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OFFICE OF INSPECTION AND ENFORCEMENT

Division of Quality Assurance, Vendor, and  
Technical Training Center Programs  
Quality Assurance Branch

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Licensee: Houston Light & Power Company

Facility Name: South Texas Project Unit 1

Inspection At: Stone and Webster Engineering Corporation, Boston, MA

Inspection Conducted: April 23-26, 1985

Inspection Team Members:

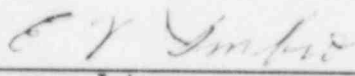
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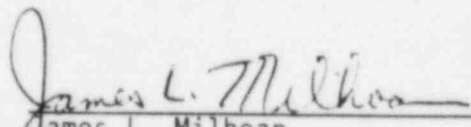
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 6/25/85  
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## SOUTH TEXAS PROJECT - UNIT 1

### Implementation Inspection of Engineering Assurance Program

April 23 through 26, 1985

#### 1. Background

On March 1, 1984, representatives of the Houston Lighting and Power Company (HL&P) presented to the Quality Assurance Branch of the Office of Inspection and Enforcement, USNRC, the details of the Engineering Assurance Program (EAP) being conducted on the South Texas Project (STP). As a result of this meeting, and additional information provided by HL&P, the NRC determined that the Engineering Assurance Program, if properly implemented, could provide the additional assurances of design adequacy normally provided by an Independent Design Verification Program (IDVP). Formal acceptance of the EAP as a substitute for an IDVP was provided via an August 20, 1984, letter to HL&P.

Since the STP Engineering Assurance Program is an on-going program, the NRC decided to monitor the effectiveness of the program in three phases: (1) implementation of the program plan and procedures, (2) review and evaluation of audit results, and (3) follow-up of corrective action. This inspection report addresses the first phase of the NRC's monitoring program. In particular, the NRC Inspection Team evaluated the depth of review being performed by the Engineering Assurance Contractor [Stone and Webster Engineering Corporation (SWEC)] for Independent Technical Assessments (ITA) 85-1 (Control Room HVAC), 85-2 (Component Cooling Water System) and 85-3 (Off-site AC Power Supply Systems). ITA 85-1 was essentially complete (although not finalized and published), 85-2 was in the early stages of review and 85-3 had only scope and document review plans available.

#### 2. Purpose

The purpose of the inspection was to establish that the independent technical assessments were being conducted in accordance with approved program plans and were in sufficient technical depth to evaluate the adequacy of the design and design process at the South Texas Project.

#### 3. NRC Inspection Team

<u>Assignment</u>	<u>Name, Position</u>
Team Leader	E. Imbro, Senior Inspection Specialist, IE
Mechanical Systems	T. DelGaizo, Consultant, WESTEC Services
	G. Overbeck, Consultant, WESTEC Services
Mechanical Components	R. Parkhill, Inspection Specialist, IE
	S. Gula, Consultant, Harstead Engineering
Electrical/I&C	G. Morris, Consultant, WESTEC Services
Civil/Structural	H. Harstead, Consultant, Harstead Engineering
	*J. Milhoan, Section Chief, Quality Assurance Branch, IE

\*Attended Exit Meeting

#### 4. Personnel Contacted

A large number of Applicant and Engineering Assurance Contractor personnel were contacted during the inspection. The following is a brief list of key personnel contacted:

<u>Name</u>	<u>Organization</u>	<u>Position</u>
R. Frazar	HL&P	EA Program Manager
S. Basu	HL&P	EA Program Staff
M. Chakravorty	HL&P	EA Program Staff
P. Garfinkel	SWEC	VP & Sr. Eng. Manager
W. Eifert	SWEC	Chief Engineer, EA
A. Banerjee	SWEC	STP EA Project Manager

#### 5. General Conclusions

There was evidence of substantial review of design calculations, piping, and instrument diagrams, electrical diagrams, design specifications, and other design documents. In view of this review effort, and the personnel interviewed (both HL&P and SWEC) and the number and type of deficiencies being uncovered by the Engineering Assurance Program, the NRC Inspection Team is satisfied, assuming satisfactory resolution of the items in this inspection report, that the Engineering Assurance Program for South Texas Project is capable of evaluating the adequacy of design and effectiveness of the design process for the systems being reviewed.

