U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 50-329/77-07; 50-330/77-10

Docket No. 50-329, 50-330 License No. CPPR-81, CPPR-82

Licensee: Consumers Power Company
1945 West Parnall Road
Jackson, MI 49201

Facility Name: Midland Nuclear Power Plant, Units 1 and 2

Inspection At: Midland Plant Units 1 and 2, Midland, MI; and Bechtel Corporate Offices, Ann Arbor, MI

Inspection Conducted: June 29 and 30, 1977

Inspector: R. E. Shewmaker (IE:HQ) 7/27/77

Approved By: D. F. Helshman, Chief 7/27/77
Reactor Construction and
Engineering SUpport Branch

Inspection Summary

Inspection on June 29 and 30, 1977, (Report No. 50-329/77-07; 50-330/77-10)
Areas Inspected: Special inspection to: (1) examine the corrections in the area of misplaced hoop tendon sheaths on the Unit 1 containment with specific emphasis on the several pieces of cut reinforcing steel; and (2) inspect the failure surface of concrete in the Unit 2 liner bulge area which was in final preparation for repairs. The inspection involved 18 inspector-hours onsite by two NRC inspectors.
Results: Of the two areas inspected, no items of noncompliance or deviations were identified.

DETAILS

Persons Contacted

Consumers Power Company (CP)

J. L. Corley, Quality Assurance Superintendent
*D. E. Horn, Field Quality Assurance Engineer
R. M. Wheeler, Engineer, Project Construction

Bechtel Power Corporation - Midland (B-M)

*A. J. Boos, Project Field Engineer
R. C. Bystrom, Engineer
*R. J. Will, Construction Engineer
*G. L. Richardson, Lead Quality Assurance Engineer
J. G. Hook, Civil Quality Assurance Engineer

Bechtel Power Company (Engineering) (BPC)

*T. P. Thiruvengadam, Resident Engineer, Ann Arbor
*D. J. Haavik, Civil Engineering Specialist, Los Angeles
**F. E. Meyer, Chief Civil-Structural Engineer, Ann Arbor
**P. Goffas, Civil Engineer, Ann Arbor

The inspector also talked with other contractor employees, including members of the technical staffs, craft supervision and craftsmen.

*Denotes those attending exit interview
**Denotes those attending only the exit interview

Functional or Program Areas Inspected

1. Preparation of Failure Surfaces for Repairs in the Unit 1 Containment

   a. A brief discussion was held on the status of the surface clean-up and removal of base concrete as well as on the investigations completed in the effort. This information indicated that Bechtel was of the opinion the area was nearly ready for repairs to begin.

   b. A detailed inspection was made from elevation 696'-2 3/8" to elevation 593'-0" covering the area between azimuths 250° and 270°. This area constitutes about 2,000 square feet of ruptured

concrete surface which had been prepared to receive the repairs. The area was visually inspected under good lighting from a distance of not more than one foot from a scaffold which spanned from 250° to 270° and was lowered 4 to 5 feet in each increment. Five minor areas which needed some additional preparation prior to any repairs were identified. The inspection, in addition to concentrating on the concrete surfaces, dealt with the ten additional cores taken from the concrete, the main steam line anchorage at elevation 691'-0", the liner meridional joint at 250° and 270° to the WF embedment, the flanges of the WF embedment at 250° and 270°, the penetrations in the assembly of four at elevation 607'-0", the trench, knuckle plate, leak chase channel and liner plate at elevation 593'-0" and the cutoff at elevation 696'-2 3/8". Except for five minor areas needing additional preparatory work before repairs commence, no indications of remaining problem areas were found.

(1) At elevation 696'-2 3/8" at the top of the removed liner plate and concrete, there was an area noted from about azimuth 270° to 264° which appeared to have cracked concrete behind the liner some 2 to 3 inches above elevation 696'-2 3/8". This area was noted to need additional concrete removal.

(2) At about elevation 693' a small rock pocket or void was found during the removal of loose concrete at about azimuth 258°. The area was approximately 20" x 12" x 10" deep and requires additional concrete removal on the edges and around the reinforcing steel.

(3) Near elevation 670' adjacent to the 250° azimuth there was a section of concrete above one of the 5" embedded channels which required additional concrete removal. The section of concrete needing removal was approximately 6" deep by 15" wide and 10" high.

(4) Near elevation 643' at azimuth 260°, there was an area needing additional concrete removal.

