FENOC
FirstEnergy Nuclear Operating Company

Beaver Valley Power Station
P.O. Box 4
Shippingport, PA 15077

Paul A. Harden
Site Vice President

724-682-5234
Fax: 724-643-8069

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L-09-249

10 CFR 50.55a

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

SUBJECT:
Beaver Valley Power Station, Unit Nos. 1 and 2
Docket No. 50-334, License No. DPR-66
Docket No. 50-412, License No. NPF-73
Response to Request for Additional Information Regarding 10 CFR 50.55a Request Numbers 1-TYP-4-B3.120-1 and 2-TYP-3-C6.10-1 (TAC Nos. ME1108 and ME1109)

By letter dated April 14, 2009, FirstEnergy Nuclear Operating Company (FENOC) submitted a 10 CFR 50.55a request for approval of proposed alternatives to American Society of Mechanical Engineers Boiler and Pressure Vessel Code Section XI requirements associated with examination of the Beaver Valley Power Station, Unit No. 1 (BVPS-1) pressurizer surge nozzle (request number 1-TYP-4-B3.120-1) and examination of accessible portions of the Beaver Valley Power Station, Unit No. 2 (BVPS-2) recirculation spray pump casing welds (request number 2-TYP-3-C6.10-1). By letter dated September 16, 2009 (Accession Number ML092370037), the Nuclear Regulatory Commission (NRC) staff requested additional information in order to complete its review of the information concerning the proposed alternatives. The FENOC response to questions related to request number 1-TYP-4-B3.120-1 is attached. FENOC hereby withdraws request number 2-TYP-3-C6.10-1, and thus, no response is provided to questions related to this request.

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-761-6071.

Sincerely,

Paul A. Harden

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NRR

Attachments:
Response to Request for Additional Information

cc: NRC Region I Administrator
NRC Resident Inspector
NRC Project Manager
Director BRP/DEP
Site BRP/DEP Representative

To complete their review, the Nuclear Regulatory Commission (NRC) staff has requested additional information regarding 10 CFR 50.55a request number 1-TYP-4-B3.120-1. Request number 1-TYP-4-B3.120-1 proposed performance of a visual examination of the Beaver Valley Power Station Unit No. 1 (BVPS-1) pressurizer surge nozzle in lieu of performance of a volumetric examination as required by American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Table IWB-2500-1, for the fourth inservice inspection (ISI) program interval. The NRC staff request is provided below in bold type followed by the FirstEnergy Nuclear Operating Company (FENOC) response.

Request Number 1-TYP-4-B3.120-1

1. **Relief is being requested from the requirements of Table IWB-2500-1, Examination Category B-D, Item No. B3.120. However, the applicable ASME Code, as stated by the licensee, ASME Code, Section XI, 2001 Edition, through 2003 Addenda, Table IWB-2500-1 does not have this item number. Please explain this discrepancy and identify the intended item number.**

   Response: Per 10CFR 50.55a(b)(2)(xxi), *Table IWB-2500-1 examination requirements,* for licensees using the 1999 Addenda through the latest edition and addenda incorporated by reference in paragraph (b)(2) (FENOC uses the 2001 Edition, through 2003 Addenda for BVPS-1), the provisions of the 1998 Code Examination Category B-D, Item No. B3.120 must be applied. Therefore, Examination Category B-D and Item No. B3.120 were referenced in Section 3.0, *Applicable Code Requirements*, of the relief request.

2. **Discuss the results of previous nondestructive examination (NDE) completed on the BVPS-1 and 2 pressurizer surge line inner radius.**

   Response: As stated in the fourth paragraph in Section 4.0, *Reason for Request*, of the relief request, the BVPS Unit No. 1 surge nozzle inner radius section has not been examined. The same paragraph states, "The BVPS Unit 2 surge nozzle inner radius section and the surge nozzle to vessel weld were ultrasonically examined during the previous interval and no recordable indications were found." Also, the BVPS Unit 2 surge nozzle inner radius section nozzle and the surge nozzle to vessel weld were ultrasonically examined during the first ten-year interval, and no recordable indications were found.

