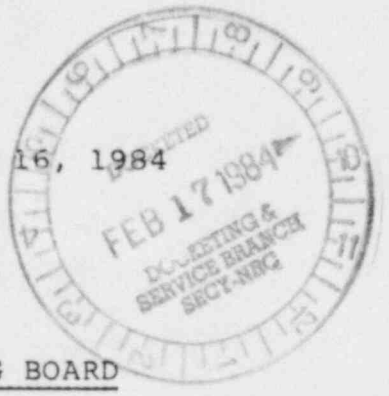
February 16, 1984



UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 50-445
TEXAS UTILITIES ELECTRIC COMPANY, ET AL.	)	50-446
	)	
	)	(Application for
(Comanche Peak Steam Electric Station, Units 1 and 2)	)	Operating Licenses)
	)	

APPLICANTS' EXPECTED FINDINGS OF FACT
REGARDING INDEPENDENT ASSESSMENT PROGRAM
FOR COMANCHE PEAK STEAM ELECTRIC STATION

By Memorandum and Order of December 28, 1983, the Atomic Safety and Licensing Board ("Licensing Board") directed that prior to future hearings each party must file findings of fact it expects will result from those hearings. During the February 20-24, 1984 hearings, the Independent Assessment Program ("IAP") performed by Cygna Energy Services for Texas Utilities' Comanche Peak Steam Electric Station will be addressed. These expected findings of fact set forth the principal facts concerning the IAP which Applicants believe will be established by the evidence presented during those hearings. Applicants also set forth below the principal conclusions we believe the Board should reach regarding Cygna's evaluation. Additional information presented during the hearings as a result of the Board's and parties'

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examination of the Cygna witnesses will be included in revised expected findings in accordance with the Board's instructions. Applicants' findings set forth below are arranged to address each of the following topics: (1) the origin and purpose of the IAP, (2) the development of the IAP and selection of the reviewer, (3) the scope of the IAP, (4) the methodology employed in the review, and (5) the results and conclusions of the IAP.[1]

With respect to the testimony of the intervenor's witnesses on this topic, we note below the general thrust of Applicants' cross-examination. However, without knowing what Cygna's response to these matters will be, we are unable to anticipate the precise areas we will examine.

I. ORIGIN AND PURPOSE OF IAP

The IAP for Comanche Peak was performed at the request of the NRC Staff to provide them with "added assurance" regarding the adequacy of the Comanche Peak facility. Specifically, while the Staff requested that some type of evaluation effort be performed, it also noted that there was no evidence of a major breakdown in quality assurance programs at Comanche Peak. Thus, the Staff did not seek an evaluation of the same scope as

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1 Applicants understand that Cygna intends to revise or clarify certain of its findings to reflect additional information received by Cygna subsequent to issuance of the draft report. Thus, Applicants may further revise their proposed findings to reflect such changes.

previous full Independent Design Verifications performed by other utilities. (See May 4, 1983, Memorandum to Licensing Board from Thomas M. Novak.)

II. CYGNA EXPERIENCE

Cygna was an appropriate organization for conducting the IAP and in view of its experience in performing such reviews and related projects in the nuclear power field.[2] More specifically, Cygna is an independent engineering consultant which has extensive experience in performing engineering and quality assurance assessments and reviews for a number of major construction projects throughout the United States. In addition, Cygna has previously performed two Independent Design Verification Programs for nuclear power reactors, viz., Mississippi Power & Light's Grand Gulf Unit 1, and Detroit Edison's Fermi 2 reviews. Further, Cygna has also provided engineering and consulting services in the nuclear power field for, inter alia, Pacific Gas & Electric Company, Commonwealth Edison Company, Bechtel Power Corporation, Yankee Atomic Electric Company, and Northeast Utilities Service Company. (Cygna Report at 1-4.) These efforts have provided Cygna with the experience necessary to perform the IAP for Comanche Peak and provide a high level of assurance that the results of the IAP are accurate and reflect the quality of design at Comanche Peak.

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2 Cygna was formally approved to perform the Comanche Peak IAP by NRC Staff letter of September 23, 1983, to Mr. R. J. Gary.

In addition to findings regarding Cygna's overall experience and qualifications, it will be demonstrated that the team of reviewers assigned to the Comanche Peak IAP, including the Project Team, the Senior Review Team and in-house consultants, were highly experienced and fully qualified to perform the review. In particular, the Project Team members had considerable experience in the specific areas for which they were responsible and many had performed similar functions in the two IDVP's performed by Cygna. Further, the Senior Review Team was composed of recognized experts in technical fields related to the IAP scope and highly experienced individuals who reviewed all conclusions reached by the Project Team and were the final authority regarding resolution of those conclusions. (Cygna Report at 1-4.) The high degree of expertise possessed by the Cygna Teams provides a high level of assurance that their findings and conclusions are accurate and correctly reflect the adequacy of the design and construction programs at Comanche Peak which were reviewed by Cygna and may be relied upon in drawing conclusions regarding the overall adequacy of design and construction at Comanche Peak.

C. Independence

Cygna Energy Services is fully independent of Applicants and, thus, its findings and conclusions were not influenced by the Applicants. Further, appropriate controls were imposed and implemented regarding communications between Applicants and Cygna

during the performance of the review which further assure that independence was maintained and the potential for or appearance of undue influence of Cygna by Applicants was eliminated. (See Cygna Report at Appendix A; Letter from D.G. Eisenhut to R.J. Gary, September 23, 1983.) This independence assures that Cygna's findings and conclusions fully reflect their own opinions and may be relied upon and should be given considerable weight by the Board in making its own determinations.

III. PROGRAM SCOPE

The Cygna Report demonstrates that the scope of the IAP for Comanche Peak was selected in accordance with the desires of the NRC Staff and is of sufficient breadth and depth to provide a sound basis for drawing conclusions regarding the adequacy of the design program and related activities for Comanche Peak. The program objectives, the systems selected for review and the horizontal and vertical reviews performed provide adequate data on which to find that the design and design control systems are adequate. The specific factual findings we expect the Board to make are set forth below.

