Georgia Power Company
Route 2, Box 299A
Waynesboro, Georgia 30830
Telephone 404 554-9961, Ext. 3360
404 724-8114, Ext. 3360

USNRC REGION II
ATLANTA, GEORGIA

PRP
OFFICIAL COPY

Georgia Power
the southern electric system

D. O. Foster
Vice President and Project
General Manager
Vogtle Project

84 OCT 29 P 1:46 A11:00

October 17, 1984

United States Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region II - Suite 2900
101 Marietta Street, Northwest
Atlanta, Georgia 30323

File: X7BG03-M66
Log: GN-431

Reference: Vogtle Electric Generating Plant-Units 1 and 2, 50-424, 50-425; Containment Pipe Rack Welds; letter GN-407, dated 8/17/84.

Attention: Mr. James P. O'Reilly

On July 20, 1984, Mr. C. W. Hayes, Vogtle Quality Assurance Manager, notified Mr. Vince Panciera and Mr. John Rogge of the USNRC of a potentially reportable condition involving cracks in the containment pipe rack welds. In previous correspondence, Georgia Power Company indicated that a final report on the evaluation of this concern would be submitted to the NRC by October 24, 1984. Georgia Power Company has completed its evaluation and has concluded that this condition is reportable as a substantial safety hazard and a significant deficiency.

Based upon NRC guidance in NUREG-0302, Revision 1, and other NRC correspondence regarding duplicate reporting of significant deficiencies and substantial safety hazards, Georgia Power Company is reporting this event as a significant deficiency pursuant to the requirements of Part 10 CFR 50.55 (e). A summary of our evaluation is attached for your information.

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

Yours truly,

D. O. Foster

D. O. Foster

REF/DOF/tdm

Attachment

See Page Two for Distribution

OFFICIAL COPY

IE 27

Distribution:

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

R. J. Kelly
R. E. Conway
G. F. Head
J. T. Beckham
R. A. Thomas
D. E. Dutton
W. F. Sanders (NRC)
R. H. Pinson
B. M. Guthrie
E. D. Groover
J. A. Bailey
O. Batum
H. H. Gregory
W. T. Nickerson
J. L. Vota (W)
L. T. Gucwa
M. Malcom (BPC)
G. Bockhold
P. D. Rice
C. S. McCall (OPC)
E. L. Blake, Jr. (Shaw, et. al.)
J. E. Joiner (Troutman, etc. al.)
D. C. Teper (GANE)
L. Fowler (LEAF)
T. Johnson (ECPG)

EVALUATION FOR A SUBSTANTIAL SAFETY HAZARD
EVALUATION FOR A SIGNIFICANT DEFICIENCY

Cracks in Containment Pipe Rack Welds

Introduction:

On July 20, 1984, Mr. C. W. Hayes, Vogtle Quality Assurance Manager, notified Mr. Vince Panciera and Mr. John Rogge of the USNRC of a potentially reportable condition involving cracks in the containment pipe rack welds.

Background:

Containment pipe racks consist of large, welded structural members. The containment pipe racks are used in certain areas to support piping systems. These racks are used where other types of pipe supports are not feasible due to the size and numbers of pipe systems in a relatively small area. Thus, the needed supports are attached to these racks. A failure of a pipe rack would leave safety-related and other piping systems in an unsupported condition.

The pipe racks are fabricated by welding structural members using a fabrication procedure defined by the Pullman Power Products (PPP) field welding engineer. Bechtel Power Corporation reviewed the design documents and related welding procedures. These procedures were found to be acceptable and did not need to be revised.

The cracks in the pipe racks were discovered subsequent to final quality control inspections. On April 24, 1984, Pullman Power Products issued eight non-conformance reports (NCRs) concerning two (2) welds with cracks on containment pipe rack R0002 and seven (7) welds with cracks on containment pipe rack R0003. Thus, nine (9) welds out of approximately twelve-hundred (1200) welds have cracks. These nine (9) welds are identified in Table 1. Subsequently, an evaluation of these NCRs indicated the existence of a potentially significant deficiency which was reported to the NRC by GPC. Also, it should be noted that pipe racks R0002 & R0003 are primary structures and support ASME Code Section III Class 1 and 2 lines and 5-way pipe whip restraints.

