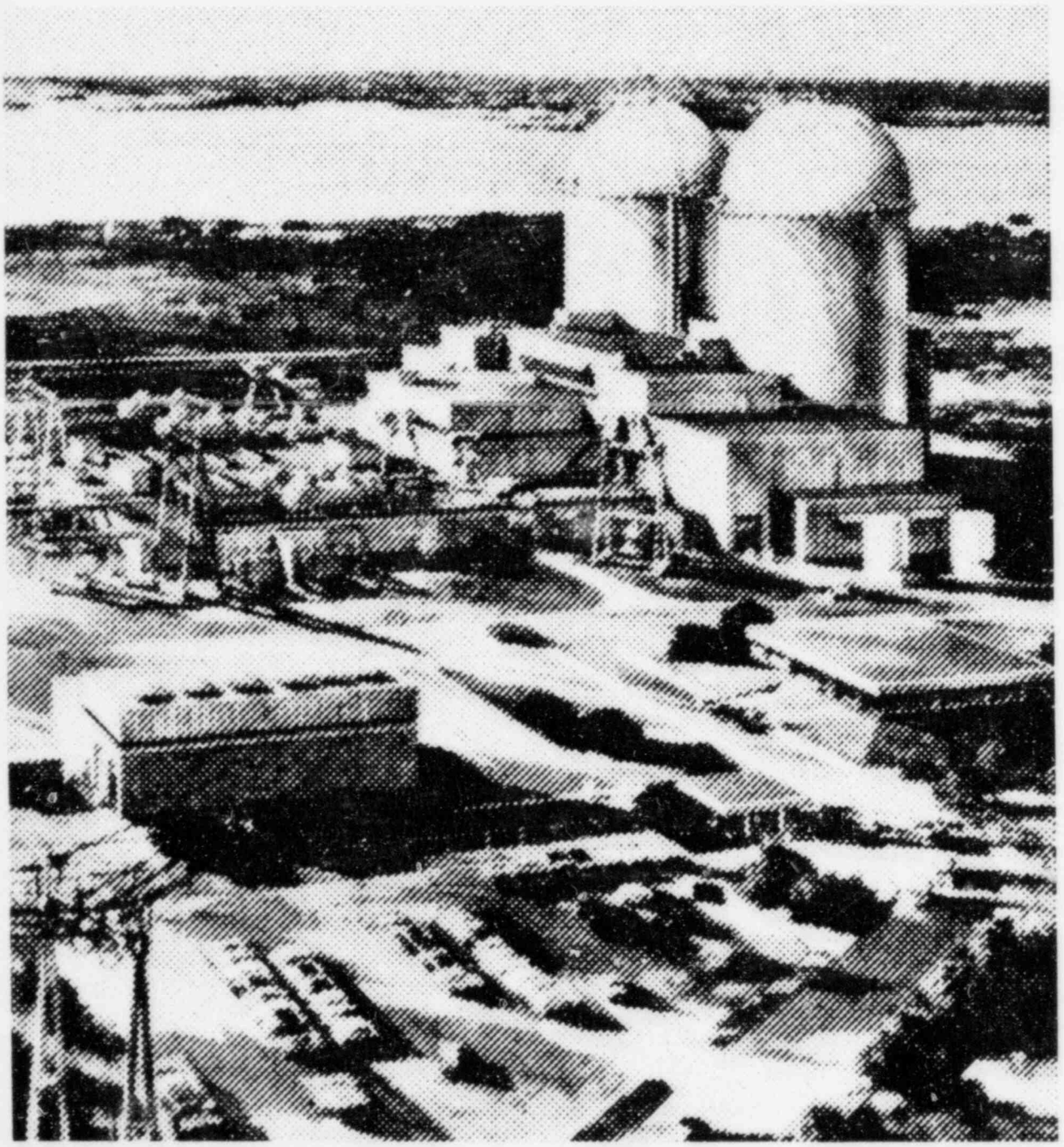
Independent Assessment Program

Texas Utilities Services, Incorporated
Comanche Peak Steam Electric Station

September 6, 1983



Proposal No. S83-12C Rev. 1

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1.0 EXECUTIVE SUMMARY

At the request of Texas Utilities, Cygna Energy Services has developed an Independent Assessment Program (IAP) which will provide added assurance that Comanche Peak Steam Electric Station (CPSES) is designed and constructed in accordance with licensing commitments, project standards, and industry practice. This program is intended to complement the numerous evaluations conducted to date in both the technical and quality assurance areas. Exhibit 1.1 illustrates how this proposed IAP combines with key previous reviews to provide the NRC with an integrated basis for evaluating the design process on Comanche Peak.

In order to satisfy the intent of this program, and to address the concerns and comments expressed by the NRC, the following objectives are specified for the CPSES Independent Assessment Program: (1) to assess the adequacy of the design control program, (2) to assess the design adequacy of a selected system, (3) to verify a selected as-built configuration, and (4) to verify implementation of selected elements of the design control system. The overall program scope shown in Exhibit 2.1 has been selected to fully satisfy the intent and objectives stated above. It includes a broad review of the design control program within Texas Utilities and Gibbs & Hill, the architect/engineer for CPSES. This broad, or "horizontal" review, is then supplemented by "vertical" reviews of selected elements of the overall design and design control process. Specifically, the vertical reviews cover implementation of the design control elements (design analysis, design changes and interfaces), design (Residual Heat Removal System, Train "B"), and as-built verification (Spent Fuel Cooling System, Train "A"). Selection of this scope is based upon the criteria taken from the May 4 and July 15 NRC letters to Texas Utilities.

The design review concentrates on the Residual Heat Removal/Safety Injection System (RHR), Train "B", from the containment sump line penetration to the RHR heat exchanger discharge nozzle. This system review will include representative elements of the mechanical, electrical, instrumentation and controls, and structural disciplines. Further, an implementation review of design analysis control will be performed on the RHR system Train B design process to augment the technical review.

Implementation reviews of the remaining two selected elements of the design control program have been chosen to provide added assurance that design changes and organizational interfaces were adequately controlled for a completed system. This completed system, the Spent Fuel Pool Cooling System, Train A, is also the subject of the as-built verification aspect of the review. This portion of the review is structured to verify that the as-built condition matches the appropriate design documents. Similar to the design review, the as-built verification is multi-disciplined.

Cygna will utilize the experience it has gained from the completion of independent reviews for Mississippi Power & Light on Grand Gulf Unit 1 and for Detroit Edison on Enrico Fermi Unit 2. Essentially, the approach involves performing the review, noting all observations, verifying the accuracy of the observations, and evaluating the potential safety impact. Throughout this process, items identified as having potential impact on plant safety are given immediate attention. This is to ensure that Texas Utilities receives timely notification of those items concluded to have a definite potential for impacting plant safety. Cygna will focus its extensive quality assurance and technical experience in this program through a two-tier approach in which every potential finding receives the attention of both the project team and senior review team.

The Independent Assessment Program will commence upon authorization to proceed by Texas Utilities. The program is scheduled to culminate in a draft final report, submitted simultaneously to the NRC and Texas Utilities on November 4, 1983. A revised final report will be prepared if necessary to incorporate NRC and Texas Utilities comments.

In summary, Cygna believes the program outlined in this document represents a rational approach to an independent assessment. If the stated objectives are met, Cygna will be able to make a definitive statement regarding the adequacy of the Comanche Peak design control system and the extent of its implementation. Thus, the effort undertaken will prove useful to both the NRC and Texas Utilities in assuring that the health and safety of the public has been adequately protected, and also to Texas Utilities as further assurance that the interest of its customers and the investment of its shareholders have been properly safeguarded.

2.0 INTRODUCTION

At the request of Texas Utilities, Cygna Energy Services has developed a program to provide supplementary evidence regarding the overall design quality of the Comanche Peak Steam Electric Station (CPSES). The program is intended to be used in conjunction with recent NRC-sponsored evaluations, especially the Construction Appraisal Team (CAT) inspection and the Special Investigation Team (SIT) review of the Walsh-Doyle allegations. The program is also intended to address the concerns and comments expressed by the NRC in letters to Texas Utilitites dated May 4 and July 15, 1983.

In the May 4 letter, the NRC stated that, due to the numerous efforts which have been initiated by Texas Utilities to assure the quality at CPSES and the fact that no previous verification programs have found produced any evidence of a major breakdown in the quality assurance programs at CPSES, an independent design verification effort of similar scope to those performed on other plants was not warranted. Nevertheless, the NRC expressed concern with regard to the complexity of the design control process and the number of outstanding design changes at CPSES.

To address these concerns, Cygna developed an Independent Assessment Program (IAP) which Texas Utilities issued for comments on June 10, 1983. In a letter dated July 15, the NRC provided three basic comments for consideration: (1) the IAP should include a technical design review, (2) the system selected for the technical design review should have demanding design parameters, and (3) the implementation evaluation of the design control program should consider more than the design change and interface control elements. At a later date, the NRC provided supplemental comments to the July 15 letter. These comments are listed and addressed in Appendix B.

In order to satisfy the intent of this program and address the concerns and comments expressed by the NRC, the following objectives are specified for the CPSES Independent Assessment Program: (1) to assess the adequacy of the design control system, (2) to assess the design adequacy of a selected system, (3) to verify a selected as-built configuration, and (4) to verify implementation of selected elements of the design control system. The overall program scope shown in Exhibit 2.1 has been selected to fully satisfy the intent and objectives stated above. It includes a broad review of the design control program within Texas Utilities and Gibbs & Hill, the architect/engineer for CPSES. This broad, or "horizontal" review, is then supplemented by "vertical" reviews of selected elements of the overall design and design control process. Specifically, the vertical reviews cover implementation of design control elements (design analysis, design changes and interfaces), design (Residual Heat Removal/Safety Injection System, Train "B"), and as-built verification (Spent Fuel Cooling System, Train "A"). Selection of this scope is based, in part, upon the criteria taken from the May 4 and July 15 NRC letters to Texas Utilities. These criteria are:

- include a cross-section of disciplines;
- include characteristics which cannot be verified by normal means, such as performance testing;
- include specific concerns identified by the NRC;
- include several interfaces;
- include design changes.

Selection of the systems for the vertical or implementation review was guided by the following criteria, taken primarily from the July 15 NRC letter:

- safety-related,
  - reactor operation
  - reactor protection
- design and materials interface with Westinghouse,
- design and materials interface with Gibbs & Hill,
- demanding design parameters,
- turned-over to the start-up group.

Based upon the above system selection criteria, the design review concentrates on the Residual Heat Removal/Safety Injection System (RHR), Train "B", from the containment sump line penetration to the RHR heat exchanger discharge nozzle. The system review will include representative elements of the mechanical, electrical, instrumentation and controls, and structural disciplines. Further, an implementation review of design analysis control will be performed on the RHR/Safety Injection Train B design process to augment the technical review.

Implementation reviews of the remaining two selected elements of the design control program have been chosen to provide added assurance that design changes and organizational interfaces were adequately controlled for a completed system. This completed system, the Spent Fuel Pool Cooling System, Train A, is also the subject of the as-built verification aspect of the review. This portion of the review is structured to verify that the as-built condition matches the appropriate design documents. Similar to the design review, the as-built verification is multi-disciplined.

The selected work scope, therefore, clearly satisfies the program intent and the specified objectives using a diverse sampling of the overall design control process. It also addresses the supplemental NRC comments contained in the July 15 letter.

This assessment program takes into account numerous project reviews which have been performed already and the areas specified by the NRC as requiring added assurance. For example, Texas Utilities has conducted self-initiated design inspections to ensure that all licensing commitments are being fully incorporated into the final design and the NRC staff has been doing their SALP reports over the last several years. The TMI Blue Ribbon Panel was formed to implement and support safety-related plant modifications in light of the Three Mile Island 2 accident. The INPO self-evaluation performed by Sargent & Lundy on the CPSES design control process is yet another example. Several other design/construction reviews have also been performed to date. Perhaps the most comprehensive were the NRC-sponsored CAT inspection and the SIT evaluation of the Walsh-Doyle allegations. Exhibit 1.1 illustrates how the CAT and SIT evaluations collectively address all key elements of the design process. The proposed IAP, therefore, provides a valuable supplement to these previous reviews.

Cygna will utilize the experience it has gained from the successful completion of independent reviews for Mississippi Power & Light on Grand Gulf Unit 1 and for Detroit Edison on Enrico Fermi Unit 2. The Cygna project team will be structured to provide a multi-leveled assessment of the technical and quality assurance aspects of any observations. There will be two functional tiers within the overall project organization: the Project Team and the Senior Review Team. The Project Team will be composed of the Project Manager, Project Engineer and other key people with experience in quality assurance, design control, nuclear plant design and construction practices. This Project Team not only has experience in the specific areas to be addressed but several of its members performed similar functions during the independent reviews of

Grand Gulf Unit 1 and Enrico Fermi Unit 2. The Senior Review Team will be made up of Messrs. B.K. Kacyra, J.E. Ward, E.F. Trainor, and L.L. Kammerzell. Mr. Kacyra, the Chief Executive Officer of Cygna Corporation, is a recognized technical expert with significant commercial and nuclear experience in the field of structural design and dynamic analysis. Mr. Ward is a recognized expert and industry spokesman on regulatory requirements and systems design. Mr. Trainor, Vice President, Quality Assurance, offers extensive experience in the fields of quality assurance and management controls. Mr. Kammerzell, Vice President and Manager of the Western Region Office, has broad-based experience in the nuclear field, including licensing, project management and systems design. This team, with assistance from in-house consultants, will review all conclusions reached by the Project Team and will be the final authority within Cygna regarding the adequacy of resolutions.

