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Company of Colorado

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July 20, 1987
Fort St. Vrain
Unit No. 1
P-87234

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Attention: Mr. Jose A. Calvo
Director, Project Directorate IV

Docket No. 50-267

SUBJECT: Transmittal of Fourth Six-Month PCRV Tendon Interim Surveillance Report and Proposal for Revised Interim Surveillance Program

REFERENCE: 1) PSC letter, Warembourg to Berkow, dated January 19, 1987 (P-87021)

2) NRC letter, Docket No. 50-267, Johnson to Lee, dated July 8, 1985 (G-85261)

3) NRC letter, Docket No. 50-267, Heitner to Williams, dated March 25, 1987 (G-87105)

4) PSC letter, Warembourg to Berkow, dated July 29, 1986 (P-86491)

5) PSC letter, Warembourg to Johnson, dated March 5, 1985 (P-85071)

6) PSC letter, Warembourg to Berkow, dated January 22, 1986 (P-86042)

7) PSC letter, Warembourg to Johnson, dated December 31, 1984 (P-84543)

Dear Mr. Calvo:

Please find enclosed a copy of the "PCRV Tendon Interim Surveillance Report" for Fort St. Vrain, dated July, 1987.

The enclosed report presents and discusses the findings of the fourth six-month interim tendon surveillance program period. The findings of the third six-month interim surveillance period were reported and submitted under the Reference (1) letter.

The submittal of the enclosed report fulfills the fourth semiannual commitment of Reference (2), Item 2.

With regard to the concerns of the NRC staff as presented in the safety evaluation enclosed with the Reference (3) letter, the following points are summarized from the enclosed tendon surveillance report:

- The discoloration observed on certain tendon parts is superficial, surface corrosion. This superficial type corrosion has an insignificant effect on the overall structural strength and integrity of the part involved.

- By way of the Reference (4) letter, PSC established a commitment to visually inspect Tendon CM 4.6 on a semiannual basis along with four other "worst-case" tendons.

- Although it is still considered that the most likely source of the water in Tendon CM 4.6 was exterior to the PCRV entering by way of the breached O-ring seal discovered in the tendon end cap, PSC is currently investigating the possibility of adding a traceable ingredient to System 46 (liner cooling water) which may allow positive identification or elimination of System 46 as the source.

New Proposal for Revised Interim Tendon Surveillance Program

The current interim surveillance program requirements, as initially outlined in the Reference (5) letter and described on Pages 2-4 of the tendon surveillance report enclosed with the Reference (6) letter, are summarized below. Also summarized are the current requirements for surveillance of the worst-case tendon group (consisting of five tendons), as initially proposed in the response to Question II.1 in the Attachment to the Reference (4) letter.

CURRENT TENDON SURVEILLANCE PROGRAM

Time Cycle	Tendon Surveillance Group	Tendons Included			
		Circumferential	Crosshead Top	Crosshead Bottom	Longitudinal
6 months	Control Tendons for Visual Inspection	3	1	2	6
6 months	Control Tendons for Liftoff Testing (included in visual group)	3	1	1(load cell)	3
6 months	New Tendons for Visual Inspection	13	1	6	24
18 months	New Tendons for Liftoff Testing (may be included in 6-month visual groups)	13	1	3	12
6 months	Worst-Case Tendons (visual inspection)	5 tendons: VM-30, BILU3, BILU4, CO 2.5, CM 4.6			

Reporting frequency for current tendon surveillance program: Every 6 months (per Reference (2), Item 2)

In lieu of the current surveillance program requirements summarized above, a revised interim tendon surveillance program is proposed below. Justification for this proposed revised program follows the program description.

PROPOSED REVISED INTERIM TENDON SURVEILLANCE PROGRAM

Time Cycle	Tendon Surveillance Group	Tendons Included			
		Circumferential	Crosshead Top	Crosshead Bottom	Longitudinal
12 months	*Control Tendons for Visual Inspection	3	1	2	6
12 months	*Control Tendons for Liftoff Testing (included in visual group)	3	1	1(load cell)	3
12 months	New Tendons for Visual Inspection	**39(initially) **13(subsequently)	1	3	12
24 months	New Tendons for Liftoff Testing (may be included in 12-month visual groups)	13	1	2	8
12 months	Worst-Case Tendons (visual inspection)	5 tendons:	VM-30, BILU3, BILU4, CO 2.5, CM 4.6		

* The specific tendons making up the Control Tendon groups for the proposed revised program shall remain the same as in the current program.