Observations:

Georgia Power Company requested the assistance of the Bechtel Material and Quality Services organization in resolving this concern. The following observations were made after a visit to the construction site to review this concern.

(1) The weld cracks are limited to the weld heat-affected zone.

(2) The pipe racks are massive, complicated structures. Distortion occurred during welding and, typically, such distortion as seen at the construction site is not easily controlled. In each instance of weld cracking, the weld had been completed without incident but excessive stress apparently was applied by the solidification shrinkage of a different weld that was completed later in the fabrication sequence.

(3) The weld particularly subject to this type of failure is a partial penetration configuration (butt or fillet) located in thick sections. When this weld is located in relation to a full penetration weld, such that the solidification shrinkage of the full penetration weld applies a tensile stress on a previously completed partial penetration weld, the cracking potential of the partial penetration weld is enhanced.

(4) It was concluded that the weld cracking resulted from the interactive events described in items (2) and (3) above.

(5) PPP welding procedures were reviewed. It was found that controls on welding parameters are adequate for the welding of complicated, massive, pipe rack structures. The need for properly defining the welding parameters necessary for minimizing cracking potential in pipe racks was discussed with the PPP field welding engineer to ensure these are included in future fabrication plans for similar structures. These parameters include:

- Application of a high preheat temperature.
- Use of a weld rod diameter as large as possible, but no less than 1/8 inch.
- Completion of any full penetration weld before starting an opposing partial penetration weld.
- Reduction of any excessive fitup gap, 1/8 inch or larger, by depositing stringer beads on one side of the gap in the groove prior to initiating the welding pass which bridges the gap.

It should be noted that due to the unfavorable configuration of these structures, occasional cracking may occur even if the above criteria have been incorporated into the fabrication plan.

Engineering Evaluation:

In lieu of extensive and protracted stress calculations, including fracture mechanics analysis, it was conservatively assumed that, had the deficient welds gone undetected, the weld cracks would have propagated (under plant operating loads) through the thickness of the structural member.

A review of the existing structural design calculations was performed. Each deficient weld was evaluated independently, i.e., the others were considered sound. It was determined that in one of the nine welds, weld failure could have caused specific pipe supports to lose the capability of providing necessary support to the pipe. The ultimate consequence could have been failure of the supported lines. The results of this evaluation are shown in Table 2.

A facility response analysis was conducted to determine if the potentially affected pipe supports in systems required to place the plant in a safe shutdown condition or mitigate the consequences of an event could result in unacceptable system functional performance and adversely affect plant safety. The analysis conservatively assumed the preexistence of a pipe failure in one train, rendering the train inoperable (due to defect propagation, pipe support failure, and subsequently failure of the pipe), concurrent with the most limiting single active failure following the onset of an event (transient or accident condition) which requires a response from that system.

The results of the engineering evaluation indicated that the deficient welds and related potential pipe failures, noted in Table 3, could have unacceptably compromised system functional performance and adversely affected plant safety, had the deficiencies gone undetected.

Review of Quality Assurance Program:

A review of the quality assurance program of Pullman Power Products was performed and there was no indication of a program breakdown.

Conclusion:

It has been concluded that this condition represents a significant deficiency found in the design and construction of a nuclear power plant which, were it to have remained uncorrected, could have affected adversely the safety of operations of the nuclear power plant at any time throughout the expected lifetime of the plant. This condition also represents a deficiency in the construction of a structure which will require extensive evaluation and repair to meet the criteria and bases stated in the safety analysis report or to establish the adequacy of the structure to perform its intended safety function. It is assumed that these postulated pipe rack weld failures, coincident with an assumed single failure, could lead to a failure to perform a required safety function; thus, this condition would also be reportable per the criteria of Part 10CFR21. However, based on the reporting criteria of Part 10CFR21 and NRC guidance in NUREG-0302, Rev. 1, Georgia Power Company is reporting this condition under the reporting requirements of 10CFR50.55(e).

