Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

June 26, 2003
NOC-AE-03001558
10CFR50.55a

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
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South Texas Project
Unit 1
Docket No. STN 50-498
Response to Request for Additional Information
Regarding Request for Alternatives RR-ENG-2-35

Reference: Letter, S. E. Thomas to NRC Document Control Desk, "Request for Alternatives to ASME Section XI Requirements Associated with Mechanical Processing of Thermally Cut Surfaces (RR-ENG-2-35)," dated June 13, 2003 (NOC-AE-03001551)

The NRC informally requested additional information regarding the request for alternatives submitted in the referenced letter. The response to that information request is provided in the enclosure to this letter.

If there are any questions regarding this response, please contact Mr. Michael Lashley at 361-972-7523 or me at 361-972-7162.

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jtc

Enclosure: Response to Request for Additional Information

A047

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Response to Request for Additional Information

1. **ASME Section XI has recognized that underwater welding is a specialized process that requires specialized testing and essential variables. EDM is a thermal metal removal process that leaves a heat affected zone similar to a weld heat affected zone. Since the EDM that is proposed by this relief request is being performed underwater, are the thermal metal removal process qualification tests going to be performed underwater to accurately simulate the production conditions on the test specimens?**

Response

Westinghouse-PCI will perform the test coupon cutting underwater. The production water depth, approximately 60 feet, will not be simulated due to limitations of the mock-up facility. Based on Westinghouse-PCI experience using the electro-discharge machining (EDM) process on submerged reactor components and internals at various depths, water depth (hydrostatic pressure) has been shown to be a non-critical parameter. During the EDM process, deionized water is injected into the cut region to flush away the cut debris and to maintain a dielectric region between the electrode and the workpiece. This water is typically injected at 30-50 psig. At deeper water depths, this injection pressure is increased to compensate for the static head (approximately 26 psig for this application). All other cutting parameters are kept the same regardless of water depth.

2. **IWA-4461.4(c) and IWA-4461.4(e) require the licensee to establish acceptance criteria for surface roughness and corrosion testing of the specimens, provide these acceptance criteria.**

Response

The EDM process generally produces surfaces smoother than flame cutting, drilling, and most milling processes with an expected resulting roughness between 500 and 32 microinches R_A (Ref. 1). The surface finish specified for the qualification coupon is 500 microinches or less on the as-cut EDM surface. This surface finish will be verified by comparison and the results will be documented on the qualification report.

Corrosion testing will be performed as part of the qualification to demonstrate that the EDM-cut surface of the weld and base material is less susceptible to corrosion than that of weld deposit and base material that has not been EDM cut. The corrosion testing will be performed in accordance with ASTM G-28 and will serve as the evaluation for concluding that EDM will not degrade corrosion resistance on the cut surface of the weld and base material. This testing also bounds the heat-affected zone.

3. If the qualification testing of IWA-4461.4 reveal that any micro-fissures or oxide layer will be left after the EDM, what type of analysis will be performed to demonstrate that these will not propagate over the life of the RPV?

Response

STP Nuclear Operating Company (STPNOC) will implement the boat sample removal of flaw segments from Unit 1 BMI J-groove welds and nozzle base material only if the EDM thermal cutting process is successfully qualified in accordance with IWA-4461.4, including having met the criteria that no cracking will be detected by the Code-prescribed visual examination in any qualification coupons. An oxide layer on the EDM-cut surfaces is not a mechanical discontinuity and should not be considered a stress riser or crack initiation site. STPNOC has evaluated the original J-groove weld, buttering, and adjacent base material of the vessel bottom head with full-depth, postulated flaws and determined them to be acceptable (Ref. 2). Additionally, in the event that a flaw (e.g., fatigue cracking or stress corrosion cracking) should subsequently originate at the EDM-cut surface for any reason, STPNOC is performing another Code evaluation, which conservatively postulates the existence of such flaws in conjunction with a boat sample excavation. The preliminary results of the analysis indicate that such flaws are likewise acceptable.

4. Will any NDE be done on the final cut surface?

Response

No. ASME Code Section XI does not require any NDE in this instance.

