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Houston Lighting & Power

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July 8, 1988
ST-HL-AE-2706
File No.: G2.4
10CFR2.201

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

South Texas Project Electric Generating Station
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Supplemental Information to Notice of Violation 498/8807-02; 499/8807-01

Reference (1): NRC letter to HL&P, L.J. Callan to J.H. Goldberg, ST-AE-HL-91640 dated June 6, 1988

Houston Lighting & Power Company has reviewed the request for additional information to Notice of Violation 498/8807-02; 499/8807-01 dated June 6, 1988 (reference 1) and submits the attached response pursuant to 10CFR2.201. An extension of the submitted date of this report, to July 22, 1988, was granted by D.M. Hunnicutt on July 6, 1988. The response correlates the electrode test data with the material properties and design criteria for effected production welds as you requested.

If you should have any questions on this matter, please contact Mr. M. F. Polishak at (512) 972-7071.

J. H. Goldberg
Group Vice President, Nuclear

SDP/ag

Attachment: Supplemental Information to Notice of Violation 498/8807-02; 499/8807-01

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Supplemental Information to Notice of Violation 498/88-02; 499/8807-01

I. Statement of Violation

During an NRC inspection conducted intermittently from January 25 through February 12, 1988, a violation of NRC requirements was identified. The violation involved failure to test welding material for different postweld heat treatment applications. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," 10CFR Part 2, Appendix C (1987), the violation is listed below:

"Failure to Test Welding Materials for Different Postweld Heat Treatment Applications

10CFR Part 50, Appendix B, Criterion IX, Control of Special Processes, states, in part, "Measures shall be established to ensure that special processes, including welding, heat treating . . . are controlled and accomplished in accordance with applicable codes, standards, specifications, criteria, and other special requirements."

Bechtel Specification 5A010PS002, Revision 13, requires that the penetration assembly to penetration sleeve weld shall be in accordance with ASME III, Division 1, 1974 Edition through Winter 1975 Addenda, Subsection NE or Subsection NC when criteria for welding, postweld heat treatment, or material are not provided in Subsection NE.

Paragraphs NC-2400 and NE-2400 of Subsections NC and NE require testing of all welding material used in construction and that the test coupons shall be postweld heat treated to the specified temperature indicated in the welding procedure specification.

Contrary to the above, the penetration assembly to penetration sleeve welds for the steam generator blowdown piping system were made using welding materials which had been tested after a postweld heat treatment at 1100 to 1200°F and not the 1300 to 1400°F temperature ranges indicated, respectively, by the applicable Ebasco Welding Procedure Specifications WP-129 and WP-69.

This is a Severity Level IV violation. (Supplement II) (498/8807-02; 499/8807-01)

II. Reason for Violation

The base materials used for the penetration assembly to penetration sleeve welds are SA-182(P5) and SA-333(P1), respectively. There are eight total welds of this type; four (4) in each unit. Five (5) welds (four in Unit 1 and one in Unit 2) were made with E-7018 filler

material in combination with ER70S2 filler material for the root pass; the remaining three welds (in Unit 2) were made with ER70S2 filler material only.

As required by the ASME Code rules, the above welds were post weld heat treated (PWHT) by STP at the 1250°F-1400°F range, which is applicable to P5 material and is specified by the Welding Procedure Specification (WPS). The weld metal coupons of the filler material, which were tested by the material manufacturer to the requirements of NC-2400, were PWHT at the 1150°F-1250°F range.

At STP the containment vessels are not required to be N-Stamped. The ASME Code, Subsection-NC has been specified for the penetration sleeves, voluntarily, to assure a technical quality which meets an established industry standard. HL&P believes that the PWHT of the weld metal coupons at P1 range (1150°-1250°F) meets the intent of the ASME Code and is consistent with the requirements of filler material classification.

The weld filler metal tests are performed, as a part of the quality program, to confirm compliance with the material specification. The welding parameters used for these tests are not intended to be the acceptance criteria for each application. The filler material qualification for a specific application is provided by the Procedure Qualifications Test Records (PQRs) which directly relate to the base metal, filler metal, pre-heat and PWHT used in the production weld.

