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L-03-088

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

Subject: Beaver Valley Power Station, Unit No. 2
BV-2 Docket No. 50-412, License No. NPF-73
Order (EA-03-009) Relaxation Request

References:

1) NRC Order EA-03-009, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 11, 2003.

2) FirstEnergy Nuclear Operating Company (FENOC) response to NRC Order EA-03-009 for Beaver Valley Power Station (BVPS) Unit 1 and Unit 2, L-03-035 dated March 3, 2003.

This letter transmits a BVPS Unit 2 request for relaxation of requirements contained in NRC Order EA-03-009 (Reference 1) establishing interim inspection requirements for pressurized water reactor pressure vessel (RPV) heads. The Order requirements involve nondestructive examination (ultrasonic, eddy current, and dye penetrant testing) of the penetration nozzles below the J-groove weld that attaches the nozzle to the head. In Reference 2, FENOC consented to the Order for BVPS Unit 1 and Unit 2 with exceptions that were identified as potential items for relaxation.

BVPS Unit 2 is scheduled for a refueling outage in September 2003 and will be conducting inspections of the RPV head penetrations. Pursuant to the procedure specified in Section IV, paragraph F of the Order, FENOC requests relaxation from the requirements specified in Section IV, paragraph C.(2)(b)(i) and C.(2)(b)(ii) for BVPS Unit 2 regarding inspection to the bottom of the RPV head penetration nozzles. Specifically, limited portions of the bottom of the RPV head penetration nozzles can not be tested utilizing eddy current and ultrasonic methods due to the physical configuration of the nozzles and the limitations of the test equipment. The portions of interest are not part of the reactor coolant system pressure boundary.

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Secondly, FENOC requests that either of the techniques described in parts IV.C.(2)(b)(i) and IV.C.(2)(b)(ii) of the Order be used for any individual RPV head penetration, allowing for the use of a combination of techniques to complete a comprehensive inspection.

Attachment 1 to this letter provides the relaxation request and justification. Relaxation Item (a) refers to the inspection of the bottom of the nozzle. Relaxation Item (b) refers to the use of a combination of inspection techniques. As demonstrated in the attachment, the requested relaxation meets item IV.F.(2) of the Order, as compliance is unnecessary and would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety.

FENOC requests approval of the subject relaxation for the fulfillment of the requirements of NRC Order EA-03-009 Part IV.C.(2)(b). A later submittal will provide supplemental information including field evaluation data and applicable supporting analysis to determine acceptability of the unexamined portions of the nozzles.

BVPS Unit 2 will perform inspections during the upcoming refueling outage (2R10) in accordance with the requirements of the Order Part IV.C.(2)(a) and Part IV.C.(2)(b); however, the inspections are not required to be completed until the next refueling outage (2R11) per the frequency specified in the Order. Therefore, given an acceptable visual examination per Part IV.C.(2)(a), NRC approval of the relaxation request pertaining to Part IV.C.(2)(b) is not required to support restart from the 2R10 BVPS Unit 2 refueling outage.

FENOC considers that, upon approval by the NRC, the alternatives proposed in Attachment 1 constitute conditions of the Order rather than regulatory commitments. Therefore, there are no new commitments identified in this document. If there are any questions regarding this matter, please contact Mr. Larry R. Freeland, Manager, Regulatory Affairs/Performance Improvement at 724-682-5284.

Sincerely,

L. William Pearce

Attachment

c: Mr. T. G. Colburn, NRR Senior Project Manager
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Central File - *Keywords: RPV head inspections, ISI*

BEAVER VALLEY POWER STATION (BVPS) UNIT 2
RELAXATION REQUEST from NRC Order EA-03-009

Alternative for Inspection of Nozzles
That Will Provide an Acceptable Level of Quality and Safety

1. Components Affected

Beaver Valley Power Station (BVPS) Unit 2 Reactor Pressure Vessel (RPV) head penetration nozzles.

Expected Unit Susceptibility Categories
Unit 2 10th Refueling Outage (2R10) – Fall 2003 – Moderate
Unit 2 11th Refueling Outage (2R11) – Spring 2005 – Moderate (projected)
Unit 2 12th Refueling Outage (2R12) – Fall 2006 – High (projected)

2. Applicable Document

Nuclear Regulatory Commission (NRC) Order EA-03-009, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 11, 2003.

