PSE&G

Public Service Electric and Gas Company 80 Park Place Newark, N.J. 07101 Phone 201/430-7000

December 21, 1977

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Mr. George Lear, Chief
Operating Reactors Branch 3
Division of Operating Reactors

Gentlemen:

FRACTURE TOUGHNESS AND
POTENTIAL FOR LAMELLAR TEARING
OF SG AND RCP SUPPORT MATERIALS
NO. 1 UNIT
SALEM NUCLEAR GENERATING STATION
DOCKET NO. 50-272

In response to your request of December 13, 1977, we have reviewed the engineering, design, material and testing requirements for the Steam Generator and Reactor Coolant Pump supports for No. 1 Unit of the Salem Nuclear Generating Station and we have reassessed their fracture toughness and determined their resistance to lamellar tearing. PSE&G's response to your specific concerns is provided in the attachment to this letter.

The fracture toughness and lamellar tearing potential of the Steam Generator and Reactor Coolant Pump supports was investigated by the NRC staff in 1976. The results of this investigation are presented in Supplement No. 2 to the Salem Safety Evaluation Report. In light of the above and a telephone conversation between Mr. Dave Verrelli of your staff and Mr. E. A. Liden of our staff on October 25, 1977, it has been determined that no further evaluation is necessary.

Should you have any further questions in this regard, please do not hesitate to contact us.

Very truly yours,

F. P. Librizzi
General Manager -
Electric Production

Attach.

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The Energy People

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ADDITIONAL INFORMATION

FRACTURE TOUGHNESS AND POTENTIAL FOR LAMELLAR TEARING OF STEAM GENERATOR AND REACTOR COOLANT PUMP SUPPORT MATERIALS

NO. 1 UNIT
SALEM NUCLEAR GENERATING STATION
DOCKET NO. 50-272

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1. Provide engineering drawings of the steam generator and reactor coolant pump supports sufficient to show the geometry of all principal elements. Provide a listing of materials of construction.

Response

The below listed drawings are attached.

Drawing No.		Title
208900-A-8823-3	-	No. 1 Unit, Steam Generator and Reactor Coolant Pump Supports, Location Plans
208903-A-8823-12	-	No. 1 and 2 Units, Steam Generator Supports
208904-A-8823-12	-	No. 1 and 2 Units, Steam Generator Supports
208905-A-8823-11	-	No. 1 and 2 Units, Reactor Coolant Pump Supports
208906-A-8823-12	-	No. 1 and 2 Units, Reactor Coolant Pump Supports
201320-AB-3557-2	-	No. 1 and 2 units, Reactor Coolant Pump Supports

The supports are constructed of ASTM A441 High Strength Low Alloy steel. Welding was done with the following rods:

AWS E70T-1 FCAW Electrodes
AWS E70T-2 FCAW Electrodes
AWS E7016, 17, 18 SMAW Electrodes
AWS F71-EL12 SAW Electrodes

2. Specify the detailed design loads used in the analysis and design of the supports. For each loading condition (normal, upset, emergency and faulted), provide the calculated maximum stress in each principal element of the support system and the corresponding allowable stresses.

Response

The detailed design loads and stresses and corresponding allowable stresses are provided in the nine tables attached.

3. Describe how all heavy section intersecting member weldments were designed to minimize restraint and lamellar tearing. Specify the actual section thicknesses in the structure and provide details of typical joint designs. State the maximum design stress used for the through-thickness direction of plates and elements of rolled shapes.

Response

Most intersecting primary members are connected flange to flange by butt welds or are connected to gusset plates by fillet welds. These types of connections are not susceptible to lamellar tearing. Those members connected by welded tee and corner joints subject to through-thickness design stresses are as follows:

Steam Generator Supports

(a) PL 18" x 4" x 2'-0", Section 10-10, Drawing No. 208904-A-8823-12 Maximum Through-Thickness Stress = 19.23 ksi

(b) Plate Girders and W36 x 280 supporting W14 x 202 columns, Plan B-B and Section 10-10, Drawing Nos. 208903-A-8823-12 and 208904-A-8823-12 respectively. Maximum Through-Thickness Stress = 19.23 ksi.

(c) PL 20" x 4'-4" x 1'-8", Detail F, Drawing No. 208903-A-8823-12. Maximum Through-Thickness Stress = 16.24 ksi.

(d) PL 20" x 3" x 3'-10", Section 7-7, Drawing No. 208903-A-8823-12. Maximum Through-Thickness Stress = 15.00 ksi.

Reactor Coolant Pump Supports

(a) PL 13" x 5" x 1'-8", Detail E and Section 5-5, Drawing No. 208905-A-8823-11. Maximum Through-Thickness Stress = 18.23 ksi.

(b) Bar 6" x 2", Section 6-6, Drawing No. 208906-A-8823-12. Maximum Through-Thickness Stress = 26.11 ksi.

(c) PL 18" x 4" x 4'-10", Section 7-7, Drawing No. 208906-A-8823-12. Maximum Through-Thickness Stress = 11.11 ksi.

(d) PL 22" x 3" x 3'-6", Section 3-3, Drawing No. 208905-A-8823-11. Maximum Through-Thickness Stress = 11.78 ksi.

There is no potential for fatigue crack growth in these members since these through-thickness tensile stresses are based on emergency and faulted conditions.

4. Specify the minimum operating temperature for the supports and describe the extent to which material temperatures have been measured at various points on the supports during the operation of the plant.

Response

Material temperatures have not been measured on the supports. The operating temperature for the supports would be at least the ambient temperature within the containment. The average operating temperature in the containment is approximately 100°F with a minimum of 70°F. The fracture toughness of the supports assures that they will not exhibit brittle behavior at these temperatures.

5. Specify all the materials used in the supports and the extent to which mill certificate data are available. Describe any supplemental requirements such as melting practice, toughness tests and through-thickness tests specified. Provide the results of all tests that may better define the properties of the materials used.

Response

Mill certificate data is available for all materials used in the supports. All primary structural members are silicon killed and normalized ASTM A441 steel subject to a supplementary requirement for Charpy V-Notch testing (20 ft.-lb. minimum at 20°F). This toughness requirement was met with ample margin.

6. Describe the welding procedures and any special welding process requirements that were specified to minimize residual stress, weld and heat affected zone cracking and lamellar tearing of the base metal.

Response

All shop welding was done in accordance with AWS D2.0, "Specification for Welded Highway and Railway Bridges." Detailed joint procedure specifications were submitted by the fabricator for review and approval by PSE&G engineering personnel. The following preheat requirements were specified to minimize residual stress:

(a) Material less than 3/4" thick shall be preheated to 100°F if the ambient temperature falls below 40°F.

(b) Material 3/4" to 1-1/2" thick shall be preheated to 150°F prior to welding.

(c) Material 1-1/2" to 2-1/2" thick shall be preheated to 225°F before welding.

(d) Material over 2-1/2" thick shall be preheated to 300°F before welding.

7. Describe all inspections and non-destructive tests that were performed on the supports during their fabrication and installation, as well as any additional inspections that were performed during the life of the facility.

Response

All welds were subject to visual inspection in accordance with AWS requirements. All full penetration shop welds were subject to magnetic particle inspection at four (4) depths supplemented, where practical, by ultrasonic inspection of the finished weld. After installation, welds on the supports were subject to another magnetic particle inspection. This inspection revealed only minor surface defects on some welds, none critical to the structural integrity of the supports. Nonetheless, these welds were repaired.