DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28201

A. C. THIES
SENIOR VICE PRESIDENT
PRODUCTION AND TRANSMISSION

P. O. Box 2178

June 2, 1972

Mr. John G. Davis
United States Atomic Energy Commission
Directorate of Regulatory Operations
Region II, Suite 818
230 Peachtree Street, N. W.
Atlanta, Georgia 30303

Re: CO:II:CEM
50-269/72-2
50-270/72-1
50-287/72-1

Dear Mr. Davis:

Please refer to the enclosure of your letter of April 21, 1972 concerning items of apparent non-compliance with 10CFR50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants". The attached information is submitted to answer your concerns identified by that enclosure.

In regard to the paragraph in your April 21, 1972 letter on the functioning of the General Office Review Committee, we wish to make the following clarifications. The General Office Review Committee will continue to implement its responsibilities and make quality assurance checks on operating activities in conformance with the Final Safety Analysis Report, the Technical Specifications, and its By-Laws. However, the Steam Production Department will appoint an audit task force which will be governed by written procedures and will be a part of the overall Steam Production Department quality assurance program. This audit task force will be similar to that of the Construction Department and will satisfy the requirements of Criterion XVIII of 10CFR50, Appendix B. The General Office Review Committee By-Laws have been revised as of March 13, 1972 to reflect this position.

Very truly yours,

A. C. Thies

A. C. Thies

ACT:vr
Attachment

ATTACHMENT to A. C. Thies' letter of June 2, 1972 to J. G. Davis

1. The change in acceptable tendon elongation in tendon stressing procedure N-4 did not receive proper review and approval. This procedure has been revised and now shows acceptable tendon elongation as originally written and specified in the FSAR.

   The lack of review and approval of this early procedure was a violation of our Quality Assurance Program. As a result of this violation, we are reviewing all procedures to assure that proper review and approval has been completed. All new procedures will be approved only by the Vice President, Construction. In addition, the Vice President, Construction will instruct future audit committees to review procedures for approval in the areas that they audit. All engineers concerned with QA have been advised of this violation and instructed to assure themselves that procedures have been properly approved before use.

2. During this inspection visit by AEC, we were able to locate calibration data sheets for July 1971 and January 1972; however, after this visit we were able to locate additional calibration data sheets for September 1971 and October 1971. The gages considered necessary for each stressing cycle were calibrated at the beginning of each stressing cycle. Cycles refer to the time at which stressing was stopped to complete buttonheading or greasing of tendons previously stressed. During buttonheading and greasing, the gages were stored in excess of a month and it was necessary to recalibrate the gages to be used on the next cycle.

   Oconee 2 had three stressing cycles which began, respectively, July 1971, September 1971 and January 1972. The first two cycles occurred during the stressing of the containment structure and the third cycle represented the time between containment stressing and secondary shield wall stressing.

   The purpose of calibration data sheets is to document the calibration of the pressure gages. The "as found" output on the calibration data sheets indicates that some gages are not within the ± 2% criteria as stated in FSAR section 5B.2.8.2. Since the gages in each instance had been in storage for considerable lengths of time between stressing cycles, and possibly subjected to rough handling, the calibrations do not represent gages taken directly from stressing usage to the calibration shop. Therefore, there is no correlation between "as found" output at the time of calibration and what actually occurred during stressing. Gages which were subjected to severe blows or shocks during stressing were replaced immediately; however, defective gages were not calibrated until the spare calibrated gage supply was exhausted.

   A review of tendons exceeding 5% of calculated elongation in respect to stressing sequence and scaffold location indicated no established pattern of deviations exceeding 5%. A complete engineering analysis of the Oconee 2 stressing program is being prepared by Duke Engineering and Bechtel.

   To improve our total program with respect to calibration, procedure 0-1, Calibration of Measurement and Test Equipment, has been implemented. Equipment covered by this procedure is being brought under this control on an orderly basis.

3. Procedure N-4, Tendon Stressing Procedure, did require that the pressure gages be checked twice daily, however, there was no specific requirement that these checks be documented. We agree that this documentation is necessary and Procedure N-4 has been revised to require that the checks be recorded. Although during your discussions with our staff it may have appeared that these daily checks were not made, we have discussed this matter thoroughly with our inspection personnel and are convinced from these discussions that these gages were checked twice each day as required, during Unit 2 stressing.

4. The results of Unit 2 Reactor Building tendon elongations were compared with Unit 1 as follows:

Percent deviation between calculated and measured elongation	Percent of total building tendons	
	Unit 1	Unit 2
5 percent	84.33%	84.0%
More than 5, but not more than 10 percent	14.23%	14.14%
More than 10 percent	1.44%	1.86%

The location of the tendons with measured elongation exceeding 5 percent of calculated elongation were not localized in any one area, but occurred at random locations. Of the 155 tendons that exceeded 5 percent, 22 were dome, 97 hoop and 36 vertical tendons.

The reasons for the differences between calculated and measured elongations have been evaluated. The calculated elongation for each tendon was performed by the prestress system supplier using their proprietary computer program. The computed calculated elongations were based on the modulus of elasticity of 29 million psi, theoretical tendon length with the tendon at the centerline of the sheath, the stressed wires are parallel and uniformly spaced along entire tendon length, a constant friction factor for all tendons and perfect stressing equipment and procedures.

The measured elongation will differ from the calculated elongation due to the following:

1) The statistical modulus of elasticity of 29.3 million psi for straight, untwisted wire.

2) The actual length and location of the tendon sheath will vary from the theoretical position due to approved placing tolerances.

3) All wires in a tendon are equal in length and the tendon is twisted to compensate for the difference in actual arc lengths. The twisting forms a wire cable configuration which does not follow the sheath centerline and which has a modified modulus of elasticity value.

4) The friction factor used in calculations is an average value based on experience. The true influence of friction on each tendon can be significantly different from the average value used in calculations.

5) The accuracy of the pressure gages is plus or minus 2 percent and the gages are calibrated in 100 psi increments. The permissible tolerance in gage accuracy combined with the possible variables in stressing techniques such as reading the gages and scales can constitute a significant difference.

The above tabular data show statistical correlation between Unit 2 elongations and those of Unit 1 which were found fully adequate and previously approved. For the five reasons cited above, theoretical elongations are not achievable in practice, and we expect similar experience on Unit 3 and plan to file a revision to the FSAR reflecting this expectation.

5. Although we cannot document it, gages were checked for calibration twice daily during stressing operations. This check was in accordance with the then existing procedure requirement that the two gages used in each operation be checked against each other. We are confident that these checks were performed even though they were not documented, therefore, we do not feel that any tendons were stressed in excess of the requirements of the FSAR. The FSAR explains differences between our stress levels and those of ACI 318-63. It is pointed out that with stressing from each end, to overstress a tendon would require that four gages plus two relief valves be out of permissible calibration limits - <u>all at the same time</u>.

6. The status of the tendon stressing program received a thorough review by members of the QA supervisory staff at the site. The Unit 1 stressing operations had previously been analyzed by both Duke Engineering and Bechtel and were considered satisfactory. Since the results of stressing operations for Unit 2 were progressing similar to the Unit 1 operations, our site people considered that the results being achieved were also satisfactory.

This is not to minimize the deficiencies noted in the areas of procedure approval and gage calibration. We are thoroughly reviewing the status and adequacy of the QA Program in these two areas as it relates to all work on the site. As noted above, we are investigating procedure approval and gage calibration in all areas of our work and are confident that the frequency of this type of deficiency will be minimized and that deficiencies that do occur will be detected during our audit process.