U. S. NUCLEAR REGULATORY COMMISSION

OFFICE OF SPECIAL PROJECTS

NRC Inspection Report: 50-445/88-15
50-446/88-11

Permits: CPPR-126
CPPR-127

Dockets: 50-445
50-446

Category: A2

Construction Permit
Expiration Dates:
Unit 1: August 1, 1988
Unit 2: Extension request
submitted.

Applicant: TU Electric
Skyway Tower
400 North Olive Street
Lock Box 81
Dallas, Texas 75201

Facility Name: Comanche Peak Steam Electric Station (CPSES),
Units 1 & 2

Inspection At: Comanche Peak Site, Glen Rose, Texas

Inspection Conducted: February 3 through March 1, 1988

Inspector: M F Runyan — 3/17/88
M. F. Runyan, Resident Inspector, Civil Structural (paragraphs 3, 4, 5, 6.a) — Date

Consultant: W. Richins, Parameter (paragraphs 2, 6.b, 7.c)

Reviewed by: H H Livermore — 3/18/88
H. H. Livermore, Lead Senior Inspector — Date

Inspection Summary:

Inspection Conducted: February 3 through March 1, 1988 (Report 50-445/88-15; 50-446/88-11)

Areas Inspected: Unannounced, resident safety inspection of applicant actions on previous inspection findings; Comanche Peak Report Review Group recommendations; and applicant actions on Issue-Specific Action Plans (ISAPs) II.a, II.c, and VII.c.

Results: Within the areas inspected, a weakness was identified concerning the disposition of field-cured concrete test cylinder discrepancies. An identified strength was the thoroughness and precision of the applicant's program to validate seismic double wall gaps in response to ISAP II.c. No violations or deviations were identified.

DETAILS

1. Persons Contacted

D. A. Balatincz, Field Coordinator, Bisco
C. Beasley, Senior Engineer, Evaluation and Research Corporation (ERC)
G. S. Braun, TENARA (TERA)
N. A. Britton, Civil Engineering, TU Electric
*W. G. Counsil, Executive Vice President, TU Electric
N. D. Hammett, Engineering Assurance, Brown and Root (B&R)
*T. L. Heatherly, EA Regulatory Compliance Engineer, TU Electric
C. R. Hooton, Civil Engineering Manager, TU Electric
*J. J. Kelley, Manager, Plant Operations, TU Electric
R. M. Kissinger, Civil Engineering, TU Electric
J. J. McNally, Engineer, Stone and Webster Engineering Company (SWEC)
*J. W. Muffett, Manager of Civil Engineering, TU Electric
*L. D. Nace, Vice President, Engineering & Construction, TU Electric
*A. B. Scott, Vice President, Nuclear Operations, TU Electric
*M. R. Steelman, Comanche Peak Review Team (CPRT), TU Electric
T. Vears, SWEC

The NRC inspectors also interviewed other applicant employees during this inspection period.

*Denotes personnel present at the March 1, 1988, exit interview.

2. Applicant Action on Previous Inspection Findings (92701)

(Closed) Open Item (445/8518-0-18): This item addressed a potential deviation regarding incorrect marking for bolt material on the Reactor Sump No.1 in Unit 1. A-193 bolts are required by Drawing 2323-51-0564. The markings on the bolts could not be identified by the CPRT inspector. This condition was identified by CPRT during an NRC witnessed inspection of Verification Package I-S-STEL-117, documented on CPRT Deviation Report (DR) I-S-STEL-117-DR1, and incorporated into Nonconformance Report (NCR) M-86-100454SX. NCR M-86-100454SX states that the bolts are acceptable as is. The basis for the disposition is that material traceability exists through documentation. The bolts were vendor supplied and the markings are military standard identification symbols for ASTM A-193, Grade B8, Class 1 bolts. The NRC inspector verified the material traceability and concurs with the disposition of NCR M-86-100454SX. This item is closed.

