



ATTACHMENT 2

UNITED STATES  
ATOMIC ENERGY COMMISSION  
WASHINGTON, D.C. 20545

February 12, 1971

Edson G. Case, Director  
Division of Reactor Standards

TURKEY POINT CONTAINMENT DOME REPAIR PROGRAM

This is to confirm our recommendation that a requirement for removal of six tendons for examination be included in Alternate Position No. 2 of your proposal dated February 9. Our recommendation is described in detail in the enclosure.

We have obtained from a major tendon supplier an estimate of the additional time required to remove and replace more than one tendon. The estimate is eight to 12 hours per additional tendon; therefore, we conclude that the extra time required is not significant in comparison to the increased assurance provided by additional tendon inspection.

*Lawrence D. Low*  
Lawrence D. Low, Director  
Division of Compliance

Enclosure:  
Recommendation

cc w/encl:  
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## BASIS FOR TENDON REMOVAL AND INSPECTION

- A. The type and extent of damage inflicted on the tendon system and the limited insitu accessibility of the wires require a "proof" inspection to produce a high level of confidence. In-service inspection can supplement an effective QA program, but not replace it.
- B. It is Compliance's position that a minimum of six tendons be removed.
1. Four selected tendons be removed before the concrete surface is hydro cleaned for the following reasons:
    - (a) To compare the actual number of damaged wires with the number reported by the insitu inspection.
    - (b) To determine the quantity of debris which got into the tendon sheaths.
    - (c) To determine how deeply the debris penetrated into the wire bundle.
    - (d) To qualitatively determine the quantity of water which may be present in the sheathing because of drill water or rain water infiltration.
    - (e) To see whether rusting or pitting of the wires has taken place.
  2. Two tendons be removed after the dome surface has been hydro cleaned by a 5000 psi spray.

- (a) To determine if a significant quantity of water has been trapped in the sheathing.
- (b) To determine if a significant quantity of grease has been washed off the wires.
- (c) To determine if partial grease blockage has occurred in the sheaths.
- (d) To determine if the hydro spray has washed the fine chips of concrete into the wire bundles.

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TURKEY POINT CONTAINMENT

ACCEPTABLE REPAIR AND SURVEILLANCE PROGRAMS

ALTERNATIVE 1

A. TENDON REPLACEMENT PROGRAM

- (1) Remove all tendons whose sheaths have been punctured during concrete removal.
- (2) Perform a detailed examination of all wires and replace those wires that do not meet tendon wire specification acceptance standards established by the applicant and acceptable to DRL/DRS.
- (3) Re-install tendons in repaired sheaths, replace protective grease, and re-tension tendons.

B. REINFORCEMENT STEEL REPLACEMENT PROGRAM

Replace all damaged reinforcement steel that fails to meet acceptance standards established by the applicant and acceptable to DRL/DRS.

C. INITIAL PROOF-TEST AND INSPECTION PROGRAM

- (1) Perform a proof-test at 1.15 Design Pressure following completion of dome repairs.
- (2) Conduct an examination (and record observations) of the repaired dome during and after the test, for any evidence of structural distress and crack patterns, including sounding over the entire dome repair area to detect any concrete delamination. Establish acceptance criteria for this test and examination that are acceptable to DRL/DRS.

D. INSEERVICE SURVEILLANCE PROGRAM

- (1) Install permanent structural provisions to facilitate access to the dome area for the purpose of inservice inspections. The elastomeric coating shall not be applied prior to 6 months after initial start of plant operation.

- (2) Conduct examinations of the repaired dome, as described in C(2) above, 6 months, 12 months, and 36 months after initial start of plant operation. Record observations and compare with those obtained during prior examinations.
- (3) Conduct tendon lift-off tests, to monitor loss of prestress, in accordance with the attached "Standard Tendon and Wire Surveillance Program for Prestressed Concrete Containments With Greased Tendons". In summary, for the dome, this will require the testing of 3 tendons, 12 and 36 months after initial start of plant operation. The acceptance criteria and required actions in the event that these criteria are not met are given in the attachment. The results of the tests shall be recorded.
- (4) Conduct tests and examinations, to detect evidence of corrosion and other deleterious effects, in accordance with the attachment discussed in D(3) above. In summary, for the dome, this will require the removal, testing, and examination of one stressed tendon wire from one tendon in each of the 3 families of dome tendons, 12 months and 36 months after initial start of plant operation. The acceptance criteria and required actions in the event that these criteria are not met are given in the attachment. The results of the tests and examinations shall be recorded.
- (5) Submit, to the Commission, a detailed report of the results of the inservice surveillance program within 3 months after the completion of those aspects of the program scheduled to be conducted at 12 months and 36 months after initial start of plant operation. These reports will be used for the purpose of review and possible revision of the inservice surveillance program.

