FENOC
FirstEnergy Nuclear Operating Company

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July 14, 2006
L-06-111

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

Subject: Beaver Valley Power Station, Unit Nos. 1 and 2
BVPS-1 Docket No. 50-334, License No. DPR-66
BVPS-2 Docket No. 50-412, License No. NPF-73
Response to Request for Additional Information
Regarding Relief Request No. BV3-RV-1

This letter forwards the response to an NRC request for additional information dated June 8, 2006. The additional information was requested in order for the NRC to complete its review of an April 7, 2006 FirstEnergy Nuclear Operating Company (FENOC) relief request.

The April 7, 2006 letter requested NRC approval to use an alternative remote mechanized examination technique for reactor vessel shell-to-flange welds during the third ten-year inservice inspection interval for Beaver Valley Power Station (BVPS) Unit No. 1 and second ten-year inservice inspection interval for BVPS Unit No. 2.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Gregory A. Dunn, Manager, FENOC Fleet Licensing at (330) 315-7243.

Sincerely,

Thomas S Cosgrove for COSGROVE

James H. Lash

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Attachment:

Response to June 8, 2006 Request for Additional Information

c: Mr. T. G. Colburn, NRR Senior Project Manager
Mr. P. C. Cataldo, NRC Senior Resident Inspector
Mr. S. J. Collins, NRC Region I Administrator
Mr. D. A. Allard, Director BRP/DEP
Mr. L. E. Ryan (BRP/DEP)

Attachment to Letter L-06-111

Beaver Valley Power Station, Unit Nos. 1 and 2
Relief Request No. BV3-RV-1

Response to June 8, 2006 Request for Additional Information

By letter dated April 7, 2006, FENOC (the licensee) submitted Relief Request No. BV3-RV-1, from the requirements of the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code (ASME Code), Section XI, non-destructive examination (NDE) requirements for BVPS-1 and 2.

The request for relief is for the third 10-year ISI interval for BVPS-1 and second 10-year ISI interval for BVPS-2, in which BVPS-1 and 2 have adopted the 1989 Edition no Addenda of the ASME Code, Sections XI and V as the examination code of record.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(a)(3)(i), the licensee has requested relief from using the techniques of Section V, Article 4, as supplemented by Section XI, Appendix I, and augmented by Regulatory Guide (RG) 1.150, Revision 1, when performing volumetric examinations of the reactor vessel shell-to-flange welds.

The licensee stated in the subject request for relief that the prescriptive, amplitude-based ultrasonic examination techniques of Section V, Article 4, supplemented by Appendix I, and augmented by RG 1.150, Revision 1 (hereafter referred to as Article 4), are technically inferior to the performance-based techniques specified in the ASME Code 1995 Edition with 1996 Addenda of Section IX, Appendix VIII, Supplements 4 and 6, as modified by 10 CFR 50.55a(b)(2)(xv), and demonstrated through the Electric Power Research Institute Performance Demonstration Initiative Program (Appendix VIII). Furthermore, the licensee states that performance-based techniques of Appendix VIII are required for all other reactor vessel shell weld examinations, having replaced the Article 4 techniques.

The Nuclear Regulatory Commission staff reviewed the information submitted by the licensee, and based on this review, determined that further information is required to complete the evaluation.

The scope of the request for information presented above and the following specific information requests presented in bold type were taken from the enclosure to Mr. T. G. Colburn's letter of June 8, 2006. It should be noted that examination code of record for Beaver Valley Power Station, Unit Nos. 1 and 2 is the 1989 Edition, no Addenda, of the American Society of Mechanical Engineers Code, Section XI.

1. **Please provide the interval between the last inspection and the proposed inspection schedule for both BVPS-1 and 2.**

Response:

The last 10-year reactor vessel examination was performed in 1996 at both Beaver Valley Power Station (BVPS) Unit No. 1 and Unit No. 2. The proposed BVPS examinations are scheduled in September of 2007 for Unit No. 1, and in March of 2008 for Unit No. 2.

2. **Please provide an analysis of round robin test results, in particular PISC II, to support the licensee's claim of greater sizing accuracy and defect sensitivity using performance-based tip diffraction techniques qualified by Appendix VIII, Supplements 4 and 6.**

Response:

The Programme for the Inspection of Steel Components Phase 2 (PISC II) round robin test results showed that prescriptive flaw sizing techniques contained in ASME Code Section XI (through the 1989 edition) were inaccurate. The Nuclear Regulatory Commission (NRC) recognized in subsequent rulemaking that the performance based techniques of ASME Code Section XI, Appendix VIII were superior.