3. (Closed) Comanche Peak Report Review Group (CPRRG) Recommendation 48: Concrete Quality Concerns Associated with Potential Mixing Blade Deficiencies

During inspections conducted from April 1, 1985, through June 21, 1985, and documented in NRC Inspection Report 50-445/85-07; 50-446/85-05, NRC inspectors identified a lack of records indicating that mixing blades in concrete mixers had been periodically inspected. This was documented as Violation 445/8507-V-04; 445/8505-V-02. The applicant is committed to American Concrete Institute (ACI) Standard ACI-304-73. Section 4.2 of this standard states that "mixers should be properly maintained to prevent mortar or dry material leakage and inner mixer surfaces should be kept clean and worn blades replaced." Section 3.9.4 of B&R Procedure 35-1195-CCP-10 states that mixing blades should be checked quarterly and replaced whenever they lose ten percent of their height. The quarterly checks were not formally required to be documented, and it was the lack of such documentation which raised the concern that the inspections had not been performed. Violation 445/8507-V-04; 446/8505-V-02 was closed in Inspection Report 50-445/86-28; 50-446/86-23, based on a procedure revision to require documented inspection of the blades. However, the concern that concrete quality may have been affected by deficient mixing blades remained open and was identified as ID Recommendation 48 in Enclosure 1 to Stello's memorandum, "Implementation of Recommendations of Comanche Peak Report Review Group," April 14, 1987. The CPRRG recommended an extensive review of concrete compression tests to determine if concrete quality had been adversely affected by the potentially defective mixing blades.

During this inspection the applicant informed the inspector that mixing blades had never been replaced and that the same trucks had been used throughout plant construction. This, combined with the fact that documented quarterly inspections of the mixing blades beginning June 6, 1985, have been satisfactory, appears to remove any suspicion that deficient mixing blades have been used. The NRC inspector visually inspected the mixing blades in truck RT-41 and verified the applicant's position that blade wear was precluded by the presence of fins at the ends of the blades. Only one small defect was identified: a one square inch hole at a blade-fin junction which appeared to be more of a fabrication defect than an erosion feature. Therefore, it appears discrepant mixing blades have not been used at the site.

In order to assess the possible effect of the mixing blades in the concrete, the NRC inspector reviewed approximately 2,000 concrete pour test records from 1977 to the present for deficiencies due to compressive strength, air content, and

slump. This review revealed 99 instances where field-cured cylinders failed to meet specifications, but failed to show a gradual quality degradation which would be indicative of mixing blade wear.

Due to the large number of field curing test failures, the NRC inspector requested information concerning the disposition of five safety-related pours, where in one case (Pour 101-E808-006) the field-cured cylinder failed at less than the design strength of 4000 psi, and in four cases (Pours 201-4885-009, 205-8873-001, 205-4852-001, and 205-4852-001) the field-cured cylinders broke at greater than 4000 psi, but less than 85 percent of the break pressure of the corresponding laboratory-cured cylinders. The 85 percent criteria is derived from ACI 318-71 and is used to demonstrate that curing methods in the field have been adequate to ensure the quality of installed concrete. Pour 101-E808-006, was documented on NCR C-2178, resulting in a retest of a core bore sample of the placement. The core sample failed at 4040 psi and the placement was determined to be acceptable. For the other four cases, however, no action was taken. The applicant's policy throughout construction was that the failure of field-cured test cylinders to attain 85 percent of the strength of lab-cured samples represented a process-control limitation rather than a quality-of-concrete problem. This position is not in violation of ACI 318-71 which states that the 85 percent criteria has been set merely as a rational basis for judging the adequacy of field curing and that instructions to be followed when these strength tests fail are not dogmatic, but are subject to judgement of the true significance of the test results. Multiple failures of field-cured samples to meet comparison specifications should have been identified as an adverse trend and resulted in an effort to improve field-curing technique. Instead, each case was considered individually and dispositioned with no action taken. The NRC inspector considers the failure to identify the adverse trend and take corrective action to be a weakness. Most safety-related placement of concrete is now complete, but for what remains, the applicant should reconsider its disposition of field-cured test failures.