** 39 until all remaining accessible circumferential tendons without a surveillance on at least one end since March 1, 1984, have been surveilled on at least one end, after which the required number shall drop to 13.

Reporting frequency for the proposed revised interim tendon surveillance program: Every 12 months

All criteria and conditions for the proposed revised interim surveillance program other than those addressed above shall remain the same as for the current surveillance program.

In the opinion of Public Service Company of Colorado (PSC), the proposed revised interim tendon surveillance program, as presented above, is justified for the following reasons:

A. Favorable overall tendon surveillance results and conclusions to date since March 1, 1984, as reported in the July, 1987, Tendon Interim Surveillance Report submitted with this letter. These surveillance results and conclusions are summarized here:

1) No new noneffective wires have been observed in any of the control tendons since the start of the interim surveillance program in June, 1985.

2) Based on the control tendon program results to date, the rate of corrosion in the tendon system is extremely low or nonexistent and of no immediate concern.

3) The tendon liftoff loads measured to date for the control tendons, in all cases, continue to be well above the minimum design loads for each tendon type; moreover, the measured liftoff loads do not exhibit any trend towards significant load relaxation or load loss.

4) Based on the latest available liftoff loads, each of the worst-case tendons provides effective prestress for the PCRV with the measured load for each tendon above minimum design load.

5) Based upon a lack of increase in noneffective wires in the worst-case tendons, it is evident that the rate of corrosion has subsided to a very low level in these tendons. This is a significant and favorable sign with regard to all other lesser-corroded PCRV tendons.

6) Of 313 total tendons liftoff tested on at least one end since March 1, 1984, representing 69.9 percent of all 448 PCRV tendons, all possess load significantly above the minimum required load for each tendon type.

7) To date, 346 of the 448 PCRV tendons, or 77.2 percent, have had a visual inspection on at least one end at least one time since March 1, 1984. Of these 346 tendons, 141 tendons have had a visual inspection on at least one end two or more times.

8) Of the 346 tendons surveilled since March 1, 1984, a total of 58, or 16.8 percent, have been observed with noneffective wires. These 58 tendons include 53 tendons with only 7 or less noneffective wires each and only 5 tendons with at least 16 noneffective wires each. No tendon surveilled to date (including the 5 worst-case tendons) possesses a number of noneffective wires above the maximum allowable number which would trigger a specific engineering evaluation.

9) Of the total of 58 tendons observed with noneffective wires, only 12 tendons have shown an increase in noneffective wires between the first and latest surveillance dates for each tendon. It is PSC's conclusion that a significant contribution to these increases in noneffective wires is attributable to the increased stress induced during a liftoff and/or retensioning of the tendons, and not due directly to corrosion alone. Based on this conclusion, the increases in noneffective wires in these 12 tendons are insignificant with regard to corrosion rate concerns.

10) Based upon (a) the lack of any increase in noneffective wires due directly to corrosion alone since the first surveillance date (March 1, 1984, or after) for each of the 12 tendons showing an increase (as concluded above), (b) no increase in noneffective wires, as of the latest surveillance date, in each of the remaining 46 tendons observed with noneffective wires, and (c) zero noneffective wires, as of the latest surveillance date, in each of the remaining 288 tendons with at least one surveillance since March 1, 1984, evidence continues to strongly suggest that corrosion is not continuing at any significant rate, if at all, in a very high percentage (97 percent or better) of all PCRV tendons.

11) From monthly tendon load cell [illegible], there continue to be no signs in any of the load-cell t[illegible]ons of a general trend toward any significant load relaxation or load loss.

12) Tendon surveillance results continue to demonstrate that, left in their present condition, every PCRV tendon will likely maintain design effectiveness, i.e., the capability of sustaining load above the minimum required load, for many years to come.

