

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

March 23, 2011

Mr. Paul A. Harden Site Vice President FirstEnergy Nuclear Operating Company Beaver Valley Power Station Mail Stop A-BV-SEB1 P.O. Box 4, Route 168 Shippingport, PA 15077

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2 - RELIEF REQUEST RI-ISI-1 AND RI-ISI-2 REGARDING THE FOURTH AND THIRD RISK-INFORMED INSERVICE INSPECTION INTERVALS (TAC NOS. ME4104 AND ME4105)

Dear Mr. Harden:

By letter dated June 10, 2010, as supplemented by letter dated December 14, 2010, FirstEnergy Nuclear Operating Company (the licensee) requested authorization of a proposed alternative to risk-informed inservice inspection (RI-ISI) programs at Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS-1 and 2) for the remainder of the BVPS-1 fourth 10-year ISI interval and the BVPS-2 third 10-year ISI interval. Specifically, the licensee requested continued use of the current RI-ISI programs with updates relevant to certain non-destructive examination requirements associated with American Society for Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Class 1 and 2 piping welds, B-F, B-J, C-F-1, and C-F-2.

The Nuclear Regulatory Commission (NRC) staff has concluded that the proposed alternative in Relief Requests RI-ISI-1 and RI-ISI-2 provide an acceptable level of quality and safety. Therefore, pursuant to Section 50.55a(a)(3)(i) of Part 50 of Title 10 of the *Code of Federal Regulations*, the NRC staff authorizes the proposed alternative for the remainder of the BVPS-1 fourth 10-year ISI interval and the BVPS-2 third 10-year ISI interval, which ends March 31, 2018 and August 28, 2018, respectively.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector. P. Harden

If you have any questions, please contact the Beaver Valley Project Manager, Nadiyah Morgan, at (301) 415-1016.

Sincerely,

Mancy L. Julgado Nancy L. Salgado, Chief

Nancy L. Salgado, Chief Plant Licensing Branch I-1 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket Nos. 50-334 and 50-412

Enclosure: As stated

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REGARDING ALTERNATIVE TO THE RISK-INFORMED

INSERVICE INSPECTION PROGRAM

FIRSTENERGY NUCLEAR OPERATING COMPANY

FIRSTENERGY NUCLEAR GENERATION CORP.

OHIO EDISON COMPANY

THE TOLEDO EDISON COMPANY

BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-334 AND 50-412

1.0 INTRODUCTION

By letter dated June 10, 2010 (Reference 1), as supplemented by letter dated December 14, 2010 (Reference 2), FirstEnergy Nuclear Operating Company (the licensee) requested authorization of a proposed alternative to risk-informed inservice inspection (RI-ISI) programs at Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS-1 and 2) for the remainder of the BVPS-1 fourth 10-year ISI interval and the BVPS-2 third 10-year ISI interval. Specifically, the licensee requested continued use of the current RI-ISI programs with updates relevant to certain non-destructive examination requirements associated with American Society for Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Class 1 and 2 piping welds, B-F, BJ, C-F-1, and C-F-2. The Nuclear Regulatory Commission (NRC) staff authorized previous BVPS RI-ISI program alternatives by letter dated April 9, 2004 (Reference 10), for the previous ISI intervals.

2.0 REGULATORY EVALUATION

Section 50.55a(g) of Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR) specifies that ISI of nuclear power plant components shall be performed in accordance with the requirements of the ASME Code, Section XI. Paragraph (a)(3) of 10 CFR 50.55a states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The NRC staff reviewed and evaluated the licensee's request pursuant to 10 CFR 50.55a(a)(3)(i).

The ISI Code of Record for the BVPS-1 fourth 10-year ISI interval, ending March 31, 2018, and for the BVPS-2 third 10-year ISI interval, ending August 28, 2018, is the 2001 Edition through the 2003 Addenda of the ASME Code, Section XI.