Cygna is in a unique position to provide the necessary independence and services to accomplish these design review objectives. A signed Statement of Independence stating Cygna's independence of Texas Utilities is provided in Section 7.0. Although Cygna has not participated in the design and construction of CPSES, recent and ongoing work experience includes: seismic re-evaluation of Category I piping and structures on Maine Yankee and Vermont Yankee; responses to I&E Bulletins 79-02 and 79-14 on Vermont Yankee; responses to I&E Bulletins 79-01B and 80-11 on Pilgrim 1 and Millstone 1; piping seismic analyses, retrofit design and field support services on Diablo Canyon 1 and 2, primary consultant for NRC's SEP program on Yankee Rowe, and Appendix R analyses and design modifications on Nine Mile Point 1. In addition, Cygna completed Independent Design Reviews for Mississippi Power & Light's Grand Gulf Unit 1 and Detroit Edison's Fermi Unit 2, as well as participated in Public Service Indiana's self-initiated INPO evaluation at Marble Hill. Cygna personnel have also conducted independent quality assurance evaluations for Houston Lighting and Power, Northern States Power, Arkansas Power & Light, Boston Edison and others.

Cygna has initiated work on this Independent Assessment Program, in order to meet key Comanche Peak project milestones. Upon approval of the program, Cygna will complete and document the assessment. Documentation will be in the form of a draft report, submitted simultaneously to the NRC and Texas Utilities for comments. A final report will then be issued to incorporate comments from the NRC and Texas Utilities.

In summary, Cygna believes the program outlined in this document represents a rational approach for an independent assessment of CPSES. By satisfying the stated objectives, Cygna will be able to provide the NRC with significant supplemental evidence regarding the overall quality of CPSES design and construction. When integrated with previous reviews sponsored by the NRC, the results of this IAP will provide the NRC with te added assurance it seeks.

3.0 METHODOLOGY

This section describes the methodology for the Texas Utilities CPSES Independent Assessment Program and will be used by Cygna Energy Services as a basis for conducting the assessment.

In order to facilitate an understanding of the project approach discussed below, Exhibit 3.1 provides a listing of the specific terminology which was established with the NRC during the Independent Design Verification Programs for Mississippi Power & Light and Detroit Edison. The same terminology will be followed in this Independent Assessment Program for Texas Utilities.

Essentially, the approach involves performing the review, noting all observations, verifying the accuracy of the observations, and evaluating the potential safety impact. To accomplish this, the review will follow the basic steps listed below:

Step 1: Collect Documents
Step 2: Develop Review Criteria
Step 3: Develop Review Procedures
Step 4: Conduct Reviews
Step 5: Project Team Review
Step 6: Senior Review Team
Step 7: Report Results

Exhibit 3.2 shows the review process from a line item on the checklist (Step 4) to the final report (Step 7). Throughout this process, items identified as having potential impact on plant safety are given immediate attention. This is to ensure that Texas Utilities receives timely notification of those items concluded to have a definite potential for impacting plant safety. Cygna will focus its extensive quality assurance and technical experience in this program through a two-tier approach in which every potential finding

receives the attention of both the project team and senior review team. Each of these teams will draw on the specialized talents of Cygna in-house consultants, as necessary. Maximum use will be made of review criteria, matrices, checklists and observation records already developed and implemented on the independent reviews for Mississippi Power & Light and Detroit Edison.

Each of these basic steps is described in the following subsections.

Step 1: Collect Documents

Documents are collected and reviewed in two stages. During the first stage, the review teams identify those central documents which guide the design control process, such as the SAR, QA manuals, and project procedures. Reviewing these central documents provide an understanding of how the work process is structured and directed.

During the second stage of data collection, the review teams identify and gather those documents needed to complete the review. Where practical, these documents are collected from Texas Utilities for review in the Cygna offices.

All documents utilized during the course of the review are logged for inclusion in the final report.

Step 2: Develop Review Criteria

A key element in the review will be the development of review criteria to measure the adequacy of the design and design control process. These review criteria are a composite of licensing commitments, CPSES requirements, and appropriate industry standards.

Texas Utilities' and Gibbs & Hill's QA programs will be evaluated using a matrix criteria which compares the key elements of their design control program to industry standards and licensing commitments. For an example matrix, see Exhibit 3.3.

Step 3: Develop Review Procedures

Each reviewer is guided by matrices and checklists that identify key elements to be evaluated during the design control review and implementation evaluation, respectively. Any time a reviewer determines that a line item on the matrices or checklist is inadequately addressed, an "Observation Record" is prepared. All observations are then reviewed to determine their potential impact on plant safety. For those determined to have potential safety impact, a "Potential Finding Report" (PFR) is prepared. Regardless of this determination of potential safety impact, the resolution to each observation is documented.

Matrices, Checklists, Observation Records and PFR's are described in more detail below.

Matrices

Matrices provide the reviewer with a listing of relevant licensing commitments and project requirements to be cross-correlated to Texas Utilities' and Gibbs & Hill's design control program documents. Exhibit 3.3 contains a typical matrix format which will be adapted to the specifics of the TUSI design control program elements. As the reviewers complete the matrix, the adequacy of the respective design control program elements is evaluated with respect to the licensing commitments and project requirements. Whenever a design control program element is

found to either not address or inadequately address a matrix element, an Observation Record is prepared and its number is recorded in the comments column of the matrix.

Checklists

Checklists provide the reviewers with a listing of key design control elements to be considered in the implementation evaluation. Appendix A provides a sample checklist form for the design control review. As a reviewer checks each line item on a checklist, its adequacy is evaluated against the review criteria. If the requirements are met, the line item is marked "satisfactory." Whenever significant conservatisms are identified, they are so noted in the "comments" column. If the reviewer is fully satisfied that the requirement has not been met, an Observation Record is prepared and its number is recorded in the comments column of the checklist.

Observation Record

A sample Observation Record form is provided in Appendix A. The observation number is a unique number sequentially assigned to each observation within a checklist.

Each observation record is prepared by the originator of the observation and then reviewed by a qualified person assigned by the Project Manager. Based on this review, an evaluation by the Project Team, consultation with Cygna specialists, and an informal conference with Texas Utilities, an Observation Record Review will be prepared. This review record rules on the validity and potential safety impact of each observation and is approved by the Project Manager and the observation originator.

The disposition of all observations, including those that are invalidated, is recorded on an Observation Log. (see Appendix A for a sample form).

Potential Finding Report

Potential Finding Report (PFR) forms are also illustrated in Appendix A. Each PFR receives a sequential number which is correlated to the observation number on the Observation Log. On this form, the cognizant reviewer records a description of the observation, an assessment as to the extent of the observation plus an evaluation of the design and safety impact.

Step 4: Conduct Reviews

Reviews of the CPSES design control process will be divided into two areas:

- Program adequacy
- Extent of program implementation

The assessment of design control program adequacy will be performed on Texas Utilities and Gibbs & Hill, the architect/engineer. Three elements of the program (design analysis, design change and interface controls) will be used to assess the extent of program implementation at Texas Utilities and Gibbs & Hill. Additional confirmation of the program implementation will be achieved through an as-built walkdown and design review.

Each review team is composed of at least two individuals jointly capable of performing and reviewing the work.

These review teams are guided by the review criteria matrices and checklists described in the previous subsections. Members of the teams perform the initial reviews, complete the matrices and checklists, and originate observations.

Step 5: Project Review

Exhibit 3.2 illustrates the role of the Project Team review in the decision process. Once an observation has been originated and reviewed by a qualified individual, the Project Team review is performed to verify the accuracy of the observation, its completeness, the design impact, and the extent. Given this information, the potential safety impact is evaluated.

An integral part of the Project Team review is interfacing with Texas Utilities to confirm the accuracy of an observation and to evaluate the design impact. To maintain independence, all apparent nonconformance with the checklists will be recorded.

In addition to reviewing observations, the Project Team reviews the completed checklists to verify their completeness and accuracy.

The Project Team is responsible for the preparation of the final report.

Step 6: Senior Review Team

All valid observations and PFR's are reviewed by the Senior Review Team.

A cognizant member of this team, assisted as necessary by Cygna in-house consultants, will review each obervation and PFR for completeness, accuracy, and potential impact on plant safety. Based on their assessment, the Senior Review Team may do either of the following:

- Approve the Project Team conclusions.
- Direct the Project Team to perform more work, such as clarifying data, redirecting the review, or performing additional assessments within the current work scope.

The Senior Review Team will also evaluate the collective safety impact of observations that are individually concluded to have insignificant safety consequences. During the entire review process, those potential findings which are identified as having potential safety impact will receive immediate and first priority attention. Should the Senior Review Team conclude that the observation does indeed have a definite potential impact on plant safety, the finding will be reported immediately to Texas Utilities in accordance with Title 10 of the Code of Federal Regulations, Part 21.

Step 7: Report Results

The results of the review process will be recorded in a final report issued concurrently to Texas Utilities and the NRC. This report will contain the following:

- Review criteria
- Checklists and Matrices
- Observation Log
- Potential Finding Reports
- An assessment of the effectiveness of the design control program

- An assessment of the implementation of the design analysis, design change and interface elements of the design control program, based upon the scope of the design and as-built reviews

- An assessment of the as-built condition of the Spent Fuel Cooling System, Train "A"

- An assessent of the design adequacy of the Residual Heat Removal System, Train "B"

4.0 SCOPE OF WORK

This section describes the scope of work for the CPSES Independent Assessment Program (IAP) and will be used by Cygna Energy Services as a reference and basis for conducting the review. Cygna plans to concentrate the IAP on the areas of design control, design and as-built verification. The scope includes a broad review of the design control program within Texas Utilities and Gibbs & Hill, the architect/engineer for CPSES. This broad, or "horizontal" review, is then supplemented by "vertical" reviews of selected elements of the overall design control process. Specifically, the vertical reviews cover implementation of design control elements (design analysis, design changes and interfaces), design (Residual Heat Removal System/Safety Injection, Train "B"), and as-built verification (Spent Fuel Cooling System, Train "A"). Selection of this scope is based upon the following criteria:

- The scope should involve safety-related systems.
- The scope should provide for a review of a cross-section of disciplines (mechanical, electrical, structural, instrumentation, etc.)
- The scope should include design and materials interface with Westinghouse and Gibbs & Hill.
- The scope should involve a system with demanding design parameters.
- The scope should include a system or element which has been turned over to the start-up group.

With these criteria in mind, the Independent Assessment Program implementation review scope of work is described below. For the design change control, interface control and as-built verification reviews the scope includes:

- the suction and discharge lines for the Spent Fuel Pool Cooling System (see Exhibit 4.1)

- the Fuel Building structure (see Exhibit 4.2) as related to the foundation for Spent Fuel Pool Cooling System equipment

- selected essential equipment such as a Spent Fuel Pool Cooling heat exchanger and pump

- instrumentation associated with the Spent Fuel Pool Cooling System

- power and control circuitry associated with vital functions of the Spent Fuel Pool Cooling System

For design analysis control and design reviews the scope includes:

- residual Heat Removal System (RHR), Train B piping from the containment sump line penetration to the RHR heat exchanger discharge nozzle (see Exhibit 4.3)

- power distribution system associated with the RHR Train B pump back to the alternate power sources

- instrumentation and control circuitry associated with the RHR Train B isolation valve located inside the isolation tank

- seismic qualification of the RHR Train B pump.

The program will integrate the conclusions of the program and implementation review activities. First, an overall review will confirm that an adequate design control process was established by project procedures and implemented for the design change, interface and design analysis elements. This implementation review will be further supplemented with the design and as-built verifications. Each of these review activities are discussed below in more detail.

4.1 Design Control Review

An evaluation of the Design Control Program governing CPSES design will be performed to assure that an adequate design control program has been established and specific design control program elements have been implemented. This evaluation will encompass the following goals:

- Determine whether Texas Utilities' design control activities as defined in their design control program documentation satisfy licensing commitments and project requirements.

- Determine whether the design control activities of Gibbs & Hill satisfies the CPSES SAR and project requirements.

To satisfy previously identified concerns, the emphasis has been placed in the areas of design analysis, design change and interface control systems for the implementation evaluation. The organizations responsible for various aspects of the design/construction process of the Spent Fuel Pool Cooling and Residual Heat Removal Train B Systems are identified in Exhibits 4.4 through 4.8. This information will guide the following reviews in order to accomplish the above goals:

4.1.1 Review of Texas Utilities' Design Control Program

Cygna proposes to perform an evaluation of the key elements of the Texas Utilities design control program as applied to CPSES design. The key elements to be included are:

- Design input documents
- Design analyses control
- Drawing control
- Procurement control

- Internal/external interface control
- Design verification
- Document control (controlled documents), including revisions
- Design change control
- Corrective action
- Internal/external audits and surveillances

This evaluation will encompass reviewing the Texas Utilities design control program documentation to assess how well it addresses CPSES SAR commitments and project requirements with respect to the above key design control elements. The evaluation will involve developing a quality program matrix similar to that shown in Exhibit 3.3, which identifies the quality requirements committed to with a cross correlation to the Texas Utilities design control program. Appropriate portions of the following Texas Utilities design control documents, will be used to develop the matrix:

- CPSES QA Program
- CPSES Project Quality Engineering Procedures
- CPSES Project Quality Engineering Instruction
- CPSES Site Document Control Procedure

Other documents may be added as the review progresses. Once the matrix is established, an analysis will be performed to:

- Determine the adequacy of the design control program in addressing the specific quality commitments.

- Assess the impact of the design control program deficiencies and/or weaknesses with respect to committed requirements governing design.

- Determine areas requiring concentrated attention during the design control program implementation evaluation.

