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

July 3, 2003
NOC-AE-03001559
10CFR50.55a

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

South Texas Project
Unit 1
Docket No. STN 50-498
Response to Request for Additional Information Regarding
Request for Alternative RR-ENG-2-32 (TAC No. MB9696)

Reference: Letter, M. E. Kanavos to NRC Document Control Desk, "Request for Alternative to ASME Section XI Requirements Associated with Half-Nozzle Repair/ Replacement for Bottom Mounted Instrument Penetrations (Relief Request RR-ENG-2-32)," dated June 19, 2003 (NOC-AE-03001549)

The NRC informally requested additional information regarding the request for alternative 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.

Steven E. Thomas
Manager,
Plant Design Engineering

jtc

Enclosure: Response to Request for Additional Information

A047

STI: 31623132

cc:

(paper copy)

Ellis W. Merschoff
Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, Texas 76011-8064

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Richard A. Ratliff
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756-3189

Cornelius F. O'Keefe
U. S. Nuclear Regulatory Commission
P. O. Box 289, Mail Code: MN116
Wadsworth, TX 77483

C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

(electronic copy)

A. H. Gutterman, Esquire
Morgan, Lewis & Bockius LLP

L. D. Blaylock
City Public Service

Mohan C. Thadani
U. S. Nuclear Regulatory Commission

R. L. Balcom
Texas Genco, LP

A. Ramirez
City of Austin

C. A. Johnson
AEP Texas Central Company

Jon C. Wood
Matthews & Branscomb

Response to Request for Additional Information

1. **Page 2 of 18, second paragraph under Proposed Alternatives and Bases Providing and Acceptable Level of Quality and Safety, discusses the modification of the BMI penetrations while referring to Figure 1. Figure 1 does not clearly show the new geometry between the old and the new nozzle. Secondly, the Alloy 52 J-groove weld is difficult to distinguish. Please provide a more detailed configuration drawing that reflects all the geometries discussed.**

Response

Portions of proprietary Framatome drawing 5027547E, Rev. 2 were faxed to the NRC to provide the requested detail quickly. A complete copy of the drawing and a request for proprietary treatment under 10 CFR 2.790 will be submitted under separate cover.

2. **Please discuss the configuration between the old and new nozzle with respect to welding and nondestructive examination to be performed, if appropriate. If no welding is to be performed between the old and new nozzle junction, please discuss the effects of crevice corrosion and life of the repair.**

Response

There is no weld between the remaining Alloy 600 upper-half of the penetration nozzle and the new Alloy 690 bottom half-nozzle. The half-nozzle repair/replacement leaves a portion of the reactor vessel low alloy steel exposed to primary water by way of the existing nozzle cracks and the gap between the new Alloy 690 half-nozzle and the existing Alloy 600 nozzle remnant. Diametrical clearances exist around the half-nozzle components. A clearance of approximately 0.004 inch exists around the nozzle remnant and 0.020 inch will exist around the new half-nozzle. Therefore, primary coolant entering from either the small gap between the nozzle components and/or the cracks remaining in the nozzle remnant will come in contact with the vessel carbon steel.

The geometry of the nozzle component gap creates the geometry of a crevice. This geometry is normally not a problem in primary water systems. Experiments were conducted as referenced in WCAP 15973-P, Revision 0 to determine the crevice corrosion rate of low alloy steel. The results indicate that the crevice corrosion rate for both aerated and deaerated conditions is less than the respective general corrosion rate. Operating experience from PWRs shows that crevice corrosion is not normally a problem in PWR systems. The crevice corrosion rates are less then general corrosion rates.

The Component Corrosion Analysis used the methodology documented in WCAP 15973-P, Revision 0, which was reviewed by the NRC and a safety evaluation (SE) was issued. STP Nuclear Operating Company (STPNOC) performed the site-specific calculations required by the SE for licensees seeking to use the methods of the topical report. The results show that the effects of general corrosion for the remaining 40-year design life and 60-year extended life are acceptable.

3. **NB-2532 requires that all plates used for vessels and all plates > 2 in. Thickness shall be examined by the straight beam ultrasonic method in accordance with ASTM A-578-08. The acceptance criteria under NB-2532.1(b)(1) allows for base metal discontinuities in the same plane that can be encompassed by a circle up to 3 in. in diameter or ½ the plate thickness in diameter. Taking this into consideration, the Alloy 52 weld pad may be deposited over large laminar segregates allowed by the Construction Code you cited.**

   On page 4 of 18, under Basis of Alternative, you state: "This UT technique will also examine the base material below the weld pad for laminations and other base material flaws." No UT of the base material prior to welding was noted in your alternative by the staff. Please indicate if this examination is going to be done prior to welding the Alloy 52 pad to assure no significant laminar defects or base material flaws are present prior to welding. If this is not part of your repair plan, then please discuss your action should base material defects be found after the Alloy 52 pad is deposited.

Response

STPNOC reviewed the Westinghouse fabrication specification and Combustion Engineering material acceptance NDE records for the Unit 1 reactor vessel bottom head (RVBH) plate. The vessel specification required that all zero degree UT indications be recorded that (1) cause a complete loss of back reflection or (2) produce a response greater than 50% of the initial back reflection accompanied by a 50% loss of back reflection. These recording criteria are very conservative and would have caused the recording of very small base material flaws if they had existed in the plate material. The zero degree UT examination records for the bottom head plate state that no recordable indications were detected. Therefore, STPNOC concludes there are no base material flaws, including laminations, in the RVBH plate due to fabrication.

