

Bechtel Associates Professional Corporation

SUBJECT: MCAR 33 (issued 7/27/79)

Differential Wire Length of Containment
Building Prestressing Tendons

INTERIM REPORT 2

DATE: September 10, 1979

PROJECT: Consumers Power Company
Midland Plant Units 1 & 2
Bechtel Job 7220

Introduction

This report summarizes Bechtel actions and evaluation regarding the differential length of wires in prestressing tendons.

Description of Deficiency

During an inspection of the Inryco Wiremil facility on July 19, 1979, Inryco and Bechtel personnel discovered that the back-tension clamp of the wire shear was not functioning during fabrication of tendon H32-246. The electrical panel controlling the tendon fabrication line was examined and the automatic back-tension selector switch was found in the off position for an unknown period of time. The wires for tendon H32-246 were scrapped. Ten percent of the wires (17 wires) for tendon H32-249, produced earlier in the day were removed from the anchor head and examined for length. There was a length differential of ± 1 inch.

It was unknown whether the back-tension device was in the on or off position when these wires were cut. The switch was turned on, four wires were run to length, sheared, and noted to be as much as 7 inches longer than the wires sheared when the switch was in the off position. A hold was placed by Inryco on all 38 tendons which were fabricated at the Wiremil facility and fabrication was discontinued.

The status of the 38 tendons is as follows:

- 1) Twenty two tendons (7 vertical and 15 horizontal) were shipped to the Midland site. The break-down is as follows:
 - a) Seven vertical tendons were installed.
 - b) Five horizontal tendons were returned to Wiremil upon arrival at Midland.
 - c) Ten horizontal tendons were stored at Midland.

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- 2) Sixteen tendons (7 vertical and 9 horizontal) were not shipped to Midland. These tendons were stored at the Wiremil facility.

NCR 2373 was issued on July 24, 1979, placing the tendons at the site on hold with QC hold tags attached to each tendon.

The differential wire length problem discovered at the Wiremil facility is in violation with the tendon and wire length tolerances given in the Midland FSAR Subsection 3.8.1.6.3.1 which states, "the differential length of any two wires in the same tendon up to 100 feet wire length is $\pm 1/16$ -inch and $\pm 1/8$ -inch for wires longer than 100 feet. Cutting tolerances for overall tendon length is $\pm 1/2$ -inch up to 100 feet and ± 1 -inch over 100 feet."

Investigation

An investigation was initiated at both the Wiremil and Melrose Park facilities by Bechtel and Consumers Power Company personnel in the following areas.

1) Manufacturing Processes

Melrose Park Facility, Illinois

Melrose Park employs a mechanical fail-safe system such that a constant tension has to be applied to the wire and a mechanical end stop engaged prior to the shearing at the wire. Several attempts at shearing wires at shorter than set lengths were unsuccessful, attesting that the fail-safe mechanics of manufacturing the tendons are effective. Accordingly, the tendons produced at Melrose Park are not affected.

Wiremil Facility, Florida

The mechanical operations at Wiremil are different from those at Melrose Park. The wire is drawn from a coil rack, passing through the driving pinch rolls and wire shear. The wire is driven through the runout guide at high speed until it passes a photo-electric cell in front of the catcher assembly. The photo-electric cell activates a brake which slows the wire until it engages the length-gage stop switch in the catcher assembly, which in turn activates the wire clamp. The pinch rollers reverse to back tension the wire and the wire shear automatically cuts the wire. Once the wire enters the catcher assembly, the operations are automatic and nearly simultaneous. The following deficiencies were observed at Wiremil.

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- a) The switch controlling the back-tension device was situated on the control panel enabling it to be switched to the off position inadvertently by the operator.
- b) The end stop limit switch had a built-in tolerance which may have allowed wires to be cut to lengths exceeding acceptable variance tolerance.
- c) The end clamp assembly had the possibility of allowing the wire to slip during back-tensioning, due to a structural defect (weld crack) in the end clamp assembly and possible low air pressure.

2) Quality Control Procedures

At the Melrose Park facility, differential wire length was checked periodically by Inryco personnel; however, no data was recorded. No such checks were made at the Wiremil facility. A QC program change has been made to check and record differential wire lengths (see corrective action for details). The duties of QC and production personnel were not well-defined at the Wiremil facility. Bechtel also expressed concern regarding other areas of Inryco's quality program. Further investigation was to be accomplished by Bechtel's quality program verification.

Safety Implications

Project engineering's investigation indicates that the quality assurance program used at the Wiremil facility broke down. The differential wire lengths in a tendon will cause wire stresses in excess of the design values. The safety margin of the containment structure is thus reduced from the design conditions as stated in the FSAR. Therefore, the deficiency is considered reportable under 10 CFR 50.55(e). However, the situation probably would not have an adverse effect on plant safety for the following reasons:

- 1) A tendon is subjected to the maximum stress during the initial prestressing operation, when they are stressed to 80% of the ultimate strength. Therefore, if a tendon can withstand the initial prestressing force, it will not fail during any design condition.
- 2) Since a tendon experiences the highest stress level during the initial prestressing operation, wires that are overstressed may break. The condition would have been detected as a part of specification requirements for broken wire.

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- 3) During the prestressing operation, the jacking force is monitored with calibrated gages and the tendon elongations are checked against calculated values. Any abnormality would be detected and corrective measures would be made.

Corrective Action

The deficiencies in the manufacturing processes observed at Wiremil are corrected as follows.

- 1) The back-tension device has been put in an on position and the switch removed from the control panel to prevent it from being turned off.
- 2) The end stop limit switch has been replaced by a switch with 0.057-inch tolerance.
- 3) The end clamp assembly has been structurally reinforced, and a pressure regulator has been added to ensure constant air pressure.

To preclude any system deficiencies from being left undetected for undetermined periods of time, a quality control inspection procedure, QC 5.1.1, was developed by Inryco. The procedure describes a method and frequency with which to measure and record the differential lengths of two wires sheared on the tendon production line. The procedure was approved by Bechtel on August 17, 1979, and had been implemented at the Melrose Park and Wiremil facilities. The areas of concern in Inryco's quality program at Wiremil were addressed during a Bechtel supplier quality department's quality program verification. Inryco's resolution was found to be satisfactory and the hold on the tendon production at Wiremil was lifted.

Disposition

- 1) Inryco will submit a tendon length correction procedure for evaluation by Bechtel for the 7 vertical tendons installed.
- 2) If Inryco's tendon length correction procedure is successful in eliminating the excessive length differentials in the 7 installed vertical tendons, then the 7 vertical tendons which are being held at Wiremil may be corrected using the same method.

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- 3) The ten horizontal tendons stored at Midland were returned to Wiremil on the week of September 10, 1979. All 24 horizontal tendons fabricated at Wiremil will not be used as originally intended. The materials may be reworked for fabrication of shorter vertical tendons.

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