4.1.2 Implementation Evaluation of Texas Utilities Design Control Program

In order to assess the degree of implementation of Texas Utilities design control program, Cygna will perform an implementation evaluation of two key elements of the Texas Utilities design control system. The key elements selected for this evaluation are design change and interface control as specifically applied to the design and construction of the Spent Fuel Pool Cooling Systems. A third element, control of design analyses, is covered under the Gibbs & Hill scope since Texas Utilities was not responsible for the design of this selected scope. The specific activities in this phase of the design control review are described below:

1. Develop an implementation review checklist. The checklist is designed to focus the review activities towards key areas of the implementation process. The checklist will contain key design control element attributes (questions derived from procedural commitments to be reviewed during the review). Emphasis will be placed on developing attributes pertaining to activities which, if not properly implemented, would result in the greatest impact on quality. The checklist will serve the purpose of ensuring depth and comprehensive coverage in the review. It is intended to be utilized only as a guide during the evaluation process and will not restrict the review investigation. To provide further review continuity, individuals who will participate in the actual review will be involved in the preparation of checklists. This will ensure that it is performed in accordance with both the content and intent of the checklist.

2. Conduct an implementation review at Texas Utilities offices. This review will concentrate on the items contained in the checklist and will be structured to identify weaknesses, assess their extent, and evaluate their impact on plant safety. The actual review will be performed by qualified personnel who will:

- Verify by examination and evaluation of objective evidence that the established design control program element has been implemented.
- Assess the degree of implementation
- Identify the impact of failures (if any) to implement the quality assurance program.

The implementation evaluation of the Texas Utilities external interface control program will focus on those activites performed by the following subcontractors:

- Gibbs & Hill
- ITT-Grinnell
- Brown & Root (N-stamp review only)
- Joseph Oat
- Reliance
- Bingham Willamette
- Borg-Warner
- Posiseal

4.1.3 Review the Gibbs & Hill Design Control Program

In conjunction with the Texas Utilities design control program review, Cygna will perform a review of the Gibbs & Hill design control program. Gibbs & Hill has been selected because they are

responsible for a major portion of the plant. This review will be performed to assess how well their design control program addresses the commitments imposed through Texas Utilities contract documents and the CPSES SAR. As a minimum, the design control program will be evaluated against the following key design control elements, as applicable:

- Design input control
- Design analysis control
- Drawing control
- Procurement control
- Internal/external interface control
- Design verification
- Document control
- Design change control
- Corrective action
- Internal/external audits and surveillance

The evaluation will involve developing quality program matrices similar to that developed during the review of Texas Utilities' design control program which identifies the design control requirements imposed through contract documents and CPSES SAR.

4.1.4 Implementation Evaluation of the Gibbs & Hill Design Control Program

In order to assess the degree of implementation of Gibbs & Hill design control program, Cygna will perform an implementation evaluation of three key elements of the Gibbs & Hill design control system. The elements selected for this evaluation are: design analysis, design change and interface control. The implementation evaluation will concentrate on Gibbs & Hill implementation of the design change and interface control activities associated with the

design and construction of the Spent Fuel Pool Cooling System and implementation of the design analysis activities as applied to the design of the Residual Heat Removal System - Train B. These evaluations will be performed at the Gibbs & Hill offices both in New York and at the Commanche Peak Steam Electric Station jobsite, as appropriate. The method of performing this implementation evaluation will be the same as that utilized for the implementation evaluation of the Texas Utilities design control program.

4.1.5 Implementation Evaluation of the Brown & Root N-Stamp Design Control Program

To supplement the evaluation of the Texas Utilities and Gibbs & Hill design control programs, Cygna will perform an implementation evaluation of the Brown & Root design change and interface control activities associated with the design and construction of the Spent Fuel Pool Cooling System. The evaluation will take place at the Commanche Peak Steam Electric Station jobsite and will be performed using the same methodology developed for the implementation of the Texas utilities design control program.

4.1.6 Design Control Review - Summary

Cygna will identify any observations during the course of the design control program review and implementation evaluation efforts which may have occurred due to the following conditions:

- Omissions in the design control program with respect to the key design control elements identified earlier.

- Implementation not in accordance with the documented design control program.

These observations will be reported in sufficient detail to assure that corrective action can be effectively implemented. The potential safety impact of each observation will also be evaluated.

Cygna's proposed approach to this review follows the schematic logic illustrated in Exhibit 3.2 of this document.

All findings will be reviewed by both the project team and the senior review team to assess their accuracy and completeness. As a part of the overview process, observations which individually have no impact on plant safety are assessed collectively to evaluate their cumulative effect on plant safety.

4.2 Design Review

To augment the design control implementation review, this part of the assessment program will consist of the multi-disciplined review of the Residual Heat Removal/Safety Injection System (RHR) Train B. The design information will be reviewed starting from the most recent revision of the drawings and applicable design documents. The technical review will cover the mechanical, electrical, instrumentation and controls, and structural aspects of the selected system elements as performed by Texas Utilities and its various contractors. Each review discipline is discussed below to provide additional insight into the depth and latitude of the efforts.

4.2.1 Mechanical Review Activities

The mechanical review activities will consider, to whatever extent it exists, the flow of information between Texas Utilities and its engineering consultants and contractors as detailed in Exhibit 4.9. Namely, it will look at the information received and how it has been integrated into the design of the RHR/Safety Injection

system for Comanche Peak. The division of responsibility for this work is summarized in tabular form on Exhibit 4.4. Some of the activities outlined below may involve review of documents, drawings, analyses and other design information furnished in whole or in part by the A/E or other outside engineering organizations.

The mechanical review will concentrate 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 the branch lines 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, will also be reviewed. The objective of this mechanical portion of the review is to perform an assessment of pipe stress, pipe support, and pump seismic qualification calculations to ensure correctness with respect to applicable code requirements, industry standards and licensing commitments. The review will also verify that the design has been adequately controlled throughout the design process and that technical information has been properly transferred between organizations, such as, from Gibbs and Hill to tne pipe support designer. The review will encompass the following activities, each of which is described in detail below:

- Detailed review of Criteria Documents
- Pipe Stress Analyses
- Pipe Support Design
- Equipment Qualification Requirements (Seismic Qualification of the Pump)
- Flued Head Design

a) Detailed Review of Criteria Documents

In order to obtain an independent assessment of the methodologies and approaches implemented in the analyses performed by the applicable organizations, the Cygna team will review the applicable design criteria documents. Based on Cygna's own expertise in piping design and analyses, a determination will be made as to the validity of the criteria used. As a minimum, the appropriate sections of the following documents will be reviewed:

- Design Specification for Piping Systems for Nuclear Service
- Design Specification for Supports and Restraints for Nuclear Service
- Final Safety Analysis Report

The documents above will form the basis for the development of checklists to be used during the verification program.

b) Pipe Stress Analysis Review Activites

The technical review of the stress analyses will consist of the following activities:

- Input Data Check
- Piping Model Check
- Review of Stress-Related Calculations
- Review of Stress Reports

Each of the above four piping activities are described in detail below.

Input Data Check

Cygna will perform a check of the piping analyses to ensure that data has been appropriately input. The input data is provided by G&H; the Cygna team will, however, review this input for general conformity to industry standards. As a minimum, the following input data will be considered:

- Internal piping pressure
- Thermal load cases
- System operating modes
- Specified anchor movements
- Application of given seismic spectra
- Application of other given external dynamic loadings

Piping Model Check

Using the criteria and operating conditions established above, the Cygna review team will obtain the latest revisions of the piping isometrics and will perform the detailed check of the piping models developmed for the stress analyses. As part of this effort, Cygna will pay particular attention to the following items, as a minimum.

- Piping geometry
- Piping section properties
- Support and restraint types and location
- Fittings, nozzles and valves
- Operating conditions

- System boundaries and classification
- Other considerations such as nodal spacing and support stiffness

Review of Stress-Related Data

In addition to the stress results, there is numerous related data to be considered. This data will be subject to a detailed review by the Cygna team which will include, but not be limited to:

- Seismic anchor movements
- Valve stem modelling
- Support, restraint, and penetration load summaries
- Local stress calculations for integral welded attachments (e.g. lugs, stanchions)

Review of Stress Reports

Upon completion of the review of the areas indicated above, the Cygna team will perform a detailed review of the results and conclusions made by the original designers. The basis for this evalution will be a careful study of the design reports issued to date. As a minimum, particular attention will be given to the following items:

- Load cases considered in analyses
- Summary of load combinations
- Nozzle reactions and valve acceleration check
- Pipe displacements

c) Pipe Support Design Activities

The technical review of the design of selected pipe supports, anchors and restraints will consist of the following activities:

- Review of input data and load combinations
- Review of design calculations
- Review of issued drawings

This review applies only to supports and restraints on the primary flow path as identified under the piping scope and to anchors in the branch lines and main flow path. Each of the pipe support review activities is described in detail below.

Review of Input Data

The Cygna review team will take a close look at the support requirements generated by the stress group for the pipe support group. Some items to be reviewed in detail are:

- Support stiffness
- Support types and locations
- Piping deflections for all essential load cases
- Load directions and magnitudes

Review of Design Calculations

Using the criteria and support requirements established above, the Cygna team will review the calculations performed by the pipe support designers. For those supports and restraints on the primary flow path, Cygna will review the

calculations in detail, paying particular attention to:

- Support stiffness
- Weld calculations
- Stress allowables
- Vendor allowables for catalog hardware
- Proper modeling for computerized calculations
- Expansion bolt allowables and baseplate flexibility effects

Review of Drawings Issued

Cygna will closely compare the analytical results of the overall piping design process with the support drawings produced. Consequently, the Cygna team will review the support drawings to ensure that the intent of the stress analysis and pipe support design has been met. Therefore, the following information will be checked on the drawing as a minimum:

- Correct type, orientation and location
- Appropriate clearances specified
- Sufficient structural and weld data
- Correct component sizes

d. Equipment Qualification Activities

The review will also consider the seismic qualification of the RHR pump and motor assembly in the RHR Train B piping. This review will consist of the following activities:

- Review of the qualification files
- Review of applicable drawings and loading input used in design calculations
- Review of design calculations performed
- Review of applicable test results

Each of the above four activites are described in detail below.

Review of Qualification File

Cygna will review the qualification files for the pump to ensure that all of the proper documentation is included. The seismic qualification status forms will be reviewed for completeness and agreement with drawings, analyses and test results.

Review of Applicable Drawings and Loading Input used in Design Calculations

Cygna will review the design calculation input data to ensure that proper dimensions, weights, material properties, temperature, pressure and seismic loadings were used.

Review of Design Calculations

Cygna will review the mechanical design to ensure that the methodology and results are in accordance with applicable code requirements, industry standards and licensing commitments.

Review of Test Results

Cygna will reivew any applicable seismic test methods to assure compliance with the applicable NRC and IEEE Standards. Input loading will be inspected to ensure that they properly envelope the required loads. Test results will be reviewed and compared to the relevant qualification criteria.

4.2.2 Flued Head Activities

The flued head design is designated as an ASME Section III component. As such, Cygna proposes to conduct the following tasks:

- Review the ASME criteria and prepare a checklist of significant items.
- Review the analysis and report, noting deviations from the criteria.

4.2.3 Structural Review Activities

The structural review of the RHR system will consist of a design check of the supports for the trays that carry the power supply cable for the pump. To verify the adequacy of the supports, the following items will be reviewed as a minimum (see Exhibit 4.11):

- Support spacing
- Loads and load combinations
- Stresses in structural members, welds, anchor bolts and baseplates

- Allowable stresses in the above

These items are described in more detail below.

Support Spacing

The relevant drawings will be reviewed to verify that the spacing of the cable tray supports meets the requirements specified.

Loads and Load Combinations

The design calculations will be checked to ensure that the correct loads and load combinations (or conservative estimates thereof) as specified in the Gibbs & Hill design criteria have been applied to the structure.

Calculated Stresses

The design calculations will be checked in order to verify that an accurate or conservative estimate of the maximum stresses in all of the structural elements has been obtained. In order to perform this task, the following will be reviewed:

- Assumptions (stated or implied)
- Computer modelling, where applicable
- Computations

Allowable Stresses

The design calculations will be checked to verify that the correct allowable stresses, as specified in the Gibbs & Hill design criteria have been used. Further check will be made to ensure that the computed stresses meet the requirements of the A.I.S.C. manual.

4.2.4 Electrical Review Activities

(As shown in Exhibit 4.10,) the electrical discipline review will focus on two specific design areas. The first area is the RHR Train B pump motor power current between 6.9 KV Safeguards Bus 1EA2 and the pump motor (TBX-RHAPRH-02). The review is limited to the power circuit and does not include the motor control circuit. One endpoint of the review will be at the terminals on the high voltage side of the control transformer. The review will not involve assessing the design adequacy of the input power circuits to the Safeguard Bus.

The second focus of the electrical review will be on the control circuit for isolation valve 1-8811B located outside of containment in the valve isolation tank. The review will commence at the 120 V terminals on the valve circuit control transformer. The review will assess the control circuit design as it interfaces with annunciator system, process computer, monitor light box, and other motor operated valve control circuits.

The division responsibilities for this work are shown in tabluar form in Exhibit 4.7. Cygna will review the SAR commitments and preliminary requirements, Westinghouse interlock sheets, design instructions and general motor and cable design spec fications to obtain review criteria. The electrical power distribution, cable

separation and routing, and equipment qualification requirements will also be noted. Review checklists will be prepared to verify that the design information was accurately and sufficiently carried through the design process into the final drawings and criteria for field fabrication and installation. In addition, the flow of design information across the contractor interfaces from Westinghouse, Gibbs & Hill, and Texas Utilities Services, Inc. will be checked to ensure that correct and adequate design information was transmitted. The specific examples of design information to be reviewed and checked are as follows:

- Verify that electrical distribution system one-line diagrams comply with basic design considerations of electrical engineering guidelines.