#### 6. Specific Comments

Specific comments on a technical discipline basis are included in the following attachment.

SPECIFIC COMMENTSI. Mechanical Systems/Power Engineering

In the mechanical discipline, the NRC Team found the depth of review consistent with that of an IDI or IDVP. The Team also found the SWEC reviewers to be highly qualified technically and familiar with the technical issues and the concerns expressed by the NRC Team. The following comments are considered noteworthy:

1. The Team found that the Control Room HVAC Mechanical Design Documents provided by BEC to SWEC were recently revised and updated just prior to commencement of the review effort. However, the team observed that in review topic 85-2, Component Cooling Water System, this was not the case. The adequacy of the method by which the EAP selects review topics and is assured that these topics are representative of the design process remains an open item.
2. SWEC Document Review Plans for four calculations were reviewed. From this review, the Team was concerned that SWEC was not systematically verifying design inputs and assumptions. The adequacy of the verification process remains an open item. Examples to support this concern are presented below.
  - a. The SWEC reviewer of HVAC calculations did not verify the correctness of references identified in the design calculations as sources of design input and therefore has not confirmed the traceability of design input through to the final design. For example, calculation 5V119VQ1023 identified a design criteria document as a source of temperature inputs; however, this document was not in SWEC's set of review documents (design criteria document 5V019VQ1031 Rev. 1). The Team was informed that the outside design temperature conditions were verified by the SWEC reviewer through use of the FSAR.
  - b. In review of calculation 5Z149ZQ1000, the SWEC reviewer did not use referenced drawings to confirm design inputs. For the length of duct dimensions used in the calculation, the SWEC review used an HVAC arrangement drawing instead of an architectural drawing. The required information was not dimensioned and the reviewer scaled the required information from a half size reduction. The referenced drawing was not in SWEC's set of review documents.
  - c. The Team also observed instances where the referenced documents no longer contained the needed design information. The team found this particularly true of specification references. For example, in calculating the heat load from an air handling unit in Room 307 (CR AHU 3V111VAH009) input values for horsepower and motor efficiency were used and a reference made to the procurement specification for the air handling units. The data sheet for this air handling unit did not specify the motor efficiency or horsepower (typically this is vendor supplied data). The Team was informed that vendor data was obtained to confirm the data; however, a comment was not provided on the document review sheet.

- d. The SWEC reviewer did not consistently identify assumptions and inputs that required confirmation at a later date. For example, design criteria #5 of Calculation 3V110MC5148 was not identified as an input that needed confirmation at a later date. The design criteria incorporated design input obtained from BEC's control group. For Room 202, the Team found that many of the inputs came from verbal communications, manufacturer's proposals, and engineering estimates. In another example, the reviewer did not identify that the location of radiation detectors in calculation 3V111MC5857 was based on preliminary information.
3. Regarding technical matters, the Team has comments concerning two issues:
    - a. The first issue involves the completeness of the verification performed by SWEC to confirm the adequacy of the Control Room HVAC system with respect to the single failure criterion. Specifically, the Team found that the extent of the single failure review was limited to a review of document 4RA369NQ1004. This document is a generic design criteria document and is not specific to the Control Room HVAC system. The Team observed that the same document is to be reviewed for the component cooling water system. The ability of each system reviewed to meet the single failure criterion must be individually assessed to fulfil the intended audit scope. The adequacy of audits with respect to the single failure criterion remains an open item.
    - b. The second issue involves an assumption used to arrive at the heat load from energized cable in cable trays which needs further technical justification to confirm its adequacy. Specifically, in calculation 3V110MC5148, a design input was used for heat load based upon an assumption that at any time, only 60% of all cables in cable trays are energized. The Team determined that the SWEC reviewer accepted this assumption based upon his engineering judgment and a technical approach described in an IEEE paper. The Team believes that the auditors should have requested the project organization to provide justification for applicability of the approach to this plant. The use of the above assumption remains an open item.
  4. The following are additional items which were observed throughout the course of the inspection or provide additional details relative to the more general comments provided above.
    - a. The closure time of the isolation dampers for the Control Room HVAC system was based upon the procurement specification. The SWEC reviewer requested additional information through RFI-1 and received Damper Data Sheets 242 and 245. The data sheets were a copy from Revision 1 of the specification, not from the Material Requisition. The specification indicated that Appendix C (the data sheets) had been deleted from the specification and made reference to Section 3 of the Material Requisition. The adequacy of the verification of this design input remains an open item.
    - b. There was an undocumented assumption in Calculation 3V111MC5857 regarding the location of the radiation detectors. In discussions with BEC, HL&P, and SWEC, it was learned that the detectors will be located at a later time and the location for purposes of the calculation