III. Corrective Action Taken and Results Achieved

Technical quality of the production welds, as described in the attached Appendix, was verified to be adequate on the basis of the following:

A) The results of Bechtel and Ebasco PQRs, with PWHT at P5 range, were compared with the results (tensile values of the coupons before and after PWHT at P1 range) on the CMTRs for the filler material which was used in the PQR tests. The results demonstrates that the tensile values for E-7018 (P1 equivalent filler material) when PWHT at 1250°-1400°F and 1100°-1150°F are in the acceptable range.

B) The hardness of four (4) welds was measured with a portable hardness tester, and the corresponding approximate tensile strength of these welds was established from the tables in ASTM A-370 specification. The tensile values are in the acceptable range.

C) After PWHT at the P5 range, the weld metal coupons made from the remaining two heats of filler material (which were used in some of the production welds) were tested to the General Test Requirements of NC-2400. The results indicate that the two heats of filler material are acceptable.

D) The calculated stresses in the penetration sleeve weld joints were reviewed against the Code allowable values. The review indicates that in the worst case loading condition the maximum stress in the weld is below 56% of the Code allowable stress value.

The data from the above reviews and tests confirm that the penetration sleeve weld joints in Units 1 and 2 have adequate strength to meet the design requirements.

IV. Corrective Steps Taken To Prevent Recurrence

The eight (8) welds identified above, four (4) in each Unit, are the only P1 to P5 welds for which PWHT is required. For these welds, adequacy of technical quality to meet the design requirements, and compliance with the intent of the Code has been verified. Therefore, recurrence controls are determined not to be necessary.

V. Date of Full Compliance

STP is presently in compliance with the requirements as specified.

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Appendix
Basis for Interpretation of Code Requirements and Technical Adequacy of Subject Welds

Reference to WPS temperature for PWHT was revised by Summer 76 addendum to Para. NC2431.1. For General Test, the Code addresses the PWHT condition in general terms; without being specific about the applicable temperature. The Code intent appears to require weld metal tests in a specific type of heat treat condition, such as, PWHT against normalized, or quenched and tempered condition.

The weld metal tests are performed as a part of the quality program to verify compliance with the material specification. Regardless of its application, the filler material is tested and certified to the classification requirements under which it is manufactured. Therefore, PWHT of the weld metal coupons at P1 range (1150°-1250°F) is consistent with the requirements of the filler material classification and meets the intent of the Code.

The base materials used for the penetration assembly to penetration sleeve welds are SA-182(P5) and SA-333(P1), respectively. Five (5) welds were made with E-7018 filler material in combination with an ER70S2 filler material root pass; the remaining three welds were made with ER70S2 filler material only.

The hardness of four (4) welds was measured with portable hardness testing equipment. The hardness readings, taken at two points for each weld, indicate a hardness range of 145-209 BHN. The corresponding approximate tensile strength for this hardness, established from the tables in ASTM A-370 specification, is in the range of 69-98ksi. This value exceeds the ASME specified minimum ultimate tensile strength (60 ksi) for the P1 base material.

Assurance for production weld acceptability is provided by the Procedure Qualification Test Records (PQRs) which are performed in accordance with NC-4300 and Section IX rules of the Code. Within the essential variable limitations specified by the Code, the PQR directly relates to the base metal, filler metal, pre-heat and PWHT used in the production welds. For E-7018 filler material, Bechtel has substantial PQR data with PWHT at the 1250°-1400°F range. This data represents filler material procured from several manufacturers. Table A shows a comparison of the tensile strength of the PQR coupons after PWHT at 1250°-1400°F, with the tensile strength of E-7018 weld metal coupon in the as welded condition, and the PWHT condition at 1100°-1150°F. The data on this table demonstrates that the tensile values for E-7018 (P1 equivalent filler material) when PWHT at 1250°-1400°F and 1100°-1150°F are in the acceptable range.