5. Will any Examination be done on this item on an ongoing basis? (Every outage or every other outage, etc.)

Response

The original J-groove weld of the two repaired BMI penetrations has been re-classified under ASME Section XI Code inservice inspection (ISI) requirements as a Class 1, Table IWB-2500-1, Examination Category B-N-2, Item B13.60 weld. This weld is an interior attachment to the reactor vessel beyond the core belt region. As such, it is subject to a VT-3 visual examination of the exposed weld surface each inspection interval under the STPNOC ISI program for the current interval. The VT-3 visual examination of this weld is intended to detect the presence of cracking, corrosion, erosion, or other structural degradation. ISI visual examination of this weld at the end of the second inspection interval will include visual examination of the boat sample cavity.

6. How will the licensee comply with IWA-4422.2.1? (NDE after "Defect Removal Without Welding or Brazing."

Response

IWA-4422.2.1 provides requirements for NDE after defect removal and when repair welding will not be performed in order to verify that the removal process had removed all of the defect. In the case of BMI flaw segment removal by boat sampling, STPNOC does not intend to remove the entire flaw or to perform a Code repair. A portion of two of the known flaws in the BMI nozzle material will be removed to support the root cause determination. Therefore, the NDE and flaw evaluation requirements of IWA-4422.2.1 are not applicable to the BMI boat sampling process.

7. What materials are the items to be thermally cut made of? (ASME SA Number, type, and grade; heat treatment condition). Will the EDM cut include the penetration tube; the original weld butter; the final J-groove weld; the RPV alloy steel material; the stainless steel cladding?

Response

IWA-4461.4 requires use of the same P-No. material for coupon as that to be cut in production. The materials to be cut in both the coupon and the reactor vessel is P-43 for the nozzle and F-43 for the weld deposit.

The cut will include a small piece of the nozzle (penetration tube) and the J-groove weld deposit only. The cut will not include any of the butter, RPV alloy steel, or stainless steel clad. The J-groove weld was not subjected to any heat treatment. It is in the as-welded condition. The nozzle was not subjected to any heat treatment after installation. The nozzle bar material was heat treated at 1700°F for two hours and air-cooled by the manufacturer prior to machining.

Actual materials are as follows:

	Coupon	Reactor Vessel
Nozzle Material	SB-166 UNS N06600	SB-166 UNS N06600
Weld Deposit	ENiCrFe-3	ENiCrFe-3 & ERNiCr-3

A limited amount of repair was performed on the vessel J-groove welds using the GTAW process with ERNiCr-3 (F-43) bare wire. It is not known if this material was used to perform repairs at the locations where the boat samples are to be taken. Both ENiCrFe-3 and ERNiCr-3 are F-43 materials in accordance with ASME Section IX. Therefore, qualification on one of the F-43 weld materials qualifies both weld materials.

8. What effect will the elimination of mechanical metal removal processes have on the susceptibility of Alloy 600 materials and their associated welds to PWSCC?

Response

The elimination of mechanical metal removal processes is expected to have no effect on the susceptibility of Alloy 600 materials and their associated welds to PWSCC. Previously performed qualification tests found that surfaces cut with the EDM process showed no signs of surface cracks and that the corrosion rates of such surfaces tested in accordance with ASTM G-28 were lower than that of as-received Alloy 600 or Alloy 600 surfaces that had been EDM-cut, ground, and polished. Thus, EDM is effectively a gentle cutting operation that typically leaves surfaced uncracked, undeformed, and less susceptible to corrosion phenomena than other mechanical cutting operations.

9. For what period of time does the licensee request this relief?

Response

STPNOC requests approval of this alternative for the duration of the current Unit 1 forced outage.

References:

1. Mark's Standard Handbook for Mechanical Engineers, Eighth Edition, p. 13-79.

2. Letter, S. E. Thomas to NRC Document Control Desk, "Request for Relief from ASME Section XI Requirements Associated with Characterizing Flaws in Bottom Mounted Instrument Penetration Welds (Relief Request RR-ENG-2-33), dated June 25, 2003 (NOC-AE-03001550)