

TENNESSEE VALLEY AUTHORITY  
EMPLOYEE CONCERNS TASK GROUP  
OPERATIONS  
CEG

Subcategory: Miscellaneous

Element: Questionable Concrete Repair (Grout)

Report Number: 313.06 - SQN

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## I. Questionable Concrete Repairs (Grout)

Two of three concerns evaluated at Watts Bar Nuclear Plant (WBN) and included in Element Report 313.06 have been evaluated at Sequoyah Nuclear Plant (SQN). The concerns identified two specific concrete areas in the WBN Turbine Building that were not properly repaired. In addition, the report includes the results of a general evaluation of other civil areas including backfill installation, structural concrete placement and grouting, since there was a potential that similar problems may have existed in these areas as indicated in the WBN report. The protective coating area was not included since this area has been evaluated under Construction Employee Concerns Task Group (ECTG) Report C010300.

NOTE: Concern IN-86-217-001 included in the same WBN Report (313.06) was not considered generic to SQN.

## II. Specific Evaluation Methodology

The employee concerns identified to Quality Technology Company (QTC) for the specific concrete areas at WBN are as listed below: (Note: The concerns are written as indicated on the K-Form.)

### IN-86-221-002

Turbine Building, elevation 676', straight out of the elevator, down a set of steps, and to the right, CI stated that the concrete/grout used to install sleeves in the wall penetrations was improperly prepared and the forms were not installed correctly. Nuclear Power Department concern. CI has no additional information.

### IN-86-221-003

Turbine Building, elevation 676', straight out of the elevator, down a set of steps, and to the left - a hole in the floor approximately 2 feet deep by 3 feet wide by 3 1/2-4 feet long was filled with grout, in lieu of concrete. Nuclear Power Department concern. CI has no additional information.

The following methodology was implemented during the evaluation of the above concerns:

- A. Expurgated files were reviewed to determine if additional information relative to the concerns could be obtained.
- B. Reviewed SQN FSAR and the TVA Topical Report for commitments.
- C. Interviewed a cognizant Quality Assurance (QA) engineer, the supervisor of the Mechanical Modifications Unit, and a cognizant civil engineer within the Modifications Unit to determine the following:
  1. Whether or not procedures existed in the areas of concrete repair, structural concrete placement and backfill.

2. To what extent had there been concrete repair type work, structural concrete placement, and backfill placement at SQN within the Office of Nuclear Power (ONP) for both safety-related and nonsafety-related structures.
3. Control of the following:
  - a. Correct concrete class and/or grout type for the specific area being repaired.
  - b. Substitution of grout for concrete where concrete was required by the specification for a particular repair.
  - c. Material preparation (mixing, etc.).
  - d. Preinspection of form work, etc., before concrete/grout placement.
- D. Interviewed cognizant Quality Control (QC) personnel for information regarding control of modifications relative to civil installations.
- E. Reviewed applicable parts of Administrative Instruction, (AI)-19, Part IV, R17, "Plant Modification After Licensing."
- F. Reviewed Modifications & Additions Instruction (M&AI)-17, R5 and R6, "Grouting of Support Baseplates or Sleeves," for compliance with construction specifications.
- G. Reviewed Corrective Action Report SQ-CAR-86-04-022 for information.
- H. Interviewed the support craft general foreman to determine any repairs performed by ONP and craft familiarity with controlling G-specifications.
- I. Performed a visual inspection of a portion of the concrete-related items performed by ONP for apparent compliance with specifications.
- J. Reviewed civil portions of workplans 11952, 11910, 10821 and 11207 for compliance with G-specifications.
- K. Interviewed the Mechanical Modifications Unit supervisor to determine how concrete repairs would be controlled to meet specification requirements in nonsafety-related structures such as the Turbine Building.

### III. Summary of Findings

#### Findings

- A. Based on a review of expurgated files for the specific concerns, no additional information was provided.

B. A review of the SQN FSAR and the Topical Report revealed the following:

1. SQN FSAR, Volume 13, Section 17.2, Amendment 2, under the heading of "Quality Assurance for Station Operation," referred to Section 17.2 of TVA Topical Report TVA-TR75-1A, R8 for the description of the QA Program for operation of SQN.
2. Paragraph 17.2.3.3 of TVA-TR75-1A, R8, in part states, "Procedures and Instructions are developed and implemented to assure that the design, construction, installation, inspection, and testing of modifications to the CSSC meet QA standards at least equal to those of the original installation."
3. SQN FSAR, Volume 4, Section 3.8, original amendment, revealed that Construction Specification G-2, "Plain and Reinforced Concrete," was the specification used for concreting operations during construction. G-2 in turn specified that repair of concrete follow Construction Specification G-34, "Repair of Concrete."