3. **It is stated in Section 4.0 that the unusual difficulty without a compensating increase in the level of quality or safety is associated with access to either the exterior surface for volumetric examination or interior surface for an enhanced visual examination. To further clarify how access to the exterior surface and interior surface is obtained:**

   a. **Describe what type of insulation is installed on the pressurizer surge line and the effort needed to remove it.**

      Response: The pressurizer bottom and the surge line have mirror type insulation. The surface is made accessible by removing the insulation surrounding the surge nozzle. The design of this insulation requires disconnection of the 78 heater cables from the immersion heaters prior to removing the insulation. Each cable consists of two wires, each mechanically connected to the heater. Care must be taken while disconnecting and reconnecting to ensure the ceramic terminal blocks connecting the wires to the heater pins are not damaged. If damaged, an unbrazing/brazing evolution would be required to replace the blocks. The dose estimate for this exam assumes that no ceramic terminal blocks would require replacement. Another concern is the presence of asbestos in the cable jackets. Special monitoring and material control would be necessary due to the presence of friable asbestos. Though airborne radioactive contamination is not typically a concern in this area, respirators would be required to address the potential asbestos exposure. Additional coveralls, suitable for asbestos work, would be required over the anti-contamination clothing, causing a heat stress concern. The BVPS-1 pressurizer bottom insulation was installed during plant construction prior to connecting the heater cables. Insulation panels span several heater pipes, and the holes provided in the insulation panels for the heater pipes do not allow the insulation panels to be lowered past the larger diameter of the ceramic terminal blocks (heater connections) at the ends of the heater pipes.

   b. **Discuss specifically the design features of the insulation that requires that all heater cables, shown in Figure 1 of the submittal, must be removed first in order to successfully remove the insulation from the pressurizer surge line.**

      Response: The BVPS-1 pressurizer bottom insulation was installed during plant construction, prior to connecting the heater cables. Inadequate sized holes were provided for the insulation openings around the heater pipes to allow the insulation to be lowered past the larger diameter of the heater connections. Each rigid insulation panel spans several heater penetrations in all three circular rows of heaters, which prohibits panel removal past the heater connections.

c. **Discuss what special considerations, if any, were required in the past when heater cables were removed.**

Response: The special considerations for cable disconnection are discussed in the response to Request 3.a above.

d. **The licensee stated that the adjacent nozzle to safe end weld, within 18 inches of the pressurizer surge line inner radius, had been examined. Discuss whether there were any special considerations such as heater cable removal, insulation removal, etc. needed during the adjacent nozzle to safe end weld examination, and if so, why was the surge line not examined during this time?**

Response: The insulation covering the nozzle to safe end weld is separate from the pressurizer bottom head insulation. The surge nozzle to safe end weld is located at a sufficient distance from the pressurizer so that removal of insulation to access the weld does not require pressurizer heater cable disconnection or pressurizer bottom head insulation removal. Removal of the insulation covering the surge nozzle to safe end weld is not sufficient to allow inspection of the pressurizer surge line inner radius.

e. **The licensee stated that there is a thermal sleeve in BVPS-1 pressurizer surge line. Please describe the configuration of the thermal sleeve in greater detail to demonstrate how access is limited and precludes an enhanced visual examination.**

Response: The thermal sleeve is located on the inside diameter of the nozzle and extends past the corner of the inner radius. The inner radius curves away from the thermal sleeve; however, the sleeve would significantly limit access to the lower portion of the radius.

f. **The licensee stated that with a manway 40 feet away from the area of interest, positioning a remote camera will be difficult. Please describe in greater detail the type of remote camera to be used and its limitations that would create an unusual difficulty without a compensating increase in the level of quality or safety.**

