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Vogtle Project

November 11, 1981

United States Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region II - Suite 3100
101 Marietta Street
Atlanta, Georgia 30303

File: X7BG03-M19
Log: GN-147

Reference: Vogtle Electric Generating Plant - Units 1 & 2
50-424, 50-425; Design Calculations Concerning Primary Loop Crossover Leg Pipe Restraints

Attention: Mr. James P. O'Reilly

Gentlemen:

Georgia Power Company is submitting the final report on the design calculations concerning primary loop crossover leg pipe restraints. In addition to the leg pipe restraints, the detailed review also identified the following components as being locally overstressed:

(a) Steam Generator lower lateral support beam embeds (8 per unit)

(b) Reactor Coolant pump tie rod embeds (8 per unit)

Enclosed is a report concerning these supports. Georgia Power Company has concluded this problem is reportable as a significant deficiency and as a substantial safety hazard under Part 10CFR21. This letter and report contains all information required by Part 10CFR21.

This report contains no proprietary information and may be placed in the NRC Public Document Room upon receipt.

Yours truly,

D. O. Foster

D. O. Foster
Project General Manager

CWH:tlp

IE 19
S1/1

xc: U. S. Nuclear Regulatory Commission
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FINAL REPORT
ON POTENTIAL SUBSTANTIAL SAFETY HAZARD/SIGNIFICANT
DEFICIFNCY REGARDING DESIGN OF PRIMARY LOOP
SUPPORTS AND RESTRAINTS

ALVIN W. VOGTLE ELECTRIC GENERATING PLANT - UNITS 1 AND 2

DER NO. 008

1.0 Introduction

This report is submitted pursuant to 10 CFR 21 and 10 CFR 50.55(e) and describes the final disposition of deficiencies associated with primary loop supports and restraints designed by Bechtel Power Corporation and delivered to Georgia Power Company (GPC) for the Alvin W. Vogtle Electric Generating Plant, Units 1 and 2, Docket Numbers 50-424 and 50-425.

A potential deficiency relating to a crossover leg pipe restraint was verbally reported to the NRC on July 6, 1981 by Georgia Power Company. A followup written report was submitted by Georgia Power Company to the NRC (Region II) on August 5, 1981 and on September 17, 1981 Georgia Power Company submitted an interim report of a reportable deficiency. In addition, Bechtel Power Corporation submitted a written report on August 21, 1981 to the NRC (Region IV) identifying the deficiency in the crossover leg pipe restraint design as reportable under 10 CFR 21. The Bechtel report also stated that as part of the corrective action to address this deficiency a review of the remaining NSSS restraint and support designs would be performed. The results of this review have identified design deficiencies affecting two additional support designs.

2.0 Individual Reporting

Charles W. Hayes, Project QA Manager, Georgia Power Company

3.0 Facility

Vogtle Electric Generating Plant, Units 1 and 2 (Georgia Power Company), Burke County, Georgia

4.0 Supplying Firms

Design: Bechtel Power Corporation, Los Angeles Power Division

Construction: Georgia Power Company

5.0 Basic Component Identification

5.1 Primary loop crossover leg pipe restraints (previously identified) (4 per unit): The crossover leg restraints are rigid frame steel weldments consisting of a horizontal beam spanning over three vertical columns. The restraint is anchored through the containment liner into the basemat. A 2'-9" fill slab is placed over the basemat liner, embedding the restraint to within 2 inches from the top of the columns.

5.2 The results of detailed review undertaken as part of the corrective action program, have identified the following components as being locally overstressed:

a) Steam generator lower lateral support beam embeds (8 per unit)
b) Reactor coolant pump tie rod embeds (8 per unit)

The embeds are steel weldments consisting of heavy plates with rear projecting steel sections embedded in concrete and exposed lugs designed to transmit shear loads to the base structure.

6.0 Deficiency Description

6.1 Primary loop crossover leg restraints: The deficiency results from an inappropriate design assumption as described below.

As a result of a request from GPC Construction to relax alignment and contact bearing requirements and an additional request to substitute connection bolting materials, the crossover leg restraint design calculation was reviewed. During the course of this review, a deficiency was identified in the assumptions used in modeling the transfer of loads from the crossover leg restraint to the fill slab and containment basemat.