Ultrasonic examination of the RVBH base material below the weld pad was not performed prior to pad deposition because:

1. Code Case N-638, Section 4.0, paragraph (b) requires a UT examination to be performed from the completed weld pad surface,
2. The UT technique to be applied on the deposited weld metal was qualified to examine the weld metal pad and the base material beneath the weld pad, and
3. One UT examination is sufficient and is consistent with ALARA for work in this high dose rate area.

The zero degree UT technique has been qualified to effectively examine for base material defects, including laminations, when applied through the weld pad. Discussions of the angle beam and zero degree UT technique qualifications are provided in the response to Question # 4 below.

If a base metal defect were found under the weld pad, the first course of action would be to characterize the indication and perform an engineering analysis of the indication for acceptability. If the analysis showed the defect to be acceptable, the disposition would be to use as is. If the indication were determined to be unsatisfactory, the weld pad would be removed and a base metal repair (i.e., temper bead weld repair) would be performed. The method or technique used for the repair would depend on the location and depth of the defect in the base material.

4. **On page 6 of 18 you discuss the post weld UT of the Alloy 52 pad. You state: "The weld pad and the base material below the weld pad will be examined by a zero degree UT technique." Please discuss the detectability of both welding and laminar defects while examining through the coarse grained austenitic structure of the Alloy 52 pad. Your discussion should include laboratory results or qualification of the UT method used to determine if base metal and welding flaws are effectively detected by your method.**

Response

The zero degree UT technique and procedure used to examine the BMI repair/replacement weld pad and base material below the weld pad has been qualified by Framatome on welded qualification blocks fabricated from Inconel weld metal and carbon steel base material. Small diameter (3/32 inch) flat bottom holes (FBH) were located in the carbon steel, at the weld-base material interface, and in the weld metal to simulate welding defects (e.g., lack of bond, lack of fusion) and laminar type cracking in the adjacent base material. The configuration of the qualification specimens allowed for overall metal paths of 0.6, 1.1, 2.2, and 3.1 inches in the weld and base material. Zero degree search units were qualified by detecting these FBHs through the appropriate depths of weld metal corresponding to the STP pad thickness and thicker pads. Because the weld metal is much more attenuative than the carbon steel material, qualification of the procedure by scanning and detecting FBHs located in weld metal also qualifies the procedure for combinations of weld metal and base material of the same overall thickness.

Additionally, small diameter (1/8 inch) side drilled holes (SDH) were fabricated in the weld material at depths of 0.5, 1.0, and 1.5 inches below the surface. These depths are sufficient to encompass both the STP weld pad thickness and approximately 0.9 inches of adjacent base material. These SDHs simulate welding defects, contamination cracking, inter-bead lack of fusion, and cracking in the adjacent base material. Angle beam (45- and 60-degree) search units were qualified by detecting these SDHs when scanned from the surface of the weld metal. Because the weld metal is much more attenuative than the carbon steel, qualification of the procedure by scanning and detecting SDHs located in weld metal also qualifies the procedure for combinations of weld metal and base material of the same overall thickness.

The BMI weld pad and RVBH base material below the weld pad will be examined using a zero degree UT examination in accordance with Article 5 of ASME Section V, 1989 Edition. The sensitivity of this UT examination will be established by scanning from the weld pad and setting the UT response from the opposite (inside) surface of the RVBH at 50% to 75% of the screen height. The accessible volume of the base material will be scanned to detect any base material laminations or other defects that produce a loss of backwall signal. Indication of the backwall signal on the UT instrument provides:

(1) Assurance of beam penetration through the weld pad and full thickness of the RVBH, and

(2) Adequate sensitivity for detection of laminations or other base material defects that are a small fraction of the allowable flaw size (e.g., 3-inch diameter lamination as cited in the question) located anywhere in the examination volume.

Therefore, the zero degree UT examination performed in accordance with Article 5 of Section V can effectively detect laminations in low alloy plate material through the weld pad. This UT technique has been qualified through calibration on the actual component and through historical experience in successfully detecting laminations.

5. The reason for the repair is due to defects in the original J-groove weld which will remain in the reactor vessel bottom head after the repair. Please discuss your plans for characterization of the defects and successive inspections in accordance with the provisions of the Code, specifically IWA-4310, IWA-4340, and IWB-2420(b). Your discussion should include the technical basis for not meeting these requirements and how an acceptable level of quality and safety is maintained.

Response

The reason for the repair/replacement of the two BMI penetrations was unacceptable defects in the Alloy 600 penetration nozzle material. No flaws have been detected or characterized on the original J-groove weld wetted surface or within the weld metal by the applied NDE techniques. The defects in the repaired penetration nozzles will remain in the RVBH. Therefore, STPNOC has requested relief from the Section XI Code requirements for flaw characterization and successive examinations. Please refer to STPNOC submittal NOC-AE-03001550, "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.

The STPNOC relief request cited above included relief from the requirements of Section XI paragraphs IWA-3100(a), IWA-3300(b), and IWB-3420 which require flaws be evaluated for acceptance and characterized to allow comparison with the flaw acceptance standards of the code. STPNOC did not reference Section XI paragraphs IWA-4310 and IWA-4330 in the cited relief request because these paragraphs contain requirements for defect removal. These requirements are applicable only after flaws are detected and characterized, evaluated for acceptance, and dispositioned as requiring repair or replacement.

6. **On page 7 of 18 you cite six precedents. Taking these precedents into consideration, please discuss your plans for successive inspections of the new repair welds.**

Response

STPNOC will perform successive inspections on repaired/replaced BMI penetration nozzles, weld pads, and J-groove welds that establish a new pressure boundary. Repaired/replaced BMI nozzles, weld pads, and J-groove welds will receive a bare metal visual examination each refueling outage in accordance with the STP Boric Acid Walkdown procedure.