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POWER COMPANY

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VPNPD-93-151
NRC-93-098

September 13, 1993

Document Control Desk
U. S. NUCLEAR REGULATORY COMMISSION
Mail Station P1-137
Washington, DC 20555

Gentlemen:

DOCKETS 50-266 AND 50-301
REQUEST FOR ADDITIONAL INFORMATION REGARDING NRC
REVIEW OF THE POINT BEACH TENDON SURVEILLANCE REPORTS
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

During the period from October 21 through October 24, 1991, Office of Nuclear Reactor Regulation (NRR) staff performed a structural audit of Point Beach Nuclear Plant (PBNP) Units 1 and 2. The audit was part of an NRR initiative to monitor the performance of and obtain information about Category I structures at licensed nuclear plants.

Following the audit, the staff requested that we submit copies of the last three reactor containment tendon surveillance reports for further NRC review. On December 23, 1991, we submitted the 1, 3, 8, 12, and 18-year tendon surveillance reports and related documents for staff review.

In a letter dated July 12, 1993, you indicated that the staff review found some discrepancies in the development of the tolerance band (upper and lower limits) of acceptable prestressing tendon force and in the analysis of the tendon force measurements. Your letter listed several questions regarding these apparent discrepancies and requested a 60-day response. This letter forwards our response to your questions. A summary of each question is given along with our response.

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If you require additional information, please contact us.

Sincerely,

for

Bob Link
Vice President
Nuclear Power

Enclosures

cc: NRC Resident Inspector
NRC Regional Administrator

KVA/jj

REQUEST FOR ADDITIONAL INFORMATION
FOR POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NOS. 50-266 AND 50-301

QUESTIONS AND RESPONSES:

A. **In the development of the tolerance bands for acceptable prestressing tendon force shown in PBNP Calculation N-89-094, WEPCo used a stress relaxation loss of 25.4 ksi, which is larger than the stress relaxation loss of 12.5 ksi indicated in the FSAR.**

PBNP Calculation N-89-094 has been superseded by Bechtel Calculation 050-C-039 (Job No. 10447-050). Bechtel Calculation 050-C-039 reconstructed the tolerance bands of acceptable prestress force in accordance with Regulatory Guide (RG) 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," using the FSAR value of 12.5 ksi for the 40 year stress relaxation loss. A copy of this calculation is included as Attachment A.

B. **WEPCo used normalizing factors to calculate the loss of prestressing force due to elastic shortening and to revise the actual test measurements and the tolerance bands of acceptable prestressing tendon force.**

WEPCo agrees that normalizing factors are not applicable when using the acceptable tendon prestressing force criteria outlined in RG 1.35, "Inservice Inspection of Ungrouted Tendons in Prestressed Concrete Containments," and 1.35.1. The above referenced Bechtel calculation (Attachment A) constructed the tolerance bands of acceptable prestress force without the use of normalizing factors. Attachment B includes all of our tendon surveillance data (1, 3, 8, 13 and 18-year tendon surveillance) plotted on the tolerance bands constructed by Bechtel. Tendon prestress forces indicated on these plots are actual, non-normalized values.

C. **WEPCo used an initial lift-off stress of $0.7f'_s$ for the tendon tests performed in 1971, 1974, 1979 and 1984. However, an initial lift-off stress of $0.73f'_s$ was used in the 1989 tendon test.**

Initial lift-off stress is used to calculate normalizing factors which account for differential elastic strain losses resulting from progressive tensioning of tendons. Since normalizing factors are not applicable to RG 1.35 and 1.35.1, the assumed initial lift-off stress is no longer relative to the trending of tendon prestress loss data. Actual lift-off forces should have been plotted on tolerance bands constructed in accordance with RG 1.35.1 for the 1989 tendon surveillance.

The plots included with Attachment B contain non-normalized tolerance bands and data.

D. **Twelve tendons were tested during the 1984 tendon surveillance. The data was plotted on twelve separate semi-logarithmic graphs with different tolerance bands of acceptable prestressing tendon force.**

Unique tolerance bands of acceptable prestress force were constructed for each tendon that was tested during the 1984 surveillance. These unique bands accounted for the actual lift-off force during installation and elastic strain losses adjusted for stressing sequence for each tendon that was tested. Discontinuities in the tolerance bands were also included to account for the removal of test wires and the actual lift-off force associated with retensioning during past surveillances.

The practice of constructing unique tolerance bands has been discontinued. Tolerance bands included with attachments A and B have been constructed in accordance with RG 1.35.1 using FSAR values for lift-off force and elastic strain losses.

E. **With respect to figures in the 1984 and 1989 surveillance reports which show the relationship between time and prestressing tendon force, it appears that WEPCo changed the values of the actual lift-off forces measured in 1971, 1974 and 1979.**

The plots of prestressing tendon force as a function of time shown in the 1971, 1974 and 1979 tendon surveillance reports, use normalized data. All normalizing factors applied to measured lift-off forces from the first three tendon surveillances are less than unity for tendons that were also tested during the 1984 and 1989 surveillances. In other words, the plotted, normalized lift-off forces shown in the first three tendon surveillances for tendons BF-23, V-3, D2-23, MH-54, V-339 and D2-227 are all less than the actual, measured lift-off forces for these tendons. The 1984 and 1989 tendon surveillance plots of prestressing tendon force as a function of time use the actual, measured lift-off forces. This gives the appearance that the values were increased from previous reports.