Note: The higher-tier criteria is specific to safety-related areas; however, G-2 applies to all permanent plant structures.

C. The following summarizes the results of interviews conducted with a cognizant QA engineer, the supervisor of the Mechanical Modifications Unit, and a cognizant civil engineer within the Mechanical Modifications Unit.

There are no Modifications and Additions Instructions for concrete repair, structural concrete placement, or backfill. However, an instruction M&AI-17 has been in existence for grout installations. Additionally, a procedure for concrete placement and repair is in the process of being developed.

Concrete repair work within ONP has been limited to areas that had been core-drilled to install sleeves and those of cosmetic nature. Five-star grout was used in all such repairs and performed according to M&AI-17. The repairs have predominately been in the Auxiliary Building with a very minimum amount having been necessary in the Turbine Building.

Those interviewed could only recall four areas where concrete had been placed and inspected by ONP personnel. These areas were curbs in the Auxiliary Building, missile protective concrete on the ERCW, and conduit encasements in unit 1 and 2 Reactor Buildings. The installations were performed under workplans 11910, 11207, 11899 and 11882 respectively. Additionally, one backfill operation had been performed during the ERCW modification under workplan 11207.

Note: Other pours had been made since SQN had gone into operation; however, construction personnel performed and documented the inspections while they were still onsite.

According to the interview, instructions were given in the workplans for the above in lieu of developing procedures. Additionally, QC hold points with reference to appropriate criteria including G-specifications and Construction IIs (Inspection Instructions) were referenced. Inspection documentation was a part of the workplan and inspection data sheets included as applicable.

Based on the interview with the aforementioned personnel within the Modifications Unit, the correct class and/or grout type for a specific area repaired would have been controlled according to the requirements of Construction Specification G-34 and Field Change Requests (FCRs) would have been written where grout was substituted for a repair area that required replacement concrete. Additionally, it was noted that the engineer did not previously require a QC hold point within the workplan for grout mixing. However, this condition had been documented on Corrective Action Report (CAR) number SQ-CAR-86-04-022. QC hold points for verification of form work and embedments have been required by the workplans for installations relative to concreting activities.

- D.1 Based on an interview with a cognizant QC shift supervisor, civil-related activities had been minimum since SQN had gone into operation. Also, up until approximately 1-1/2 years ago, any inspections relative to concrete were performed by construction. Inspections by both construction and those conducted by ONP QC personnel were documented in the workplan based on hold points noted by the responsible engineer. Additionally, inspection data sheets were included in the workplan where required.

It was noted that since obtaining inspectors with a background in the concrete and soils area and a civil engineer in the Modifications Unit, improvements in the civil area had been implemented. (Example: M&AI-17 had been revised to include in-process tests according to Construction Specification G-51. These tests were not previously required by the instruction.

- D.2 According to conversation with a cognizant civil QC inspector within ONP, he was not aware of any areas where G-34 had been violated. The use of grout in repair areas inspected by their unit and those previously performed by construction for ONP had been within dimensional criteria that would permit the use of grout. Structural concreting operations (noted in Paragraph C) were delayed until equipment was purchased to perform the required physical tests. Additionally, during the backfill placement (as noted in Paragraph C), an inspector was borrowed from the WEN Project since SQN did not have certified inspectors. Documentation of these items was a part of the workplan.

- E. A review of Administrative Instruction, AI-19, Part IV, R17, revealed that M&AIs are required to ensure modifications to the plant meet at least the specification to which the plant was originally built. The M&AIs are required to be consistent with the construction G-specifications. However, M&AIs are not required for a workplan if the appropriate level of detail is placed into the workplan detailed instructions. Additionally, specific G-specifications needed for any modification are required to appear by reference in the workplan.

Based on the above and conversations with a supervisor within the Plant Operations Review Staff and a cognizant QA engineer, SQN was within program requirements by documenting inspections in the workplan in lieu of having M&AIs for concreting and backfill activities.

- F. A review of M&AI-17, R5 and R6, "Grouting of Support Baseplates or Sleeves," revealed that portions of the procedure were not consistent with Construction Specification G-51 and G-34 requirements. Specifically, both revisions reviewed, allowed core-drilled holes to be grouted without scarifying the surface. Additionally, the procedures allowed the engineer to reduce and/or waive 12-hour surface wetting requirements before grouting. Up until revision 6 of the instruction, the physical tests required by Construction Specification G-51 were not implemented in the instruction. Based on an interview with cognizant QC personnel, the physical testing had not been conducted.

