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SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards summary info re containment vessel out-of-roundness issue raised during litigation following termination of Contract 206 per R Auluck request.Out-of-roundness will have no detrimental effect on structural capacity.

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December 8, 1982
G02-82-967

Docket No. 50-397

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
CONTAINMENT OUT-OF-ROUNDNESS

Attached is a summary of information relating to the Containment Out-Of-Roundness issue which was raised during litigation following termination of Contract 206. This information was requested by Dr. R. Auluck of your staff. Please let us know if additional information is required.

Very truly yours,

G. D. Bouchey
Manager, Nuclear Safety and Regulatory Programs

EAF/jca
Attachment

cc: R Auluck - NRC
WS Chin - BPA
R Feil - NRC Site

B001

"CONTAINMENT OUT-OF-ROUNDNESS"

Background

The "containment out-of-roundness" issue was raised by the 206 Contractor during litigation following default of the 206 Contract as a contributing cause for construction delay on that contract. Reinforcing bars for the containment base mat and bio-shield wall were detailed and fabricated based on theoretical containment geometry represented on design drawings produced by the Architect-Engineer. If deviations between as-built containment geometry and theoretical containment geometry had been excessive, this could have had an adverse effect on constructability under the 206 Contract. As brought out in the Contract 206 litigation, the as-built deviations from design geometry of the containment were not excessive, and were not real restraints to contruction progress.

As-built containment geometry could also be a potential concern because of the following:

(a) Fit-up of piping to containment penetrations
(b) Span length of radial beams in the drywell
(c) Thickness of bio-shield wall
(d) Distribution of stress in the containment vessel

Each of these is discussed below:

(a) Fit-up of Piping to Containment Penetrations

If the location (vertical, radial, tangential) and orientation of the ends of the containment penetrations differ significantly from design location and orientation, and these deviations are not considered in the design, fabrication, and stress analysis of the piping which is welded to the penetrations, then non-conforming conditions will exist which could require redesign and rework. However, on WNP-2 as-built information was provided to the design organizations responsible for piping design, and was used as a basis for final design, fabrication, and as-built stress analysis of piping. Therefore, this factor was accommodated in design at WNP-2.

(b) Span Length of Radial Beams in the Drywell

A similar requirement to factor as-built information into final design exists for structural steel beams inside the drywell, which span radially from the sacrificial shield wall to beam seats on the containment vessel, and to which pipe whip restraints, and supports for piping, conduit, ductwork, and instrumentation tubing are attached. The as-built geometry of the containment vessel must be known so the beams can be cut precisely to their required length. This as-built information was provided to the contractor responsible for fabrication and installation of the radial beams, and the beams were fabricated accordingly.

(c) Thickness of Bio-Shield Wall

In construction of the 5-foot thick biological shield wall around the steel containment vessel, the reinforced concrete is placed against a compressible foam and fiberglass filler on the outside of the containment vessel. This filler provides a 3-inch separation between the steel containment and the reinforced concrete biological shield wall. Thus, the steel containment, with attached filler material, serves as a form for the concrete placement. If the radial position of the containment vessel at a particular azimuth and elevation deviates from the theoretical position, then the thickness of the biological shield wall could be greater or less than what is required, unless the as-built geometry is accounted for by adjusting the position of the outer form for the concrete placement. A thicker wall than required would have no adverse affect on structural or shielding capacity of the biological shield wall. If the wall were thinner than required, this could have an adverse affect. The Architect-Engineer evaluated the as-built geometry of the containment vessel and concluded that reductions in structural and shielding capacity of the biological shield wall, due to as-built geometry of the containment vessel, were not significant. Based on this evaluation, the contractor constructing the biological shield wall was directed to maintain the outer radius of the wall at its design location.

(d) Distribution of Stress in Containment Vessel

If the as-built containment geometry differs significantly from the theoretical geometry, this could result in distribution of stresses under postulated loading during normal operation and accident conditions which may be significantly different than what was assumed in design. Consequently, the ASME code, which provides rules for design and construction of the WNP-2 containment vessel, provides tolerances for acceptable deviations from theoretical geometry. Paragraph NE4221.1 of ASME Section III, Summer 1972 Addenda (which is the applicable code for the WNP-2 containment), limits the difference between the maximum and minimum diameter at any cross section of the containment vessel to 1% of the nominal diameter of the vessel at that cross section. As documented in the as-built survey submitted by the containment vessel contractor to the Architect-Engineer in mid-1975 (Submittal No. 213-00-7050) there is one location (Elevation 564'-10") where the as-built out-of-roundness exceeds the ASME code allowable value by less than 1/16" (5.375" actual versus 5.33" allowable).