A. Program Objectives

Consistent with requests of the NRC, the following objectives were specified for the CPSES Independent Assessment Program:

1. To assess the adequacy of the design control system,

2. To verify implementation of adequate elements of the design control system,

3. To assess the design adequacy of a selected system, and

4. To verify the selected as-built configuration.

The overall program included a broad review of the design control program within Texas Utilities and Gibbs & Hill, the architect/engineer for CPSES. This "horizontal" review was supplemented by "vertical" reviews of selected elements of the overall design and design control process. These vertical reviews evaluated implementation of three design control elements, viz., design analysis, design changes and interfaces, one design element (Residual Heat Removal/Safety Injection System, Train B) and one as-built verification element (Spent Fuel Pool Cooling System Train "A"). (Cygna Report at 2-1.)

B. System Selection

The systems selected for the independent review were chosen to satisfy the guidelines expressed in NRC letters to Applicants of May 4 and July 15, 1983, regarding the scope of the review. These guidelines provided for a review that included a cross-section of disciplines, characteristics which cannot be verified by normal means (such as performance testing), several organizational interfaces, and design changes.

In order to select a system appropriate for the vertical (implementation) review, Cygna applied several criteria, drawn from the NRC's July 15, 1983, letter to Applicants. These criteria were, as follows:

1. The review should involve a safety-related system;

2. The system review should include a design and materials interface with the Nuclear Steam Supply System (NSS) vendor, Westinghouse;

3. The system review should include a design and materials interface with the Architect/Engineer (A/E), Gibbs & Hill;

4. The review should involve a system with demanding design parameters; and

5. The review should include a system which has been turned over to the start-up group.

Based upon the above selection criteria, the vertical design review concentrated on the Residual Heat Removal (RHR)/Safety Injection System-Train B, from the containment sump line penetration to the RHR heat exchanger nozzle. To augment the technical review an implementation review of design analysis control was also performed on the design process associated with the RHR/Safety Injection Train B. (Cygna Report at 2-2.)

To provide added assurance that design changes and organizational interfaces were adequately controlled for a completed system, the Spent Fuel Pool Cooling System - Train A, was examined. This system was also the subject of the as-built verification aspect of the review to verify that the as-built condition matched the appropriate design documents. Similar to

the design review, the as-built verification covered the structural, electrical, piping, pipe support and instrumentation and control disciplines. (Cygna Report at 2-2 to 2-3.)

C. Design Control (Horizontal) Review

To ensure that an adequate design control program had been established for CPSES, Cygna evaluated the Design Control Programs governing CPSES design. This evaluation was constructed to determine (1) whether Applicants' design control activities, as defined in their design control program documentation, satisfied licensing commitments and project requirements; and (2) whether the design control activities of Gibbs & Hill satisfied the FSAR and project requirements. This "horizontal" review was conducted to ensure that an adequate program was in place to provide control over the design and related construction activities. (Cygna Report at 2-3.)

1. Review of Applicants' design control program

Cygna performed an evaluation of the key elements of the Applicants' design control program, as applied to CPSES design. The key program elements examined by Cygna included:

(1) Design input documents
(2) Design analyses control
(3) Drawing control
(4) Procurement control
(5) Internal/external interface control
(6) Design verification
(7) Document control (controlled documents), including revisions
(8) Design change control
(9) Corrective action

(10) Internal/external audits and surveillances

This evaluation also included a review of Applicants' design control program documentation to assess its satisfaction of FSAR commitments and project requirements with respect to the above key design control elements. (Cygna Report at 2-4.)

The objectives of the design control program review were, as follows:

(1) Determine the adequacy of the design control program in addressing specific quality commitments;

(2) Assess the impact (significance) of the design control program deficiencies and/or weaknesses with respect to commitments and requirements governing design; and

(3) Determine areas requiring concentrated attention during the design control program vertical implementation evaluation.
(Cygna Report at 2-4.)

2. Review of Gibbs & Hill design control program

In conjunction with Applicants' design control program review, Cygna performed a review of the Gibbs & Hill design control program to assess whether their design control program adequately addresses the commitments imposed through Applicants' contract documents and the FSAR. The Gibbs & Hill design control program was evaluated against the same key design control elements as the Applicants' design control program review. (Cygna Report at 2-5.)

D. Implementation Evaluations (Vertical Review)

To augment the programmatical horizontal reviews described above, five aspects of the design process were selected for evaluation of their implementation, viz., (1) control of design changes, (2) control of design analyses, (3) interface control, (4) design of the RHR/Safety Injection - Train B System, and (5) an as-built verification of the Spent Fuel Pool Cooling System - Train A. Because of the focus of this aspect of the review on particular systems, components, or processes, this was termed the "vertical" portion of the Cygna review, i.e., an in-depth evaluation of how the design process was being implemented. (Cygna Report at 2-5 to 2-6.) Each element or system included in the review is discussed below.

1. Design change controls

Cygna evaluated the adequacy of both Applicants' and Gibbs & Hill's implementation of their design change control systems, focussing on the Spent Fuel Pool Cooling System design drawings and specifications. Further, to supplement that evaluation, Cygna also reviewed the Brown & Root design change control program as it pertains to their responsibilities as N-stamp holder. In their review, Cygna verified by examination and evaluation of objective evidence that established design change control program elements had been implemented, assessed the

degree of implementation, and evaluated the impact (significance) of failures (if any) to implement the quality assurance program. (Cygna Report at 2-6 to 2-7.)

2. Design analysis control

With respect to the design analysis control evaluation, Cygna focused its activities on the Gibbs & Hill design of the Residual Heat Removal System - Train B. These evaluations were performed at the Gibbs & Hill offices both in New York and at the Comanche Peak jobsite. Using checklists, Cygna personnel reviewed calculations, computer programs, and their references to ensure that the procedures noted in the program review had been implemented. (Cygna Report at 2-7.)