Note: Filling of gaps for surface mounted plates that fall within the criteria of Construction Specification G-32 does not require testing of the grout/mortar for expansion, compressive strength, and, etc. Additionally, saturation with water is only required just before the application of mortar. However, according to conversations with the cognizant engineer in the Modifications Unit, a cognizant QC inspector and the craft general foreman, grouting of baseplates had been performed according to Construction Specification G-51 in that they were formed, and the gap was normally approximately 1-inch. In this case, the in-process tests and the 12-hour saturation requirements according to Construction Specification G-51 would have been required.

- G. As noted previously, Corrective Action Report SQ-CAR-86-04-022 had been written to document that M&AI-17 had not been followed to mix grout according to the manufacturer's recommendations. The CAR documented that water content had not been previously measured in performing grouting operations.

The CAR remains open, pending an evaluation to determine the maximum allowable variation of water to grout, and obtain required strength. It was noted that corrective action is being tracked by ONP-QA based on the fact that a portion of the initial response to the CAR was rejected by them. Initiation of the CAR resulted in a revision to M&AI-17 to include documenting mix proportions and in-process test requirements required by G-51.

- H. Based on an interview with the support craft general foreman, all grouting of baseplates had been accomplished by forming before installing the grout. He, additionally, stated that there had been very little repair work conducted in nonsafety-related areas. Most repairs had been limited to sleeves for mechanical and electrical penetrations.

It was noted that craftsman performing concrete-related activities depended primarily on the engineer and instructions given in the workplan and did not maintain familiarity with the G-specifications.

- I. With the assistance of the support craft general foreman, several areas relative to concrete work that had been performed by ONP were visually inspected for apparent conformance with requirements. Specific items observed were as follows:

1. Two sets of baseplates that had been grouted in the Turbine Building and Auxiliary Building. The gap thickness ranged from approximately 1/2-inch to 1 1/2-inches. According to conversation with the cognizant general foreman, the areas were formed and 5-star grout was used. No problems were noted based on the visual inspection; however, in-process tests according to G-51 would have been required.
2. Observed a concrete repair around a structural steel column base in the Turbine Building. Replacement concrete was used in the repair as required by Construction Specification G-34, therefore, the installation was acceptable.
3. Observed several repairs around mechanical sleeves and electrical penetrations in the Auxiliary Building that had been grouted by ONP. With the exception of one sleeve, the use of grout was acceptable based on repair dimensions. It was later determined that the grout used in lieu of replacement concrete for this sleeve in particular was authorized by FCR 3065 as included in workplan 11309. Therefore, it was acceptable to use grout in all sleeve and/or penetration repairs observed, based on apparent dimensions.

- J. The following summarizes the results of the workplans reviewed in the civil area for compliance with G-specifications. Protective coatings were exempt from the review since this area has been evaluated under Construction ECTG Report C010300.

1. Workplan 11952 included the installation of grouted anchors. Hold points for QC verification were included and the applicable G-specification referenced (G-32). Hold points included verification of hole size, depth and visual roughness, anchor fabrication, installation, curing, and anchor testing. In addition to documenting the inspection in the workplan, inspection data sheets from M&AI-10 and 17 were included to document anchor installation and testing.
2. Workplan 11910 included concrete placement of two curbs in the Auxiliary Building. Necessary QC hold points for the concreting operation were included. These hold points for the concreting operation were dimensional tolerances, scarifying, vendor batch plant inspection, placement, curing, form removal, and concrete testing.

A discrepancy was noted in that the workplan specified that the concrete surface be wet sacked for 12 hours before concrete placement. This is contrary to the requirements of Construction Specification G-2, Paragraph 14.2.1. This paragraph stipulates that Section 7.3 for cleaning lift joints and bonding new concrete to old shall apply to all horizontal construction joints. Paragraph 7.3.8 of Section 7.3 in turn stipulates that superior bonding is obtained if the surface of the lift in place is dry.

Contrary to the requirements of AI-19, Paragraphs 4.1.2.13.b, the necessary G-specification was not referenced in the workplan. However, this is not considered a problem since the Construction IIs were referenced which in turn references the appropriate G-specification(s).

The workplan additionally specified that any visible voids after placement of the concrete be repaired according to M&AI-17. Based on a review of R6 of this instruction, it does not incorporate or give reference to Construction Specification G-34 which is the controlling specification for concrete repair.