3. Applicable Requirement

NRC Order EA-03-009 requires ultrasonic, eddy current, and/or dye penetrant testing of RPV head penetration nozzles at various intervals, depending on their susceptibility to primary water stress corrosion cracking. The BVPS Unit 2 RPV head is currently in the moderate susceptibility category. The requirements governing ultrasonic and eddy current testing for RPV head in the moderate susceptibility category are stated in Section IV.C.(2)(b)(i) and IV.C.(2)(b)(ii) of the Order, respectively.

NRC Order EA-03-009 Section IV.C.(2)(b) states that, for plants in the moderate category,

> *(b) Either:*
> *(i) Ultrasonic testing of each RPV head penetration nozzle (i.e., nozzle base material) from two (2) inches above the J-groove weld to the bottom of the nozzle and assessment to determine if leakage has occurred into the interference fit zone, OR*

(ii) Eddy current testing or dye penetrant testing of the wetted surface of each J-Groove weld and RPV head penetration nozzle base material to at least two (2) inches above the J-groove weld.

...shall be performed at least once over the course of every two (2) refueling outages.

Relaxation Item (a)

Relaxation is requested from parts IV.C.(2)(b)(i) and IV.C.(2)(b)(ii) of the Order. Specifically, the relaxation is related to ultrasonic, eddy current, and dye penetrant testing of a limited bottom portion of the RPV penetration nozzles below the J-groove welds. These limited bottom portions of the nozzle are not part of the pressure boundary.

Relaxation Item (b)

Relaxation is requested from part IV.C.(2)(b) of the Order, specifically, to allow for the requirements to be fulfilled using a combination of the techniques described in parts IV.C.(2)(b)(i) and IV.C.(2)(b)(ii) of the Order.

4. Reason for Request

Relaxation Item (a)

NRC Order EA-03-009 requires that ultrasonic or eddy current testing extend to the bottom of the RPV penetration nozzle. FirstEnergy Nuclear Operating Company (FENOC) is requesting approval of a proposed alternative to the requirements that is appropriate for the ultrasonic and eddy current probes used at BVPS Unit 2, the physical configuration of the bottom portion of the nozzles, and the phenomena of concern as identified in the Order. Reasons for requesting the proposed alternative are as follows:

a. The bottom end of the CRDM penetration nozzles at BVPS Unit 2 are externally threaded and internally tapered. This prevents UT or eddy current data acquisition (in a zone extending up approximately 1.25" from the bottom of each nozzle), utilizing the current inspection equipment.

b. Ultrasonic or eddy current testing of the lower portions of the nozzle (that cannot be inspected due to nozzle geometry) is not significant to the phenomena of concern. The phenomena of concern are leakage past the J-groove weld and circumferential cracking in the nozzle above the J-groove weld. This is

appropriately reflected in the requirement (as stated in Section 3 above) that the ultrasonic or eddy current testing extend to 2 inches above the J-groove weld. However, the Order also requires that ultrasonic or eddy current testing be extended to the bottom of the nozzle. The nozzle is essentially an open-ended tube and the nozzle wall below the J-groove weld is not part of the reactor coolant system pressure boundary. The area of the nozzle below the J-groove weld will be addressed in a supplemental submittal with supporting analysis to determine acceptability.

c. The Order allows for performing dye penetrant testing in lieu of eddy current or ultrasonic testing. The presence of thermal sleeves in the vast majority of the CRDM penetrations prohibits dye penetrant testing of the tapered ID surface of the tube. Dye penetrant testing of threaded surfaces, like the tube OD, is difficult due to physical restraints and the need to properly clean the surface to provide accurate test results. As a result, performing dye penetrant testing on the bottom nozzle area would require thermal sleeve removal, extensive manpower, and would result in significant radiation exposure to personnel. The radiation exposure is estimated to be in excess of 100 man-rem, without a compensating increase in the level of quality or safety.