4. Reinforcing Steel in the Reactor Cavity (ISAP II.a) (48055)

ISAP II.a involved an incident where the intention to add additional rebar failed when a revised drawing did not reach the field in time. The ISAP also addressed the generic implications of this incident. The following activities for ISAP II.a were reviewed by the NRC inspector during this report period. Previous inspections regarding ISAP II.a were documented in NRC Inspection Reports 50-445/86-01, 50-446/86-01; 50-445/85-13, 50-446/85-09; and 50-445/85-11, 50-446/85-06.

a. Review Circumstances Leading to Provision for and Deletion of Subject Rebar (NRC Reference 02.a.02.00)

The NRC inspector reviewed the Results Report, Revision 1, in which the following facts were presented. The structural job engineer, based on his professional experience, concluded that minor cracking of concrete in Reactor Building 1, at the corners of slots provided for neutron detectors could occur in the event of a loss of coolant accident (LOCA). As a result, he estimated the additional quantity of rebar needed to prevent the cracking, which resulted in Revision 3 to structural Drawing 2323-51-0592. Since this change was merely an enhancement, backup calculations were not performed. The revised drawing arrived in the field after the concrete pour was completed and was documented on NCR C-669. After TU Electric concluded that the rebar modification was discretionary, Revision 4 to the subject drawing was issued to delete the added rebar. Since the structural calculation of record did not include the rebar placement of Revision 3, it was not changed with the issuance of Revision 4. An analysis of the as-built condition of the Unit 1 reactor cavity by Gibbs & Hill (G&H) was previously reviewed by the NRC inspector (NRC Report 50-445/85-11; 50-446/85-06). G&H concluded that the omitted reinforcing steel was not required to maintain the structural integrity of the reactor cavity. The NRC inspector concurred with this result. The review of the circumstances of the subject case appeared to be adequate and the NRC inspector agreed with the CPRT conclusion that the additional rebar was not required.

No violations or deviations were identified.

b. Review Rebar Omissions Documented in Project NCRs (NRC Reference 02.a.03.00)

A total of 21 NCR documented cases of rebar omission in Units 1 and 2 safety-related Category 1 building structures were identified by the CPRT, excluding the previous subject case. The NRC inspector reviewed the subject NCRs and subsequent conclusions presented in the Results Report. All of the 21 NCRs, in contrast to the previous subject case, were due to errors in placement of rebar and were not caused by failure of the engineering/field change interface to convey impending design changes. Thirteen cases pertained to missing [illegible] ned to missing vertical or horizontal [illegible] tained to missing shear ties. Based on [illegible] ults Report conclusion that no other [illegible] to the subject case had been documented [illegible] justified. The 21 rebar placement

errors were either corrected in the field or analyzed "use as is."

No violations or deviations were identified.

c. Review Sample of Pour Cards for Use of Current Design Documents and Review Engineering Field Interface of Major Embedments (NRC References 02.a.04.00 and 02.a.05.00)

The applicant randomly selected a total of 66 concrete pour cards, including the subject case, each of which involved the embedment of reinforcing steel. For each pour card, the referenced design drawing was compared to the current design drawing with respect to reinforcement requirements for the particular structure involved in the pour. The NRC inspector reviewed the selected pour cards and resulting analysis. There were no additional instances identified where reinforcement requirements were changed subsequent to the pour. In addition, the CPRT reviewed 100 percent of the pour cards for major embedments in Reactor Building 1. Out of 124 embedments reviewed by CPRT, there were no additional cases of post-construction changes in the design of embedment structures. The CPRT review of pour cards provided convincing evidence that the subject case was an isolated incident.

No violations or deviations were identified.

d. Design Change Procedures and Their Effect Regarding Implementation (NRC Reference 02.a.06.00)

The CPRT reviewed document control, installation and inspection, and construction hold procedures for both the time of the previous subject case (May 1977) and the time of the review (October 1985).

The procedure review focused on the following items:

- Clear identification that the drawing is released for construction.
- Controlled transmittal of the drawing from Engineering to site document control.
- Controlled distribution to the field.
- Construction hold notices.
- Pre-placement inspection of rebar and embedded items.