(5) Penetration barrel 2#73 of the penetration assembly of four was found to be radially deformed over approximatel 300° of its circumference. The deformation area consisted of a ring of material deflected outward about 3/8 to 1/4 inches at the weld area between the barrel and the 1/2 inch thickened liner plate.

c. The remaining area of concern consisted of the tears and deformations between azimuths 270° and 280° at elevation 670' that were associated with the wind ring girder that was welded to the inside of the liner plate. As a result of several windows and three concrete cores which were cut into this area, the decision was made to remove a 4' x 10' panel from azimuth 270° to 280° and between elevations 668' and 672'. In this area, the liner was removed and the embedded angles left in place and 2" to 3" of concrete removed. All loose and damaged concrete had been removed and the area was ready for repair.

2. Preparation of Tendon Sheathing and Reinforcing Steel Prior to Concrete Placement to Correct Mislocated Tendon Sheathing at the Main Steam Penetrations on Unit 2

a. A discussion was held to understand the current status of the repairs proposed for the problems associated with the misplaced tendon sheathing. Bechtel indicated that concrete placement in the last four lifts above elevation 703'-7" had been blocked out over 76° of azimuth. The first lift in the blockout area was prepared for placement except for final sheathing alignment survey, placement of some radial ties not yet in place and correction of eighth reinforcing bars which had to be cut during the relocation of tendon sheathing. It was stated that the chemistry of the involved reinforcing had been established through bounding values from three heats of steel and that the qualification of a welding procedure was being completed at Bechtel's San Francisco materials laboratory this week.

b. An inspection of the areas near the main steam line penetrations indicated that the status as outlined was correct. The specific details around each of the cut pieces of reinforcing steel were examined to ascertain whether the proposed repairs would be appropriate. From the information submitted by the licensee with a letter dated June 20, 1977, it appeared that the repairs would be possible from the standpoint of physical space limitations. The additional penetration barrel stiffeners and extension ring were in place and the corrective action completed for the component. The tendon sheaths had been relocated and the original clearances and separation distances have been maintained. The area was ready for concrete placement except as noted in item a. previously.

Exit Interview

The inspector met with the licensee representatives and Bechtel personnel (denoted above under Persons Contacted) at the conclusion of the inspection on June 29, 1977.

The five areas needing minor additional work were noted and it was agreed that this work would be completed prior to the initiation of repairs. The inspector stated that the technical evaluation of the proposed repairs for the misplace tendons and the liner bulge would probably be concluded during the meeting the next day at Bechtel in Ann Arbor. At that time, a decision would be made regarding concrete placement and any necessary additional work.

Repair Program Review Meeting

The following personnel participated in the June 30, 1977 meeting, conducted at the Bechtel Ann Arbor, MI offices:

Consumers Power Company

W. R. Bird, Project Construction and Engineering Quality Control Manager
R. Rogness, Engineer Services
C. A. Hunt, Engineering Services
R. Wheeler, Project Construction Engineer

Bechtel Power Corporation, Ann Arbor Office (unless otherwise noted)

K. Wiedner, Engineering Manager
P. A. Martinez, Project Manager
R. L. Castleberry, Project Manager
J. C. Hink, Assistant Project Engineer
F. E. Meyer, Chief Civil Engineer
M. Elgaaly, Staff Civil Engineer
T. E. Johnson, Staff Civil Engineer, San Francisco Power Division
D. J. Haavik, Concrete Engineering Specialist, Los Angeles
J. M. Klacking, Project Quality Control Engineer
T. Thiruvengadam, Resident Site Engineer
G. Butler, Construction Coordinator

Bechtel Power Corporation, Midland Site

D. L. Osborne, Quality Control Engineer
S. Grant, Construction Engineer
R. J. Mills, Construction Engineer

U.S. Nuclear Regulatory Commission, IE

R. F. Heishman, Chief Reactor Construction and Engineering Support Branch, RIII
R. E. Shewmaker, Senior Structural Engineer, Headquarters

The purpose of the meeting was to discuss the results of the review of technical aspects of the corrective action proposed by the licensee in a letter dated June 20, 1977, which addressed the Unit 1 tendon sheathing mislocation. Enclosed with the letter which was noted as an interim report on the 10 CFR 50.55(e) item was a final report by Bechtel dated June 13, 1977. In addition, the meeting was held for the purpose of reviewing the completed investigations on the Unit 2 liner bulge area, including the testing program and the proposed repairs. This meeting was to update the information obtained during a meeting on April 14, 1977, reported in IE Inspection Report 50-330/77-06.