3. Workplan 10821 was written to install a D-shaped concrete shield wall in the Auxiliary building. (Note: This installation was conducted while construction was still on site; therefore, the inspection was conducted by them.) With the exception of the following, the workplan included sufficient instructions and reference to Construction IIs to acceptably perform the concrete installation, including the installation of form work and reinforcing steel.
  - a. The plan stipulated surface wetting for 12 hours before concrete placement. Additionally, the concrete repair made according to FCR 2013 in the workplan required this step. (See J.2 above for criteria discrepancy.)
  - b. Post-placement repair criteria gave reference to make any necessary repairs according to M&AI-17 in lieu of G-34. (See J.2 above.)

4. Based on a general review of workplan 11207 written to install backfill and a concrete missile shield slab, no problems were noted. Specific criteria including Construction Specification G-9, drawings and Construction IIs were referenced and/or included in the workplan.
- K. Based on an additional interview with the supervisor of the Mechanical Modifications Unit, the only distinction that would be made in repairs performed in a nonsafety-related structure and a safety-related structure is that engineering would perform any necessary inspections in lieu of QC.

#### Conclusion

With the exception of the grout preparation discrepancy which had previously been identified by ONP, the issues presented by concern numbers IN-86-221-002 and IN-86-221-003 were not considered a problem at SQN. The discrepancy identified by ONP was documented on Corrective Action Report SQ-CAR-86-04-022 which has not been closed.

There were no indications that grout had been used in the Turbine Building or safety-related structures where replacement concrete would have been required unless approved by a FCR. Additionally, preinstallation inspections such as form work were performed and documented in the workplan. Backfill installation had been limited to one area and based on a review of the workplan, no discrepancies were noted.

However, discrepancies were noted when similar conditions were evaluated in the areas of structural concrete placement and grouting. The discrepancies noted were as follows:

- A. As noted in Section III.C of this report, portions of M&AI-17 are not consistent with the requirements of Paragraph 3.2.1 of G-34 and Paragraph 3.1 of G-51 in that core-drilled holes are not required to be scarified before installation of the repair material. Additionally, the 12-hour surface wetting criteria is allowed to be reduced or waived which is contrary to G-34 and G-51 requirements where grout or drypack mortar is used.
- B. Even though implementation of in-process testing according to G-51, Section 8.0, was a part of the corrective action given in Corrective Action Report SQ-CAR-86-04-022, the impact as to the affect in regards to quality has not been addressed for those installations conducted previously where the in-process testing was not performed.
- C. Based on the workplans reviewed, there were indications that engineering personnel were not familiar with specific requirements of Construction Specifications G-2 and G-34. This is based on the requirements stipulated in workplans 11910 and 10821 where wetting of the surface was required before placing the concrete.

Note: This is not considered a problem detrimental to quality since the workplans revealed that surfaces were scarified. Even though superior bonding may have not been obtained, acceptable bonding should have occurred if all surface water was removed.

Additionally, the above workplans specified that voids (if any) be repaired according to M&AI-17. This instruction does not incorporate or give reference to Construction Specification G-34 which is the controlling concrete repair specification.

Even though specific ONP instructions did not exist for all civil areas, this was not considered a problem. This was allowed by AI-19 and Construction IIs (Inspection Instructions) were referenced in the workplans which were reviewed by the Plant Operations Review Committee (PORC).

Additionally, it was noted that actions to improve areas relative to concrete had started. This was exemplified in that a recent revision to M&AI-17 incorporated in-process testing requirements, and an instruction for concrete placement and repair has been initiated.

#### IV. Root Cause

Not applicable

#### V. Generic Applicability

Generic applicability has been established in WBN Report 313.06.

#### VI. References

1. WBN Element Report 313.06
2. SQN FSAR, Volume 13, Section 17.2, Amendment No. 2
3. SQN FSAR, Volume 4, Section 3.8, Original Amendment
4. TVA Topical Report, TVA-TR75-1A, Revision 8, Section 17.2
5. ONP Instructions:
  - MAI-17, R5 and R6
  - MAI-10, R10
  - AI-19, Part IV, R17
  - AI-12, R22
6. TVA General Construction Specification G-34, R4
7. TVA General Construction Specification G-2, R5

VI. References (Continued)

8. TVA General Construction Specification G-51, R2
9. TVA General Construction Specification G-32, R11
10. Workplan numbers: 11910  
11207  
11899  
11309  
11952  
10821
11. Corrective Action Report SQ-CAR-86-04-022
12. Construction ECTG Report C010300
13. FCR 3065
14. FCR 2013
15. Immediate Action Report 12 OP313

VII. Immediate and Long-term Corrective Actions

SON Engineering personnel should evaluate the consequences of findings as indicated in this report and on Immediate Action Report 12 OP313.