The NRC inspector reviewed portions of the procedures used to justify the general CPRT conclusion that all procedures past and present were adequate to ensure quality. The only significant procedural weakness identified by CPRT, which may have contributed to the

previous subject case, was a lack of formal procedures related to the generation of Construction Hold Notices (CHN). Current procedures for CHNs are more formalized and are adequate.

The CPRT procedure review was a comprehensive effort which encompassed all aspects of the subject case.

No violations or deviations were identified.

e. Review of Results for Generic Applications (NRC Reference 02.a.07.00)

In order to verify the adequacy of the action plan to consider generic applications, the applicant assessed the placement of rebar that had been exposed in association with ISAP II.b, "Concrete Compressive Strength." A total of 87 rebar placements were exposed for analysis in regard to ISAP II.b. The Project made as-built sketches of the exposed areas and a third party compared the sketches to the design requirements. Eight minor discrepancies were identified, each of which was evaluated to be acceptable without corrective action. This analysis further supported CPRT's claim that the subject case was isolated and that the ISAP action plan did not need to be expanded.

No violations or deviations were identified.

The conclusion of the ISAP II.a Results Report, Revision 1, signed October 23, 1987, that the administrative controls and resulting placement of rebar is adequate to meet or exceed design requirements was well supported. This completes the NRC review of ISAP II.a.

5. Maintenance of Air Gap between Concrete Structures (ISAP II.c) (46053) (46055)

The following activities for ISAP II.c were reviewed by the NRC inspector during this report period. Previous inspections regarding ISAP II.c were documented in NRC Inspection Reports 50-445/87-11, 50-446/87-09; 50-445/87-09, 50-446/87-07; 50-445/87-06, 50-446/87-05; 50-445/86-26, 50-446/86-22; 50-445/86-22, 50-446/86-20; 50-445/86-15, 50-446/8612; 50-445/86-07, 50-446/86-05; 50-445/86-03, 50-446/86-02; and 50-445/86-01, 50-446/860-01.

a. Analyze Final As-Built Condition and Documentation of Final As-Built Condition (NRC References 02.c.03.00 and 02.c.04.00)

The NRC inspector witnessed Bisco inspections of seismic double wall gaps subsequent to debris removal. Bisco

inspections were performed in accordance with procedure NQA-3.09-1.08, "Building Separation Gap and Condition Inspections," Revision 0. These inspections were documented on the following construction operation travelers:

Traveler CE87-1914-01-8904

Inspection of the double walled building separation gap between the Auxiliary building and Safeguards building, Unit 1. Minimum gap width as specified on Design Change Authorization (DCA) 21829, Revision 8, varies between 1" and 3/4" for unsealed areas, and is 1 1/2" for sealed areas. The minimum gap width observed was 1 1/2" except for several pieces of rotofoam, duct tape, bolts, nails, and wires. Loose items will be removed, as well as, fixed items (such as nails) which violate dimensional tolerances.

Traveler CE87-1855-01-8904A

Inspection of the double walled building separation gap between the Reactor building and Auxiliary building, Unit 1. Minimum gap width, as specified on DCA 21829, Revision 8, varies between 2" and 1/2", depending on elevation. The greatest discrepancy found was a 15 square foot area with a separation width of 1.906" encompassing an area where the required separation width is 1.914" or 1.970". Other discrepancies identified were areas where form ties and concrete ridges caused local dimensional violations.

Bisco officials stated that all identified discrepancies would be documented on NCRs and corrected prior to the final closeout inspection to be performed by the applicant's QC inspectors.

The NRC inspector verified that the two referenced double wall gap inspections were performed in accordance with Procedure NQA-3.09-1.08. Bisco employees used calibrated probes to test dimensions and used cameras to visually inspect surface conditions. The CPRT and Bisco considered all loose debris to be unacceptable whereas fixed deformities (such as embedded form ties) were considered acceptable as long as dimension tolerances were not violated.