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TURKEY POINT CONTAINMENT

ACCEPTABLE REPAIR AND SURVEILLANCE PROGRAMS

ALTERNATIVE 2

A. TENDON REPAIR PROGRAM

- (1) Examine the tendons whose sheaths have been punctured during concrete removal. Record the results of the observations.
- (2) Remove a tendon, selected by CO, examine all the wires in the tendon, and compare the actual number of wire defects (defined by criteria established by the applicant and acceptable to DRL/DRS) with the number recorded as a result of the observations made with the tendon in-place. If the number of defects found by examination of the removed tendon exceeds the number found by examination of the in-place tendon by more than 20% reject Alternative 2 and proceed with Alternative 1.
- (3) Replace damaged wires in accordance with criteria established by the applicant and acceptable to DRL/DRS.

B. REINFORCEMENT STEEL REPLACEMENT PROGRAM

Replace all damaged reinforcement steel that fails to meet acceptance standards established by the applicant and acceptable to DRL/DRS.

C. INITIAL PROOF-TEST AND INSPECTION PROGRAM

- (1) Perform a proof-test at 1.15 Design Pressure following completion of dome repairs.
- (2) Conduct an examination (and record observations) of the repaired dome during and after the test, for any evidence of structural distress and crack patterns, including sounding over the entire dome repair area to detect any concrete delamination. Establish acceptance criteria for this test and examination that are acceptable to DRL/DRS.

D. INSERVICE SURVEILLANCE PROGRAM

- (1) Install permanent structural provisions to facilitate access to the dome area for the purpose of inservice inspections. The elastomeric coating shall not be applied prior to 6 months after initial start of plant operation.

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- (2) Conduct examinations of the repaired dome, as described in C(2) above, 6 months, 12, 24, and 36 months after initial start of plant operation. Record observations and compare with those obtained during prior examinations.
- (3) Conduct tendon lift-off tests, to monitor loss of prestress, in accordance with the attached "Special Tendon and Wire Surveillance Program". In summary for the dome, this will require the testing of 12 tendons 6, 12, 24, and 36 months after initial start of plant operation. The acceptance criteria and required actions in the event that these criteria are not met are given in the attachment. The results of the tests shall be recorded.
- (4) Conduct tests and examinations, to detect evidence of corrosion and other deleterious effects, in accordance with the attachment discussed in D(3) above.

In summary for the dome, this will require the removal, testing, and examination of one stressed tendon wire from one tendon in each of the 3 families of dome tendons, 6, 12, 24, and 36 months after initial start of plant operation. The acceptance criteria and required actions in the event that these criteria are not met are given in the attachment. The results of the tests and examinations shall be recorded.

- (5) Submit, to the Commission, a detailed report of the results of the inservice surveillance program within 3 months after the completion of those aspects of the program scheduled to be conducted at 6, 12, 24, and 36 months after initial start of plant operation. These reports will be used for the purpose of review and possible revision of the inservice surveillance program.