3.0 TECHNICAL EVALUATION

3.1 Applicable Code Requirements

ASME Code Section XI, 2001 Edition through 2003 Addenda

IWB-2500, Examination and Pressure Test Requirements Table IWB-2500-1, Examination Categories Class 1 Piping Welds

> Category B-F, Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles Category B-J, Pressure Retaining Welds in Piping

IWC-2500, Examination and Pressure Test Requirements Table IWC-2500-1, Examination Categories Class 2 Piping Welds

> Category C-F-1, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping Category C-F-2, Pressure Retaining Welds in Low Alloy Steel Piping

3.2 Licensee's Proposed Alternative

The licensee proposed to update the RI-ISI program approved for the previous 10-year ISI intervals and apply the updated program to the current 10-year ISI intervals. Other non-related portions of the ASME Code, Section XI are unaffected.

The proposed updated RI-ISI program is based on Westinghouse Owners Group (WOG) WCAP-14572, Revision 1-NP-A, "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report," and WCAP-14572, Revision 1-NP-A, Supplement 1, "Westinghouse Structural Reliability Risk Assessment Model for Piping Risk-Informed Inservice Inspection."

3.3 NRC Staff's Evaluation

The licensee's previous RI-ISI program for Category B-F, B-J, C-F-1, and C-J-1 pressure retaining welds, as outlined in References 3 through 9, was developed in accordance with the methodology of WCAP-14572, Revision 1-NP-A, which was reviewed and authorized by the NRC (Reference 11). In Reference 1, the licensee requests NRC authorization to extend the use of its RI-ISI programs to the current ISI intervals. The scope of the BVPS-1 and 2 RI-ISI programs remains limited to Category B-F, B-J, C-F-1, and C-F-2 piping welds.

An acceptable RI-ISI program plan is expected to meet the five key principles of RI decisionmaking, discussed in Regulatory Guide (RG) 1.174 (Reference 12) and RG 1.178 (Reference 13). These principles are:

- 1. The proposed change meets the current regulations unless it is explicitly related to a requested exemption.
- 2. The proposed change is consistent with the defense-in-depth philosophy.
- 3. The proposed change maintains sufficient safety margins.
- 4. When the proposed change results in an increase in core damage frequency (CDF) and/or large early release frequency (LERF), the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.
- 5. The impact of the proposed change should be monitored by using performance measurement strategies.

The first principle is met because an alternative ISI program may be authorized pursuant to 10 CFR 50.55a(3)(i) and, therefore, an exemption request is not required.

The second and third principles require assurance that the alternative program is consistent with the defense-in-depth philosophy and that sufficient safety margins are maintained. Assurance that the second principle is met is based on the application of the approved methodology and not on the particular inspection locations selected. The submittal stated that the methodology is approved for use for the proposed 10-year RI-ISI intervals. In response to the NRC staff's request for additional information (RAI) (Reference 2), the licensee stated that there hasn't been any changes made to the design basis events as a result of the RI-ISI program. Therefore, the NRC staff finds that both the second and third principles, defense-in-depth and safety margins, are met.

The fourth principle requires an evaluation of the change in risk between the proposed RI program and the program the licensee would otherwise be required to implement. The NRC staff's assessment of principle four is shown in Section 3.3.1.

The fifth principle of RI decisionmaking states that the impact of the RI-ISI program should be monitored by performance measurement strategies. Monitoring of these programs encompasses many facets of feedback or corrective action which includes periodic updates. As stated in Reference 1, the BVPS-1 and 2 RI-ISI program is a "living" program and the information has been updated and analyzed in accordance with WCAP-14572, Revision 1-NP-A, Supplement 1 (Reference 11), and Revision 1-NP-A, Supplement 2 (Reference 14). Consistent with these topical reports, new information has been incorporated in the BVPS-1 and 2 RI-ISI program. This includes revised consequences for pipe segments, revised failure probabilities for a limited number of segments based on industry and plant experience and plant modifications, and updated test intervals for a limited number of segments. The NRC staff finds that the fifth principle of RI decisionmaking is met.

