The applicable accident is a Large Break Loss of Coolant Accident (LBLOCA). Since the application of [optimized weld overlays] OWOLs or [full structural weld overlays] FSWOLs will enhance the integrity of welds and the reactor coolant system, the probability of a previously evaluated accident is not increased. The consequences of a LBLOCA have been previously evaluated and found to be acceptable. Application of OWOLs or FSWOLs to the existing welds will cause no change to the dose analysis associated with a LBLOCA. Therefore, the leak-before-break (LBB) evaluation update does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The LBB evaluation update will allow application of OWOLs or FSWOLs to mitigate potential primary water stress corrosion cracking (PWSCC) of the existing welds. These welds provide a primary pressure boundary function. This request does not change the function of the welds, or the way the plant is operated; it supports the application of OWOLs or FSWOLs that will enhance the ability of the welds to perform the pressure boundary function. Therefore, the proposed LBB update does not create the possibility of a new or different kind of accident from any-accident previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

   Response: No.

   Margin of safety is related to the ability of the fission product barriers to perform their design functions during and following accident conditions. These barriers include the fuel cladding, the reactor coolant system, and the containment. This request does not involve a change to the fuel cladding or the containment. This amendment request updates the LBB evaluation to account for the application of OWOLs or FSWOLs to the existing reactor coolant pump suction and discharge- nozzle dissimilar metal welds for the Davis-Besse Nuclear Power Station. The effect of applying a weld overlay repair has been evaluated with respect.to the LBB evaluation at these locations. This evaluation addresses mitigation of PWSCC in these welds and allows the application of a PWSCC resistant weld overlay that has the added benefit of producing compressive stresses on the inner portion of the existing welds. Acceptable residual stresses for purposes of satisfying this requirement are those which, following the application of OWOLs or FSWOLs with Alloy 52/52M weld metal, provide a PWSCC resistant barrier and also result in reduced stresses on the inner portion of the welds. Acceptable residual stresses are those which, after application of the weld overlay, are substantially reduced on the inner portion of the nozzle susceptible material at operating temperatures, pressures, and loads. In addition, the compressive stresses which exist in the interior of the dissimilar metal weld are increased to the point where the PWSCC of an existing flaw may be arrested. The crack growth analyses resulting from these through-thickness residual stresses ensure that any PWSCC flaws would be acceptable within the inspection interval of the dissimilar metal weld. The effect of the adverse morphology on leakage due to

PWSCC cracking was also evaluated. The effect of the application of the weld overlay is to increase the critical flaw size, resulting in additional margin between the critical flawsize and the leakage flaw size. Although the longer flow path and considerations of crack morphology for the Alloy 82/182 weld location reduces leakage somewhat for a given through-wall flaw, the larger critical flaw size following application of the weld overlay allows for increased leakage margin. The evaluation described above demonstrates that these welds will perform as originally intended and that the adverse effects of PWSCC will be mitigated. Therefore, the proposed LBB update does not involve a significant reduction in a margin of safety. Based on the above, FENOC concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

As documented above, the proposed change does not involve a significant reduction in a margin of safety.

The NRC staff has reviewed the licensee's analysis and based on this review, determined that the three standards of 10 CFR 50.92 are satisfied. Therefore, the NRC staff has determined that the amendment involves no significant hazards consideration.

7.0 CONCLUSION

On the basis of its review of the updated DBNPS LBB evaluation, the NRC staff finds that the licensee has demonstrated that (1) the FSWOL and OWOL will provide favorable compressive stresses in the inner region on the DMW to mitigate potential PWSCC; (2) a margin of more than 10 exists between the calculated leak rate from the leakage flaw size and the detection capability of the RCS leakage detection system; (3) a margin of more than 2 exists between the critical flaw size and the leakage flaw size; (4) input parameters (e.g., loadings and crack morphology) are applied consistent with SRP Section 3.6.3; and (5) the methodology is adequate. Therefore, the RCP discharge and suction nozzles with associated DMWs exhibit LBB behavior consistent with the guidance in SRP Section 3.6.3, Revision 1. Pursuant to GDC-4 of Appendix A to 10 CFR Part 50, the NRC staff concludes that the licensee is permitted to continue to exclude consideration of the dynamic effects associated with the postulated rupture of the RCP discharge and suction nozzles from the current licensing basis at DBNPS.

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 amendments will not be inimical to the common defense and security or to the health and safety of the public.

8.0 REFERENCES

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