3. Interface control

In the Interface Control implementation evaluation for Applicants and Gibbs & Hill, Cygna again focused on the design and construction of the Spent Fuel Pool Cooling System. To supplement this evaluation, Brown & Root activities in this area were also included. The external interface control review for Applicants evaluated activities performed by the following sub-contractors: Gibbs & Hill, ITT-Grinnell, Brown & Root (N-stamp review only), Joseph Oat, Reliance, Bingham Willamette, Borg-Warner and Posiseal. (Cygna Report at 2-7.)

4. Technical design review

In addition to the design control implementation review, Cygna performed a multi-disciplined technical design review of the Residual Heat Removal/Safety Injection System (RHR) - Train B. Cygna reviewed the design starting from the most recent revision of the drawings and applicable design documents. Cygna evaluated the mechanical; electrical, instrumentation and controls; and structural aspects of the design. Each review discipline is discussed below to provide additional insight into the depth of the efforts. (Cygna Report at 2-8.)

a. mechanical review activities

The mechanical review focussed on the pipe stress analysis of the RHR/Safety Injection System (Train B) piping from the containment sump penetration to the Heat Exchanger Nozzle and all branch lines out to the first anchor. Pipe supports located on the main flow path and branch line anchors, as well as the seismic qualification of the RHR pump, were also included. The review verified the design adequacy and ensured that technical information was properly transferred between organizations, such as from Gibbs & Hill to the pipe support designer. (Cygna Report at 2-8 to 2-9.)

b. structural review activities

The structural review of the RHR system consisted of a design check of the supports for the cable trays that carry the power supply cable to the pump. To verify the adequacy of these supports, Cygna reviewed (at a minimum) support spacing, loads and load combinations, stresses in structural members, welds, anchor bolts and baseplates, and allowable stresses. (Cygna Report at 2-9.)

c. electrical review activities

The electrical discipline review focused on two specific design areas. The first area of review was a portion of the RHR Train B pump motor power current, including the power circuit. The second focus of the electrical review was the control circuit for isolation valve 1-8811-B, located outside of the containment in the valve isolation tank. The review assessed the technical adequacy of control circuit design as it interfaces with annunciator system, process computer, monitor light box, and other motor operated valve control circuits. (Cygna Report at 2-10.)

5. As-built verification

The final activity of the vertical reviews was an as-built walkdown of the Spent Fuel Pool Cooling System - Train A which was conducted to assure that systems, components and structures were installed to the latest design documents. The as-built

review team performed a detailed field verification, including checks of components associated with the mechanical, structural, electrical, and instrumentation and control disciplines. (Cygna Report at 2-10 to 2-11.)

IV. INDEPENDENT ASSESSMENT PROGRAM METHODOLOGY

The scope and depth of Cygna's review of Applicants' and Gibbs & Hill's design control programs and program implementation provides an adequate basis on which to assess the adequacy of those programs. The review methodology employed by Cygna in the Comanche Peak IAP consisted of a thorough, systematic examination of information relevant to identified program objectives. Cygna's review methodology was appropriate for the review performed and assures that reliable and probative evidence of the adequacy of design control programs is presented by Cygna's Report. This methodology included documentation of the review activities, identification if items considered to be inconsistent with established review criteria, multi-level evaluation of each such item for potential safety and programmatic significance, and documentation of resolutions and conclusions. The seven basic steps of the review process which provide substantial evidence supporting the above findings and conclusions are discussed below.

A. Document Collection

Cygna collected and reviewed documents in two stages. During the first stage, the review teams identified those central documents which guide the design control process, such as the FSAR, QA manuals, and project procedures. Reviewing these central documents provided an understanding of how the work process was structured and directed. During the second stage of data collection, the review teams identified and gathered those documents needed to complete the review. By conducting the implementation review at the most convenient work location (typically where the documents were kept), the review teams were able to develop a better understanding of both the documents and the methods used in their generation. (Cygna Report at 3-2; Appendix C.)

B. Review Criteria

A key element of the Cygna review was the development of review criteria to measure the adequacy of the design and design control process. These review criteria were developed by Cygna by combining licensing commitments, NRC requirements, industry codes and standards, and Cygna engineering and design experience. These review criteria provided an appropriate means by which the

adequacy of a system design and design control process could be measured thoroughly and consistently throughout the design review process. (Cygna Report at 3-2 to 3-3; Appendix E.)[3]

C. Review Procedures

The horizontal review portion of Cygna's effort employed detailed matrices to assure that consistently thorough attention was focussed on each item being reviewed, while the vertical reviews were guided by extensive checklists which served the same purpose. When a reviewer determined that a line item on the matrix or checklist appeared to have been inadequately addressed by the item under review, it was noted on the checklist or matrix, as appropriate. Each such discrepancy was reviewed by the Project Review team to determine if it should be recorded as an observation. Any observations later determined to a have potential safety impact were recorded as a "Potential Finding Report". (Cygna Report at 3-3.)

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3 Throughout the process, items identified as having potential impact on plant safety were given immediate attention. By focusing its extensive quality assurance and technical experience in this program, Cygna ensured that every potential finding received the prompt attention of both the Project Team and Senior Review Team. This important step assured Applicants of the timely notification of any items concluded to have a definite potential for impact on plant safety. (Cygna Report at 1-5.)

1. Matrices

All programmatical reviews employed a quality program matrix, which identified the quality requirements committed to with a cross correlation to Applicants' and Gibbs & Hill's design control programs. Using these matrices, the Applicants' and Gibbs & Hill's design control programs were evaluated for adequacy against licensing commitments and project requirements. (Cygna Report at 3-3 to 3-4; Appendix D.)

2. Checklists

Checklists employed in the vertical implementation evaluations required that a reviewer check each line item, as its adequacy was evaluated against the review criteria. To assure the Cygna-prepared checklists focussed review activities on the key areas of the five implementation processes noted above (see Section III.D.), the checklists contained key design control element attributes (derived from procedural commitments to be examined during the review) and design evaluation guidelines. The checklist served the purpose of ensuring consistently comprehensive coverage in each element of the review. In addition, the checklists were utilized only as a guide during the evaluation process in that they did not restrict the scope of the reviewers investigation. (Cygna Report at 3-4 to 3-5; Appendix H.)