Due to ongoing issues related to degradation due to primary water stress-corrosion cracking in components that contain Alloy 82/182 welds, the NRC staff requested that the licensee provide information about how the Electric Power Research Institute (EPRI) Materials Reliability Program (MRP) initiative MRP-139, Revision 1, "Primary System Piping Butt Weld Inspection and Evaluation Guideline (MRP-139)" inspection guidelines are being implemented in conjunction with the RI-ISI program. In the response (Reference 2) to the NRC staff's RAI, the licensee stated that it will comply with the selection criteria and frequency of EPRI MRP-139. This response addresses the NRC staff concerns regarding this issue, and therefore, is acceptable.

3.3.1 Probabilistic Risk Assessment

The BVPS-1 and 2 ISI program for the examination of Class I piping is in accordance with an RI process that was approved by the NRC by letter dated May 1, 2006 (Reference 14). The licensee's request for an alternative to the current requirements for the BVPS-1 fourth 10-year interval and the BVPS-2 third 10-year interval uses the same methodology previously approved for the third and second 10-year interval, respectively.

Several assessments of technical capability were made to the BVPS-1 and 2 probabilistic risk assessment (PRA) models. An independent PRA peer review was conducted in 2002 under the auspices of the WOG. In 2007, a gap analysis was performed against the ASME PRA Standard and RG 1.200, Revision 1 and a follow-up peer review of the human reliability analysis (HRA) was performed in 2007 to evaluate the change in HRA methodology since the 2002 WOG Peer Review.

BVPS-1 and 2 used the RI-ISI methodology defined in WCAP-14572, Revision 1-NP-A to produce alternative ISI requirements. Risk significance information was used during the development of the RI-ISI program to support consequence assessment, risk ranking and delta risk evaluation. The quantitative results from the risk evaluation along with deterministic insights were presented to an expert panel in an integrated decision-making process.

Based on the results of the revised risk analysis and expert panel evaluation, seven high safety significant (HSS) piping segments changed to low safety significance and fifty low safety significant (LSS) piping segments changed to high safety significance for BVPS-2. Twenty six LSS segments were reclassified as HSS, and twenty four HSS segments were reclassified as LSS for BVPS-1. These changes are a result of the reclassification of pipe segments based on the revised segment failure probabilities, updated test interval, and/or revised consequences using the BVPS-1 and 2 PRA model. WCAP-14572-NP-A recommends that pipe segments with Risk Reduction Worth (RRW) greater than 1.005 should be categorized as HSS, while the segments with RRW values between 1.001 and 1.004 should be identified for additional consideration by the expert panel. The reclassifications and existing segment classifications were reviewed by the BVPS-1 and 2 RI-ISI expert panel. The expert panel reclassified three quantitative HSS segments for BVPS-1 and seven quantitative HSS for BVPS-2 as LSS, based on the "with operator action consequences" guidance of WCAP-14572, Supplement 2 (Reference 14) and concluded that the remaining segments remain unchanged.

A change in risk evaluation was performed using the updated segment categorization to compare the original Section XI program with the revised BVPS-1 fourth interval RI-ISI program

and the revised BVPS-2 third interval RI-ISI program. Five reactor coolant system segments and one safety injection system segment (six total segments) were added to the BVPS-1 RI-ISI program as VT-2 visual inspections; and three reactor coolant system segments and six safety injection system segments (nine total segments) were added to the BVPS-2 program as VT-2 visual inspections to meet the change in risk criteria discussed in WCAP-14572. In response to the NRC staff's RAI, the licensee stated that the change-in-risk calculations were performed in accordance with the guidelines provided within WCAP-14572, Revision 1-NP-A, Section 4.4.2. In addition, the licensee showed that the total risk for the BVPS-1 fourth interval RI-ISI program and the BVPS-2 third interval RI-ISI program continues to remain lower than ASME Code, Section XI requirements with and without operator actions.

Per WCAP-14572, Revision 1-NP-A, Section 4.5.2, the licensee is required to re-evaluate their RI-ISI programs on a 40-month period basis, thus ensuring RI-ISI programs at BVPS-1 and 2 are maintained as living programs.

