Docket Nos. 50-508/509

50.55(e) Report

Washington Public Power Supply System

Box 1223 Elma, Washington 98541 (206) 482-4428

Docket Numbers 50-508 and 50-509

January 22, 1982
G03-82-069

U. S. Nuclear Regulatory Commission, Region V
Office of Inspection and Enforcement
1450 Maria Lane, Suite 260
Walnut Creek, California 94596-5368

Attention: Mr. B. H. Faulkenberry
Chief, Reactor Construction Projects Branch

Subject: PROJECT NOS. 3 AND 5
FINAL REPORT OF POTENTIAL 10CFR50.55(e)
CONCRETE PLACEMENT ABW 019 AND 21, 428.50 (D/N #35)

References: 1) G03-81-2724, dated November 11, 1981, R. S. Leddick to B. H. Faulkenberry, same subject.
2) NRC, Region V Letter, not dated, B. H. Faulkenberry to R. S. Leddick, same subject.

Reference 1 provided your office with a final report of the subject condition. Upon review of the report, it was determined that additional information was required by your office to facilitate NRC evaluation of the actions taken to correct the described deficiency. As a result, Reference 2 outlined NRC questions that had arisen and directed the Supply System to provide answers within 30 days of receipt of the letter. Responses to the questions asked in Reference 2 are as follows:

Item 1 Structural Integrity of the Repaired Wall

1a) Question:

Is there a basis for concluding that the concrete in the placement is essentially homogeneous? That is, are the repairs bonded to the parent concrete without shrinkage cracks or other deleterious effects?

Response:

The hardened concrete surfaces, against which fresh concrete or grout was placed, were sound, clean, sufficiently rough with some coarse

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Item 1 Structural Integrity of the Repaired Wall (Continued)

1a) Response: (Continued)

aggregate particles exposed. Surfaces were sloped where necessary to preclude air entrapment. The hardened surfaces were wetted for 24 hours prior to placement to prevent absorption of water from the fresh concrete and grout. Inspection and vibrator access portals were installed in the formwork to allow proper concrete consolidation. This preparation is in accordance with ACI 301 Paragraph 6.1 and 9.2, and assured the existence of a strongly bonded joint between the hardened and fresh material.

In the opinion of Ebasco Engineering, the repairs are satisfactorily bonded to the parent concrete without significant shrinkage cracks or other deleterious effects.

1b) Question:

Since the voided areas were identified by excavation (chipping) from the exposed surfaces is there a basis for concluding that all significant void areas have been identified?

Response:

The Ebasco Engineering Report Paragraph A5 lists the causes which contributed to the nonconforming condition. The most important cause was the congested rebar condition on both faces of the wall which impeded consolidation through the rebar curtains. The original placement was made by depositing the fresh concrete in the unreinforced middle of the wall and vibrating the concrete through the rebar curtains. It is highly unlikely that a significant void would exist in the middle of the wall and not be exposed on the concrete surface.

In addition to chipping from the surface, voids were searched for by drilling inspection holes through two RP plates and by removing penetration sleeves.

It is Ebasco Engineering's opinion that no significant voids remain undetected.

1c) Question:

Certain void areas such as the side of the doorway between 417.5 and about 422.0 were so extensive as to constitute a full unplanned cold

Item 1 Structural Integrity of the Repaired Wall (Continued)

1c) Question: (Continued)

joint. It is our experience that such unplanned angular joints often require additional reinforcement in the form of dowels. Since dowels were not added, what is the basis for concluding that the shear strength of the wall at such a location has been maintained?

Response:

The west side of the doorway did in fact have a 4 inch to 12 inch deep layer of unsound concrete which was removed by chipping. The additional trim reinforcing steel (horizontals, verticals, diagonals, and U-bars) which were installed around the doorway prior to the original concrete placement were not removed during the chipping process. These bars, which were still partially embedded in concrete after completion of chipping, will act as dowels to tie the old and new concrete sections together.

The original finite element analysis for this wall section indicates that this wall will experience in-plane shear but not out-of-plane shear. These stresses will be transferred around the doorway and the concrete on the surface of the west side of the doorway will experience little or no shear stress.

Since the repaired concrete at the side of the doorway will experience little or no shear stress, and the existing rebar will act as dowels to tie the old and new concrete together, it is Ebasco Engineering's opinion that additional dowels were not required and that the shear strength of the wall has been maintained.