When discrepancies were noted on the checklists, they were automatically reviewed by at least two members of the project team. These team members were responsible for evaluating (1) the completeness and accuracy of each discrepancy, and (2) the potential design impact. If upon review those team members believed the information was both complete and accurate, and the discrepancy had a potential impact on design, an Observation was documented on an Observation Record. (Cygna Report at 3-4 to 3-5; Appendix F.)

3. Observation Record

Each Observation Record was then reviewed by a person qualified in the appropriate discipline, evaluated by the Project Team in consultation with Cygna specialists, and discussed with Applicants' technical and quality assurance staffs. This extensive review was documented on an Observation Record Review which documents Cygna's assessment of the probable cause and resolution of each observation. Each determination set forth in an Observation Record Review was approved by the Project Manager and the observation originator. (Cygna Report at 3-5; Appendix F.)

4. Potential Finding Report

Observations determined to have a potential safety impact were recorded on Potential Finding Reports (PFRs). For each PFR (Cygna identified only one PFR in the Comanche Peak IAP), the

cognizant reviewer recorded a description of the observation, his/her assessment as to the extent of the observation, and an evaluation of the design and safety impact. The PFR was then reviewed by the Senior Review Team for completeness and accuracy. (Cygna Report at 3-5.)

Had the Senior Review Team determined that an observation indicated that a condition existed which had a definite potential impact on plant safety, it would have been reported to Applicants' and to the NRC by the Cygna Project Manager. The PFR identified for Comanche Peak was determined not to have a definite potential impact on plant safety and thus was not required to be reported. (Cygna Report at 3-5; Appendix F; see Section V.D., infra.)

D. Program and Implementation Evaluation

The Cygna review of the CPSES design control process was divided into two areas, viz., program adequacy and program implementation. Cygna reviewed for adequacy the design control programs of both Applicants and Gibbs & Hill, the architect/engineer. To assess the extent of design control program implementation by both organizations, Cygna examined three elements of the program (design analysis, design change, and interface controls). In addition, further confirmation of the program implementation was achieved through the as-built walkdown and design review. (Cygna Report at 3-6.)

To assess program adequacy, Cygna's review examined the procedural controls established for design input, design analysis, drawings, procurement, internal/external interfaces, design verification, documentation and design changes, as well as measures established for corrective action, and internal/external audits and surveillances. The matrices and checklists employed in these reviews ensured that governing criteria would be met and that any deviations would be noted. (Cygna Report at 3-6 to 3-7.)

In the program implementation review, Cygna assessed the technical adequacy of the design analysis in several general areas. These areas included design activities in a broad variety of disciplines, involving different design organizations and interfaces. The review included examination of key aspects of the design analyses in each area. The areas reviewed and the scope of each review are, as follows.

1. Pipe stress analysis

The Cygna review of pipe stress design analyses focussed on four phases of those analyses, viz., input data, computer modelling, consideration of special features, and stress report data. (Cygna Report at 3-7.)

2. Pipe support design

As with the pipe stress analysis review, Cygna's evaluation of pipe support design activities focussed on key aspects of design. The key aspects of the support designs examined by Cygna were the input data, the design calculations themselves and the drawings. (Cygna Report at 3-7 to 3-8.)

3. Equipment qualification

Cygna's review of the equipment qualification area involved a detailed examination of documentation, drawings, design calculations and test results to assure the adequacy of this process. (Cygna Report at 3-8.)

4. Flued head

Cygna also reviewed the key aspects of the design process concerning the flued head penetration, focussing on the selection of appropriate input data, computer model adequacy and satisfactory design output. (Cygna Report at 3-8.)

5. Structural design

Cygna performed an extensive review in the structural design area by examining Gibbs & Hill cable tray support designs. The review focussed on the key aspects of the design process of cable tray supports to verify the technical adequacy of cable tray support designs at Comanche Peak. (Cygna Report at 3-8 to 3-9.)

6. Electrical review

Cygna performed an extensive review of the power and instrumentation and controls design program. The particular systems examined were the [Train B RHR pump motor power distribution and the control circuitry to the Safety Injection System containment sump isolation valve control circuity.] In its review, Cygna examined the electrical distribution system for satisfaction of basic design considerations of electrical engineering and appropriate regulations and standards identified in the FSAR. In addition, Cygna reviewed conformance of Gibbs & Hill control circuitry with design input documentation from Westinghouse and examined the design documents and specifications for appropriate identification of safety-related components. (Cygna Report at 2-10; 3-9 to 3-10.)

7. As-built walkdowns

The Cygna team performed a detailed walkdown of the Spent Fuel Pool Cooling System. As part of this walkdown, Cygna examined component locations, installation of equipment in accordance with specifications and vendor data, proper identification of cables and raceways and welding and support orientation. (Cygna Report at 3-10.)

E. Evaluation of Discrepancies and Observations

1. Project Review Team

To evaluate the potential safety impact of a discrepancy or observation identified in the review process, a Project Team was assigned to verify the accuracy, completeness, design impact and extent of each concern. For each observation or discrepancy the proper course of action was further evaluated through a controlled interface between Applicants and the Project Team to confirm the accuracy of the observation and evaluate its design impact. All such interfaces with Applicants were recorded in the form of conference reports or telephone conversation reports. (Cygna Report at 3-10 to 3-11.)

2. Senior Review Team

A Senior Review Team was assembled to examine all valid observations and potential findings reports. Each observation was reviewed by a cognizant member of the team (assisted as necessary by Cygna in-house consultants) for completeness, accuracy and potential impact on plant safety. The Senior Review Team either approved project team conclusions or directed that additional work be performed on particular observations. (Cygna Report at 3-11.)