Based on the use of the approved methodology and on the reported results, the NRC staff finds that any change in risk associated with the implementation of the RI-ISI program will be small and consistent with the intent of the Commission's Policy Statement and consistent with RG 1.178.

4.0 <u>CONCLUSION</u>

Based on the above evaluation, the NRC staff has concluded that the proposed alternative in Relief Requests RI-ISI-1 and RI-ISI-2 provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed alternative for the remainder of the BVPS-1 fourth 10-year ISI interval and the BVPS-2 third 10-year ISI interval, which ends March 31, 2018 and August 28, 2018, respectively.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

5.0 <u>REFERENCES</u>

- 1. Letter dated June 10, 2010, "Requests for Alternative Non-Destructive Examination Requirements for ASME Class 1 and Class 2 Piping Components," Agencywide Documents Access and Management System (ADAMS) Accession No. ML101650649.
- 2. Letter dated December 14, 2010, "Response to Request for Additional Information Related to Risk-Informed Inservice Inspection Requests RI-ISI-1 and RI-ISI-2 (TAC Nos. ME4104 and ME4105)," ADAMS Accession No. ML103540097.
- 3. Letter dated July 24, 2002, "Risk-Informed Inservice Inspection Program Plans ISI (Inservice Inspection) Program Relief Request," ADAMS Accession No. ML022060549.
- 4. Letter dated February 18, 2003, "Reply to Request for Additional Information Regarding Risk-Informed Inservice Inspection Program Relief Request," ADAMS Accession Number RAI response ML030550118.

- 5. Letter dated May 14, 2003, "Reply to Request for Additional Information Regarding Risk-Informed Inservice Inspection Program Relief Request," ADAMS Accession No. ML031390030.
- 6. Letter dated August 22, 2003, "Updated Reply to Request for Additional Information Regarding Risk-Informed Inservice Inspection Program Relief Request," ADAMS Accession Number ML032380051.
- 7. Letter dated October 28, 2003, "Risk-Informed Inservice Inspection Program Relief Request," ADAMS Accession No. ML033070119.
- 8. Letter dated December 19, 2003, "Risk-Informed Inservice Inspection Program Relief Request," ADAMS Accession No. ML033630588.
- 9. Letter dated February 20, 2004, "Additional Information Regarding Risk-Informed ISI Program," ADAMS Accession No. ML040570641.
- Letter dated April 9, 2004, "Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS-1 And 2) - Risk-Informed Inservice Inspection (RI-ISI) Program (TAC Nos. MB5687 AND MB5688)," ADAMS Accession No. ML040780805.
- 11. Letter dated December 15, 1998, Safety Evaluation of Topical Report WCAP-14572, Revision 1, "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report," ADAMS Accession No. ML042610375.
- 12. NRC Regulatory Guide 1.174, Revision 1, An Approach for using Probabilistic Risk Assessment in Risk-Informed Decisions On Plant-Specific Changes to the Licensing Basis, dated November 2002, ADAMS Accession No. ML023240437.
- 13. NRC Regulatory Guide 1.178, Revision 1, An Approach for Plant-Specific Risk-Informed Decision Making: Inservice Inspection of Piping, dated September 2003, ADAMS Accession No. ML032510128.
- Letter dated May 1, 2006, "Final Safety Evaluation for Pressurized Water Reactor Owners Group Topical Report WCAP-14572, Revision 1-NP-A, Supplement 2, "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report Clarifications (TAC No. MC3979)," dated June 22, 2006, ADAMS Accession No. ML061160035.

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Date: March 23, 2011

P. Harden

If you have any questions, please contact the Beaver Valley Project Manager, Nadiyah Morgan, at (301) 415-1016.

Sincerely,

/ra/

Nancy L. Salgado, Chief Plant Licensing Branch I-1 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket Nos. 50-334 and 50-412

Enclosure: As stated

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*see memo dated February 24, 2011

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