- Review electrical power and control systems overall design against appropriate regulations and standards identified in SAR.

- Review electrical design criteria for voltage tolerance limits and incorporation into the RHR pump assembly specifications and motor nameplate data.

- Check cable size for adequate ampacity, voltage drop and short circuit considerations.

- Check cable voltage rating and insulation rating against electrical design criteria.

- Check cable specification and cable manufacturer's data for incorporation of cable ratings.

- Review cable schedule and raceway (conduit) design for maintenance of voltage and system separation requirements.

- Check short-circuit analysis for maximum fault current at the generator bus caused by a fault at the RHR-Train B pump.

- Check breaker interrupting rating for compliance with 6900V switchgear specification.

- Check protective relay settings.

- Verify conformance of the Gibbs & Hill control circuit with design input documentation from Westinghouse.

- Verify that design documents and specifications identify Nuclear Safety Related components as appropriate.

- Check interconnection and control cable identification and routing against the cable and raceway schedule and routing design criteria.

- Check electrical isolation between safety and non-safety currents.

4.3 As-Built Verification

The final activity is to assure that the systems, components and structures have been installed to the latest design documents. To accomplish this, an as-built review team will perform a detailed field verification of the Spent Fuel Cooling System Train A and selected elements of the fuel building. This team will review mechanical, structural, electrical and instrumentation and control areas. The walkdown will consider the following as a minimum:

- Identification, location and installation of piping and mechanical equipment.

- Location, configuration and detailing of pipe supports and supporting structures.

- Cable and raceway identification, installation, routing, separation and termination.

- Instrumentation location and identification.

- Equipment location, orientation, anchorage, support structures, and identification.

5.0 PROJECT ORGANIZATION

Exhibit 5.1 illustrates the organization proposed by Cygna for this Independent Assessment Program. The project is organized to provide multiple levels of review to ensure that each matter receives thorough technical and management attention. This multi-level review process involves a Project Team and a Senior Review Team. As needed, each of these teams will draw on the specialized talents available within a group of Cygna consultants.

Mr. Larry Kammerzell will act as Principal-in-Charge for the performance of this effort. As a principal of the firm, and Vice President in charge of the Western Region offices, he will ensure that the appropriate resources are concentrated on this effort. Mr. Kammerzell has the authority to represent Cygna in all matters, including contractual and commercial. He has over 20 years of nuclear-related experience and, prior to joining Cygna, held responsible engineering and management positions with Stone & Webster Engineering Corporation, United Engineers and Constructors, General Atomic Company, and the U.S. Navy.

Ms. Nancy Williams will act as Project Manager for the proposed scope of work. She will direct all aspects of the project and will be the prime contact with Texas Utilities' staff representatives. In this capacity, she will be responsible for the day-to-day monitoring of the progress of the work. Ms. Williams has significant experience with respect to the engineering and management of nuclear power projects. Her specific experience as Assistant Project Manager on the Independent Design Verification Program for Enrico Fermi Unit 2 will be directly applicable to the work being performed for Texas Utilities.

Mr. John Minichiello will be the Project Engineer. He will be directly responsible for all technical aspects of the assessment program. He will ensure that the assessment criteria are fully developed, that project procedures are properly implemented, and that all resolutions consider design impact. Whenever necessary he will utilize the expertise available on the team of Cygna consultants. He will also review and approve all resolutions. Mr. Minichiello has over 13 years of experience in the nuclear industry, including technical management of projects.

Messrs. Chuan Liu, John Minichiello, Andrew Cowell, Alan Moersfelder, Robert Hess, and Paul DiDonato act as the Group Leaders for the review work in the areas of Pipe Support, Pipe Stress, Seismic Equipment Qualification, Electrical/I&C, As-Built Verification and Design Control, respectively. In this role, they will be responsible for the technical quality of the review in their areas of expertise. They will also be responsible for developing new criteria, checklists and work instructions. Each of these lead engineers will participate, as needed, in reviewing and resolving observations.

Mr. Liu was the Lead Pipe Support Reviewer on the Grand Gulf Unit 1 and Fermi 2 Reviews. His fourteen years' of design experience includes work on pipe supports for five other nuclear plants.

Mr. Cowell has considerable experience using electronic and mechanical testing equipment, writing and modififying computer programs, and static and dynamic testing of large bore piping. This research experience coupled with field assignments for seismic equipment qualification reviews will be directly applicable to the seismic qualification work on this IAP.

Mr. Moesfelder has over thirteen years experience in the power industry. His expertise in Electrical and Control and Instrumentation engineering have been demonstrated in projects such as the design nuclear power plant control complex facilities and backfit modifications.

Mr. Hess has over seventeen years of experience covering a broad spectrum of engineering, including systems analysis and the design of nuclear plant systems and components.

Mr. DiDonato's nine years of experience in the development, implementation, evaluation and auditing of quality assurance programs uniquely qualifies him for this scope of work. He will be assisted by high-qualified quality assurance engineers, as necessary, for this efort. Mr. DiDonato has performed a similar role for Cygna on the Grand Gulf and Fermi 2 Independent Design Verification Programs, thus providing valuable experience to support this effort.

Since Texas Utilities' management will be relying on the results of the this program to assess the adequacy of the construction of Comanche Peak, Cygna's approach includes the formation of a Senior Review Team to review all observations.

The Senior Review Team will be comprised of Mr. B. K. Kacyra, Chief Executive Officer (Cygna Corporation), Mr. J. E. Ward, Consultant to Cygna (MAC), Mr. L. Kammerzell, Vice President (Cygna Energy Services West Coast Regional office), and Mr. E. F. Trainor, Vice President (Cygna Energy Services). The composition of this team brings to bear Cygna's depth of experience in the areas of structural/piping analysis, system design and licensing, safety analysis and risk assessment, and quality assurance, respectively. In addition to the key project team members discussed above, Cygna will utilize speciality consultants, as needed, in the areas of PWR design, system analysis, codes and standards, electrical, and I&C. These individuals will be

utilized in a support capacity for activities which may be required, such as technical interpretation of the codes and standards as applied to the Comanche Peak corrective actions. From time to time, certain other support personnel could be utilized in order to ensure the cost-efficiency of the effort. Resumes of project members typical support personnel who would be utilized are provided in Appendix C.

6.0 QUALITY ASSURANCE

Cygna will perform the work as applicable, in conformance with the requirements of the Cygna Quality Assurance Manual (QAM). The requirements set forth in the QAM are in conformance with the requirements of 10CFR50, Appendix B, ANSI N45.2, and ASME III, NCA 4000. The program has been successfully exercised and approved by and for Mississippi Power and Light, Detroit Edison Company, Pacific Gas and Electric Company, Commonwealth Edison Company, Bechtel Power Corporation, Yankee Atomic Electric Company, and Northeast Utilities Service Company, to name a few. The QAM is listed in the CASE Register of Quality Control Evaluated Suppliers.

7.0 STATEMENT OF INDEPENDENCE

This statement attests to the fact that Cygna Energy Services and the members of the Independent Assessment Program project team have no vested interest in the outcome of our effort to provide added assurance as to the adequacy of the Comanche Peak Steam Electric Station (CPSES) design control program.

Cygna Energy Services has performed no engineering design work or construction services on the Texas Utilities' CPSES project, nor for any other Texas Utilities project. However, from October 4 to October 6, 1982 Cygna conducted a seminar on general probabilistic risk assessment for management and licensing personnel.

No member of the Cygna Project Team nor of the Cygna Energy Services corporate management has ever worked for Texas Utilities nor been associated with any design activities on the CPSES project while employed by any other organization.

No member of the Project Team or any corporate officer or any relative thereof owns stock in Texas Utilities.

I believe this satisfies the current NRC requirements regarding the independence of the engineering firm.

Larry Kammerzell — 1/2/83

Larry Kammerzell — Date
Vice President

8.0 SCHEDULE

This effort shall be scheduled in two phases. Phase one covers the program reviews and the following implementation evaluations: design change control interface control and as-built verification. Phase two provides for the addition of two more implementation evaluations: design analysis control and a technical review. These schedules are shown in Exhibits 8.1 and 8.2, respectively.

9.0 FINAL REPORT OUTLINE

An outline of the final report to be issued concurrently to the NRC and Texas Utilities is provided below:

1.0 Executive Summary

- 1.1 Introduction
- 1.2 Scope of Work
- 1.3 Project Organization
- 1.4 Methodology
- 1.5 Results
- 1.6 Conclusions

2.0 Program Review Scope

- 2.1 Program Objectives
- 2.2 System Element Selection
- 2.3 Program Review
  - 2.3.1 Review of Texas Utilities' Design Control Program
  - 2.3.2 Review of Gibbs & Hill's Design Control Program
- 2.4 Implementation Evaluations
  - 2.4.1 Design Change Control
  - 2.4.2 Design Analysis Control
  - 2.4.3 Interface Control
  - 2.4.4 Technical Design Review
  - 2.4.5 As-built Verification

3.0 Methodology

3.1 Document Collection
3.2 Review Criteria
3.3 Procedures

3.3.1 Matrices
3.3.2 Checklists
3.3.3 Observation Records
3.3.4 Potential Finding Report

3.4 Program Reviews and Implementation Evaluations
3.5 Project Review Team
3.6 Senior Review Team

4.0 Review Results and Conclusions

4.1 Design Control Program
4.2 Implementation Evaluation
4.3 Conclusions

5.0 Appendices

Appendix A: Definitions and Nomenclature
Appendix B: Documents Reviewed
Appendix C: Program Review Matrices
Appendix D: Observation Records
Appendix E: Potential Final Report
Appendix F: Checklists
Appendix G: Statement of Independence

EXHIBITS

EXHIBIT 1.1

CPSES IMPLEMENTATION
REVIEW MATRIX

Element	CAT	SIT	IAP
Design Input Document Control		X	
Design Analysis Control		X	X
Drawing Control	X	*	*
Procurement Control	X		*
Internal/External Interface Control	X	X	X
Design Verification Control		X	*
Document Control	X	*	*
Design Change Control	X	X	X
Corrective Action Control	X	*	*
Internal/External Audits and Surveillances Control	X		*
Design		X	X
As-Built	X	*	X

X = Full Review

* = Touched-on, But No Specific Review

EXHIBIT 2.1

INDEPENDENT ASSESSMENT ACTIVITIES

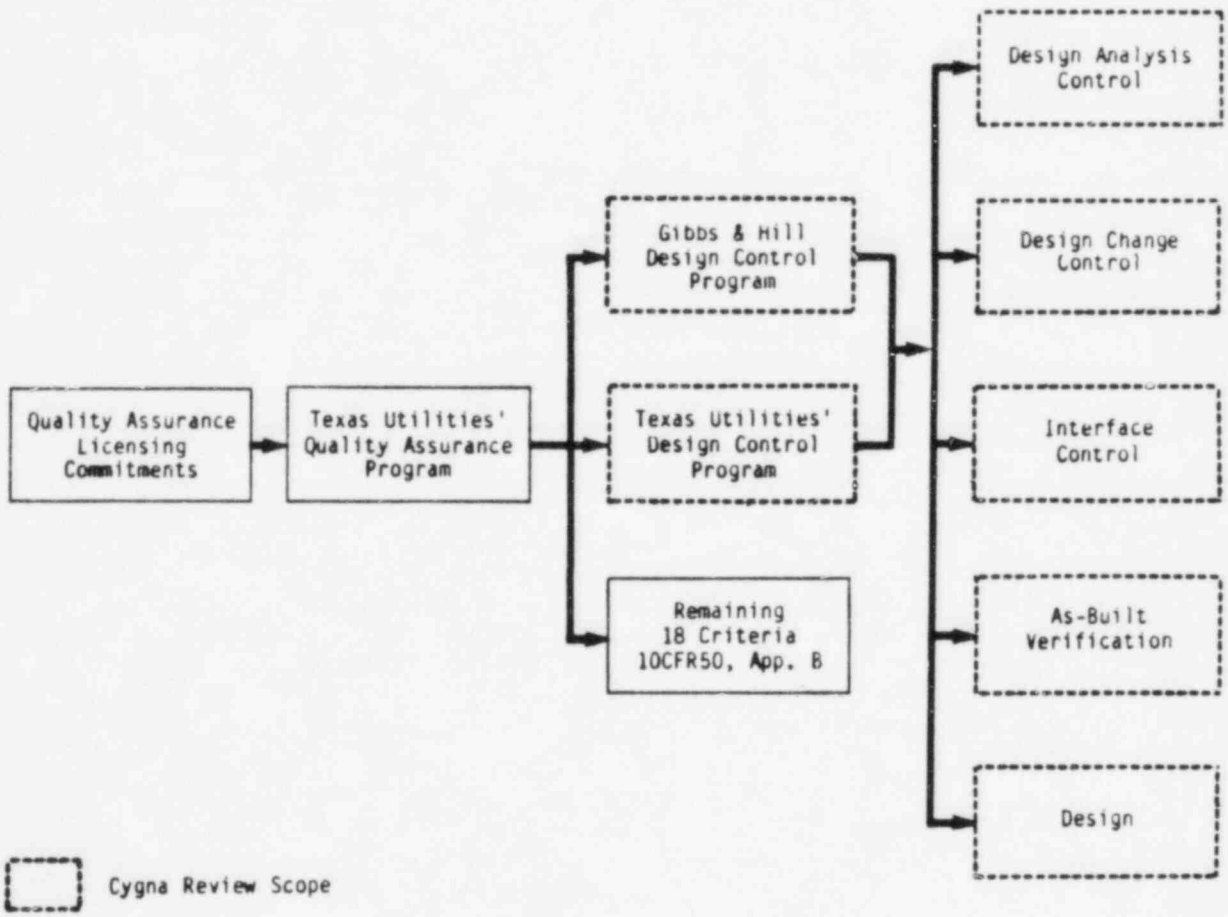


EXHIBIT 3.1

TERMINOLOGY

Term	Definition
Checklist	A listing of key items to be checked during the independent assessment. The checklist provides a guide to the reviewer; it is neither all inclusive nor limiting.
Review Criteria	A compilation of acceptable procedures and standards. The adequacy of the design control process is measured against these criteria.
Observation	Identification of an item in nonconformance with the project review criteria.
Invalid Observation	Any observation which is judged to be inaccurate as a result of further review.
Valid Observation	An accurate and complete observation as judged by the Project and Senior Review Teams.
Potential Finding	A valid observation having a potential impact on plant safety as judged by the Project Review Team.
Vertical Review	A review of selected systems or elements of the total plant design.
Horizontal Review	A quality assurance review of design control procedures and their implementation.
Definite Potential Finding	A potential finding verified by the senior review team to have a potential impact on plant safety. This is a reportable finding to TUSI and the NRC.