Relaxation Item (b)

As described in Section 3 above, NRC Order EA-03-009 requires that either ultrasonic OR eddy current testing be performed. FENOC is requesting approval of a proposed alternative to the requirements that are appropriate to the ultrasonic and eddy current probes used at BVPS Unit 2 and the physical configuration of the nozzles. The proposed alternative is to allow for the requirements to be fulfilled by using a combination of techniques described in parts IV.C.(2)(b)(i) and IV.C.(2)(b)(ii) of the Order for a complete and comprehensive inspection of individual RPV head penetrations. Reasons for requesting the proposed alternative are as follows:

a. Varying nozzle configurations of the 65 CRDM penetration nozzles (thermal sleeves vs. open housings) and the vent line (interference fit vs. clearance fit) combined with the vendor's current probe design and inspection technology make it prudent to inspect individual penetrations using different inspection techniques.

b. Performing inspections consistent with the requirements of either part IV.C.(2)(b)(i) OR IV.C.(2)(b)(ii) of the Order on a per penetration basis does not compromise quality or safety.

5. Proposed Alternatives and Basis for Use

Relaxation Item (a)

In lieu of requiring that ultrasonic or eddy current testing of each RPV head penetration nozzle extend to the bottom of the nozzle, FENOC proposes that the ultrasonic and eddy current testing conducted pursuant to Sections IV.C(2)(b)(i) and IV.C(2)(b)(ii) of NRC Order EA-03-009 be required to extend to as close as practicle to the bottom of the nozzle. On the outermost penetrations (Penetrations 62 through 69), available design information indicates that the length of tube between the bottom of the weld and the beginning of the thread relief is reduced to a minimum of 0.8" on the downhill side. On all other nozzles, the minimum distance is shown to be greater that one inch. Figure 1 shows the nozzle configuration of the outermost penetrations.

Although available design information indicate dimensions for the length of nozzle between the bottom of the weld and the beginning of the thread, our experience gained during BVPS Unit 1's inspections in the spring outage (2003) has shown that the design details concerning the extension of the weld leg down the OD of the nozzle are not absolute. For this reason, this submittal will be supplemented with field evaluation data and applicable supporting analysis to demonstrate acceptability of the unexamined portions of the nozzles.

The requirement that ultrasonic or eddy current testing extend to 2 inches above the J-groove weld will remain unaffected.

This proposed alternative will provide an acceptable level of quality and safety because the only portion of the nozzle inspection exempted is the portion below the J-groove weld that will not be inspected due to nozzle geometry. Below the J-groove weld, the nozzle is essentially an open-ended tube and the nozzle wall in this portion is not part of the reactor coolant system pressure boundary.

The following information is obtained from the finite element stress analysis results of the Control Rod Drive Mechanism (CRDM) penetration nozzles performed by our vendor (Westinghouse) for a 3-Loop plant of similar design and construction as BVPS Unit 2. The following summarizes a comparison of the geometry for the vessel head, CRDM nozzles, as well as the vessel head temperature.

	Reference Plant	BVPS Unit 1	BVPS Unit 2
RPV Head Inner Radius	79.094 inches	79.094 inches	79.094 inches
RPV Head Thickness	6.188 inches	6.188 inches	6.188 inches
CRDM Nozzle OD	4.000 inches	4.000 inches	4.000 inches
CRDM Nozzle ID	2.750 inches	2.750 inches	2.750 inches
RPV Head Op. Temp.	597°F	595°F	595°F

The physical locations of the penetration nozzles on the BVPS Unit 2 vessel head are consistent with those of the reference plant and BVPS Unit 1. In addition, the BVPS Unit 2 vessel head temperature is lower than that of the reference plant. Based on the above comparison, it is concluded that the information from the reference plant and BVPS Unit 1 is applicable to BVPS Unit 2. A similar relaxation request was approved for BVPS Unit 1 on April 18, 2003.

The scope of the relaxation request involves only non-destructive examination (NDE) of the penetration nozzles below the J-groove weld. The examination coverage is expected to be a minimum of 0.8 inch on partial arcs of the outermost penetrations and greater than 1 inch in other cases, as measured from the bottom of the J-groove weld towards the bottom of the nozzle. An analysis using a flaw tolerance approach will be used to determine the significance of an axial flaw in the unexamined region of the nozzle. As stated above, this analysis will be provided in a supplemental submittal to demonstrate acceptability of the unexamined portions of the nozzles.