Response: A flexible cable boroscope-type camera, containing a transmission and power cable for a portable light source was considered for this application. However, it would be difficult to lower the camera from the man-way (only access point), which is located off-center on the upper head. Because the man-way is not centered above the surge nozzle, it would be difficult to guide the camera through the approximate 2-foot diameter area at the center of the heaters. The camera would also need to be guided through two sets of baffle plates located inside the pressurizer that support the heaters and then through 3/8-inch

diameter holes in the metal screen (retaining basket) located at the surge nozzle, which covers the area of interest. It is likely that the camera would have to be inserted through several different holes in the retaining basket to access the area of interest. To further complicate access, the holes in the screen are likely no longer 3/8 inch in diameter due to the forming process of the retaining basket, which makes the holes out of round. As stated in the response to Request 3.e, the surge nozzle contains a thermal sleeve that would obstruct access to the lower portion of the inner radius area.

4. **As previously stated, the licensee stated in Section 4.0 that the unusual difficulty without a compensating increase in the level of quality or safety is associated with access to the exterior surface for volumetric examination. High dose rates in this area and the time spent in high dose areas are the primary concerns hindering access to the area of interest. To further clarify aspects associated with the dose estimate please describe the following:**

   a. **It is stated in Section 4.0 that heater cables were repaired to assess potential short circuits in refueling outage 1R08. Discuss how much dose was received during this activity and do current dose estimates agree with this data point.**

      Response: The actual dose received during this 1991 activity is not known. However, the estimated dose for rework of two of the 78 heater cables was 1.2 rem. This was based on a dose rate of 600 millirem per hour (mR/hr) at that time, and the estimated time to disconnect (0.25 hours per cable) and reconnect (0.75 hours per cable) the two cables. The current dose rates (shown in the table on page 4 of 6 in Section 4.0) are lower than the 1991 dose rates due to zinc addition, on-line chemistry, and chemical cleaning activities performed during refueling outages that have occurred since 1991.

   b. **Discuss whether the historical dose rates in this area are comparable to what they are now and whether the dose rate in the area of interest is constant or does it vary.**

      Response: The dose rates from the radiological survey taken during the seventeenth refueling outage in 2006 are lower than the dose rates during the eighth refueling outage in 1991 when the cable rework was performed. The dose rates have been reduced for the reasons discussed in response to Request 4.a. The current dose rates are considered to be stable at this time.

c. **The dose estimate demonstrates a variance in the dose rates seen by boilermakers, examiners, and electricians. Please explain the reason for this variance.**

Response: The dose rates are based on the area where each worker will be positioned. The dose rate at the cables is 200 mR/hr; at the surge nozzle the rate is 100 mR/hr on contact and 60 mR/hr greater than 30 centimeters away. The electricians and insulators will be in direct contact with the cables and insulation above the cables. The boilermakers can stand further away while cleaning the area of interest. The examiners will be close to the nozzle area for the examination.

d. **It is stated in Section 4.0 that the BVPS-2 pressurizer surge line was inspected ultrasonically during the last outage. Discuss how dose rates vary from BVPS-1 to BVPS-2 and what are the variances between the two units that allowed BVPS-2 to be examined, but not BVPS-1.**

Response: A specific dose estimate was not developed for insulation removal and inspection of the BVPS-2 pressurizer surge line nozzle. However, the dose estimate for inspection of the BVPS-1 pressurizer surge line nozzle was substantial (17.7 rem), and the largest portion of the dose is attributed to disconnection and reconnection of heater cables (15.6 rem). The BVPS-1 and BVPS-2 pressurizer bottom heads have different insulation designs. The BVPS-2 insulation can be removed without disconnecting the heater cables. The insulation panels are split at the heater penetration center lines, allowing the panels to be lowered around the heater connections. This BVPS-2 design allows for the ultrasonic testing to be performed without hardship.

e. **It is stated in Section 5.0 that as an alternative to the required code examination, a visual examination (VT-2) of the pressurizer surge nozzle area, with the insulation installed, will be completed in conjunction with the boric acid walkdown, during every shutdown. Discuss the estimated dose received from performing VT-2 examinations every shutdown and how this compares to the performance of the required volumetric examination over the same ISI interval.**