The assumed condition of a free standing crossover leg restraint fixed at the basemat, neglecting the presence of the surrounding 2'-9" thick fill slab, does not adequately represent the existing condition of a partially embedded frame. The presence of the fill slab reduces the flexibility of the crossover leg pipe restraint embedded columns. Because the restraint is a statically indeterminate frame structure having more than one load carrying path to its anchorage, the externally applied load is distributed to

each path in proportion to its relative stiffness. Neglecting the stiffening effect of the fill slab concrete surrounding the columns causes an incorrect distribution of the load, underestimating the stresses in certain elements.

Because the crossover leg pipe restraints are the only statically indeterminate frame structures in the fill slab, this deficiency is limited to the crossover leg restraint analysis.

6.2 Steam generator lower lateral support embeds and reactor coolant pump tie rod embeds: The deficiency results from not considering bending stresses in shear lugs as described below.

There are four steam generator lower lateral support beams in each unit which resist lateral loads due to earthquake motions and postulated pipe breaks in the primary coolant piping. The horizontal beam transmits shear loads into embeds which are located in the secondary shield walls and primary shield. The loads are transmitted into the embeds by means of the beam base plate acting against a shear lug which is an integral part of the embed. These lugs were correctly sized based on shear stress requirements only, however, moments induced in the lugs by the eccentrically applied loads were neglected. This condition could result in excessive local yielding in which case the embed may not have sufficient capacity to resist the combined seismic and LOCA loads.

There are 12 reactor coolant pump tie rods in each unit which transmit axial loads (seismic and LOCA) to the embeds in the secondary shield walls and primary shield wall. Eight of these tie rods are oriented at an angle to the walls; thus the tie rod tension loads create both tension and shear on the embed. Again, the deficiency resulted from not considering moments induced in the shear lug by the eccentrically applied loads.

Because the steam generator lower lateral support embeds and reactor coolant pump tie rod embeds are the only NSSS restraint and support embeds employing this particular shear lug design concept, this deficiency is limited to these identified embeds only.

7.0 Analysis of Safety Implications

7.1 Primary loop crossover leg restraints: The use of more realistic boundary conditions results in stresses that exceed the allowables.

7.2 Steam Generator lower lateral support beam embeds and reactor coolant pump tie rod embeds: Consideration of bending moment results in stresses that exceed the allowables.

In all cases, the overstressed parts may not have sufficient capacity to resist the loads that would be induced due to seismic and LOCA loads. This condition represents a substantial safety hazard.

8.0 Corrective Actions

8.1 Primary loop crossover leg restraints: Reanalysis of the restraint has resulted in additional stiffener plates, splice plates, and changing of bolts to exclude threads from shear planes. The modified restraints have been installed on Unit 2 and are expected to be installed on Unit 1 by December 31, 1981.

8.2 Steam generator lower lateral support beam embeds and reactor coolant pump tie rod embeds: These embeds will be modified by providing additional stiffeners welded to the existing embeds. Each embed was re-analyzed in detail and both bending and shear stresses were determined considering all the applicable loads. The modifications are designed to reduce the stresses and deformations in all parts of the assembly to within the allowable stress and deformation limits and provide assurance of a positive load transfer mechanism into adjacent concrete.

Embed plate modifications will be incorporated into the applicable design drawings which will be re-issued following incorporation of appropriate revisions.

8.3 The design of embeds with a configuration which could result in significant bending in shear lugs has been investigated. This deficiency was established to be unique to the particular design configuration identified above. In other design configurations bending stresses were considered.

8.4 The chief civil-structural engineer re-emphasized to all civil-structural engineers, in writing, the quality requirements for origination and checking of design calculations including proper criteria and methodology.

The chief civil-structural engineer met with the civil-structural engineering group supervisors to discuss proper implementation of these quality requirements.

The Vogtle Project civil-structural engineering group supervisor met with the Vogtle Project civil-structural group leadership to discuss specific implementation of these quality requirements on project and methods to prevent recurrence of this problem.

9.0 Conclusion

These deficiencies are considered reportable under 10 CFR 50.55(e) and 10 CFR Part 21. All applicable project documentation for this report is available for inspection at Bechtel's facility in Building No. 46, 11445 South Lakewood Boulevard, Downey, California 90241.