The Pressure Vessel Research Council (PVRC) began conducting round robin studies in the United States on thick section pressure vessel steel plates in the late 1960's to measure Non-Destructive Examination (NDE) effectiveness and to examine ways to improve reliability. The PVRC provided four assemblies to a European consortium that was interested in exploring the capability of reactor pressure vessel NDE procedures to detect and size flaws in thick pressure vessel steel sections. The group performing the evaluation became known as the Plate Inspection Steering Committee (PISC I).

PISC I detection results for Defect Detection Probability (DDP) showed a wide variability in detection performance related both to flaw type and examination teams.

The Programme for the Inspection of Steel Components Phase 2 (PISC II) was another international round robin study conducted in the early to mid 1980's to quantify the effectiveness of Ultrasonic Test (UT) procedures on thick section steel assemblies. In summary, this round robin study also demonstrated the ineffectiveness of UT examinations based on the 50 percent Distance Amplitude Correction (DAC) sensitivity as shown below:

- About one-half of the flaws in Plate 3 were not detected by any team including flaws as deep as 3 inches (75mm), about one-third of the flaws were detected at a moderate level, and the remaining one-sixth were detected by all teams.[1]

When examination sensitivity was increased to 20 percent DAC and 10 percent DAC, most flaws were detected to some degree, but there was a large scatter in DDP results. It was also noted that special procedures such as Synthetic Aperture Focusing Techniques (SAFT), Amplitude Locus Curves (ALOK) and Time of Flight Diffraction (TOFD) provided better DDP, but there was still considerable variability for flaws up to 10 mm (0.4 inches) deep.

Flaw sizing results from the PISC II study also showed that ASME Code flaw sizing techniques based on probe motion and amplitude drop were inaccurate for determining the through-wall extent of known flaws.

The following information supports the claim that Appendix VIII techniques are superior to ASME XI techniques. These excerpts were obtained from the NRC's documented evaluation of the proposed rule[2] and analysis of the final rule[3] that imposed Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," to ASME Code Section XI.

- "Until 1989, UT requirements contained in Section XI were based on prescriptive procedures for inservice inspection (ISI) and preservice inspection (PSI)."[2]

- "It was recognized in the mid 1970's that the Section XI procedures did not always produce reliable detection or sizing of cracks and other flaws."[2]

- "Appendix VIII first appeared in the 1989 Addenda of the ASME Code. In contrast to the prescriptive requirements contained in Section XI through the 1989 Edition, the requirements of Appendix VIII allow any combination of procedures, equipment and personnel to be used for ISI as long as this combination can pass a statistically designed performance demonstration blind test on representative mockups containing realistic flaws."[2] [The capability to detect and size flaws has been successfully demonstrated through the qualification of Beaver Valley Power Station inspectors by the Electric Power Research Institute in accordance with ASME Code Section XI, Appendix VIII requirements.]

- "Operating experience, round robin trials and research results have identified deficiencies in the older prescriptive UT examination methods."[2]

- "A summary of some of the shortcomings in inservice inspection reliability include: . . . The discouragingly poor flaw detection and sizing performance, and the large variability between procedures, that was observed during national and international studies such as the PNNL-Piping Inspection Round Robin (PIRR) . . . and the Programme for the Inspection of Steel Components (PISC II). . . ."[2]

- ASME XI Appendix VII and VIII were developed as industry consensus documents in response to the draft regulatory guide published in 1984. Expedited implementation of the performance demonstration requirements in ASME Code Appendix VIII is necessary to bring nuclear power plants into compliance with the General Design Criterion (GDC) 14 of 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," or similar provision in the licensing basis for these facilities; and Criteria II and XVI of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."[2]

- The NRC concluded, based on their documented evaluation that, imposition of ASME Code Section XI, Appendix VIII, would greatly enhance the overall level of assurance of the safety and reliability of detection and sizing of cracks and flaws, and delineates a method for qualification of personnel and procedures.[2]

- "These performance demonstration programs will greatly increase the reliability of detection and sizing of cracks and flaws. [Emphasis added.]"[3]

NOTES

1. Ultrasonic Inspection of Heavy Section Steel Components - The PISC II Final Report, Elsevier Applied Science, 1988.

2. Documented Evaluation, Attachment 2A to the proposed rule that imposed Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," to ASME Code Section XI. The Documented Evaluation is referenced on Federal Register Volume 62, No. 232, (Wednesday, December 3, 1997), page 63906.

3. Federal Register Volume 64, No. 183, Wednesday, September 22, 1999, page 51393.