REVIEW PROCESS FLOW CHART

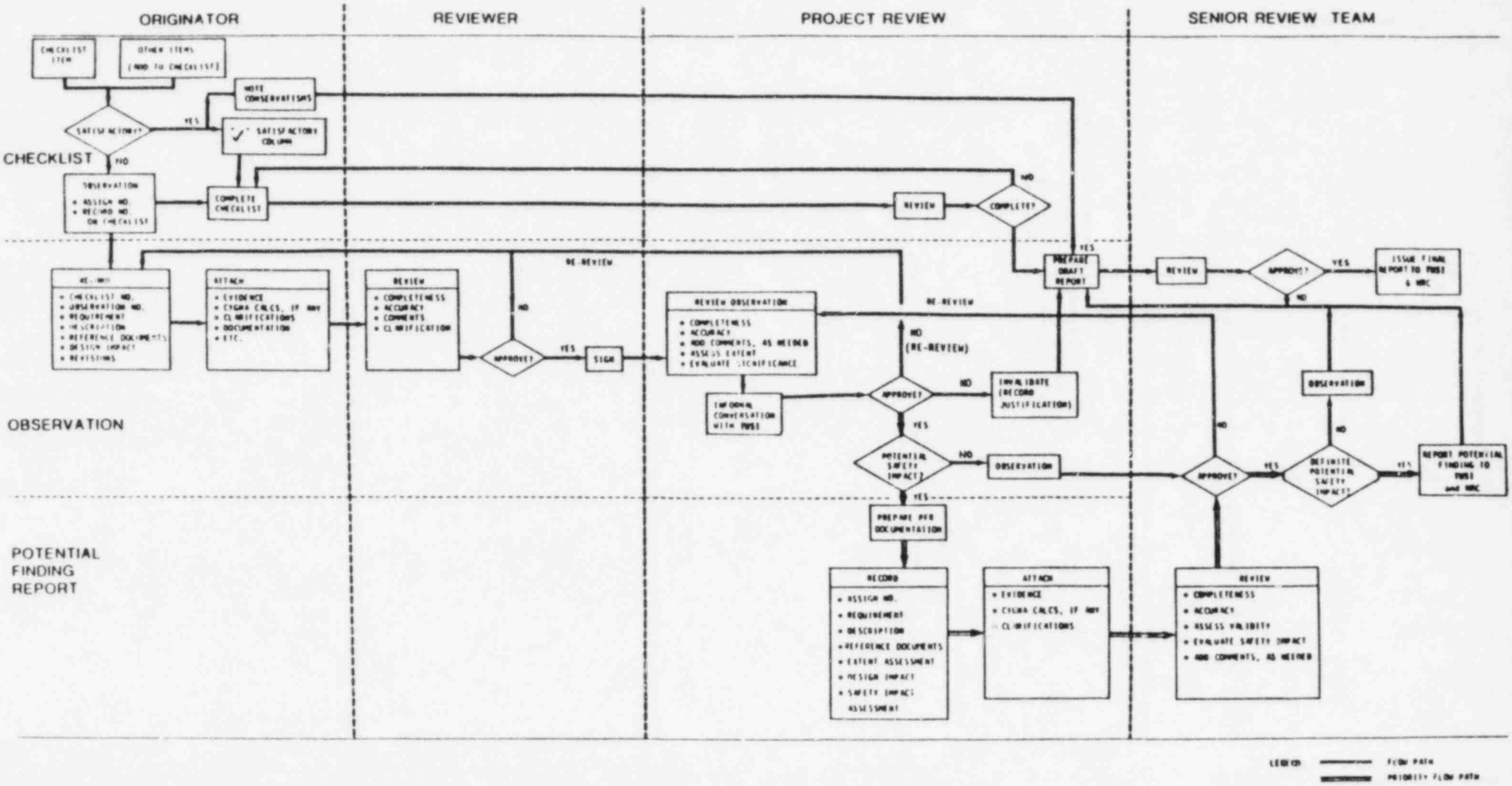


EXHIBIT 3.3

TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX - DESIGN CONTROL

ITEM NO.	QUALITY PROGRAM REQUIREMENTS	GOVERNING DOCUMENTS	TUSI PROGRAM REVIEW				
		N45.2.11 LINE	FSAR	QA PLAN	CP-EP	CP-QP	COMMENTS
	"QA Requirements for the Design of Nuclear Power Plants"						
1	Are procedures developed to assure that design activities are carried out in a planned, controlled, orderly and correct manner?	2.2					
2	Do the program procedures cover the following:						
	a. Responsibilities or organizations involved in the program, such as owner, A-E, NSSS supplier and other contractors?	2.2					
	b. Responsibilities within design organizations?	2.2					
	c. Technical information exchanges across external and interal interfaces?	2.2					
	d. Document control including review, approval, release, distribution, and revision?	2.2					
	e. Maintenance and retention of design documents.	2.2					
	f. Management review of status and adequacy of program?	2.2					
	g. Necessary training of personnel performing activities covered by ANSI N45.2.11?	2.2					
	h. Identifying appropriate design input?	2.2					

EXHIBIT 3.3 (continued)

TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX - DESIGN CONTROL

ITEM NO.	QUALITY PROGRAM REQUIREMENTS	GOVERNING DOCUMENTS		TUSI PROGRAM REVIEW			COMMENTS
		N45.2.11 LINE	FSAR	QA PLAN	CP-EP	CP-QP	
	i. Preparation of design criteria, standards and other criteria?	2.2					
	j. Specifying quality levels, acceptance standards, and record requirements?	2.2					
	k. Selection of design verification networks?	2.2					
	l. Performance of design verifications?	2.2					
	m. Conducting audits of design activities, their reporting and followup.	2.2					
	n. Taking corrective action?	2.2					
	o. Controlling design changes?	2.2					
	Design Input Requirements						
3	Are design inputs, such as design bases, regulatory requirements, codes and standards, identified, documented and their selection reviewed and approved?	3.1					
4	Are Changes from specified design inputs identified, approved, documented and controlled?	3.1					
5	Do design inputs include the applicable requirements of ANSI N45.2.11, Para. 3.2?	3.2					
	Design Process						
6	Are procedures sufficient to assure that applicable design inputs are correctly translated into specifications, drawings, procedures and instructions?	4.1					

EXHIBIT 3.3 (continued)

TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX - DESIGN CONTROL

ITEM NO.	QUALITY PROGRAM REQUIREMENTS	GOVERNING DOCUMENTS		TUSI PROGRAM REVIEW			COMMENTS
		N45.2.11 LINE	FSAR	QA PLAN	CP-EP	CP-QP	
7	Are appropriate quality standards identified, documented and their selection reviewed and approved?	4.1					
8	Is traceability provided from final design to original input?	4.1					
	Design Analyses						
9	Is analysis (calculations, comp., etc.) sufficiently detailed as to purpose, method, assumptions, design input, references, and units so that it can be readily understood?	4.2					
10	Are calculations identified by subject, originator, reviewer and date such that they are retrievable?	4.2					
11	Design Analysis	4.2					
	Are procedures written to provide for the following:	4.2					
	a. Identifying documents to permit ready reference and retrieval?						
	b. Defining the objective of the analyses?						
	c. Definition of design inputs and their sources?						
	d. Documenting the results of literature searches or other applicable background data?						

EXHIBIT 3.3 (continued)

TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX - DESIGN CONTROL

ITEM NO.	QUALITY PROGRAM REQUIREMENTS	GOVERNING DOCUMENTS N45.2.11 LINE	FSAR	TUSI PROGRAM REVIEW QA PLAN	CP-EP	CP-QP	COMMENTS
	e. Documenting assumptions and identifying those assumptions that must be verified as the design proceeds?						
	f. Identification of machine calculations including machine type, code or programming, inputs and outputs?						
	g. Review and approval?						
	Drawings						
	Are procedures established for the preparation and control of drawings?	4.3					
	Specifications						
	Are procedures established for the preparation and control of specifications?	4.4					

EXHIBIT 3.3 (continued)

TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX - DESIGN CONTROL

ITEM NO.	QUALITY PROGRAM REQUIREMENTS	GOVERNING DOCUMENTS N45.2.11 LINE	TUSI PROGRAM REVIEW FSAR	QA PLAN	CP-EP	CP-QP	COMMENTS
12	Are provisions for internal and external interfaces established for: a. Identification of Interface? b. Responsibilities for organizations? c. Lines of communications? d. Documentation requirements for the flow of design information?	5.1 5.2					
13	Are Design Verification Provisions established (by whom, documented/ auditable, extent)?	6.1 6.2					
14	Do Design Verification Methods include: a. Design Reviews? b. Alternate Calculations? c. Qualification Testing?	6.3					
	Document Control						
15	Do procedures assure that documents, and changes thereto are reviewed for adequacy, approved for release by authorized personnel and properly distributed?	7.0					
16	Does Design change control include provisions for the reason for changes and their appropriate review/approval?	8.0					
17	Is a system established for corrective action?	9.0					
18	Are audits of Design Controls performed?	11.0					
19	Is record of documents and revisions established per ANSI N45.2.9	10.0					

EXHIBIT 3.3 (continued)

TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - TEXAS UTILITIES QUALITY ASSURANCE PROGRAM MATRIX - DESIGN CONTROL

ITEM NO.	QUALITY PROGRAM REQUIREMENTS	GOVERNING DOCUMENTS	TUSI PROGRAM REVIEW				
		N45.2.11 LINE	FSAR	QA PLAN	CP-EP	CP-QP	COMMENTS
20	Are changes reviewed and approved by the same organizations doing original unless specifically delegated?	7.0					
21	Do procedures for document control include:	7.0					
	a. Identification of personnel positions or responsible organizations?						
	b. Identification of proper documents used for the design?						
	c. Coordination and control of design interfaces?						
	d. Assure that proper documents are accessible and used?						
	e. The establishment of distribution lists?						

LEGEND

N45.2.11	American National Standards Institute for "Design of Nuclear Power Plants" draft 2, revision 2.
FSAR	Comanche Peak Steam Electric Station Final Safety Analysis Report.
QA Plan	Comanche Peak Steam Electric Station Quality Assurance Plan
CP-EP	Comanche Peak Steam Electric Station Engineering Procedure Manual
CP-QP	Comanche Peak Steam Electric Station Quality Procedures

