

10/26/73

THREE MILE ISLAND NUCLEAR STATION - DOCKET NO. 50-289

Supplemental Testimony on Concrete Quality

By

LEON L. BERATAN

Contention 9

"It is contended that the concrete pouring of the containment and ring girder has not been properly done and does not meet quality assurance standards."

The Regulatory Staff monitored the pouring of the Three Mile Island Unit 1 reactor containment building to assure that it was properly done and met the quality assurance standards. In the course of construction, voids in the concrete behind the dome tendon bearing plates were detected. The bearing plates are steel plates cast in the concrete to transmit the forces from the post-tensioned tendons to the concrete. As a consequence, the Applicant was required by the AEC to conduct a special study to establish an acceptable procedure for the removal of deficient concrete and reinforcement, the preparation of the building for repairs, and the repouring of new concrete.

The special repair procedures were reviewed by the Regulatory Staff and found acceptable as described in Section 3.10 of the Staff Safety Evaluation Report [SER] of July 11, 1973.

7910100

583

1411 250

As senior structural engineer in the Technical Assistance Branch of Regulatory Operations, I was assigned the responsibility to assist the field inspectors in verifying that these repair procedures were carried out properly.

I conducted several site inspections prior to, during, and upon completion of the repairs. On July 19, 1973 I conducted a special inspection to review the Quality Assurance (QA) records relative to the repair of the Three Mile Island Unit 1 containment ring girder. These QA records were kept by the applicant to satisfy the requirements of 10 CFR 50 Appendix B (the QA criteria). I audited the following records which constitute a voluminous file (of approximately 20 boxes):

1. Concrete placement and strength test records prepared for the applicant by his contractor. The concrete placement was in accordance with American Concrete Institute (ACI) standards and each pour of the concrete was sampled for consistency and strength in accordance with American Society for Testing Materials (ASTM) standards.
2. Mill test reports prepared by the manufacturer of the reinforcing steel describing the tensile strength and chemical composition of the steel. These records were available for the steel used in the replacement hoops which were substituted for the spiral reinforcements which had to be removed. These hoops were placed

1411 251

around the tendon conduit behind the bearing plates.

3. Records for the cadwelds which were used to splice reinforcing bar segments. A cadweld splice is made by placing a sleeve around the two bars to be joined; the annular space between the bars and the sleeve is filled with molten metal. The splice is achieved by the solidification of the molten metal, locking the bars in the sleeve. The record of each splice is prepared by the applicants' quality control staff in accordance with the requirements of Appendix B of 10 CFR 50. Testing of sample and production splices is performed in accordance with procedures described in AEC Regulatory Guide 1.10.
4. Records of the placement of epoxy bonding compound prepared by the applicant's quality control staff. This epoxy bonding agent is used to facilitate the bonding of fresh concrete to hardened concrete. The use of epoxy was proposed by the applicant and found acceptable by the Regulatory staff.
5. Records reflecting the installation and location of strain gauges. These strain gauges were installed by the applicant as required by the Regulatory staff to monitor the strength of the repaired section of the ring girder during the reactor building structural integrity test.

6. Records reflecting observations for cracking in the repaired concrete. The Regulatory staff requires these observations during the concrete construction and during the structural integrity test. Records must be maintained for cracks observed which are greater than 0.01 in. in width.

Based on the audit of these documents and supplemented by the periodic inspection reports submitted by the AEC field inspectors, I have made the following determinations:

1. The placement of concrete was controlled such that the fresh concrete was placed in properly prepared and cleared areas. The areas were inspected before pouring by AEC field inspectors to determine that all required reinforcing was in place and that all preparatory work had been accomplished in accordance with good engineering practice. Laboratory reports of long term break strengths of the concrete were found to equal or exceed the required strength of the concrete in the ring girder as specified in the applicant's Final Safety Analysis Report (FSAR).
2. The reinforcing steel used was of proper chemistry and tensile strength to meet the requirements specified by ASTM standards.

3. The cadweld splices were installed and inspected and all tested splices met specified requirements. The cadweld splice sampling and test program was in accordance with Regulatory Guide 1.10.
4. The concrete placement records indicated that the epoxy bounding compound was brushed or sprayed on the old concrete just ahead of the concrete pour. It remained tacky as required while the layer of concrete was poured.
5. Strain gages were installed in the repaired section of the ring girder to monitor the stress levels during the structural integrity test. The installed gages have been tested and are functioning.
6. Cracks are being monitored and none have been found which exceed 0.005 inches in width. These are within the 0.01 inch limit. These cracks will be monitored during the structural integrity test and the inservice inspection.

From the above observations, the examination of the documents, and physical examination of the repair, it is my opinion that the ring girder has been repaired in an acceptable manner and meets quality assurance standards. The structural integrity of the ring girder and containment appears assured and will be demon-

strated by the reactor building structural integrity test which is required by the Regulatory staff as part of the acceptance test program.