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May 19, 2009
L-09-102

10 CFR 50.55(a)

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

SUBJECT:
Beaver Valley Power Station, Unit No. 2
Docket No. 50-412, License No. NPF-73
Response to Request for Additional Information Regarding Proposed Alternative Reactor Vessel Head Penetration and J-Groove Weld Repair Methods
(TAC No. MD9970)

By letter dated October 9, 2008, FirstEnergy Nuclear Operating Company (FENOC) submitted a 10 CFR 50.55a request for approval of a proposed alternative to certain requirements associated with reactor vessel weld repair methods to be used during the remainder of the current Beaver Valley Power Station, Unit No. 2, 10-year inservice inspection interval which ends August 28, 2018. By letter dated April 8, 2009, the Nuclear Regulatory Commission (NRC) staff requested additional information in order to complete its review of the information concerning the proposed alternative. The FENOC response to this request is attached.

Westinghouse Technical Report WCAP-13998, "RV Closure Head Penetration Tube ID Weld Overlay Repair," was used as a basis for this response and is provided as Enclosure A. WCAP-14519, "RV Closure Head Penetration Tube ID Weld Overlay Repair," is provided as Enclosure B. Westinghouse's Affidavit, Proprietary Information Notice and Copyright Notice are also provided in Enclosure C.

As Enclosure A contains information proprietary to Westinghouse Electric Company LLC, it is supported by an affidavit signed by Westinghouse, the owner of the information. The affidavit provided in Enclosure C sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses the considerations listed in 10 CFR Section 2.390(b)(4). Accordingly, it is respectfully requested that the Westinghouse proprietary information to be withheld from public disclosure.

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NRR

There are no regulatory commitments contained in this letter. 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,

Peter P. Sena III

Attachment:
Response to Request for Additional Information

Enclosures:

A. WCAP-13998, Revision 1 "RV Closure Head Penetration Tube ID Weld Overlay Repair," November 1995 (Proprietary)
B. WCAP-14519, "RV Closure Head Penetration Tube ID Weld Overlay Repair," November 1995 (Non-Proprietary)
C. Westinghouse Affidavit, Proprietary Information Notice, and Copyright Notice.

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

To complete their review, the Nuclear Regulatory Commission (NRC) has requested additional information regarding the 10 CFR 50.55(a) request. The NRC staff request is provided below in bold type followed by the FirstEnergy Nuclear Operating Company (FENOC) response for Beaver Valley Power Station Unit No. 2.

In Section 5.1 of Enclosure A, it was stated that the depth of the excavated cavity of an inside diameter (ID) axial flaw repair will be no greater than 0.125-inch. This is different than the requirements of WCAP-15987, Revision 2-A, Section 2.2.1, on which this repair process is based.

a. **Justify the change in cavity depth from the requirement of WCAP-15987.**

   Response:

   The cavity depth is not a critical parameter in the implementation of a repair on the ID surface. The goal of the inlay is to isolate the susceptible material from the environment. The purpose of the excavation is to accommodate the application of weld layers to meet that requirement. The depth specified in WCAP-15987 (Reference 1) is a nominal dimension and the depth needed to accommodate three weld layers while still maintaining the tube ID. Since two weld layers will be applied, less excavation is required and 0.125 inches of excavation is all that is needed. The smaller thickness of the cavity excavated for two layers would mean a slightly thinner weld, which would produce less residual stress.

b. **How many layers of weld overlay will be applied to a 0.125-inch deep cavity?**

   Response:

   The number of layers can be controlled by the size of the weld bead, but the minimum number of layers is two. Two layers are required for the base metal regions, like the ID, and three layers are specified for application over existing welds, such as outside diameter (OD) repairs, as stated in the NRC staff safety evaluation for WCAP-15987. The third layer is required over the welded regions because of potential weld dilution.

c. **How will the ID be restored?**

   Response:

   The weld is machined to restore the ID after the weld is completed.

d. Discuss the expected chemistry of the weld overlay surface, if overlay layers are applied in a 0.125-inch depth cavity and the surface is restored to maintain the desired ID.

Response:

The expected chemistry of the weld surface is that of a typical Alloy 52 weldment with no significant dilution.

2. The repair of an outside diameter circumferential flaw below the J-groove weld was specifically excluded from the embedded flaw repair process, as discussed in Section 2.1 of WCAP-15987. If this repair is to be included, please describe the repair procedure, nondestructive examination, and acceptance criteria.