EXHIBIT 4.1
SPENT FUEL POOL COOLING ELEMENT

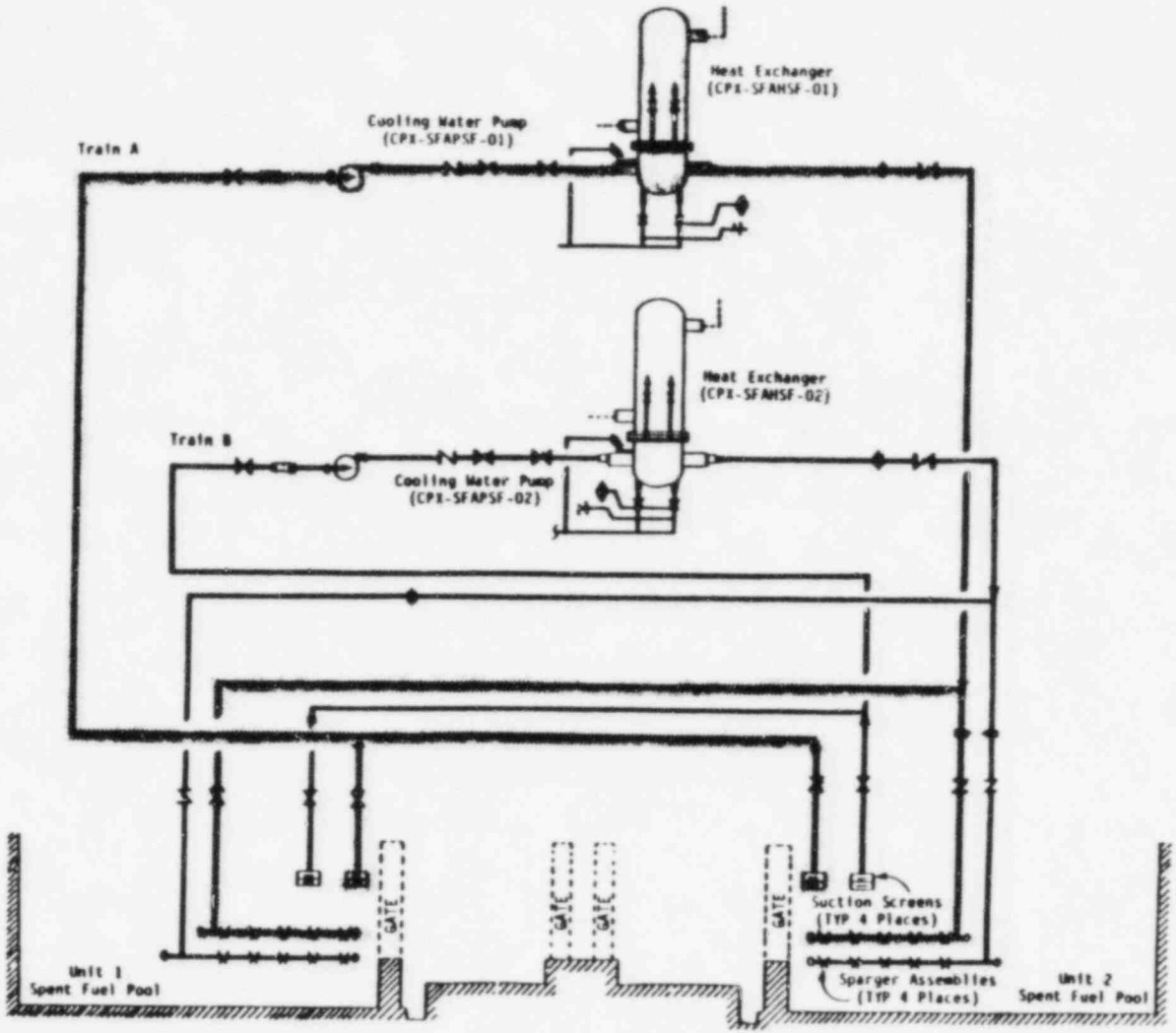


EXHIBIT 4.2
GENERAL ARRANGEMENT DRAWING, FUEL BUILDING

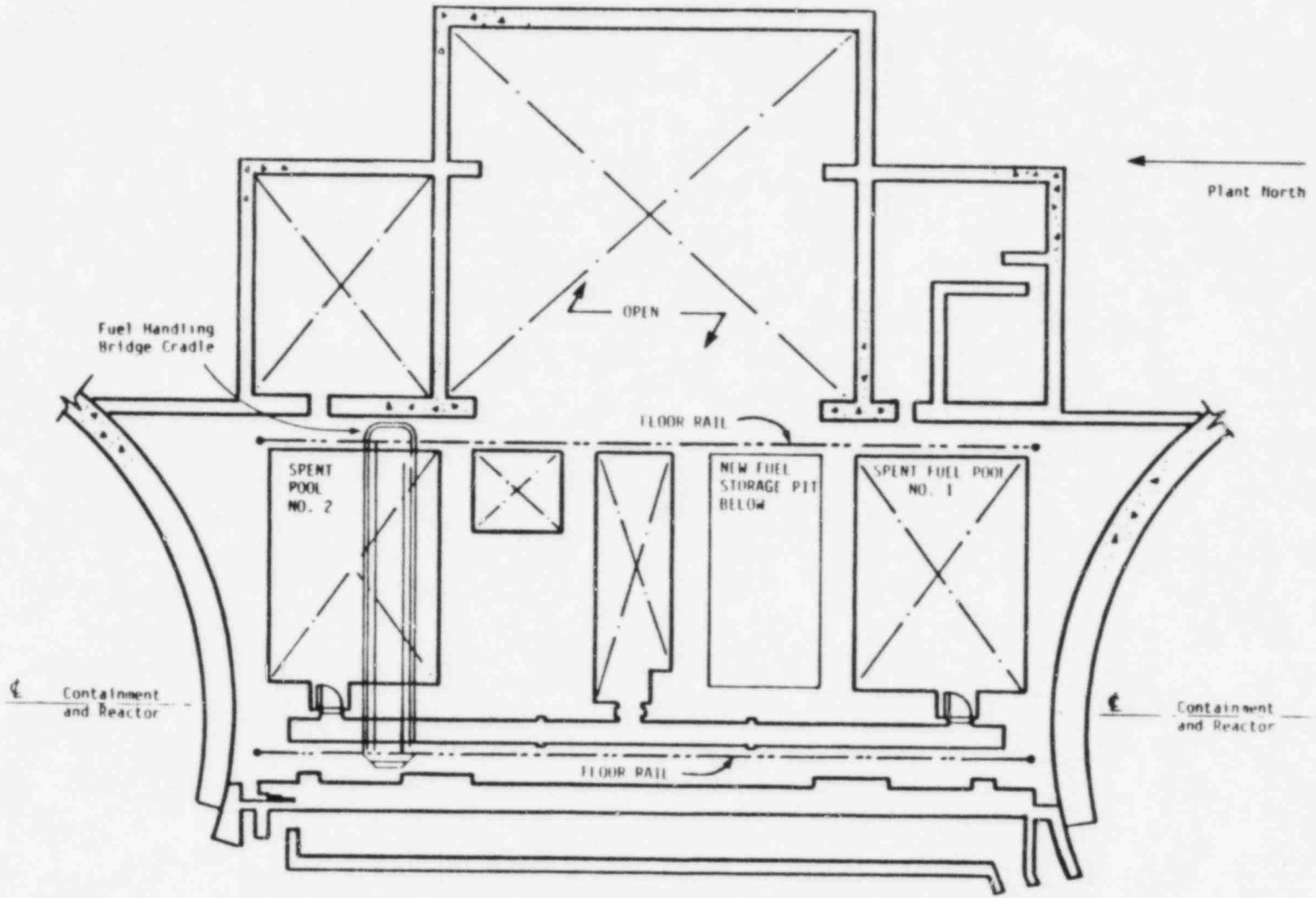


EXHIBIT 4.3

RHR TRAIN "B" FLOW DIAGRAM

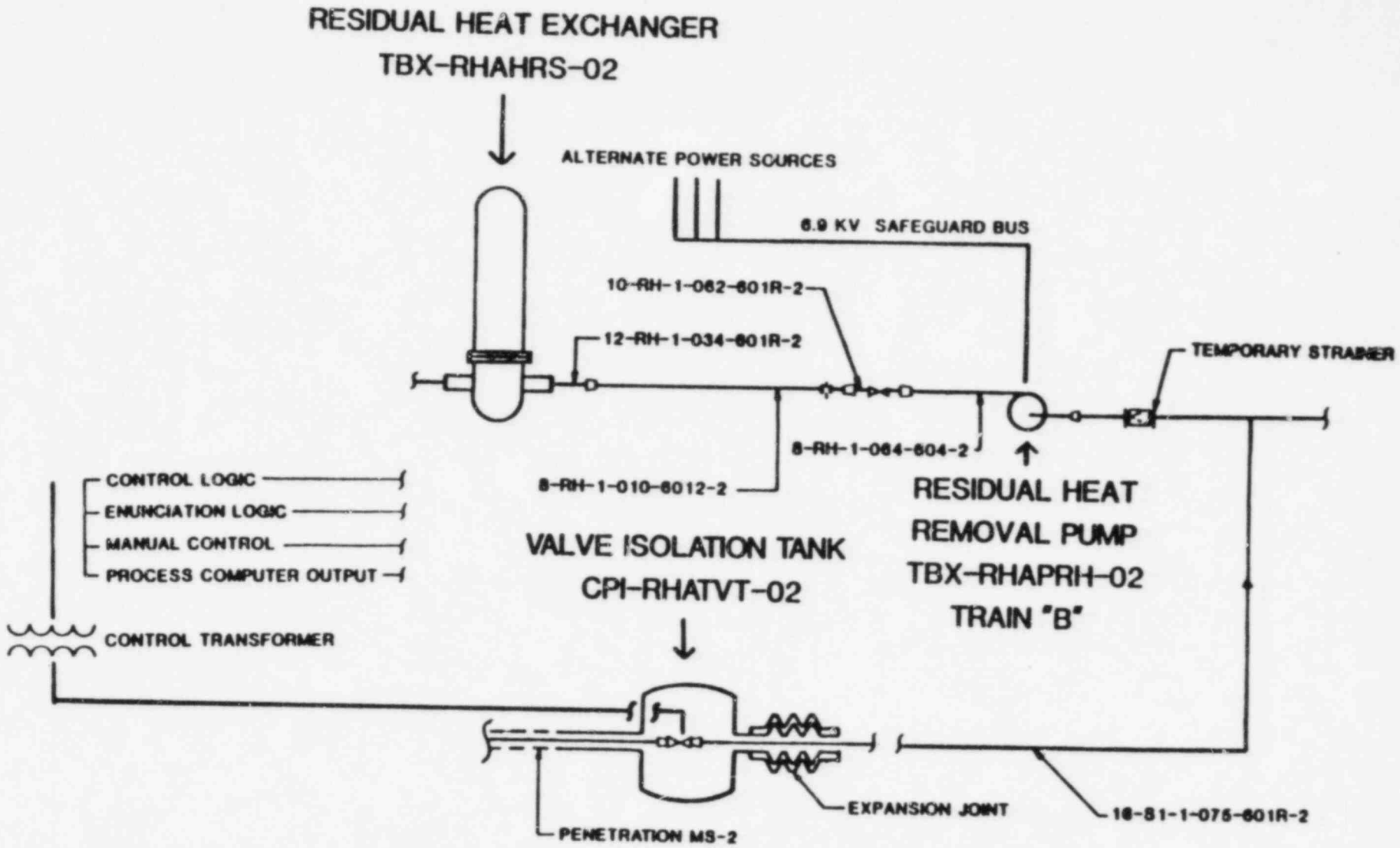


EXHIBIT 4.4

RESPONSIBILITY MATRIX
MECHANICAL
(SPENT FUEL POOL COOLING AND RHR)

		Texas Utilities	G&H	W	ITT Grinnel	B&R	NPSI
1)	Conceptual Design	X(1)	X	X(2)			
2)	Design Criteria		X	X(2)			
3)	System Design		X	X(2)			
4)	Piping Layout		X				
5)	Pipe Stress Analysis		X				
6)	Input to Pipe Stress						
	a) ARS		X				
	b) SAM		X				
	c) Hydrodynamic Loads		N/A				
	d) Support Stiffness		X				
7)	Pipe Support Design	X			X(4)		X
8)	Pipe Anchor Design	X			X		X
9)	Equipment Supports		X				
10)	Installation					X	
11)	Purchase Specifications		X				
12)	Procurement	X					
13)	As-Built Drawings						
	a)Pipe	X					
	b)Pipe Supports	X					

(1)Approval Only

(2)For NSSS components including R.H.R. system

(3)Balance of plant

(4)Responsible for a majority of the supports

EXHIBIT 4.5

RESPONSIBILITY MATRIX
EQUIPMENT
(SPENT FUEL POOL COOLING - TRAIN A)

		Texas Utilities	G&H	J. Oat	Bingham Willamette	Borg-Warner	Posiseal	B&R
1)	Conceptual Design	X(1)	X					
2)	Design Criteria		X					
3)	Qualification Requirements		X					
4)	Input Design Loads		X					
5)	Analysis, Qualification Reports and Fabrication Drawings							
	a. Cooling Water Pump				X			
	b. Heat Exchanger			X				
	c. Butterfly valves						X	
	d. Check and Gate Valves					X		
6)	Purchase Specifications		X					
7)	Procurement	X						
8)	Installation							X
9)	As-Built Configuration	X						

(1)Approval Only

EXHIBIT 4.6

RESPONSIBILITY MATRIX
ELECTRICAL AND I&C
(SPENT FUEL POOL COOLING - TRAIN A)

		Texas Utilities	G&H	Reliance	B&R
1)	Conceptual Design	X(1)	X		
2)	Design Criteria		X		
3)	Pump Motor Design Specification		X		
4)	Contractor Purchase Order	X			
5)	Equipment Qualification Requirements		X		
6)	Design Package Document		X		
7)	Cooling Pump Motor Control Panel			X	
8)	Electrical Power and Control One-Line Diagrams		X		
9)	Cable Specification and Routing Requirements		X		
10)	Cable Tray and Raceway Design		X		
11)	Instrumentation Design		X		
12)	Procurement	X			
13)	Installation				X
14)	As-Built Configuration	X			

(1) Approval Only

EXHIBIT 4.7

RESPONSIBILITY MATRIX
(ELECTRICAL/INSTRUMENT AND CONTROLS
(RHR TRAIN B)

		Texas Utilities	G&H	Westinghouse	B&R
1)	System Descriptions			X	
2)	System Logics			X	
3)	Electrical Wiring Diagrams			X	
4)	Equipment Qualification Requirements			X	
5)	Equipment Qualification			X	
6)	Pump and Valve Procurement and Specifications			X	
7)	Electrical Power and One-line Diagrams		X		
8)	Instrument and Control Diagrams		X		
9)	Schematic and Connection Diagrams		X		
10)	Termination Diagrams		X		
11)	Cable and Raceway Supports		X		
12)	Cable and Raceway Schedule		X		
13)	Installation Specifications		X		
14)	Installation				X

EXHIBIT 4.8

RESPONSIBILITY MATRIX
(STRUCTURAL)

		Texas Utilities	G&H	B&R
1)	Conceptual Design	X(1)	X	
2)	Design Criteria		X	
3)	Building Arrangement		X	
4)	Seismic Analysis		X	
5)	Structural Analysis		X	
6)	Input Loads			
	a) Ground Spectra		X	
	b) Other Loads		X	
7)	Structural Design		X	
8)	Final Drawings		X	
9)	Purchase Specification		X	
10)	Procurement	X		
11)	Construction			X
12)	As-Built Configuration	X		

(1)Approval Only

EXHIBIT 4.9

VERTICAL REVIEW
PIPING AND COMPONENT
(RHR/SAFETY INJECTION)