is a best estimate of the final location. The assumption regarding the location of the radiation detectors in the calculation remains an open item.

- c. Reference 7 of Calculation 5V019VQ1031, Rev. 1 could not be located in the SWEC documentation. Apparently, the SWEC reviewer relied upon FSAR information to verify the numbers in the calculation. Verification of the calculational input remains an open item.
- d. Design Criteria Item 4 states that heat gain from electrical equipment, cable trays, and lighting assumes that at any time only 60% of all trays (Class 1E and Class non-1E) are energized. This assumption does not appear to have been confirmed by BEC. The assumption is based upon another assumption that during an emergency condition, a loss of offsite power condition exists and that all non-1E loads are lost. This may not be the case. The Team further believes that these assumptions will not have significant impact on the sizing of equipment in the Control Room; however, they could be significant in the design of Switchgear Room cooling equipment. It appears that these assumptions are used elsewhere in the plant including Switchgear Rooms. The justification of these assumptions for the aforementioned applications remains an open item.
- e. In calculating heat loads from the air handling unit in Room 307 (3V111VAH009), input values for horsepower and motor efficiency were referenced to the procurement specification for the unit. The data sheet did not specify these values. Apparently, these values were estimates (50 HP and 89% efficiency) which were not properly documented. The justification of these assumptions remains an open item.

## II. Mechanical Components/Engineering Mechanics

In the area of engineering mechanics, the NRC Team found the depth of review consistent with that of an IDI or IDVP. The Team also found the SWEC reviewers to be highly qualified technically and familiar with the technical issues and concerns expressed by the NRC Team. Since the SWEC mechanical components review of 85-2 had not yet progressed to completing the checklists, the NRC Team inspected SWEC's depth of review associated with 85-3 "Stress Analysis of the RHR/SI System" and 83-4 "Pipe Support Design of the RHR/SI System." The following comments are considered noteworthy.

- 1. Regarding the structural frame analysis program, BISEPS, which is used extensively in the design of pipe support frames, it did not appear that SWEC reviewers familiarized themselves with the inputs and outputs of this program by referring to the users manual. Specifically, the SWEC reviewer was not able to explain to the satisfaction of the Team that he understood how Beta angle was input. Your verification of the adequacy of this program for the application remains an open item. This verification may be warranted since SWEC does not utilize this program as its standard practice.
- 2. It was not apparent to the team how the engineering mechanics department at SWEC is reviewing the effectiveness of the project's handling of design changes in the pipe stress and pipe support areas. The adequacy of the review plans for this area remains an open item.

