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RECEIVED
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Mr. John T. Collins
Regional Administrator, Region IV
Nuclear Regulatory Commission
611 Ryan Plaza Dr., Suite 1000
Arlington, Texas 76012

Dear Mr. Collins:

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
Final Report Concerning Reactor
Vessel Core Support Tolerance

On July 26, 1983, pursuant to 10CFR50.55(e), Houston Lighting & Power Company (HL&P), notified your office of an item concerning the reactor vessel core support ledge. Attached is the final report concerning this item.

If you should have any questions concerning this item, please contact Mr. Michael E. Powell at (713) 993-1328.

Very truly yours,

R.H. Goldberg for

G. W. Oprea, Jr.
Executive Vice President

MEP/mpg

Attachment: Final Report Concerning Reactor Vessel Core Support Tolerance

IE-27 1/1

W2/NRC2/d

cc:

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Revised 12/21/83

South Texas Project
Units 1 & 2
Final Report Concerning the Unit 1
Reactor Vessel Core Support Tolerance

I. Summary

An optical survey of the installed Unit 1 Reactor Pressure Vessel (RPV) revealed two (2) non-conforming conditions.

(1) A tilt in the reactor vessel and associated tilt of the core support ledge in excess of allowable limits.

(2) A waviness condition in the core support ledge that exceeds flatness criteria.

Based upon the results of extensive evaluations of these two (2) conditions, we have concluded that they do not constitute a safety hazard. The South Texas Project (STP) Unit #1 may operate without repair of these conditions with no detrimental effects.

II. Description of Deficiency

On July 26, 1983, pursuant to 10CFR50.55(e), Houston Lighting & Power Company (HL&P) notified the NRC Region IV of an item concerning the reactor vessel core support ledge. A detailed description of the identified concerns follows.

In March and June of 1983 optical measurements were taken of major Unit 1 NSSS components to assess NSSS equipment installation. These measurements included intermediate locations on the core support ledge between the major axes of the Unit 1 RPV. When the data was reported an out of levelness condition was identified. Reduction of the data obtained from the optical survey indicated a maximum "peak-to-valley" seal ledge/mating surface waviness of .018 inches. In addition, a tilt of the support ledge was identified and found to be approximately 0.006 degrees. The Westinghouse tolerances for the maximum waviness of the support ledge and maximum tilt across the support ledge are .005 inches and .0024 degrees respectively. The differential settlement of the Unit #1 RCB (see FSAR Figure 2.5.C-13A) has been within the design criteria of 0.5 inch across the containment mat along any axis (see FSAR Section 2.5.4.11). This design basis tilt of 0.5 inches would result in a maximum tilt angle of 0.0148 degrees.

Combustion Engineering, Inc. (CE), the vessel manufacturer, has been questioned concerning the origin of such a waviness condition. Discussions with CE have indicated, and are supported by data supplied, that the condition is not the result of the flange machining since the machining was performed on a vertical boring mill on which the upper vessel assembly rotates on a turntable while the surfaces in question are machined by a stationary cutting tool. The 26 foot diameter turntable is loaded hydrostatically with hydraulic oil by numerous pumps. A large differential pressure between the pumps will cause machine shutdown. The rocking motion required to machine the wavy condition on the support ledge surface is therefore not permitted by the design. Furthermore, the as-built dimensions taken at the CE facility on the support ledge surface indicate a flatness of 0.0005 inches.

Optical measurements on the flange mating surface during a set up operation after flange machining also show a flatness of 0.0005 inches. As-built measurements which could provide any additional information about the waviness condition were not taken during the subsequent operations to complete the vessel assembly. Operations performed after machining were final girth seam welding of the upper vessel assembly to the lower assembly and local heat-treatment. The vessel was then hydrotested, NDE inspected, prepared for shipment, and shipped on a barge to a port near the site. After arriving at the site the vessel was placed in outside storage where it remained for two years before being moved to containment and set. None of these steps are unique to the STP reactor vessel, and the only difference in the design configuration of the vessel is the rotolok stud system which includes a larger diameter, more massive vessel flange with more material removed to accommodate the larger diameter studs and the stud hole sleeves.