1d) Question:

Is there any experimental data available which provides a basis for concluding that such a repaired placement is structurally similar to a placement which requires cosmetic repairs only. For instance does ACI or any other institution have some comparative load capability data?

Response:

The repair methods employed to repair this wall placement are identical to the methods described in ACI 301 Par. 9.2 and the "Design and Control of Concrete Mixtures" published by the Portland Cement Asso-

Item 1 Structural Integrity of the Repaired Wall (Continued)

1d) Response: (Continued)

ciation. Secondly, the nuclear industry has experienced many other situations involving concrete rock pockets, voids, and honeycombing in which repairs were made in a similar manner (ex. St. Lucie #1 & #2, Waterford #3, Hope Creek). Tests using pulse-velocity techniques and other non-destructive examination methods have been used to evaluate the repairs.

It is Ebasco Engineering's opinion that the wall has been restored to a condition such that the original design conditions and margins have been satisfied and the capability of the structure to function reliably and safely is unimpaired.

Item 2 Repair of Wall

2a) Question:

Was each "RP Plate" examined by chipping or drilling to assure the integrity of the anchorage?

Response:

Only those RP plates located in areas exhibiting rock pockets, honeycombing, or voids were investigated by chipping or drilling. Chipping behind plates was continued until sound concrete was encountered. In no case did the unsound concrete extend to the anchor plates on the ends of the anchor bolts. After chipping was complete, one RP-3 and one RP-2A plate were drilled with five - 5/8" ø inspection holes. No voids were found behind the RP-2A plate. A small void was found behind the middle hole of the RP-3 plate. Since the anchor plates are embedded in parent concrete and all unsound concrete has been removed and repaired, it is Ebasco Engineering's opinion that the integrity of the RP plate anchorage is unimpaired.

2b) Question:

When epoxy or other grout was used to fill voided areas behind the plates, how was complete filling of the voids assured?

Response:

As was stated above, only one - 5/8" ø inspection hole on the RP-3 plate was filled with epoxy grout. The depth of the void did not ex-

Item 2 Repair of Wall (Continued)

2b) Response: (Continued)

ceed 1/8 inch and did not extend to any of the other four inspection holes. Grout was pumped into the hole until grout seeped out of the pump fitting located on the external surface of the plate. It is Ebasco Engineering's opinion that this small void has been completely filled.

Item 3 Corrective Action to Preclude Repetition

Question:

Section C.2. addresses corrective action to prevent recurrence of similar problems. This section simply states that certain listed remedies "-- have been discussed with the contractor--". It is our position that listing the remedies discussed with a contractor does not meet 10CFR50.55(e) (3) which states, in part, that reports shall include a description of "-- the corrective action taken, and sufficient information to permit analysis and evaluation of the deficiency and of the corrective action". Please provide information which defines the actions actually taken by the contractor to prevent recurrence.

Response:

The Ebasco Engineering Report Paragraph C2 identified five (5) items to be undertaken by M-K to prevent recurrence of similar nonconforming conditions. These items were more than just "discussed" with M-K. Items b, c, and e (increased concrete slumps, use of 3/8" mix, modifications of rebar placement, additional observation/vibrator access ports in forms and penetrations, improved lighting on future night shift placements) were listed on the subject NCR under the "Action to Prevent Recurrence" section.

Item a (training of personnel in the proper use of vibrators) has been implemented by M-K through personnel training sessions for which documentation is available.

Item d (reduced concrete temperature for increased workability) was documented in an Ebasco to M-K letter dated July 15, 1981 which in part states "The concrete (for ABW 005, 007-428) will be supplied at 65°F maximum". Documentation is available to show that this was done.

Finally, Paragraph C2 states "To date, the severe occurrence of the voids in this placement is a one time occurrence by contractor, Morrison-

Item 3 Corrective Action to Preclude Repetition (Continued)

Response: (Continued)

Knudsen." Therefore, it was not deemed necessary to require major changes in M-K's management personnel, quality control program, or operating procedures.

The Supply System considers the responses detailed above to satisfactorily answer the NRC questions outlined in Reference 2. Should you have any questions or desire further information, please contact me directly.

R. S. Leddick (1000)
Program Director, WNP-3/5

DRC/tt

cc: J. Adams - NESCO
D. Smithpeter - BPA
Ebasco - New York
WNP-3/5 Files - Richland