### III. Electrical Discipline/Instrumentation & Control Discipline

In the electrical and I&C areas, the NRC Team generally found the depth of review consistent with that of an IDI or IDVP. The Team also found the SWEC reviewers to be highly qualified technically and familiar with the technical issues and concerns expressed by the NRC Team. The following comments are considered noteworthy:

1. The Team reviewed the draft SWEC electrical inputs to the Document Review Plan (DRP) for Task 85-1 Control Room HVAC system.
  - a. The NRC Team found that SWEC inputs to the DRP did not specifically identify the applicable FSAR Section, Design Criteria, Standards, etc. Documents reviewed were not referenced by Document Number and revision date as well as Document Title. How HL&P plans to ensure the DRP's traceability remains an open item.
  - b. A number of items in the specific task plan were not reviewed at this time. HL&P's review of the following areas remains open pending confirmation that they have been included:
    - 1) Motor operated valve feeder sizing and overload heater selection will be covered in Task 85-2 because there were no MOVs in the HVAC system studied.
    - 2) Motor starting and running voltage as well as equipment grounding will be reviewed in 85-3.
2. The Team also reviewed the controls sections to Task 85-1 and had the following comments:
  - a. The Team observed that the system description and the set point calculations had not yet been prepared and therefore the SWEC reviewer correctly identified this portion of the review as indeterminate. Review of these documents remains an open item.
  - b. The Team found that the following interfaces identified in the Control Room HVAC system design criteria and the scope document for Task 85-1 were not included in the SWEC review. Review of these interfaces remains an open item.
    - 1) The system design criteria indicates that the chilled water supply is required to maintain the Control Room air handling unit discharge air at 53°F. The Team noted that chilled water was controlled by a three-way on-off valve in series with the cooling coil. This would put full cooling water flow either through the coil or completely bypass the coil. The ventilation calculations used a maximum discharge temperature of 53°F. The control circuit was not reviewed by SWEC.
    - 2) The system design criteria requires that the control of deluge valve for the fire protection on the charcoal filters prevent inadvertent actuation. This control system was not reviewed by SWEC.

- c. In certain instances, the Team found that the SWEC review did not identify or question the effect of potential failures of non-safety-related equipment on the safety-related equipment.
    - 1) Nine large non-safety-related duct heaters are required by the design criteria to be tripped on an accident condition. While the reviewer did verify that an interlock was provided from the engineered safety features actuation system to trip these units, the reviewer failed to note that this interlock was used in a non-safety-related dc control circuit to trip non-safety-related load center breakers. This type circuit must be energized to trip the load. Because non-safety-related equipment was utilized to trip these loads, load shedding could not be assumed. The HVAC calculation for the Control Room ventilation is based upon no heat input from these sources.
    - 2) The Computer Room cooling unit is non-safety-related and is fed from the normal chilled water system. No review had been performed to review the potential flooding effects in the Control Room area caused by failure of the Computer Room cooling unit during a seismic event. Also the system design criteria implies that the Computer Room cooling unit is shutdown during plant upset condition. This would eventually force the plant computer to be shutdown. This area had not been reviewed by SWEC.
  - d. Approximately twelve different type instrumentation devices are used on this system. The team found that the reviewer only looked at the toxic gas analyzer. The radiation monitors, which were specifically identified in the scope document and in the document review plan, had not been reviewed by SWEC because the documentation was not available. The Team also noted that, contrary to their expectations, SWEC did not include one complete instrument loop in their review. The Team had expected to see a sample of complete instrument loops reviewed from the sensor through the transmitter, to the electronic processing equipment, to the output signals, to the controlled devices and monitors. Review of the aforementioned areas remains an open item.
3. The Team also reviewed the scope document and document review plans for Task 85-3 Part II medium voltage AC. The following items remain open pending confirmation that they have been included in SWEC's review of 85-3:
- a. System short circuit studies are limited to the medium voltage switchgear rather than extended to the medium voltage containment electrical penetrations.
  - b. The control of the loading of the diesel generator did not include a review of the emergency power sequencer (interdiscipline interface).



- c. The review of the control of the medium voltage switchgear was not extended to the capability of the dc bus to adequately supply dc control power from the 125 V dc batteries (system interface).
- d. Protective relaying calculations were not reviewed for different type loads on the medium voltage buses including motors, load centers, and backup protection for the electrical penetrations.
- e. A review of the NSSS interface did not include the undervoltage and underfrequency inputs into the reactor protection system and the NSSS outputs to the medium voltage switchgear.