There was no report of any problems with handling of the vessel during shipment or at the site, and there were no external signs of vessel distress.

Based on the data available, the cause of the waviness discrepancy has not been identified.

In mid-1983, an assessment of the RCB indicated a differential settlement of approximately 0.007 degrees. Thus, RCB settlement may be the origin of the reactor vessel tilt. No other cause of the tilt has been identified.

III. Corrective Action

Westinghouse was requested to evaluate the impact of the waviness effect (0.018) inches of the vessel mating surface/core support ledge and the maximum design basis tilt (0.0148 degrees) of the reactor vessel and to ascertain whether the conditions constituted a significant deficiency. Westinghouse contacted Combustion Engineering (the vessel fabricator) concerning the nonconformances identified and provided the field data to them for evaluation and recommendations. Combustion Engineering has completed its evaluation, issuing an addendum to the Combustion Engineering Analytical Report for the South Texas Project Unit 1 Reactor Vessel. No further corrective action, other than the analysis of the changes in the loading on the reactor vessel and the Westinghouse evaluations summarized in this report, are required. ASME Code, Section III, allowable limits are not exceeded.

IV. Recurrence Control

No significant deficiencies in fabrication or installation of the vessel have been identified. The design basis differential settlement criteria for the reactor containment building (one-half inch tilt across the diameter of the building along any axis) has not been exceeded. Therefore, no recurrence control is required.

V. Safety Analysis

The reactor vessel and the interfacing equipment including the reactor internals, the control rod drive mechanisms and drivelines, the reactor vessel supports, the reactor coolant piping and the refueling equipment have been evaluated for possible safety implications of the waviness and tilt conditions. The results of the evaluations on the various equipment are as follows:

A. Reactor Vessel:

Calculations show that the closure head flange will deflect to follow the contour of the vessel mating surface due to the bolt-up loading. The O-ring gaskets will therefore seal. The deflection of the closure head flange creates an additional stress in the closure head of approximately 6.0 ksi. The addition of 6.0 ksi to the maximum stress intensities reported in the stress report does not result in stress intensities which exceed the allowable limits. Additionally the reactor internals flanges also deflect to conform to the support ledge surface so that there is no significant increase in bearing stress. The increase in bearing stress on the vessel support ledge due to the tilt condition on the ASCO vessel was found to be 5.5 psi. This increase is negligible compared to the governing bearing stress on the core support ledge.

B. Reactor Internals:

The deflection of the internals flanges to conform to the core support ledge may generate a shear stress of 5.85 ksi in the flanges. The flanges will remain elastic and applicable ASME Code limits are satisfied. A tolerance study indicates that the clearances between the various interfaces will not cause interference during operation. Limiting interface loads between the reactor internals and the vessel were calculated and found to be below the loads considered for design and operating conditions in existing stress reports. Further, the additional loadings result in minimal additional stresses on the internals.

C. Control Rod Drive Mechanisms and Drivelines:

Analysis of the tilt condition on the ASCO vessel indicates that the significantly larger tilt at ASCO resulted in a negligible increase in imposed loads, and the tilt condition is bounded by the existing analysis. The same analysis is applicable to the STP. In addition, the tilt will have no effect on the Rod Control Cluster Assembly (RCCA) drop time.

D. Reactor Vessel Supports:

The tilt results in no significant increase in the support loads. The tilt condition is bounded by existing analysis.

E. Reactor Coolant Piping:

The tilt results in a negligible increase in the reactor vessel nozzle loads due to the reactor coolant piping. The tilt condition is bounded by existing analysis.

F. Refueling Equipment:

A tolerance study of the refueling equipment shows that the clearances between the various refueling equipment interfaces do not close due to the tilt condition. No interference conditions are anticipated.

In summary, based on the results of these evaluations, the out-of-levelness condition on the reactor vessel support ledge and mating surface does not constitute a safety hazard. The STP Unit 1 plant may operate without repair to the condition with no detrimental effects. Therefore, the conditions do not constitute a safety hazard pursuant to 10CFR50.55(e).

In view of the fact that the cause of the waviness condition has not been determined, the Unit 2 reactor vessel will be surveyed following installation to determine if a similar condition exists. Any discrepancies identified will be reported as a separate item.