Response:

The repair procedure is to seal off the circumferential flaw with Alloy 52M weldment. No excavation of the flaw will be needed. The embedded flaw repair technique may be applied to OD axial or circumferential cracks below the J-groove weld because they are located away from the pressure boundary, and the proposed repair of sealing the crack with Alloy 690 weld material would isolate the crack from the environment as stated in section 3.6.1 of the NRC staff safety evaluation for WCAP-15987.

The finished weld will be examined by liquid penetrant (PT), ultrasonic (UT) and eddy current testing (ECT) to ensure acceptability. Specifically, the entire surface of the overlay will be examined by PT, with acceptance criteria of no indications. Additionally, the penetration tube will be examined from the ID surface using UT and ECT to confirm that the repair process did not introduce any new flaws or adversely change the size or characteristics of the previously identified flaw(s).

3. Describe how far the J-groove weld overlay will extend onto the penetration tube, as discussed in Section 5.2.2 and 5.2.3 of Enclosure A of the licensee's submittal.

Response:

In both cases, the overlay will extend onto and encompass the OD of the penetration tube. The seal weld will extend beyond the Alloy 600 weld material by at least one half inch as stated in the NRC staff safety evaluation for WCAP-15987.

4. **As discussed in Section 5.2.6 of Enclosure A of the licensee's submittal, justify the change in the number of layers of weld overlay applied to base metal locations from that specified in Section 2.1 of WCAP-15987.**

   Response:

   There is no change to the number of layers specified in WCAP-15987. Two layers are required for the base metal regions, like the ID as stated on page 1 of the Sequence and Summary of WCAP Approval section of WCAP-15987. Three layers are specified for application over existing welds, such as OD repairs, as stated in the NRC staff safety evaluation for WCAP-15987. The third layer is required over the welded regions because of potential weld dilution.

5. **Discuss whether there is a potential for hot cracking due to high sulfur content (>0.01%) of the 308 stainless steel cladding when Alloy 52 weld overlay is applied.**

   Response:

   There is a potential for hot cracking due to sulfur content of the 308 stainless steel cladding when Alloy 52 weld overlay is applied. However, in no instance will a weld be considered acceptable until nondestructive examination surface exams are negative for crack indications. FENOC has performed four similar embedded flaw repairs and has not experienced any hot cracking, which suggests low sulfur content in the stainless steel cladding.

6. **In Section 5.3 of Enclosure A of the licensee's submittal, it is stated that, "The residual stresses produced by the embedded flaw technique have been measured and found to be relatively low..." Please provide information on the measurement technique used and measurement data.**

   Response:

   As described in WCAP-13998 (Reference 2), Section 7, the hole drilling method of residual stress measurement was used to determine the buildup of residual stresses from welding on the reactor vessel closure head and penetration tube. This technique involves mounting a three strain gage rosette at the location where the measurement is required. A small hole is drilled at the center of the rosette and the relieved strain is measured by the three gages of the rosette. The relieved strain and elastic constants of the material and the constants for the rosette are used to calculate the residual stress.

WCAP-13998 (Reference 2), Table 7.3-1 provides the measurement data with respect to residual stresses prior to and after the weld repair process. As a result, the individual measured stress components (axial and hoop) prior to and after welding were bounded by calculated values but still indicated an overall increase in residual stresses.

7. **In Section 5.3 of Enclosure A of the licensee's submittal, it is also stated that, "the post-repair examinations...will be performed in accordance with those described in the Westinghouse Electric Company letter to the NRC dated October 1, 2003 (Reference 8)." ... "Future inspections of reactor vessel head penetrations and J-groove welds repaired utilizing the embedded flaw repair process, along with submission of any necessary reports, will be in accordance with 10 CFR 50.55a(g)(6)(ii)(D), which requires implementation of Code Case N-729-1 with certain conditions." Will post repair examination inspection be performed using the requirements of Code Case N-729-1 with conditions prior to return of service?**

   Response:

   Post repair examination inspection will be performed using the requirements of Code Case N-729-1 with conditions as required by 10 CFR 50.55a(g)(6)(ii)(D) prior to return of service.

References:

1. WCAP-15987-P, Revision 2-P-A, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," December 2003

2. WCAP-13998, Revision 1, "RV Closure Head Penetration Tube ID Weld Overlay Repair," November 1995

3. L-09-291, "10 CFR 50.55a Request for Alternative Repair Methods for Reactor Vessel Head Penetrations and J-Groove Welds," Dated October 9, 2008