Corrective Action:

A review of the dispositioned nonconformance reports covering this event indicated that the corrective actions included:

- Application of a high preheat temperature.
- Use of a large diameter weld rod.
- Completion of the full penetration welds before starting an opposing partial penetration weld.
- Reduction of any excessive fit-up gaps.

More interaction between the Bechtel Power field welding engineer and the Pullman Power Products field welding engineer is planned to avoid future occurrences of this problem.

Repair of the weld cracks (to be completed under the dispositioned NCRs) in racks R0002 and R0003 will result in welds with minimal residual stress which are not subject to future potential failure. Additionally, identical pipe racks in the containment which were installed after this occurrence also are not subject to cracking because a proper welding sequence was used. However, there are two categories of uncracked welds in the similarly designed containment pipe racks which may require corrective action. First, there may be welds in racks R0002 and R0003 which did not crack but because of configuration remain as potential failure sites due to potentially high residual welding stress. The second category includes welds in those containment pipe racks which are of the same configuration as racks R0002 and R0003.

The uncracked welds in these two categories which were not incorporated within the corrected welding sequence guidelines (this fact will be ascertained by a review of the installation records) must be presumed to contain residual welding stresses of an unknown, but high amount, which could be just below the threshold of failure. The additive stress of a possible future seismic event or other operating condition could overload the weld and cause weld cracking.

To minimize the potential for future containment rack cracking the following corrective actions have or will be completed:

1. All cracked welds in racks R0002 and R0003 have been identified.

2. Identify all uncracked welds in the generic (R0001 through R0004) rack design which could have high residual welding stress due to configuration of the structure.

3. Select and apply the optimum corrective action from the four alternatives listed below for each uncracked weld on each rack to reduce residual welding stress in the rack structure.

    - Local Stress Relief
    - Reinforce Joint with Doubler Plates
    - Remove and Replace Weld
    - Load Test to 25% over Seismic Load

    The selection will be based on a comparative evaluation to determine that method which could be most economical and/or time efficient.

Georgia Power Company will document any corrective actions used on a pipe rack weld.

TABLE 1

CRACKED WELDS IN CONTAINMENT BUILDING PIPE RACKS

PPP NCR	RACK #	MEMBERS * JOINED BY DEFICIENT WELD
3958	R0003	P-326 to B-10
4295	R0002	P-322 to P-324
4570	R0002	P-314(B-0) to B-32
4571	R0003	P-313(B-0) to B-32
4864	R0003	B-1 to B-2
4865	R0003	P-324 to B-17
4866	R0003	B-13 to B-16
4941	R0003	P-91 to P-95
4941	R0003	P-43 to Embed

* P = Plate
B = Beam

TABLE 2

POSTULATED LINE FAILURE DUE TO
PROPAGATION OF PIPE RACK R0003 WELD CRACKS
BETWEEN PLATES P91 AND P95 (NCR PP-494)

LINE #	*POSTULATED FAILED PIPE SUPPORTS
V1-1204-125-10"	H015
V1-1204-126-10"	H015 thru H018
V1-1201-118-3"	H001 thru H005, and H007 thru H010
V1-1201-193-2"	H001, and H004 thru H009

System 1201 - Reactor Coolant System
System 1204 - Safety Injection

* These pipe supports are attached to rack R0003. The rack structural deficiency could have caused support failure, leading to line failure.

TABLE 3

REPORTABLE POTENTIAL LINE FAILURES CONSIDERED DUE TO POSTULATED FAILURE OF PIPE RACK (R0003) WELD P91 TO P95

V1-1201-118-3"
V1-1201-193-2"
V1-1204-125-10"
V1-1204-126-10"

System 1201 - Reactor Coolant System
System 1204 - Safety Injection