1. Investigation Program

Ten addition 2 1/2" diameter concrete cores were cut from the area of distress to a depth of about 6". This brought the total number of cores cut from the inside face to twelve.

Additional liner plate had been removed from the elevation of the wind girder from 270° to 280° azimuth.

2. Proposed Repairs

The extent of concrete dry-pack placement was revised to only include the vertical trench that results from the removal of a section of the failed water pipe. This area will be dry-packed to a surface approximately 10" behind the original surface. Concrete/rock anchors will be installed at 12" centers in the trench across the interface between existing concrete and the dry-pack.

Grouting where the thickness of grout is to be greater than 5" will be completed with welded wire fabric reinforcement in place to prevent shrinkage cracks. Areas where the grout thickness will be less than 5" will be placed without added reinforcing.

In areas where 5" channels do not remain embedded in the concrete containment wall and welded studs cannot be added, there will be rock anchors installed into the base concrete.

The vertical angles welded to the liner plate on 14" centers will by 2" x 2" x 3/16". The circumferential weld at the base of the cylindrical wall liner plate and the transitional knuckle plate will not be removed. Instead, the remaining 10" to 12" of wall liner will be prepared to allow a full penetration weld using a backing strip. The liner will be replaced in 4' high by 20' sections.

The repairs to the lower penetration assembly of four barrels consists of the removal of the 6 Nelson studs around each, the removal of the 1/2" thickened liner plate leaving the four barrels in place. As a result of radial deformations in one of the barrel assemblies, it will be necessary to remove that deformed portion and replace it with another short barrel using a full penetration circumferential weld. The thickened liner plate will be replaced with a series of angles acting as the anchors.

The area of the wind girder will be repaired by replacing the liner plate to the existing embedded angles and grouting the space between the liner and the existing concrete surface.

The repairs will involve the replacement of approximately 2,000 square feet of liner plate, 15 cubic feet of dry-pack and 500 cubic feet of grout.

3. Testing

A series of four test blocks were made and tested to obtain a value of the repaired anchor stiffness which was necessary to compute liner plate stresses. These tests were conducted at the University of Michigan using the concrete mix used at the site, a roughened surface and angles embedded in the grout which was placed against the roughened concrete surface. In addition, tests were completed on 6" x 12" cylinders to determine the tensile strength of the grout and the bond strength to the old concrete. The average tensile strength from these tests indicated 130 psi with the failure being at the epoxy attachment to the test machine platens. The split cylinder tension tests indicated about 400 psi. Both of these tests would indicate sufficient tensile capacity for the concrete liner plant anchorage system. The 28-day grout compressive strengths are in excess of 6,000 psi.

The results of the liner anchorage angle tests supported by analytical studies indicated the failure mode and provided the P-delta relationship to compute the liner stresses. The techniques used in the computations followed those of Bechtel Topical Report, BC-TOP-1, Revision 1, December 1972 which has been used previously and accepted by the staff.

As a result of the discussions, the following statements and agreements were made:

For the Unit 1 misplaced tendon sheaths:

a. For the welding of reinforcement AWS 12.1-75 should be met.

b. The licensee can proceed with repairs.

c. The licensee is to notify Region III when welding qualifications for the weld procedure are complete.

d. The licensee is to notify Region III when welding is to commence.

e. The licensee is to complete a final report on this subject as a 50.55(e) item as indicated in the letter of June 20, 1977, to Region III.

For the Unit 2 liner plate bulge:

a. Corrective action on the 5 items identified in the Report Details (Section 1.b) are to be completed prior to grout placement.

b. The licensee can proceed with repairs and no embedded instrumentation for surveillance is needed.

c. The licensee is to notify Region III when the first field welding between liner replacement sections and existing liner is to commence.

d. The licensee is to notify Region III when the first grout placement will occur.

e. The licensee is to complete a 50.55(e) final report on this subject addressing as a minimum the following subjects:

(1) Cause

(2) Field Investigations

(3) Testing Program

(4) Redesign and Repair Program

(5) Action to preclude recurrence

(6) Safety statement and conclusions addressing the 50.55(e) requirements.

(7) Proposal for surveillance of repairs which might be necessary during tendon stressing, the STI and CILRT or during some period after operation.