A principal function of the Senior Review Team was to evaluate the collective safety impact of observations that individually had been determined to have insignificant safety consequences. This review team assured that a highly experienced

group of individuals not involved in the day-to-day review process could independently assess the collective impact of individual findings and observations.[4] (Cygna Report at 3-11.)

V. REVIEW, RESULTS AND CONCLUSIONS

A. Overview

The Cygna Report demonstrates that Cygna's review of Applicants' and Gibbs & Hill's design control programs was a detailed examination of those programs, and Cygna's conclusions regarding the adequacy of those programs are accurate and well-founded. The results of that review demonstrate the adequacy of those programs and provide substantial evidence that those programs satisfy applicable design and quality requirements and commitments and have resulted in a final product which satisfies applicable requirements and commitments.

The Cygna Report demonstrates that the observations made during Cygna's technical review raise no concern for the overall adequacy of the design process. Cygna properly resolved each of its observations. Given that none of Cygna's observations revealed a condition that would prevent a sructure, system or component from performing its intended safety function, and that many observations had already been identified by the responsible design organization, there are no adverse implication for other

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[4] Had the Senior Review Team determined that an observation had a definite potential impact on plant safety, the finding would have been reported immediately to Applicants, and to the NRC in accordance with 10 C.F.R. Part 21.

aspects of the design process not within the scope of Cygna's review. In view of the mammoth scope of a project the size of a nuclear power reactor, involving millions of separate design decisions and calculations, it is unreasonable to expect that a quality assurance program will detect all design errors. While perfection in design is the objective, the Atomic Energy Act and NRC Regulations recognize that such perfection is unattainable as a practical matter. What is required as a matter of law is that there be reasonable assurance that the plant, as built, can and will be operated without endangering the public health and safety. See Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2), ALAB-756 (December 19, 1983), slip op. at 6-7 (construction quality assurance). Such reasonable assurance is provided by the Cygna review.

B. Design Control Program

1. Applicants

Cygna's review of Appliants documented design control program resulted in no observations. Cygna concluded that the design control program, as documented in the CPSES QA Plan, Project Quality Engineering Procedures and Supporting Instructions, Site Document Control Procedures and the Quality Procedures in total, adequately addressed the requirements of ANSI-N45.2.11, draft 2, revision 2, "Quality Assurance Requirements for the Design of Nuclear Power Plants," as committed to in the CPSES Final Safety Analysis Report. This

conclusion is supported by the quality program matrix shown in Appendix D to the Report, which identifies the design quality requirements committed to with a cross correlation to the respective procedural controls within the Applicants' design control program documents. (Cygna Report at 4-1.)

2. Gibbs & Hill

Cygna's review of the Gibbs & Hill documented design control program also resulted in no observations. Cygna concluded that the design control program, as documented in the Gibbs & Hill CPSES Project Procedure and Project Guide Manuals, adequately addressed the requirements of ANSI N45.2.11, draft 2, revision 2. Appendix D of the Cygna Report correlates the design quality requirements committed to with the respective procedural controls within the Gibbs & Hill design control program documents. (Cygna Report at 4-1 to 4-2.)

C. Evaluation of Design Control Program Implementation

1. Design Change Control

a. Applicants

The implementation evaluation of Applicants' Design Change Control Program resulted in four valid observations (see Cygna Report, Exhibit 1.9, Sheets 1-3). Cygna recognized that Applicants were already aware of three of these observations (DC-01-01 through DC-01-03) through the various other reviews and

audits performed at CPSES. In fact, Applicants had initiated a new document control program prior to Cygna's review to improve on conditions existing in the Document Control Program. This new system entails establishing tighter control over document distribution and an enhanced design change tracking system. The major elements of the new system are:

(1) Centralization of existing document distribution points (file custodians) into several Document Control Center Satellite stations.

(2) An accurate computerized listing of all design drawings, listing all outstanding design changes.

(3) Revise the existing document control center manually operated design change and design document logging and distribution system via the use of the new computerized document control system. A systematic verification of the computerized data base was made to ensure accuracy.

The above described system, which was developed and partially instituted during the IAP, was approximately 85% complete as of October 15, 1983. A Cygna follow-up review of a substantial document sample determined that each of the three observations was resolved. (Cygna Report at 4-2 to 4-3.)

With respect to the fourth observation (DC-01-04), which concerned the accuracy of the Field Design Change and Review Status log, Cygna determined that at the time of their initial observation this log was in the process of being developed and was not being utilized as a control document for a complete, accurate listing of design changes, but rather simply to status

design reviews. This listing was subsequently verified by Cygna for accuracy and context, and the observation was closed. (Cygna Report at 4-4.)

b. Gibbs & Hill

The implementation of the Gibbs & Hill design change control program resulted in one valid observation (DC-02-01). This observation identified instances where design specifications and changes had been issued (in 1974 and 1975) prior to the performance of design review and/or resolution of design reviewer comments. Cygna determined that the Applicants' audit program had revealed the same condition during 1975 and 1976 and that Applicants and Gibbs & Hill conducted extensive corrective action and follow-up activities. In addition, continued monitoring of this area in the form of audits by Applicants and Gibbs & Hill and Gibbs & Hill surveillance has been performed. Based on these facts, Cygna determined that closure of this observation was appropriate. (Cygna Report at 4-4 to 4-5.)

c. Brown & Root

The implementation review of the Brown & Root design change control system revealed that any design changes generated were handled via the CPSES design change and document control program. This review resulted in no observations. (Cygna Report at 4-5.)

2. Design analysis control

Cygna reviewed the Gibbs & Hill design analysis control program for appropriate implementation and noted two valid observations (DC-02-02 and DC-02-03). These observations involved the use of a particular version of the ADLPIPE computer program (version 2C) for pipe stress calculations whereas (1) the FSAR listed ADLPIPE version 1C as a design basis and (2) the later version used later editions of the ASME Code than specified in the FSAR. Cygna closed this first observation upon determining that the cause of this finding was simply a failure to update the FSAR to reflect the use of a more advanced version of ADLPIPE. The second observation was closed by virtue of the identity of key provisions of the two Code versions and satisfaction of the intent of the Code of record. (Cygna Report at 4-5 to 4-6.)

