GULF STATES UTILITIES COMPANY

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August 6, 1985
RBG - 21818
File No. G9.5

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

River Bend Station - Unit 1
Docket No. 50-458

Enclosed for your review is Gulf States Utilities Company response to a request for additional information provided by your Staff regarding the containment ultimate capacity analysis for River Bend Station. This response was previously discussed in telephone conversations with Mr. H. Polk of your Staff and Dr. Lowell Greimann of Ames Laboratory on July 31, 1985, and August 2, 1985.

Sincerely,

J. E. Booker

J. E. Booker
Manager-Engineering
Nuclear Fuels & Licensing
River Bend Nuclear Group

JEB/ERG/DEV

Enclosure

B001 1/1

RESPONSES TO COMMENTS AND QUESTIONS REGARDING
THE ULTIMATE PRESSURE CAPACITY OF STEEL CONTAINMENT
OPENINGS AND PENETRATIONS FOR RIVER BEND STATION

COMMENT RESPONSES

1. The comparison on pages A-14 and B-13 is provided as a check of the input loads to determine if there had been an input error. It is not provided to verify finite element analysis.

2. The hand calculation method (p. A-22) to calculate nodal stresses using nodal force yields reasonable results since the nodal forces are the sum of the element stresses. We agree that generally element stresses at centroids are used to arrive at nodal stresses. However, the present method was considered desirable because no interpolation or extrapolation was necessary. We have recalculated the stresses at node 13 (see response to Question No. 7), using Dr. Greimann's suggested method. Results show that there is no difference in the ultimate capacity.

3. The steel has sufficient ductility and the ultimate pressure for general yielding is lower than the pressure at which instability or buckling would occur.

QUESTION NO. 1 RESPONSE

The stiffener in question between nodes 53 and 233 is subjected to very high bending stress due to structural discontinuity at the corner of the door in the bulkhead region. This stress is therefore secondary as defined in ASME III NE-3213.9 (b).

Local failure of the stiffener by yielding would not affect the capacity of the bulkhead to resist internal pressure. Therefore, the stiffener was removed from the model for general yield analysis. Since the critical failure regions of the bulkhead are away from the stiffener location, removal of the stiffener did not have significant effects on the results of the analysis as shown on page A44.

QUESTION NOS. 2,4 AND 5 RESPONSE

The numbers used in the calculations are correct and are based on the final drawings. Numbers on pages B-37 and B-33 are preliminary.

QUESTION NO. 3 RESPONSE

For a triangular element, the input for element incidence in ANSYS requires 4 nodes (last node input twice). In ANSYS, the last node is treated as two nodes, therefore it shows two sets of results for the same node.

QUESTION NO. 6 RESPONSE

Equation for σ_y (membrane) is for averaging the nodal point forces of the elements connected to the node.

QUESTION NO. 7 RESPONSE

An average width of the element halfway between nodes 13 and 14 is used to compute $\overline{FY}_{13}$. We have recomputed the stress at node 13 using element stresses and then linearly extrapolating to node 13. The stress intensity at the center of elements 112 and 129 are 24.78 ksi and 13.35 ksi respectively, and the stress intensity at node 13 becomes 30.17 ksi by extrapolating the above two numbers. The ultimate pressure capacity of the equipment hatch is calculated to be 57 psi if Service Level C criteria of the ASME Code and actual material strengths are used. This number is very close to the calculated capacity (56 psi).

QUESTION NO. 8 RESPONSE

We agree with your intuition that M_α in general would be positive. This is also implied by the example given in Ref. 5, article 130, for a spherical shell subjected to external pressure with fixed ends. But this is true only when the ring beam is relatively stiffer with respect to the shell. In the subject case, the ring beam is relatively flexible against rotation and since the support of the ring beam is away from the centerline, it rotates clockwise under the internal pressure, causing negative movement M_α on the shell.

The peak moment away from the flange/shell juncture is very close to the M_α at the juncture.

QUESTION NO. 9 RESPONSE

Yes. SHELL1 was used to analyze the steel portion of the model in Fig. 2. SHELL1 uses a finite difference method to solve equilibrium equations and uses a total of 474 subdivisions for the whole containment. The maximum subdivision is approximately 2.8 feet long.

The bending stress in the knuckle region results from structural discontinuity between the cylindrical shell and the lead. Therefore, the bending stress is secondary in accordance with ASME III NE2317.8, 2317.9, and Table NE-3217-1.

QUESTION NO. 10 RESPONSE

Yes. The plastic capacity of the section for the containment is computed using the technique on page E-4.

QUESTION NO. 11 RESPONSE

Load path redistribution over 4 elements was based on engineering judgement. Since the redistribution of forces occur as a result of yielding, portions of the computed stresses are secondary and do not enter into the computation of ultimate capacity.

QUESTION NO. 12 RESPONSE

A drawing showing details of the control rod removal tube has been provided informally to Dr. Greimann and to Mr. H. Polk of the NRC Staff.