This recorded exceedence of the tolerance established in the ASME code is not significant, and has no effect on the structural capacity of the containment or the validity of the stress analysis performed in accordance with ASME design rules for the postulated loading conditions. At all other locations the as-built geometry is well within the ASME code limit. The single deviation will be documented and accounted for by the contractor having design responsibility for the containment vessel.

Given this background, the only containment as-built geometry issue which could potentially affect plant safety is the compatibility of the as-built geometry with the containment stress analysis. Following is a summary of information provided in response to questions asked informally of the Supply System by the NRC staff:

Response to Questions from NRC Staff:

1. Dates and Locations the Problems Occurred

No problems related to as-built geometry of containment which adversely affect containment structural adequacy, or invalidates containment stress analysis have been identified. The allegations that containment vessel out-of-roundness was excessive and caused constructability problems for the 206 Contractor, occurred initially in May 1974 (RFI 206-290, dated May 16, 1974).

2. Parties Involved in Identifying and Correcting Such Problems

The concerns voiced by the 206 Contractor and identified as a cause of construction delay were evaluated by the Architect-Engineer, and resolved through providing a response to the contractor's request for information (RFI 206-290), and through subsequent meetings and discussions with the contractor. Prior to providing this response to the RFI, the Architect-Engineer's site and home office engineering groups reviewed the as-built information on containment geometry to assess whether the vessel out-of-roundness was within ASME tolerances, and to evaluate the affect of the as-built condition on structural capacity, shielding, and constructability of the bio-shield wall. Their conclusion was that the as-built geometry was acceptable and had insignificant affect on design margins or constructability of the bio-shield wall.

3. Correspondence/Documents Related to the Subject Issue from the Onset of Problems to the Final Resolution

RFI 206-290, issued on May 16, 1974, by the 206 Contractor, was answered on August 7, 1974, by the Architect-Engineer. The RFI requested direction on whether to hold the outside radius of the bio-shield wall, since the containment vessel as-built location could vary within a large tolerance allowed by the ASME code. Burns and Roe directed the Contractor to hold the outer radius, and let the inner radius vary to accommodate the as-built containment geometry.

4. Measures Taken to Resolve the Issue

As indicated above, the as-built geometry was reviewed by the Architect-Engineer in August 1979, and direction provided to the 206 Contractor on how to proceed with construction on the reinforced concrete bio-shield wall. The final as-built survey information was submitted by the containment vessel contractor in mid-1975 (File No. 213-00-7050), and approved on September 3, 1975 by the Architect-Engineer.

5. A Complete Description of the QA/QC Aspects of this Issue

Documents reflecting the identification of the perceived problem, and the containment as-built information have been identified above. The non-conforming condition relating to the slight exceedence of the ASME limit on out-of-roundness at one location, will be properly documented and accounted for in accordance with existing project procedures.

6. Rationale/Justification of the Resolution

See background and Items 1-5 above.

7. Overall Assessment of the Out-Of-Roundness Problems and Evaluation of Applicable Requirements of Codes with Respect to Existing Deviations

As indicated above, the as-built geometry of the containment vessel is in compliance with the "out-of-roundness" criteria established in ASME Section III, NE-4221.1, Summer 1972 Addenda, except at one cross section (Elevation 564'-10") where the maximum diameter (44'-6 7/8") exceeds the minimum diameter (44'-1½") by 5 3/8" which is less than 1/16" in excess of the ASME code limit of 1% of the nominal diameter of 44'-4 3/4". This slight exceedence of the ASME tolerance limit has no significant affect on structural capacity of the containment vessel, or on the calculated distribution of stresses in the containment vessel under the postulated loading conditions. This slight exceedence of the ASME limit on out-of-roundness will be properly accounted for and documented by the 213 Contractor, who has design responsibility under the rules of the ASME code for the containment vessel.

8. Conclusion

Containment vessel out-of-roundness has been measured, evaluated, and found to have no detrimental affect on structural capacity of the containment vessel, nor on any other aspect of plant design related to plant safety, and is therefore acceptable.