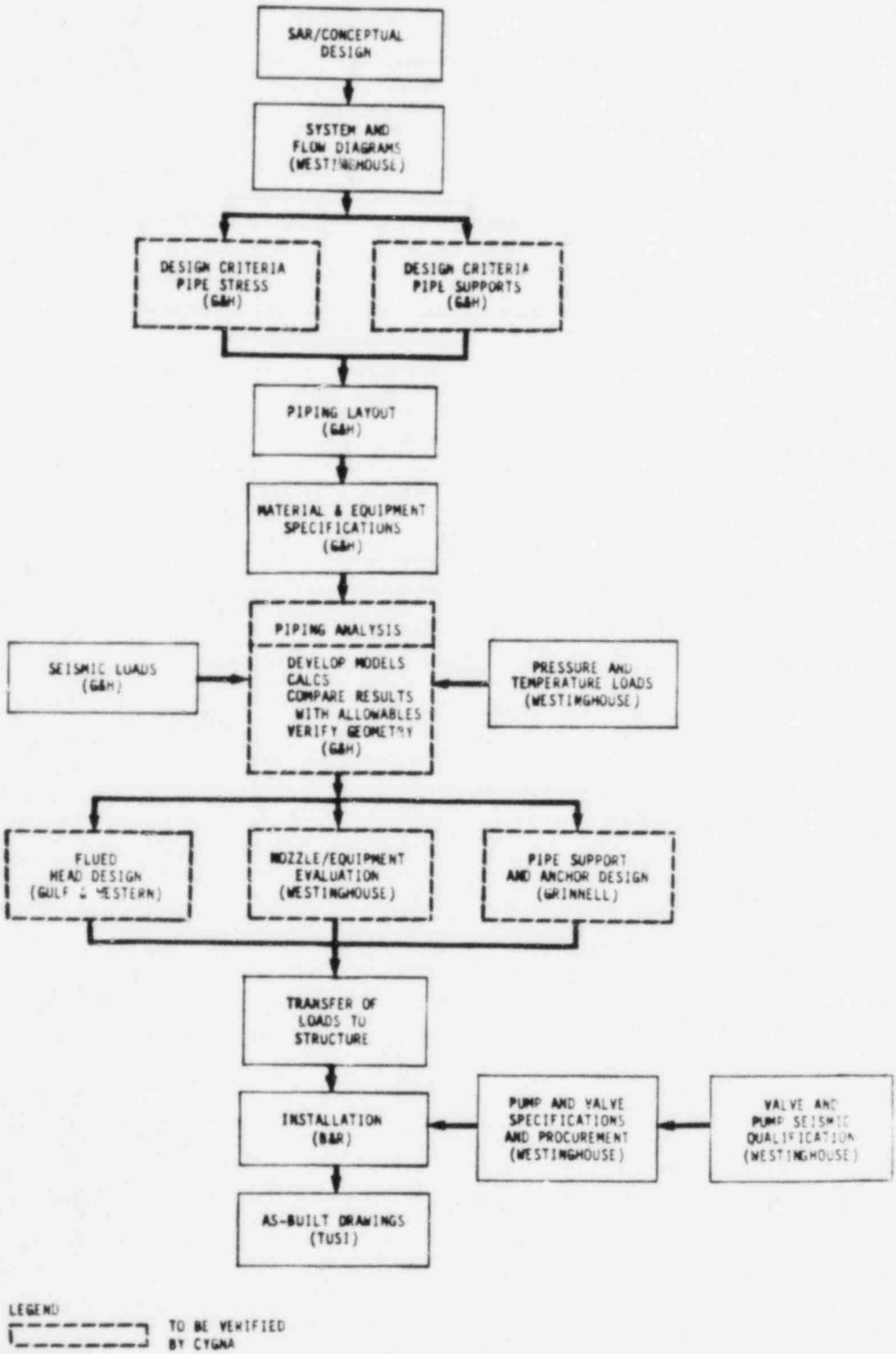


EXHIBIT 4.10

VERTICAL REVIEW
ELECTRICAL/INSTRUMENT & CONTROLS
(RHR/SAFETY INJECTION)

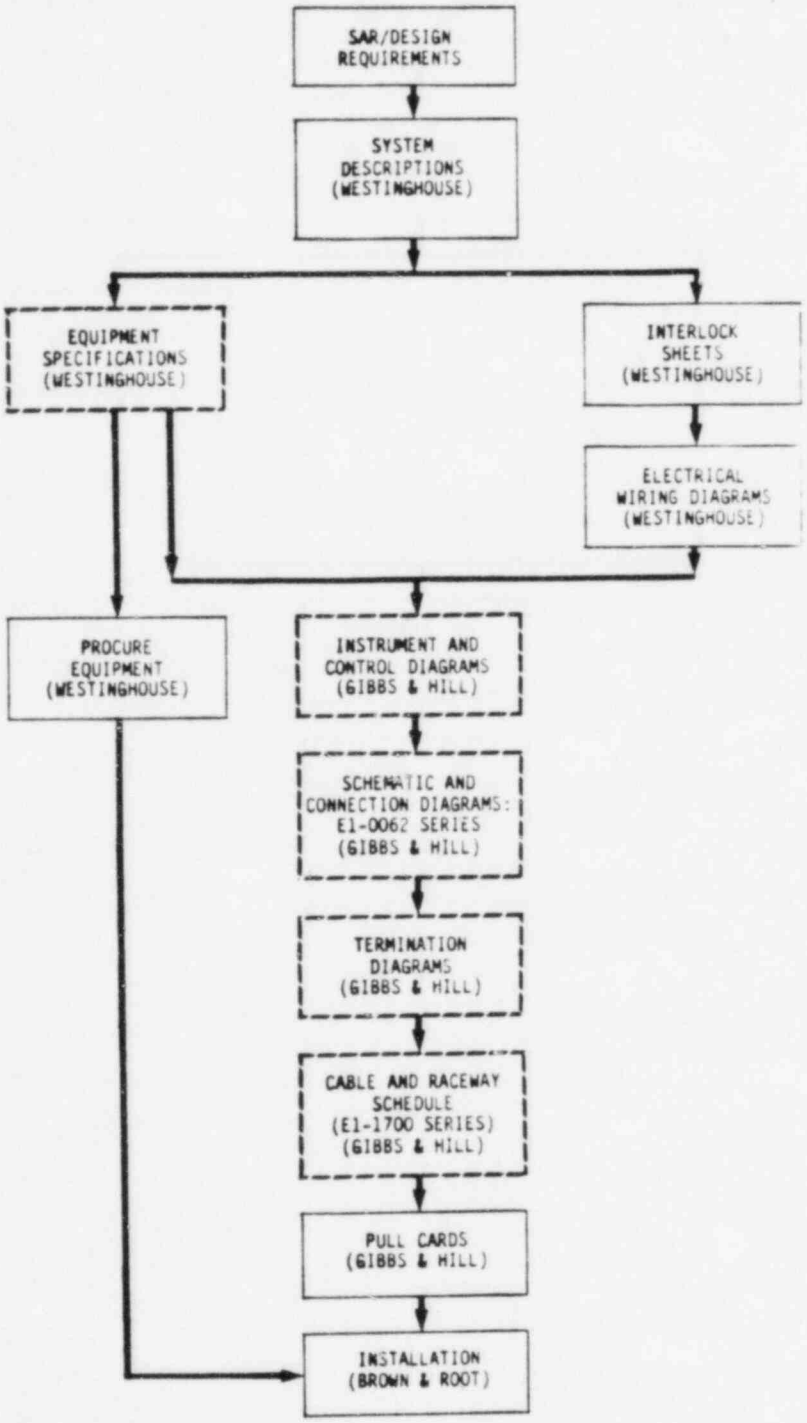


EXHIBIT 4.11

VERTICAL REVIEW
RACEWAY SUPPORTS
(RHR/SAFETY INJECTION)

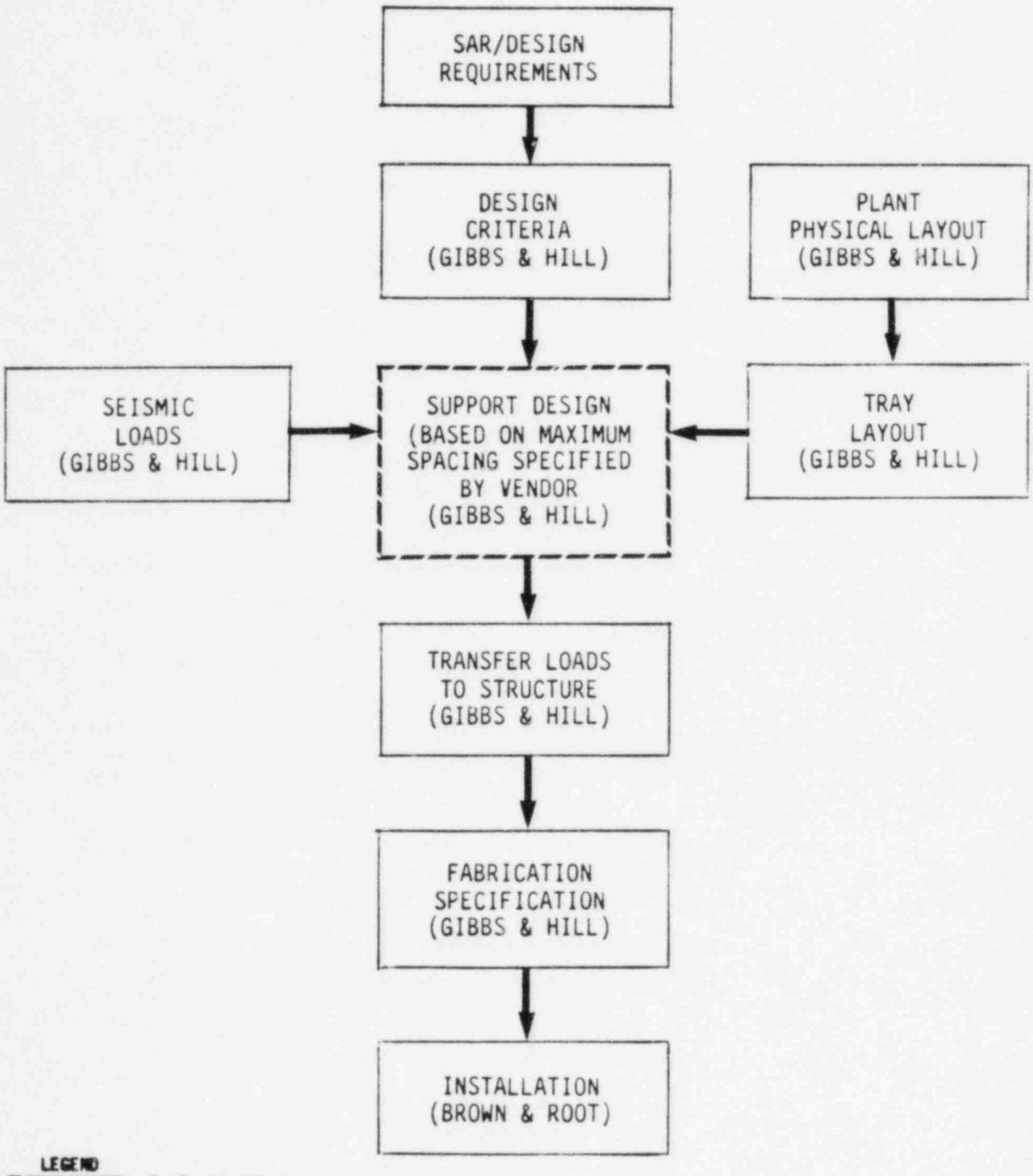
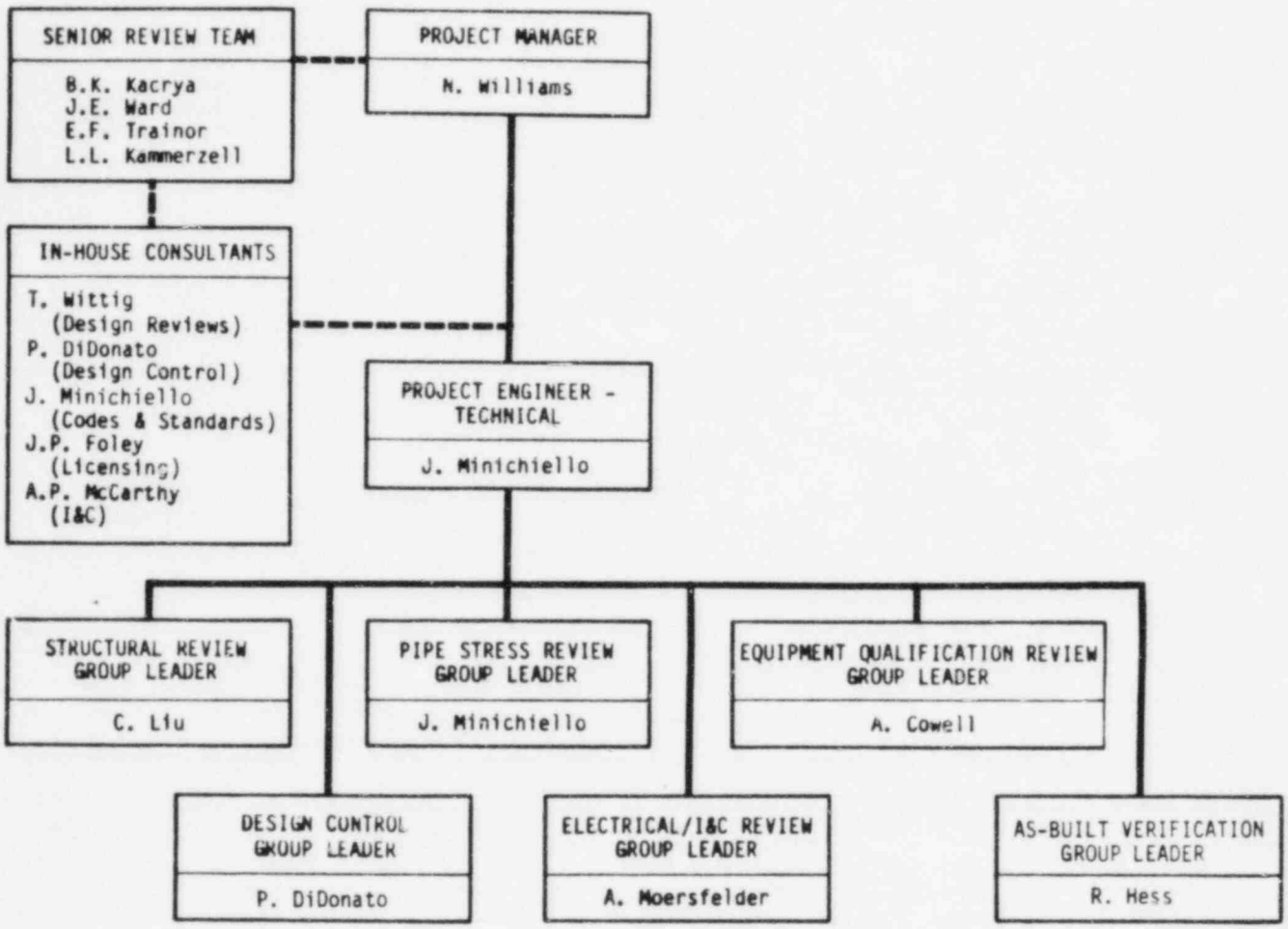


