

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-498/87-16
50-499/87-16

Construction Permits: CPPR-128
CPPR-129

Dockets: 50-498
50-499

Licensee: Houston Lighting & Power Company (HL&P)
P. O. Box 1700
Houston, Texas 77001

Facility Name: South Texas Project (STP), Units 1 and 2

Inspection At: South Texas Project, Matagorda County, Texas

Inspection Conducted: April 27 through May 22, 1987

Inspectors:

D. M. Hunnicutt
for J. I. Tapia, Reactor Inspector, Operations
Section, Reactor Safety Branch

6/9/87
Date

R. C. Stewart
R. C. Stewart, Reactor Inspector, Operations
Section, Reactor Safety Branch

6/8/87
Date

Approved:

D. M. Hunnicutt
D. M. Hunnicutt, Chief, Operations Section
Reactor Safety Branch

6/9/87
Date

Inspection Summary

Inspection Conducted April 27 through May 22, 1987 (Report 50-498/87-16;
50-499/87-16)

Areas Inspected: Routine, unannounced inspection of site design activities and
licensee action on previously identified inspection findings.

Results: Within the two areas inspected, no violations or deviations were
identified.

DETAILS1. Persons ContactedHL&P Personnel

S. Head, Supervisor, Project Compliance
W. Evans, Engineer, Project Compliance

Bechtel

C. Humes, Project Engineer
C. Kraft, Quality Engineer

2. Licensee Action on Previously Identified Inspection Findings

An inspection was conducted of the licensee's response to the following items identified during the NRC Construction Appraisal Team (CAT) inspection (NRC Inspection Report 50-498/85-21; 50-499/85-19):

a. Incorporation of Changes into Drawings (CAL 85-21-52, PEA 2.b Violation 86-12-10)

This item concerned the discrepancies observed in FCRs and FCNs being modified upon incorporation into the referenced design drawings.

Engineering department procedures have been revised (EDP-4.47 Revision 5, EDP-4.49 Revision 7, and EDP-4.62 Revision 6). The procedures now require that if technical information contained in the previously approved amendment is changed, the change can only be made by the issue of another amendment. Editorial changes must be identified in the revision block of the parent document. The appropriate personnel have received retraining regarding the revised procedures. This item is considered closed.

b. Concrete Expansion Anchor (CEA) Not Derated Per IEB 79-02 (CAL 85-21-40)

The NRC CAT inspector reviewed Wiss, Janney, Elster, and Associates (WJE) Report No. 81C52Q, entitled "Tension, Shear and Relaxation Testing of Expansion Anchors at the South Texas Project," dated May 29, 1981, and found that two individual tests for the 1/4-inch diameter CEAs indicated ultimate load capacities lower than the allowable load times the required 4.0 factor of safety. Specification 5A010SS1000, "Installation of Expansion Anchors, Rock Bolts, Grouted Anchor Bolts, and Core Drilling for the South Texas Project," Revision 7, gives the allowable loads derived from the STP - specific test performed by WJE. The test report submitted by WJE was reviewed by the NRC inspector in conjunction with the review of the licensee's response to NRC Bulletin No. 79-02 (see NRC Inspection

Report 50-498/86-25; 50-499/86-23). It was found that the allowable tensile load adopted for the CEAs in question was the average of 12 individual test results reduced by one standard deviation. This value was found to be 976 lbs. and was rounded-off to 1000 lbs. The value identified by the NRC CAT inspector (890 lbs.) was based on three individual test results and did not include all of the test data available.

The specified capacity for 1/4-inch CEAs with 1 1/8-inch minimum embedment, after applying the 4.0 factor of safety to the 1000 lbs. is 250 lbs. The adopted value of 1000 lbs. is conservative when compared to the manufacturer's published rated capacity of 1453 lbs. Based on the results of the NRC inspector's review, this matter is considered closed.

c. Slippage of Concrete Expansion Anchors (CAL 85-21-41)

The NRC CAT inspector also reviewed the CEA load/slip curves documented in Appendix C of WJE Report No. 81C52Q. The CAT inspector expressed concern that for the 1 1/4-inch diameter CEAs at the allowable load of 5.7 kips specified for the standard minimum embedment of 8 1/2-inches, the tested slippage was 1/16-inch. The CAT inspector also noted that at the increased allowable load of 8.6 kips specified for the deeper embedment of 10 1/2-inches, the slippage was 3/16-inch. It was the CAT inspector's opinion that the identified slippages had not been adequately considered in the design criteria in that they did not represent repeated loading and that the impact on the piping system analysis had not been considered.