Response: The dose received during the VT-2 examination of the pressurizer surge line area is minimal (less than 1 millirem). Section XI of the ASME Code and site procedures allow a VT-2 to be performed without insulation removal by examining the horizontal surfaces of the insulation at the insulation joints and examining the surrounding area, including floor areas or equipment surfaces located underneath the pressurizer. Therefore, the time required to perform the VT-2 examination is a fraction of the time required for the ultrasonic examination, and the distance from the radiation source is much greater for the VT-2 examination compared to the ultrasonic (volumetric) examination. The estimated

dose for the VT-2 examination of the pressurizer surge line area is small compared to the estimated dose for the required volumetric examination.

5. **It is stated in Section 4.0 that special equipment was designed to perform this specific volumetric examination. Please describe this equipment, rational for its use, and reasons why it is not viable to use.**

   Response: Ultrasonic Test (UT) transducer shoes designed for the specific geometry of the Unit 1 surge nozzle were procured to facilitate volumetric examination of the nozzle. However, the dose associated with the exam preparations outweighs the benefits of performing the examination.

6. **It is stated in Section 4.0 that fatigue is the only credible failure mechanism applicable for the pressurizer surge line nozzle. To further clarify aspects of this degradation mechanism, please describe the following:**

   a. **It is stated in Section 4.0 that the inner radius of the pressurizer surge line is less susceptible to fatigue problems than a nozzle to vessel weld. Please provide a more thorough explanation as to why the cast SA-216 Grade WWC steel pressurizer surge line inner radius is less susceptible to fatigue than a nozzle to vessel weld.**

      Response: The statement of susceptibility to fatigue problems is in reference to the relative susceptibility of a pressurizer bottom head constructed as a one-piece casting and one constructed with a welded nozzle insert. In a one-piece casting design the area of the inner radius does not have a weld susceptible to thermal fatigue from postulated reactor coolant insurge/outsurge events. The microstructure of the cast is unchanged in the area of the inner radius, thus eliminating the potential for fabrication defects that may be introduced during the welding process and mircostructural differences that may be present at the casting to weld volume interface. These potential weld defects and microstructural discontinuities may provide stress risers for the initiation of a fatigue flaw. Therefore, the inner radius area of a single piece casting designed pressurizer bottom head would have a lower overall susceptibility to fatigue failure than one of welded design.

b. **It is stated in Section 4.0 that the chances of having a pre-existing flaw are less likely in the inner radius casting than a nozzle to vessel weld due to the manufacturing processes. Please provide a more thorough explanation as to why it is less probable that a pre-existing flaw exist in the inner radius of the pressurizer surge line as opposed to a nozzle to vessel weld. Discuss whether there is a difference in acceptance criteria for pre-service examination.**

Response: As noted in the response to Request 6.a, the bottom head of the pressurizer is a one piece casting and does not have any fabrication induced metallurgical anomalies. There is no reason to believe that a casting flaw would exist in the area of the inner radius, since the casting is expected to be of a relatively homogenous structure throughout. If a welded nozzle design is used in the fabrication process, metallurgical discontinuities are created at the weld fusion zone and there is the potential for slag inclusions and fusion defects that meet the fabrication code acceptance criteria to remain in the weld. Therefore, the number of potential defects in the pressurizer inner radius area in a one piece casting design is significantly less than that of a welded nozzle design pressurizer bottom head.