3. Interface control

Cygna found that interface control activities by Applicants and Gibbs & Hill were effective, and no observations were identified. (Cygna Report at 4-6.)

In sum, Cygna's review of the design, design change, design analysis and interface control programs was thorough and the observations noted by Cygna were properly resolved. Cygna properly resolved the observations concerning these control programs and the observations raise no concern for the adequacy of that program. In conclusion, there is reliable and probative

evidence that supports a finding that the above-described control programs for Applicants, Gibbs & Hill and Brown & Root were appropriately implemented.

C. Technical Review Evaluation

Cygna performed its technical review along two paths. First, Cygna reviewed the general guidelines provided to each engineer to determine if these were in compliance with licensing commitments and sound engineering practice. Cygna then reviewed a sample of each calculation to assure that the guidelines were followed. By following this procedure, Cygna was able to determine both the adequacy of the design methods and also the depth of training given to each engineer.

As a result of the technical review, Cygna identified a total of 29 observations in six areas. Of these, Cygna determined upon further review prior to issuing its report that three were invalid. The areas reviewed and the associated number of observations are, as follows:

(1) Pipe stress - 9
(2) Pipe supports - 4
(3) Equipment qualification - 0
(4) Electrical - 0
(5) Cable tray supports - 8
(6) walk down - 5

Except for one observation in the Cable Tray Support area, each observation was closed out by either expanded sample size (to determine if the error was extensive) and/or additional calculations (to determine design impact). As a result of

Cygna's review of the open Cable tray support observation, Cygna prepared a Potential Finding Report which is addressed later (see Section V.D.). (Cygna Report at 4-6 to 4-7.)

1. Pipe Stress Implementation Evaluation

Cygna's pipe stress review covered two areas, viz., the RHR/Safety Injection piping from the containment sump to the RHR heat exchanger, Train B (Gibbs & Hill) and the flued head penetration (Gulf & Western). In reviewing the pipe stress analysis, Cygna focussed on both the general methodology employed and the implementation of that methodology. (Cygna Report at 4-7.)

a. general methodology

Cygna had three observations on the general methodology used by Gibbs & Hill in its pipe stress analyses. Cygna observed that in two instances (PI-00-01 and PI-00-02), Gibbs & Hill had not accounted for factors which could affect the design: (1) weld mismatch as it affects stress intensification factors and (2) an appropriate stress allowable for welded attachments. In subsequent reviews, Cygna determined that Gibbs & Hill had, in fact, accounted for these factors in an appropriate manner, consistent with the Code of record and, thus, no significant design impact resulted from these observations. Accordingly, these observations were closed. (Cygna Report at 4-6 to 4-7.)

Cygna also observed (PI-00-03) that Gibbs & Hill had not considered the possible effect of higher order modes on dynamic analyses. However, Cygna subsequently determined that Gibbs & Hill does instruct its engineers to review the dynamic results for adequate support loads, including consideration of higher order modes. In addition, given that Gibbs & Hill correctly utilized the ADLPIPE program and also clearly met other FSAR commitments, Cygna concluded that further investigation into the potential safety impact of this observation was not warranted and the observation was closed. (Cygna Report 4-8.)

b. implementation

Cygna's review of two piping problems resulted in five observations concerning implementation of pipe stress analysis procedures. These observations dealt with: (1) incorrect wall thickness (PI-00-01); (2) omission of response spectra (PI-02-01); (3) different support location from as-built (PI-02-02); (4) improper use of thermal expansion loads (PI-02-03); and (5) incorrect allowable nozzle loads (PI-02-05). Upon further review, Cygna determined that all observations could be closed. Four of these observations were simply isolated cases, as determined by expanding the sample size. The other case involved the use of an incorrect pipe schedule (the correct schedule was provided in the specification) for nozzles on the RHR tube side nozzles. Further analysis showed no design impact occurred,

however, and additional sampling on other piping found no other instances of this discrepancy. (Cygna Report at 4-8, Appendix F.)

As an overview, Cygna found the Gibbs & Hill methods appropriate and generally well implemented. The depth of the Gibbs & Hill documentation and referencing made the review process proceed smoothly. (Cygna Report at 4-8.)

For the flued head analysis, Cygna had only one observation (PI-03-01), concerning modeling, which had no impact on the design. Cygna then reviewed 15 of the remaining 18 flued head analyses to determine the extent of the error and found it isolated to this one problem. Cygna was highly complimentary of the Gulf and Western documentation of its analyses. (Cygna Report at 4-9.)

2. Pipe support review

Cygna's review of pipe supports encompassed all supports on the main flow path between the containment sump and heat exchanger, plus the anchors on all branch lines in Gibbs & Hill piping stress problems AB-1-69 and AB-1-79. For these supports, Gibbs & Hill had prepared the pipe support design specification and TUSI, ITT-Grinnell, and NPSI had performed the majority of the final large bore pipe support reviews. (Cygna Report at 4-9 to 4-10.)

a. methodology

Only one observation resulted from Cygna's review of the general methodology (PS-09-01). This observation related to seismic displacements outside the working range of spring hangers. However, after further review, Cygna determined that Applicants' evaluation of this matter, confirmed by additional checks by Cygna, demonstrated that this observation had no significant impact on plant safety. (Cygna Report at 4-9.)

b. implementation

In reviewing the 31 specific pipe support calculations associated with the supports, Cygna made three observations, as follows: (1) improper anchor bolt embedment length shown on drawing (PS-02-01); (2) incorrect data given to the support group (PS-10-01); and (3) incorrect allowable loads for a particular type of U-bolt (PS-12-01).

After further review, Cygna believed that the last two (PS-10-01 and PS-12-01) were isolated errors with no impact on safety. In reviewing PS-02-01, Cygna determined that the embedment length shown on the drawing was not used in the installation.[5] (Cygna Report at 4-9 to 4-10.)