The licensee agreed with the CAT inspector that the slippage of 3/16-inch, corresponding to the increased allowable load for the deeper embedment length, was high and potentially adverse to the pipe stress and the distribution of loads to the pipe supports. Accordingly, Specification No. 5A010SS1000 was revised to preclude the use of the higher loads allowed for deeper embedment lengths. The licensee performed a review to identify any designs which specified deeper embedments to obtain higher allowable loads. Since the deeper embedment lengths required bolts of nonstandard lengths, only 20 supports were identified in the licensee's review. The identified pipe supports were reanalyzed to determine whether the actual design loads were below the load level corresponding to the slippage of 1/16-inch which was analyzed and found to be acceptable. Three supports were identified as having high design loads and were reworked by field change requests to replace the unacceptable wedge-type CEAs with ductile-type.

The potential slippage of 1/16-inch was considered to be acceptable by the licensee. The NRC inspector reviewed the technical basis for the licensee's position in light of the CAT inspector's concerns. It was determined that although the stress analyses of piping systems did not include a specific numerical allowance for the variation in

pipe support stiffness that could be introduced by the slippage of 1/16-inch, the analyses implicitly recognized a finitely bounded stiffness of pipe supports which provided an envelope of values to account for variations in actual stiffness. In addition, the design analyses also considered the potential maximum clearance of 1/8-inch which would result from the allowed installation gap of plus or minus 1/16-inch between pipe and support. These two design considerations introduce a margin in the analyses which negates the effect of a 1/16-inch deflection on the expected stiffness of the pipe supports. The deflection of 1/16-inch is only expected upon full capacity loading which is applicable to few supports.

Specification No. 5L010JQ1000, "Design Criteria for Pipe Supports," Revision 6, Table 4.36.1-1, provides design criteria restrictions for the use of wedge-type CEAs. This document precludes the use of wedge-type CEAs in pipe supports for ASME Class 1 piping of all sizes and for ASME Class 2 and 3 large bore piping subject to vibratory loading. The design criteria restrictions effectively control potential slippage effects by allowing wedge-type CEAs only for non-Class 1 small bore piping and for non-Class 1 large bore piping which is not subject to vibratory loading.

The potential slippage of CEAs accepted in the design analyses does not reduce the ultimate load capacity of the CEAs. The structural designs of cable tray supports, conduit supports, HVAC duct supports and other miscellaneous supports are based on equivalent static analyses using peak spectral seismic responses that are independent of specific natural frequencies. Therefore, the design of these supports are not affected by the potential slippage of the CEAs. The slippage only has the potential to affect the design of pipe supports which involve considerations of stiffness under vibratory loads. Based on the results of the NRC inspector's review, the design criteria correctly incorporates the results of the load/slip curves and the CAT inspector's observations. This item is considered closed.

3. Onsite Design Activities

An inspection was conducted to determine whether onsite design activities, including controls for engineering and construction initiated field changes, were being conducted in compliance with the technical and quality assurance requirements described in the STP FSAR. Revision 17 of the QA Program Description (QAPD) for the design and construction phase of the STP was submitted by HL&P on March 23, 1987, in accordance with the requirements of 10 CFR 50.55(f)(3). This document was reviewed by the NRC inspectors and found to satisfy the design control criteria of 10 CFR 50, Appendix B.

Bechtel Project Quality Program Manual represents the Bechtel Western Power Corporation Quality Program for the STP. It describes the requirements of Bechtel Topical Report BQ-TOP-1, Revision 3A, as modified

in Part B of I&P Quality Assurance Program Description. This manual also describes the quality program related activities of engineering, procurement, construction management, and quality assurance for the STP.

The following implementing procedures utilized in the QA program of the principal designer were reviewed by the NRC inspectors:

- a. Bechtel Engineering Department Procedures (EDPs) -
 - ° No. 4.1, "Design Criteria," Revision 5
 - ° No. 4.37, "Design Calculations," Revision 5
 - ° No. 4.46, "Project Drawings," Revision 8
 - ° No. 4.47, "Drawing Change Notice (DCN's)," Revision 5
 - ° No. 4.49, "Project Specifications," Revision 7
 - ° No. 4.50, "ASME Component Design Specifications," Revision 4
 - ° No. 4.55, "Project Material Requisitions (PMR's)," Revision 5
 - ° No. 4.61, "Non-Conformance Reports (NCR's)," Revision 2
 - ° No. 4.62, "Field Change Request/Field Change Notice (FCR's/FCN's)," Revision 7
 - ° No. 4.63, "Supplier Deviation Disposition Request (SDDR's)," Revision 6
- b. STP Standard Site Procedures (SSPs) -
 - ° No. 8, "Nonconformance Reporting," Revision 3
 - ° No. 34, "Technical Requirements and Walkdown Procedure for As-Building of Piping Systems," Revision 3
 - ° No. 37, "Configuration Control Package," Revision 2
 - ° No. 39, "Engineering Procedure for As-Built Reconciliation of Safety-Related Piping Systems and Associated Pipe Supports," Revision 1
 - ° No. 45, "Field Material Requisition Preparation and Approval," Revision 1
 - ° No. 49, "Field Change Request," Revision 1