For this specific examination, the acceptance standards applied to a preservice and inservice examination are identical.

c. **Discuss how in-service flaws are identified and characterized on the BVPS-1 pressurizer surge line inner radius without the use of a volumetric examination technique to ensure the integrity of the reactor coolant pressure boundary.**

Response: As noted in the previous responses, 6.a and 6.b, the one piece casting design is less susceptible to postulated in-service induced fatigue flaws. In the unlikely event that an in-service flaw should develop, it would be detected by the VT-2 examination. Inservice flaws cannot be identified or characterized on the inner radius without the volumetric exam.

d. **With a lack of a means to characterize potential in-service flaws, discuss what measures will be taken by the licensee to prevent a postulated in-service flaw from challenging the integrity of the reactor coolant pressure boundary.**

Response: The likelihood of a postulated fatigue flaw in a one-piece casting designed bottom head is considered small due to the lack of potential stress risers from fabrication induced defects and metallurgical discontinuities that may be present in the welded design. Also, as noted below in response to Requests 7 and 8, plant procedures incorporate enhanced strategies for the mitigation of pressurizer insurges and outsurges, and primary water chemistry is maintained in

accordance with EPRI guidelines. Therefore, the proposed visual examinations and leakage monitoring program employed at Beaver Valley Power Station are appropriate to maintain a high confidence of continued safe operation. The proposed alternative is consistent with the alternative submitted and approved in the previous 10-year interval.

7. **Discuss whether any thermal transients that have occurred could have affected the structural integrity of the BVPS-1 pressurizer surge line inner radius.**

   Response: Beaver Valley Power Station participated in the Westinghouse Owners Group efforts that led to the development of WCAP-14950, "Mitigation and Evaluation of Pressurizer Insurge/Outsurge Transients," dated February 1998. In addition, Westinghouse has performed site-specific analysis and described the analysis in WCAP-15351, "Evaluation of Pressurizer Transients Based on Plant Operations for Beaver Valley Unit 1," dated March 2000, for the pressurizer to surge line nozzle and lower shell. That analysis incorporates a conservative representation of past transients, thermal stratification of the surge line during plant heat-up, shutdown and operation as well as a projection of past transients through the period of extended operation. WCAP-15351, Supplement 1, "Evaluation of Beaver Valley Unit 1 Pressurizer Insurge/Outsurge Transients with Revised Operating procedures," dated August 2005, led to modification of plant operating procedures to incorporate enhanced strategies for the mitigation of pressurizer insurges and outsurges.

   The WCAP-1531, and WCAP-1531, Supplement 1 analyses model the pressurizer surge line inner radius. The results of these analyses show that the inner radius is not the bounding location for either stress or cumulative usage factor.

   Therefore, the structural integrity of the pressurizer inner radius is not adversely affected by past thermal transients nor by postulated future thermal transients.

8. **Discuss whether water chemistry transients that have occurred could have affected the pressurizer surge line inner radius.**

   Response: Neither BVPS-1 or BVPS-2 have experienced resin intrusions or chemical addition transients. Primary water chemistry is maintained to the Industry standard Electric Power Research Institute "PWR Primary Water Chemistry Guidelines." Therefore, there have been no water chemistry transients that affected the pressurizer surge line nozzle inner radius. The inner radius surface of the pressurizer and the pressurizer surge line are fabricated with austenitic stainless steel on all surfaces exposed to reactor coolant water. Stainless steel has been shown to be robust as a pressure boundary material and is resistant to chemical attack.

9. **Discuss whether the leak before break analysis for this pipe is impacted by the inability to examine this pipe per ASME requirements.**

   Response: The BVPS-1 leak before break analysis was performed with no credit or consideration of inservice inspection, and therefore, the inability to ultrasonically examine this location has no impact on the analysis.

10. **The proposed alternative for a VT-2 visual examination with insulation on the pipe, will only identify a through wall leak. Considering the safety significance of this component, please describe how there is not a compensating increase in the level of quality or safety by performing the required volumetric examination or enhanced visual examination as permitted by Section 50.55a(b)(2)(xxi) of Part 50 of Title 10 of the Code of Federal Regulations (10 CFR).**

    Response: The proposed VT-2 examination will only identify a through wall leak. However, based on the available leakage detection methods noted in the relief request, the unlikely presence of a flaw (given the reliable past performance and one piece cast design of this component), along with the described hardship and unusual difficulty associated with both the external UT and internal enhanced visual examinations, performing these examinations would not provide a compensating increase in the level of quality or safety.