A correlation of the principal elements (carbon, manganese, silicon, phosphorous and sulfur) for E-7018 and ER70S2 is shown in Table B. This comparison demonstrates that the physical characteristics (tensile and

yield strength) of ER70S2 will be comparable to E-7018. Therefore, the tensile values for ER70S2 are comparable when PWHT is performed at the 1250°-1400°F range. The Ebasco PQR W-194, recently qualified, using ER70S2 filler material and PWHT at 1375°F for 5 hours, also provides additional data to support the above conclusion. The chemistry of the filler material (ER70S2) used for this PQR is similar to the other heat/lots of ER70S2 filler material listed in Table B.

In addition to the above, one heat each of the E7018 and ER70S2 filler material used in some of the production welds were still available on site. Test were performed on this material to confirm acceptability of the filler material used. Weld metal coupons from these two heats were prepared, PWHT at 1305°-1380°F, and tested in accordance with NC-2431.1, General Test requirements. The results of these tests show tensile strengths of 71,100 (E7018) and 71,800 (ER70S2) psi, both of which exceed the tensile strength of 60,000 psi (For P1 base material) required by the ASME Code.

The PQR data in Table A, the results of hardness tests and the results of weld metal tests confirm that the tensile strength of the filler material used in production welds is comparable to the values reported on the certified material test reports. Based on the above tests and the historical PQR data, HL&P has concluded that the subject penetration sleeve welds in Units 1 and 2 are technically sound and acceptable.

TABLE A

COMPARISON PQR TENSILE STRENGTH WITH CMTR TENSILE STRENGTH

Bechtel PQR	PQR TENSILE STRENGTH PWHT 1250-1400°F	E7018 CMTR TENSILE STRENGTH (KSI) AS WELDED	E7018 CMTR TENSILE STRENGTH (KSI) PWHT, 8 HRS. 1100-1150°F
73	67.0 67.5 BM 67.3 67.5	-NA-	-NA-
594	73.6 77.8 74.3 78.9	73.8, 77.1, 80.9	70.5, 76.2, 73.6
595	73.8 77.8 73.4 78.8	73.8, 77.1, 80.9	70.5, 76.2, 73.6
599	BM 66.7 66.8	-NA-	-NA-
722	70.5 72.6 70.3 71.1	77.0, 78.3	73.0, 77.5
784	BM 60.2, 60.4	81.6, 77.0, 77.0	77.5, 73.0 NR
804	BM 66.0, 66.3	76.4, 80.8	77.6, 72.8
819	BM 65.7, 65.7	76.4, 80.8, 72.1	77.6, 72.8, 72.0

BM - Failure occurred in base metal.

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TABLE B

COMPARISON OF CHEMICAL ANALYSES OF ER70S2 WITH E7018 FROM CMTRS

Bechtel PQR	ELEMENT, %	ER70S2	HEAT NO.	E7018	HEAT NO.
594	C	0.05	065006	0.047	650N526
	Mn	1.35	(MCF 218)	0.82	
	Si	0.56		0.29	
	P	0.013		0.008	
	S	0.022		0.021	
774	C	0.04	422A1641	0.04	412T2161
	Mn	1.23	(MCF 660)	1.09	
	Si	0.52		0.37	
	P	0.018		0.013	
	S	0.010		0.015	
774	C	0.04	422A1641	0.05	421W4341
	Mn	1.23	(MCF 660)	1.06	
	Si	0.52		0.44	
	P	0.018		0.011	
	S	0.010		0.017	
804	C	0.04	422A1641	0.058	04L663
	Mn	1.23	(MCF 660)	0.97	
	Si	0.52		0.36	
	P	0.018		0.015	
	S	0.010		0.023	
804	C	0.04	422A1641	0.051	422S801
	Mn	1.23	(MCF 660)	0.99	
	Si	0.52		0.40	
	P	0.018		0.014	
	S	0.010		0.018	
819	C	0.04	422A1641	0.045	40186321
	Mn	1.23	(MCF 660)	0.83	
	Si	0.52		0.36	
	P	0.018		0.010	
	S	0.010		0.016	

	ELEMENT, %	ER70S2	HEAT NO.
W194 (Ebasco)	C	0.05	411N5551
	Mn	1.04	(REF. 185)
	Si	0.48	
	P	0.005	
	S	0.018	

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