c. Bechtel Work Plan Procedures (WPPs) -

- ° No. 20.1, "Field Change Notice," Revision 8
- ° No. 22.2, "Guidelines for Notifying ECI On Changes To SEO I&C Generated Drawings," Revision 0

d. Ebasco Site Instruction -

- ° No. 2.17, "Requests for Engineering Assistance," Revision 2

The NRC inspectors found that the reviewed procedures and instructions are employed for control of engineering design work to meet technical and regulatory requirements. These controls identify responsibilities and provide procedures to assure that the design requirements are correctly translated into the final design. The controls also provide for preparation of appropriate documentation to permit review of the process used and of the results obtained. The controls provide for the identification and specification of appropriate quality standards and for control of changes and design interfaces. Design criteria are assembled by the project during the initial stages of design. These criteria include the criteria contained in safety analysis reports and other project requirements. The design criteria are maintained current and serve as a basis for preparation of the final design.

The design control program incorporates measures for identification and control of design interfaces among the various engineering disciplines on the project, between the project and technical support groups within Bechtel, and of such external interfaces as the construction contractor, nuclear steam supply system supplier, other equipment suppliers and contractors performing design work, and HL&P. These measures include: (a) identification of technical responsibilities of the various design groups and provisions for coordination of design documents among them, (b) description of responsibilities of provisions for coordination with other design and engineering support groups within Bechtel, and (c) definition of interfaces and control of communication with organizations external to Bechtel.

Essentially all engineering documents are prepared by project personnel and include drawings, specifications, design analyses, system descriptions and technical reports. They are verified or checked in accordance with project procedures. Project group supervisors are responsible for all engineering work performed within their discipline and for approval of engineering documents prepared within their groups. Procedures and instructions for verification and checking of drawings, calculations, and specifications are included in the procedures governing the preparation of these documents. These procedures identify the positions of individuals responsible for verification or checking and require that design errors be identified and followed up through correction. Verifiers and checkers on the project are required to verify the incorporation of required corrections. Documents cannot be released without verification or

checking. Key design documents for systems and structures important to safety are subject to design verification, which may be accomplished by:

- (a) critical design reviews, either individual or interdisciplinary;
- (b) alternate calculations; or (c) qualification testing.

Design verification is performed for the following key documents: system descriptions, flow diagrams, piping and instrument diagrams, control logic diagrams, electrical single-line diagrams, structural systems for major facilities, site arrangement, and equipment location drawings. Specifications, calculations, and computer programs in support of the key documents are verified. Documentation of the design verification is provided by a design verification report signed by the appropriate individual. Design documents other than key design documents, identified above, are checked for technical correctness and conformance to design input requirements.

Engineering department procedures establish the extent of checking, the duties of the checker, and the extent of his responsibility to which he attests with his signature or initials. The signature or initials of the checker and date affixed on the design document in accordance with the engineering department procedure satisfies the criteria of the Regulatory Guide 1.64. Traceability of characteristic signatures and initials to the individual is provided.

Design changes, including field changes, are subjected to design control measures commensurate to those applied to the original design. Checking and review of design changes are performed by the project engineering team to the same level as that of the original design. Changes to design requirements or completed designs produced by project engineering, which may be proposed by suppliers and contractors, are required to be reviewed and accepted by project engineering.

In the case of proposed changes to the original design initiated at the construction site, the design changes are reviewed, accepted, and documented by Bechtel site engineering. "Work authorization acceptance" of design changes is required prior to implementation. "Work authorization acceptance" of field change requests by unit engineering is permitted; however, site engineering confirms "work authorization acceptance" within the time period designated in the applicable procedures. Final inspection may be based on unit engineering accepted field change requests, subject to reinspection if project engineering does not confirm unit engineering acceptance. For design changes proposed by suppliers, acceptance of the design change by project engineering is required prior to shipment of the item to the jobsite. In all cases, approval of the proposed design change by project engineering is required prior to fuel load.

Certain design work may be performed by Bechtel site engineering providing it is in compliance to the design control features utilized in the design office by Bechtel project engineering. Suppliers are not allowed to change Bechtel design requirements or Bechtel reviewed supplier design

documents without obtaining approval by Bechtel project engineering. Constructor/contractor construction site changes to engineering design are documented by means of change requests which require authorization by project engineering. Significant or unique changes are authorized individually. Project engineering may give written authorization in the form of specifications or other instructions to field organizations to make routine changes. Field organizations have the authority to approve changes to design details in cases where the original design details were prepared by that field organization.

The NRC inspectors reviewed four FCRs and two FCNs which were randomly selected from the HL&P records management system for independent review. This review provided verification of the programmatic adequacy and proper implementation of Bechtel procedures affecting the control of quality-related design activities.

4. Exit Interview

The NRC inspector met with licensee representatives and the resident inspector at the conclusion of the inspection and discussed the results of the inspection.