The lift-off forces measured during the 1989 tendon surveillance were normalized prior to plotting them along with the other, non-normalized lift-off forces from previous surveillances. We realize that this is inconsistent, however, it explains the discontinuity of the 1989 data. Plots included with Attachment B use actual, measured lift-off forces only, with tolerance bands constructed in accordance with RG 1.35.1.

F. **There are apparent discrepancies in the development of the**

tolerance band and the measurement data analysis.

WEPCo agrees that an accurate and meaningful tendon surveillance program is essential to ensure that the containment prestressing system is functioning adequately. Revised tolerance bands have been constructed in accordance with RG 1.35.1 and are included with Attachment A. Actual, measured lift-off forces have been taken from all previous surveillances and are plotted on the revised tolerance bands and trended in Attachment B. These plots will be revised to reflect subsequent data resulting from future tendon surveillances.

PBNP tolerance bands have been constructed in accordance with RG 1.35.1, using the conservatively estimated FSAR design values in determining the time-dependent loss factors.

G. **Some tendon force measurements of the 1989 tendon surveillance test are approaching the final minimum design effective prestressing tendon forces.**

Plots included with Attachment B superimpose the results of the PBNP tendon surveillances on tolerance bands constructed in accordance with RG 1.35.1. A study of these plots concludes that no measured lift-off forces fall below 90 percent of the predicted lower limit of prestressing force. All future tendon surveillance data will be incorporated on the plots of Attachment B to provide acceptance and trending information.

H. **Are the average minimum design prestressing stresses written in the Technical Specification 15.4.4 VII adjusted for the creep, shrinkage and stress relaxation losses?**

The average minimum design values for prestress level written in the Technical Specification 15.4.4.VII, "Tendon Surveillance," are the FSAR minimum final effective prestress values. Therefore, all losses (initial and time-dependent) are included.

I. **Please provide complete data that show the stress and strain relationship of the three tendons detensioned and retensioned during the eighteen-year tendon surveillance.**

RG 1.35 recommends the simultaneous measurement of elongation and jacking force be made at a minimum of three approximately equally spaced levels of force during retensioning. Appendix B of the eighteen-year tendon surveillance report includes elongation readings for tendon D1-205, HK-31 and V-208 at approximately 1673 lbs/wire, between 5857 and 6693 lbs/wire and at approximately 0.8 F_u.

Elongation measurements were compared to elongations recorded during the initial tensioning. Retensioning elongations which

vary from the original elongations by more than 5% require further investigation per PBNP tendon surveillance procedures. Retensioning elongations which vary from the original elongations by more than 10% should be considered reportable to the NRC in accordance with RG 1.35.

Tendon V-208 displayed an acceptable variance of +4.9%. Tendon D1-205 and HK-31 displayed variances of +8.3% and 9.2% respectively. These two tendons were the subject of VSL Corporation Nonconforming Report PBNP-1 '89 and PBNP-2 '89 and were found to be acceptable.

All the information pertaining to tendon elongation measurements for the eighteen-year tendon surveillance is contained in the Eighteen-Year Inservice Tendon Surveillance Test Report, Revision 0, prepared by the VSL Corporation. We understand that this report is currently in your possession.

Attachment A: Bechtel Calculation 050-C-039, "PBNP Containment Tendon Prestress Acceptance Limits", Rev. 0

Attachment B: PBNP Calculation N-93-042, "Tendon Surveillance Program Prestress Summary", Rev. 0

ATTACHMENT A

Bechtel

9801 Washingtonian Boulevard
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(301) 417-3000

June 8, 1992

Mr. G. D. Frieling
Manager, Nuclear Engineering Section
Wisconsin Electric Power Company
231 W. Michigan
P. O. Box 2046
Milwaukee, Wisconsin 53201

Attention: Mr. Daniel Craig

Subject: WEPCO Contract No. C44787
Bechtel Job Number 10447-050-071
Post Tensioning Predicted Loss Curves
NOPS 92-002 File: 0260

Reference: RTS 10447-050-071

Dear Mr. Frieling:

As requested in the referenced RTS, we have redone PBNP Calculation N-89-094, "PBNP Containment Tendon Prestress Acceptance Limits." A copy of the replacement calculation, No. 050-C-039, is attached for your use. This assignment is now complete. The calculation was previously sent to you (Attn: D. Craig) for review prior to issue as a final calculation.

We request that you sign, date, and return a copy of this letter as acknowledgement of Wisconsin Electric Power Company's acceptance of the completed work.

If you have any questions or comments, please do not hesitate to call.

Sincerely,

BECHTEL POWER CORPORATION

S. G. Veale
Project Engineer

SGV/GHG/db

Wisconsin Electric Acceptance

Manager, Nuclear Engineering Section or Designee

Date 6/11/92

Attachment: Calculation 050-C-039, Rev. 0

cc: Daniel Craig, w/1