Cygna found that, in general, the support calculations were well done. Cygna also found the calculations well documented and referenced. (Cygna Report at 4-10.)

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5 Applicants intend to comment on this observation and to request that Cygna revise its conclusion accordingly.

3. equipment qualification review

To determine acceptability of equipment qualification procedures, Cygna reviewed the RHR Train B pump (TBS-RHAPRH-02) by Westinghouse. The review included the pump, motor and auxiliary equipment. Cygna found no items requiring further review and found all the Westinghouse documentation in good order. In particular, Cygna reviewed those items noted by the earlier NRC seismic qualification audit as needing corrections and found that Westinghouse had addressed each appropriately. (Cygna Report at 4-10.)

4. electrical review

In the electrical area, Cygna reviewed the Gibbs & Hill design of both Train B RHR pump power distributions and the isolation tank, Safety Injection System (SIS), and valve control circuitry. The review covered both the adequacy of the design documents (compliance with licensing requirements) and the design calculations themselves. In the review, Cygna found no items requiring further assessment and, therefore, had no observation in this area. (Cygna Report at 4-10.)

5. Cable tray support evaluation

Gibbs & Hill produced the structural calculations and designs for the cable tray supports. Rather than have one specific calculation for each tray support, Gibbs & Hill used several standard support details, e.g., a standard 3 level

support or 2 level support, further separated into one, two or three way restraint designs. Gibbs & Hill then collected similar "standard" designs and evaluated them in a single generic calculation. Separate calculations were performed for unique support designs. (Cygna Report at 4-11.)

Cygna reviewed those supports associated with the RHR Pump power supply cable tray. These 40 supports were based on 8 standard calculations, (15 standard details), and represent 43% of the cable tray supports for the plant. In the review of the standard calculations, Cygna found seven areas which required further review for design impact. Of these seven observations, three involved computer analyses and assumptions, two involved assumptions made for hand calculations, and two applied to loads and load combination methods. To assess the significance of the seven observations, both Cygna and Gibbs & Hill performed detailed calculations to determine:

(1) the validity of the original assumptions;

(2) the effect of conservatisms in the original analysis, and

(3) the design impact of changes in support geometry and modeling.

Cygna determined that all seven observations produced no significant impact on the design or on the safety of the plant. Cygna found that the conservatisms present in the original design outweighed the effects of later design changes.[6] (Cygna Report

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6 Applicants understand that the revisions Cygna intends to make to its observations concern in large measure cable tray (footnote continued)

at 4-11 to 4-12; Appendix F.)

In reviewing each checklist and observation, Cygna noted one or more of the identified areas existed in each standard calculation. Consequently, Cygna examined not only each matter by itself, but also assessed the cumulative effect of all on the design process. Based on Gibbs & Hill's reevaluation of each support calculation (utilizing Cygna's comments), Cygna properly concluded that sufficient margins to allowable stress levels existed for the supports within the review scope. Nonetheless, Cygna believed that the cumulative effect of these observations needed to be evaluated. Accordingly, Cygna prepared a PFR which is addressed below (see section V.D.). (Cygna Report at 4-12.)

6. as-built verification

Cygna's as-built verification of the Spent Fuel Pool Cooling System was separated into three categories, viz., (1) electrical, instrumentation and controls, (2) mechanical (piping supports), and (3) structural. The purpose of the walkdowns was to verify that the field installation is in compliance with the latest revision of the relevant construction documents and drawings. Cygna documented seven observations during its walkdown, consisting of three Electrical, four Mechanical and zero Structural. Included in the electrical walkdown was a review of

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(footnote continued from previous page)
support designs. Accordingly, we do not address here the details of Cygna's findings concerning cable tray supports.

separation requirements, grounding components, cable installation and cable terminations. No valid observations which could impact on plant safety were made. (Cygna Report at 4-12.)

a. separation requirements

The field verification of electrical separation requirements was performed by reviewing the separation in identified control panels as well as the associated electrical raceway installation. The panels and raceway were found to be maintained in accordance with separation criteria of the electrical erection specification and requirements described on the cable tray and conduit plan drawings. (Cygna Report at 4-12 to 4-13.)

b. grounding

The review of the electrical grounding system consisted of verifying that the raceway system and spent fuel pool cooling pump had been grounded in accordance with the requirements of the electrical erection specification and grounding drawings. The observation made in this area (WD-07-01) was subsequently found to be invalid because the questioned ground was not safety-related. (Cygna Report at 4-14.)

c. components

The components review effort was performed for equipment and instrumentation associated with Spent Fuel Pool Cooling System Train A. The only observation (WD-07-02) made in this area was

closed because the component noted not to have been installed (temperature indicator) was later determined to have been deliberately withheld from installation to avoid damage during ongoing construction. In addition, this item was not a safety-related item. (Cygna Report at 4-14 to 4-15.)

d. cable installation

Cygna's cable installation review focussed on four areas, the most important of which was the routing. The three other areas reviewed were cable supporting, spacing and bend radius requirements. The review of these items verified proper cable installation. Only one observation (WD-07-03), concerning the identification number of a portion of conduit, was made.

Although this instance only involved a difference in unit numbers between a drawing and the installed cable, in order to provide assurance that there were no further discrepancies of this type which might have an impact on design or plant safety, a further review was performed by Cygna. To ensure that the discrepancy was an isolated case, a random sample of (eight) 8 safety-related conduits in the fuel building was chosen for further examination. All identification numbers in this sample were verified to be correct. This observation was, therefore, considered to be an isolated case with no potential impact on design or plant safety and was closed. The conduit numbers and their termination points were verified against the identification given in the raceway schedule. (Cygna Report at 4-15 to 4-16.)

e. cable termination

Cygna's cable termination verification consisted of reviewing the cable field terminations against the requirements of the connection drawing and cable schedule. The review included twenty-three (23) cables associated with the spent fuel pool cooling system. The review confirmed that cables were correctly installed. (Cygna Report at 4-17.)