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STANDARD TENDON AND WIRE SURVEILLANCE PROGRAM  
FOR PRESTRESSED CONCRETE CONTAINMENTS WITH GREASED TENDONS

I. TENDON LIFT-OFF TESTS

- A. The following numbers and types of tendons shall be tested for loss of prestress:
- (1) 3 dome tendons; 1 located in each 120° sector (i.e., three families of tendons) and distributed to provide representative sampling.
  - (2) 3 vertical tendons; uniformly distributed around the shell circumference.
  - (3) 3 hoop tendons; one located in each 120° sector, and distributed at different elevations to provide representative sampling.
- B. The tendons shall be tested to measure the lift-off forces ( $F_{st}$ ) among each group of tendon samples of (A) above and calculate the effective prestress loss ( $F_{sl}$ ) by subtracting the measured value from the value at initial tensioning ( $F_{si}$ ). The calculated loss shall be normalized to the nominal value ( $F_{sn}$ ), established at time of initial tensioning.
- C. Each of the tested tendons shall be identified with one of the following categories:
- (1) Category I - Tendons with not greater than 15% decrease in prestress force.  
Category II - Tendons with greater than 15% but less than 25% decrease in prestress force.  
Category III - Tendons with 25% or greater decrease in prestress force.
- D. The results of the tests shall be used in the following manner:
- (1) If all 3 tendons in a group (dome, vertical and hoop) are determined to be in Category I, the test for that group is acceptable.



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- (2) If 1 tendon in a group is determined to be in Category II and the other 2 tendons in Category I, another sample of 3 tendons in the group shall be tested. If all 3 tendons in the second sample are determined to be in Category I, the test for the group is acceptable.
- (3) If any 2 tendons in the initial sample in a group are determined to be in Category II, or any 2 tendons in the initial plus the second sample are determined to be in Category II, or any tendon is determined to be in Category III, the test for the group is unacceptable and an immediate report shall be made to the Commission.

## II. TENDON WIRE TESTS AND EXAMINATIONS

- A. The following numbers and types of stressed tendon wires shall be removed from the tendon groups for test and examination to detect evidence of corrosion or other deleterious effects:
  - (1) Dome Tendons - One from each of the 3 families of tendons
  - (2) Vertical Tendons - One from each 120° sector.
  - (3) Horizontal Tendons - One from the lower third, upper third, and mid-height of shell.
- B. The wires shall be examined for visible evidence of corrosion or other deleterious effects, and tensile tests shall be performed on three samples cut from each wire (one at each end, and one at mid-length) of a maximum length practical for testing.
- C. If any serious deterioration is noted as a result of the tests and examinations an immediate report shall be made to the Commission.

## III. FREQUENCY OF TESTS AND EXAMINATIONS

The tests and examinations identified in Sections I and II shall be performed one year and three years after the initial start of operation, and at five year intervals thereafter.

## IV. REPORTS

The results of the tests and examinations normally shall be provided to the Commission in accord with standard Technical Specification requirements.

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SPECIAL TENDON AND WIRE SURVEILLANCE PROGRAM

I. TENDON LIFT-OFF TESTS

This section is identical to the Standard Program with the following exceptions:

Item A.(1) shall be changed to:

- (1) 12 dome tendons; 4 each located in different 120° sectors (i.e., three families of tendons) and distributed to provide representative sampling.

Item D shall be changed to:

D. The results of the tests shall be used in the following manner:

- (1) If all 12 tendons in the dome group are determined to be in Category I, the test for the dome tendons is acceptable.
- (2) If one tendon in the dome group is determined to be in Category II and the other 11 tendons in Category I, another sample of 12 dome tendons shall be tested. If all 12 tendons in the second sample are determined to be in Category I, the test for the group is acceptable.
- (3) If all 3 tendons in the vertical or hoop group are determined to be in Category I, the test for that group is acceptable.
- (4) If 1 tendon in the vertical or hoop group of 3 tendons is determined to be in Category I and the other 2 tendons in Category II, another sample of 3 tendons in the group shall be tested. If all 3 tendons in the second sample are determined to be in Category I, the test for the group is acceptable.
- (5) If any 2 tendons in the initial sample in a group are determined to be in Category II, or any 2 tendons in the initial plus the second sample are determined to be in Category II, or any tendon is determined to be in Category III, the test for the group is unacceptable and an immediate report shall be made to the Commission.

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II. TENDON WIRE TESTS AND EXAMINATIONS

This section is identical to the Standard Program.

III. FREQUENCY OF TESTS AND EXAMINATIONS

The tests and examinations identified in Sections I and II shall be performed 6, 12, 24, and 36 months after the initial start of operation.

- V. The detailed results of the tests and examinations shall be provided to the Commission in reports submitted within 3 months after their operation.