B. With regard to the proposed change in surveillance time cycles from 6 months to 12 months and 18 months to 24 months:

1) It has become apparent based on surveillance results to date that the rate of tendon corrosion is slow enough in all tendons (including the worst-case tendons) that the proposed increased time cycles are adequately sufficient to monitor the rate.

2) Tendon liftoff tests should be kept to a minimum due to safety considerations, personnel and plant equipment, related to handling of the tendon jack. Additionally, numerous tendon liftoff tests may be detrimental to the tendons, especially those which are in a degraded condition.

C. With regard to the proposed change in emphasis on which tendons are surveilled (i.e., increase in circumferential tendons and reduction in longitudinal and bottom crosshead tendons for the new-tendon groups):

1) For circumferential tendons, since March 1, 1984:

a) 117 of the total 310 circumferential tendons have had no liftoff test on at least one end.

b) 101 of the total 310 tendons have had no visual inspection or liftoff test on either end.

c) The revised program would accelerate the inspection of circumferential tendons from 26 on an annual basis to 39 until all accessible tendons have been surveilled on at least one end.

2) For bottom crosshead tendons, since March 1, 1984:

a) 18 of the total 24 bottom crosshead tendons have had at least a visual inspection on at least one end four(4) or more times.

b) 24 of the total 24 tendons have had at least a visual inspection on at least one end three(3) or more times.

c) 17 of the total 24 tendons have had a liftoff test on at least one end two(2) or more times.

d) 20 of the total 24 tendons have had a liftoff test on at least one end one(1) or more times (the remaining four(4) tendons are inaccessible for liftoff).

3) For longitudinal tendons, since March 1, 1984:

a) 78 of the total 90 longitudinal tendons have had at least a visual inspection on the top end four(4) or more times.

b) 89 of the total 90 tendons have had at least a visual inspection on the top end three(3) or more times (the remaining tendon is inaccessible for visual inspection).

c) 76 of the total 90 tendons have had a liftoff test one(1) or more times.

4) PCRV top-head activities on longitudinal tendons should be kept at a minimum while the reactor is at power to mitigate possible accidental shutdown scenarios as a result of a top-head annular shield plate being removed.

PSC proposes initiation of the revised interim tendon surveillance program as described above following the submittal of the fifth(5th) six-month interim surveillance report due Janua 21, 1988, under the current six-month program. Based on this sta ate for the revised program the first twelve-month revised pro m report would be due January 21, 1989, with subsequent reports due every twelve months thereafter. The revised surveillance program would continue until such time as it is deemed appropriate to further propose revision to the program based on future surveillance results and trends.

In the Engineering Report attached to the Reference (7) letter, it stated that PSC was contemplating the removal of one or two PCRV tendons for the purpose of conducting additional investigations into alternative long-term corrosion arrest and protection methods. Also indicated was that PSC would look into the feasibility of developing a new type of tendon load cell which could be installed on existing tendons.

As a result of the very favorable overall tendon surveillance findings to date (as discussed starting on page 5 of this letter), the need for removal of the two tendons is now questionable both from a technical as well as an economical point of view. Therefore, PSC has reconsidered removal and replacement of any existing PCRV tendons and must defer the decision to remove tendons based on the tendon corrosion rate and degradation experienced in the future.

Please be aware, however, that twelve new replacement tendons have been fabricated and delivered, and that the process of tendon replacement has been considered to the extent that should any unexpected serious degradation occur PSC would be prepared to respond to the situation in a timely fashion.

Likewise, progress has been made on a new type of tendon load cell with the design, fabrication and initial off-site testing of two prototype models. Additional on-site test programming and facilities have not been developed for the prototypes at this time and PSC has placed an indefinite hold on this project.

PSC will continue to monitor the condition of the PCRV tendons via the tendon surveillance program with the commitment to reinitiate work in the areas of tendon replacement and load cell development should future surveillance results and trends indicate the need.

If you should have any questions concerning the current tendon surveillance report or the proposal for a revised interim tendon surveillance program, please contact Mr. M. H. Holmes at (303) 480-6960.

Very truly yours,

D W Warembourg

D. W. Warembourg, Manager
Nuclear Engineering Division

DWW:TSE/mn

Enclosure

Letter and enclosure reviewed by: [signature]

7-15-87
Date

Licensing Review By: [signature]

Date: 7/16/87