The NRC inspector identified the above activity as a strength in that the efforts of Bisco engineers and interfacing applicant representatives to clean and validate the double wall gaps were clearly professional and reflected an excellent attitude toward quality.

No violations or deviations were identified.

b. Revision of Engineering Calculations to Reflect Final As-Built Condition (NRC Reference 02.c.05.00)

The NRC inspector reviewed SWEC calculation 16345-CS(B)-044, "Assessment of Seismic Air Gaps Between Structures, Unit 1," dated October 22, 1987. The objective of this calculation was to show that inter-building relative displacements during the Safe Shutdown Earthquake (SSE) are less than the minimum required gaps as proposed in Design Basis Document (DBD) -CS-019, Revision 1. The actual building gaps will be verified by the applicant's QC inspectors to be greater than the DBD required gaps. The SWEC calculation considered the worst-case condition of maximum seismic and thermal deflections. The results of the SWEC calculation are preliminary in most cases and require confirmations of various assumptions and boundary conditions. The gap requirements of DBD-CS-019 were found by SWEC to be acceptable with the exception of gap dimensions specified between the containment internal structure and containment shell. An attachment to the calculation provided revised gap dimensions to be incorporated in the next revision of DBD-CS-019. SWEC's representatives expect other gap requirements to remain unchanged even after all confirmations are cleared.

The NRC inspector reviewed the calculation for assumptions, methodology, numerical accuracy, and conclusions. All questions were satisfactorily answered by SWEC officials.

No violations or deviations were identified.

This completes the NRC inspection of ISAP II.c. Inspection of the final approved calculations and final quality control (QC) inspections of the double walls will be addressed under the Corrective Action Program (CAP) in association with Issue A21.

6. Quality of Construction (ISAP VII.c)

Issue-Specific Action Plan VII.c was initiated by TU Electric to provide assurance that unidentified concerns related to the quality of construction of the hardware would be identified, evaluated, and resolved. This ISAP was a self-initiated program developed independent of issues raised by external sources. Populations of homogeneous QC-accepted safety-related construction work products were randomly sampled. Reinspections and/or documentation reviews were performed for the sampled hardware. The results were collectively evaluated with conclusions and recommendations

presented for each population in the appendices to the Results Report for ISAP VII.c.

The following activities for ISAP VII.c were reviewed by the NRC inspector during this report period:

a. Concrete Placement (NRC Reference Item 07.c.27.00) (47056)

The NRC inspector reviewed the Results Report for ISAP VII.c, Appendix 18, "Concrete Placement." Questions resulting from this review were satisfactorily answered by the responsible CPRT engineer and by reference to Safety Significance Evaluations (SSE) contained in the main document file. Field inspections were performed and documented in previous NRC inspection reports (50-445/87-02, 50-446/87-02; 50-445/86-26, 50-446/86-22; 50-445/86-01, 50-446/86-01; 50-445/85-18, 50-446/85-15; 50-445/85-16, 50-446/85-13; 50-445/85-14, 50-446/85-11; 50-445/85-13, 50-446/85-09). The NRC inspector reviewed documentation in the CPRT working files that supports CPRT activities and conclusions for this population including: (1) population description, homogeneity justification, and sampling methods; (2) matrices used for determining adverse trends and tabulating deviations versus attributes; (3) documentation used as reference for the identification of inspection attributes and the compilation of CPRT inspection procedures; and (4) justification for the root causes, generic implications, recommendations, and conclusions detailed in the Results Report. NRC inspections of SSEs were performed and documented in NRC Inspection Report 50-445/87-04; 50-446/87-04. The Results Report conclusion that there is reasonable assurance that concrete is adequately installed to perform its safety-related function appeared justified by the details of the report and supporting working files noted above. The implementation of corrective actions documented in Section 4.0 of the Results Report will be inspected under the Civil/Structural CAP. This completes the NRC review of ISAP VII.c, Appendix 18.