7. Mechanical walkdown (piping and supports)

The purposes of the mechanical walkdown were to verify the as-built location of pertinent features of the piping system such as valves, branch connections, elbows and supports, and to verify the as-built condition of the supports. Except in the few instances where any form of measurement (either accurate or approximate) was not possible, the location of all piping elements was verified to be in conformance with the relevant drawings. There was a total of 91 supports on the selected piping system, 48 of which were fully accessible for inspection. The configuration and general form of all of the remaining 43 supports were found, by visual inspection, to be in agreement with the design drawings. In addition, the accessible dimensions and hardware data for seven (7) of the 43 supports were checked. This sample provides an adequate basis on which to judge the conformance of the as-built supports with their design. (Cygna Report at 4-17 to 4-18.)

Of the four observations made during the mechanical walkdown, three had been identified by Applicants prior to the Cygna review and appropriate action (both specific and generic) was instituted at that time (WD-01-02, WD-02-02 and WD-03-01). The remaining observation (WD-02-01), which concerns the clearance between a strut of one support and a pipe clamp of another, was closed because the calculated relative movements of the two supports did not result in an interference. (Cygna Report at 4-18 to 4-19.)

8. Structural walkdown

Cygna's structural walkdown consisted of an inspection of the floor, walls and ceiling of the Unit 1 Pump room for spalling, voids, general formwork and other conditions; the location, size, finish and grout of certain component foundations; the location and size of particular spent fuel pool penetrations; and a randomly selected sample of 5 cable tray supports in Pump Room 1 and the adjacent area. Although a detailed inspection of the interior of the Pump Room was not possible since all surfaces have been painted, the exterior walls, which had not been painted, exhibited good workmanship. All other observed items proved to be satisfactory. (Cygna Report at 4-19 to 4-20.)

D. Potential Finding Report

During the course of the independent assessment program, Cygna identified a total of thirty-three valid observations, including one which was considered to be a potential finding. The potential finding concerned the implications of the various technical deficiencies in cable tray support designs. While each deficiency, by itself, did not affect the acceptability of these support designs, Cygna was not initially certain that the cumulative effect would not have a potential impact on plant safety. Accordingly, a PFR was initiated on this matter.

Upon more detailed review, Cygna concluded that the PFR should be closed. Their determination was based on four considerations which provide assurance that no adverse safety consequences would have resulted even had the noted deficiencies in safety cable tray designs not been detected. In the first instance, a thorough reanalyses of the supports within the Cygna scope using advanced computer design techniques demonstrated that the design margins for support components are greater than 10%. Second, the designs within the Cygna scope of review covered an extremely large sample (43%) of the supports in the plant. Third, Cygna noted that additional reviews of supports are conducted by Gibbs & Hill with respect to field changes to a particular support. Subsequent changes to each support reference all changes made to it, thus ensuring that the approval considers

all changes. Finally, at bottom, there simply was no potential safety impact from the original observations. (Cygna Report at 4-20 to 4-21.)

Given Cygna's thorough review of the cable tray support design process, and its conclusion that none of the observed design deficiencies resulted in inadequate designs, no concern is raised regarding either the design process or the designs themselves. Reasonable assurance exists that this design process for cable tray supports resulted in designs that can and will perform their intended function, and no concern is raised that the operation of the facility will endanger the public health and safety.

VI. CASE'S TESTIMONY

CASE filed testimony of Messrs. Walsh and Doyle regarding the Cygna Report. This testimony consists of various technical arguments regarding designs of individual components and includes certain allegations regarding the conduct of Cygna's review. The nature and scope of Applicants' cross-examination of these witnesses will, of course, depend on Cygna's response to their allegations. Consequently, because Applicants are unable to anticipate Cygna's response or position on these matters we cannot predict what cross-examination will be necessary of those witnesses. Nonetheless, we note that we intend to cross-examine these witnesses, as necessary, to assure the record reflects any

inaccuracies in their testimony and to establish those areas which are beyond the scope of Cygna's review and, thus, this hearing.

Respectfully submitted,

Nicholas S. Reynolds/WAH

Nicholas S. Reynolds

William A. Horin

William A. Horin

Counsel for Applicants

BISHOP, LIBERMAN, COOK,
PURCELL & REYNOLDS
1200 Seventeenth Street, N.W.
Washington, D.C. 20036
(202) 857-9817

February 16, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
TEXAS UTILITIES ELECTRIC COMPANY, et al.	)	Docket Nos. 50-445 and 50-446
	)	
(Comanche Peak Steam Electric Station, Units 1 and 2)	)	(Application for Operating Licenses)

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing "Applicants' Expected Findings of Fact Regarding Independent Assessment Program for Comanche Peak Steam Electric Station" in the above-captioned matter were served upon the following persons by overnight delivery (*), or deposit in the United States mail, first class, postage prepaid, this 16th day of February, 1984, or by hand delivery (**) on the 17th day of February, 1984.

**Peter B. Bloch, Esq.
Chairman, Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Dr. Walter H. Jordan
881 West Outer Drive
Oak Ridge, Tennessee 34830

*Dr. Kenneth A. McCollom
Dean, Division of Engineering Architecture and Technology
Oklahoma State University
Stillwater, Oklahoma 74074

Mr. John Collins
Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive
Suite 1000
Arlington, Texas 76011

Chairman, Atomic Safety and Licensing Appeal Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. William L. Clements
Docketing & Service Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

**Stuart A. Treby, Esq.
Office of the Executive Legal Director
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Chairman, Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Renea Hicks, Esq.
Assistant Attorney General
Environmental Protection
Division
P.O. Box 12548
Capitol Station
Austin, Texas 78711

Lanny A. Sinkin
114 W. 7th Street
Suite 220
Austin, Texas 78701

*Mrs. Juanita Ellis
Preside t, CASE
Metro Center Hotel
600 Commerce Street
Fort Worth, Texas 76102

William A. Horin

cc: Homer C. Schmidt
Robert Wooldridge, Esq.