Hoop stress analysis and crack propagation calculations currently are being performed for a postulated axial flaw in the un-inspected region of tube. The magnitude of the stresses in these portions of the nozzles is low based on information from other plants of similar design and construction. Given the correspondingly low crack growth rates, these analyses will confirm that there are no challenges to the structural integrity of the vessel head penetration nozzles from the unexamined bottom portions of the nozzles within the scope of this request.

This proposed alternative does not affect ultrasonic or eddy current testing of the portion of the nozzle involved in the phenomena of concern. Therefore, the proposed alternative provides an acceptable level of quality and safety since the unexamined bottom portions of the nozzle are not involved in the phenomena of concern.

In conclusion, this requested relaxation meets item IV.F.(2) of the Order, as compliance with the Order for the nozzles would result in hardship or unusual difficulty without a compensating increase in the level of safety.

Relaxation Item (b)

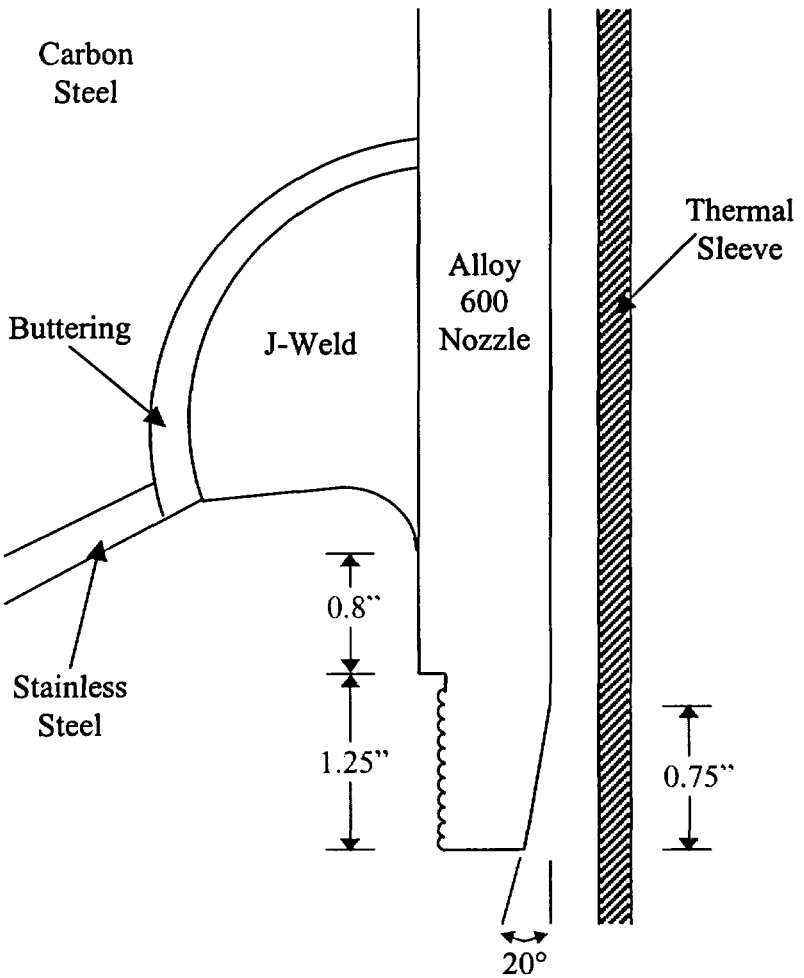
As an alternative to requiring that either ultrasonic OR eddy current techniques be used for the entire inspection of the RPV head, FENOC proposes that the testing conducted pursuant to Section IV.C.(2)(b) of NRC Order EA-03-009 be one of the techniques or a combination of the techniques described in parts IV.C.(2)(b)(i) and IV.C.(2)(b)(ii) for individual RPV head penetrations.

This approach will provide the ability to match the most appropriate inspection technique, IV.C.(2)(b)(i) OR IV.C.(2)(b)(ii), to the specific physical configuration of each individual nozzle. As such, inspections of the RPV head penetrations performed in this manner will meet the level of quality and safety required by part IV.C.(2)(b) of the Order.

6. Duration of Proposed Alternatives

The proposed alternatives will apply only during the period in which NRC Order EA-03-009 is in effect.

Figure 1: BVPS Unit 2 CRDM Penetration Nozzle Configuration
Outermost Penetrations (62 through 69)



Outermost Penetrations (62 - 69)
Design Detail