No violations or deviations were identified.

b. Cement Grout (NRC Reference Item 07.c.32.00) (47056)

The NRC inspector reviewed the Results Report and supporting CPRT working files for ISAP VII.c, Appendix 21, "Cement Grout." Questions resulting from this review were satisfactorily answered in discussions with the responsible CPRT engineer and/or reference to specific SSEs. Documentation reviews were performed and

reported by the NRC inspector in NRC Inspection Report 50-445/86-26, 50-446/86-22. NRC inspections of SSEs were performed and documented in NRC Inspection Report 50-445/87-04; 50-446/87-04.

The Results Report concludes that there is reasonable assurance that the grout placements have been adequately performed in conformance with the design based on: (1) the results of the activities performed and documented in the working files and, (2) the satisfactory closure of PDR-60 (a QA/QC Program Deviation Report). PDR-60 addresses Inspection Procedure QI-QP-11.0-6, Revision 0, which contained no requirement to verify surface temperature prior to grout placement. Earlier and subsequent procedures included this requirement. Corrective Action Request CAR-080X, Revision 3 was issued to address PDR-60. Stone and Webster responded to CAR-080X in letter SWTU-4473. SWEC identified 160 grout placements found in the inspection log for the time period that CPI-CPP-11.0-6, Revision 0 was in effect. In all cases, the surface temperature was determined by SWEC to be within allowable limits based on a review of ambient temperature records, additional inspection records, and/or the location of the placements in an enclosed environment.

The NRC inspector reviewed PDR-60, CAR-080X, and SWTU-4473 to ensure that this situation was adequately addressed. No corrective action recommendations were listed in the Results Report.

The NRC inspector reviewed documentation in the CPRT working files that supports CPRT activities and conclusions for this population including: (1) population description, homogeneity justification, and sampling methods; (2) matrices used for determining adverse trends and tabulating deviations versus attributes; (3) documentation used as reference for the identification of inspection attributes and the compilation of CPRT inspection procedures; and (4) justification for the root causes, generic implications, recommendations, and conclusions detailed in the Results Report.

The conclusions stated in the Results Report appeared to be justified by the details of the report and supporting working files noted above. No violations or deviations were identified. This activity is complete and no further NRC inspection is planned for this reference item.

c. Epoxy Grout (NRC Reference Item 07.c.33.00) (47056)

The NRC inspector reviewed the Results Report and supporting CPRT working files for ISAP VII.c, Appendix 22, "Epoxy Grout." Questions resulting from this review were satisfactorily answered in discussions with the responsible CPRT engineer and/or reference to specific SSEs. Documentation reviews were performed and reported by the NRC inspector in NRC Inspection Report 50-445/86-26, 50-446/86-22. NRC inspections of SSEs were performed and documented in NRC Inspection Report 50-445/87-04; 50-446/87-04.

The results report concludes that there is reasonable assurance that the grout placements have been adequately performed in conformance with the design based on the results of the activities performed and documented in the working files. No corrective action recommendations were listed in the Results Reports.

The NRC inspector reviewed documentation in the CPRT working files that supports CPRT activities and conclusions for this population including: (1) population description, homogeneity justification, and sampling methods; (2) matrices used for determining adverse trends and tabulating deviations versus attributes; (3) documentation used as reference for the identification of inspection attributes and the compilation of CPRT inspection procedures; and (4) justification for the root causes, generic implications, recommendations, and conclusions detailed in the Results Report.

The conclusions stated in the Results Report appeared to be justified by the details of the report and supporting working files noted above. No violations or deviations were identified. This activity is complete and no further NRC inspection is planned for this reference item.

7. Exit Meeting (30703)

On February 29, 1988, R. F. Warnick, H. H. Livermore, and J. S. Wiebe met with L. D. Nace and A. B. Scott to discuss February inspection findings and other matters of interest.

An exit meeting was conducted March 1, 1988, with the applicant's representatives identified in paragraph 1 of this report. No written material was provided to the applicant by the inspectors during this reporting period. The applicant did not identify as proprietary any of the materials provided to or reviewed by the inspectors during this inspection. During this meeting, the NRC inspectors summarized the scope and findings of the inspection.