EXHIBIT 5.1

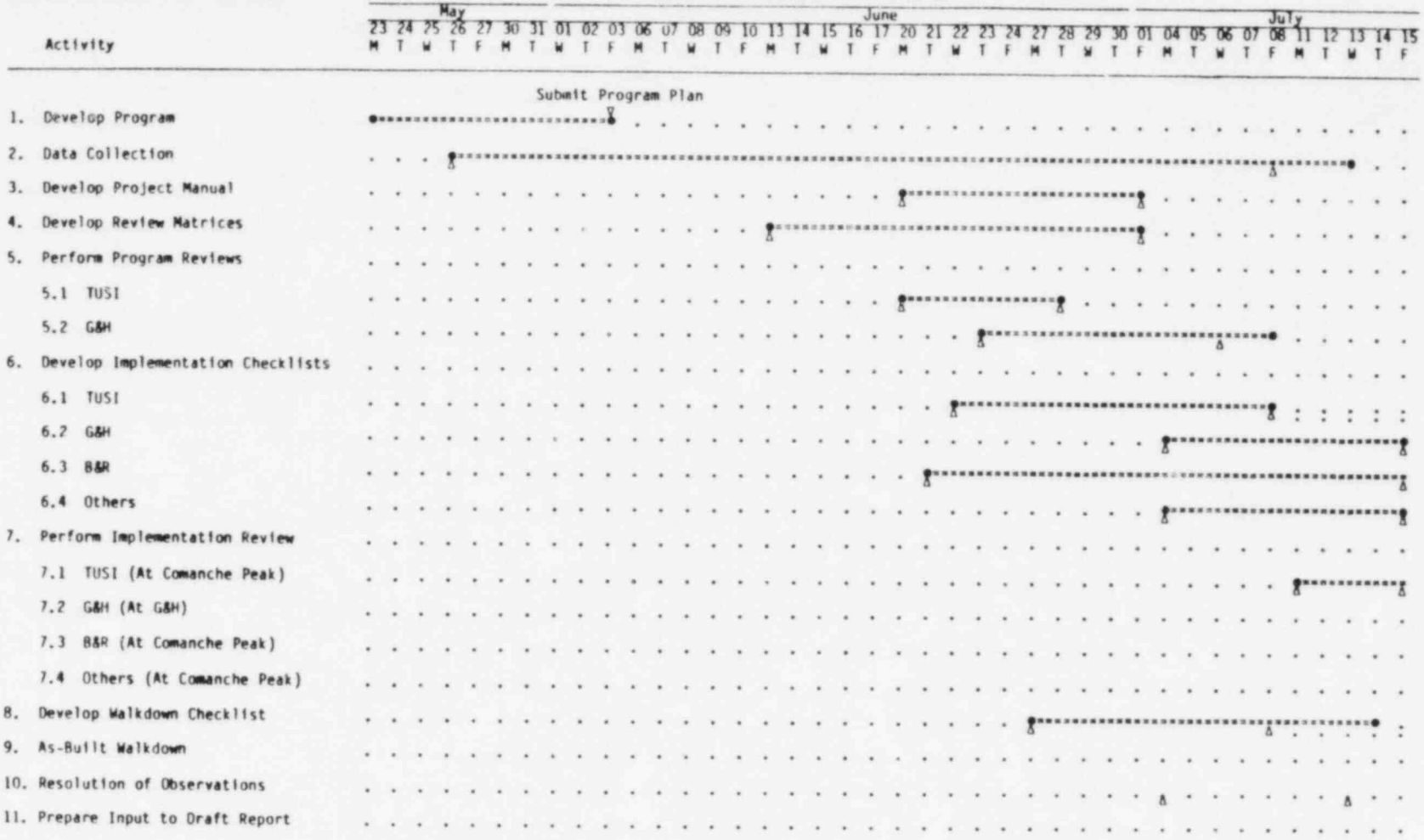
PROJECT ORGANIZATION



LEGEND
——— Project Direction
– – – – Consultation

Texas Utilities Services, Inc.
Independent Assessment Program Schedule (Phase 1)
September 6, 1983, Rev. 4, Page 1

EXHIBIT 8.1
PROJECT SCHEDULE - PHASE 1



NOTATION

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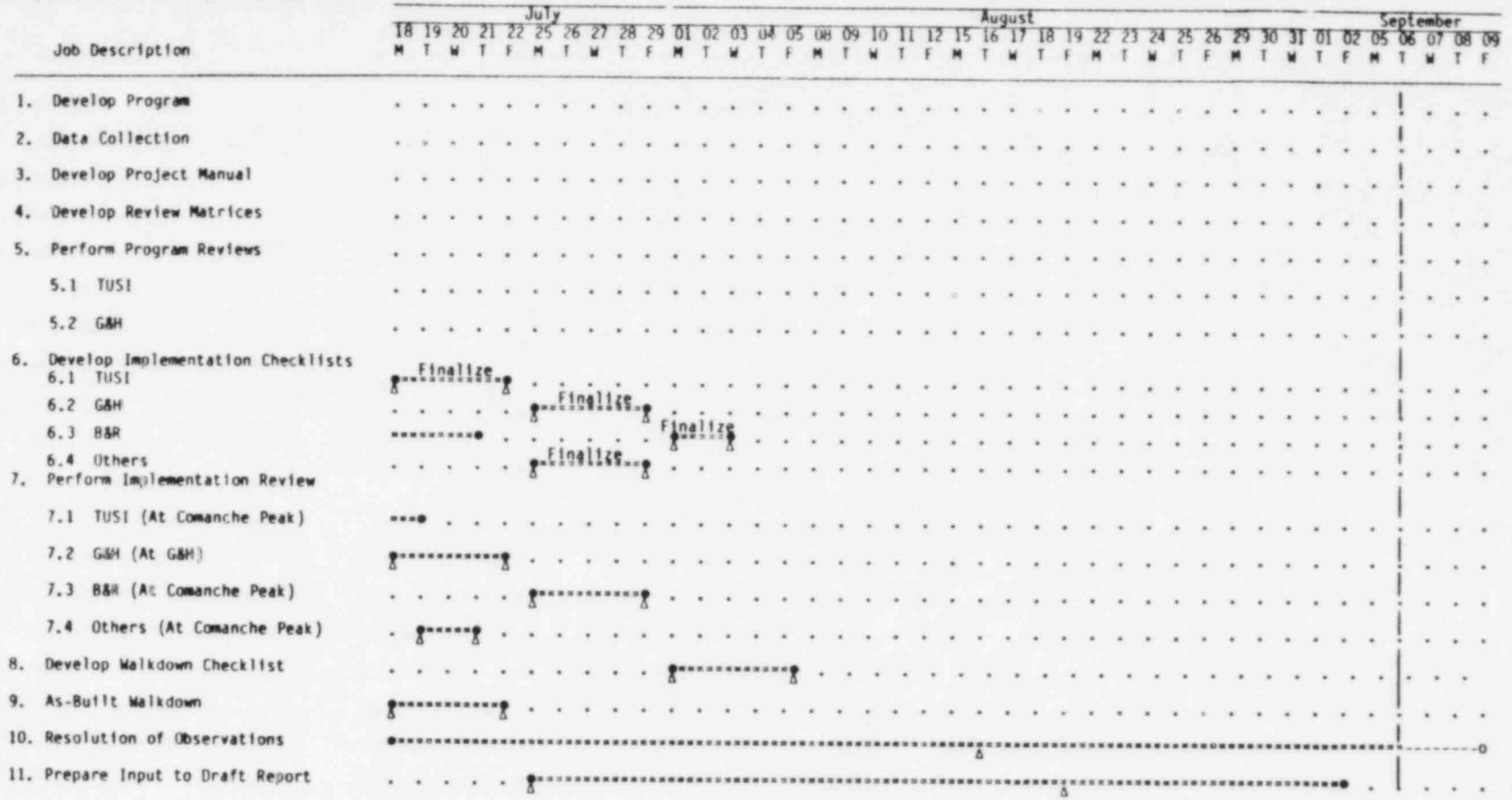
---------- Forecast Line
********** Progress line

Δ Original Milestone
o Forecast Milestone
● Completed Milestone

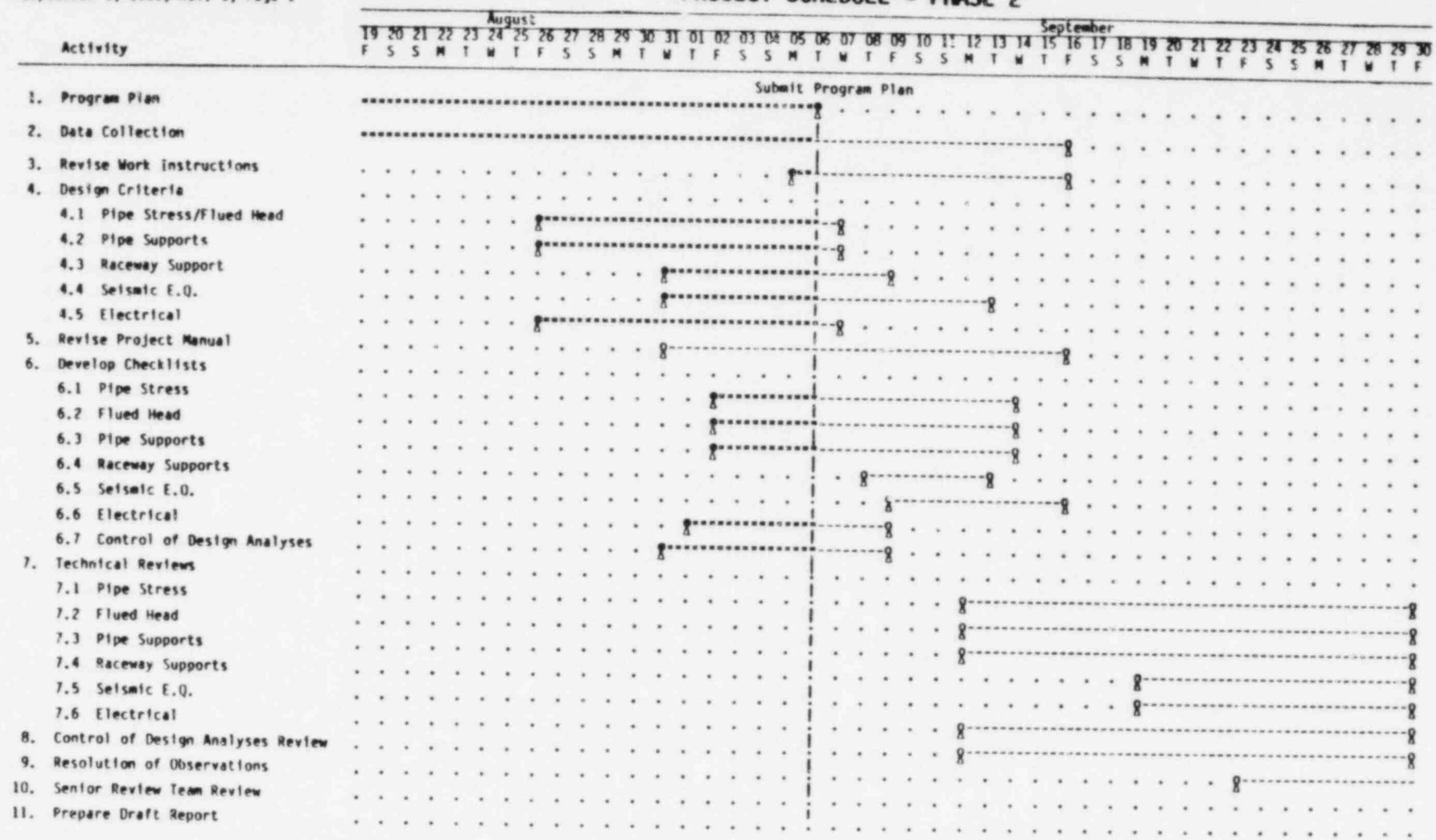


NOTATION

. . . . Slip Line	Δ Original Milestone
********** Forecast Line	o Forecast Milestone
---------- Progress line	• Completed Milestone

Texas Utilities Services, Inc.
Independent Assessment Program Schedule (Phase 2)
September 6, 1983, Rev. 0, Page 1

EXHIBIT 8.2
PROJECT SCHEDULE - PHASE 2



NOTATION

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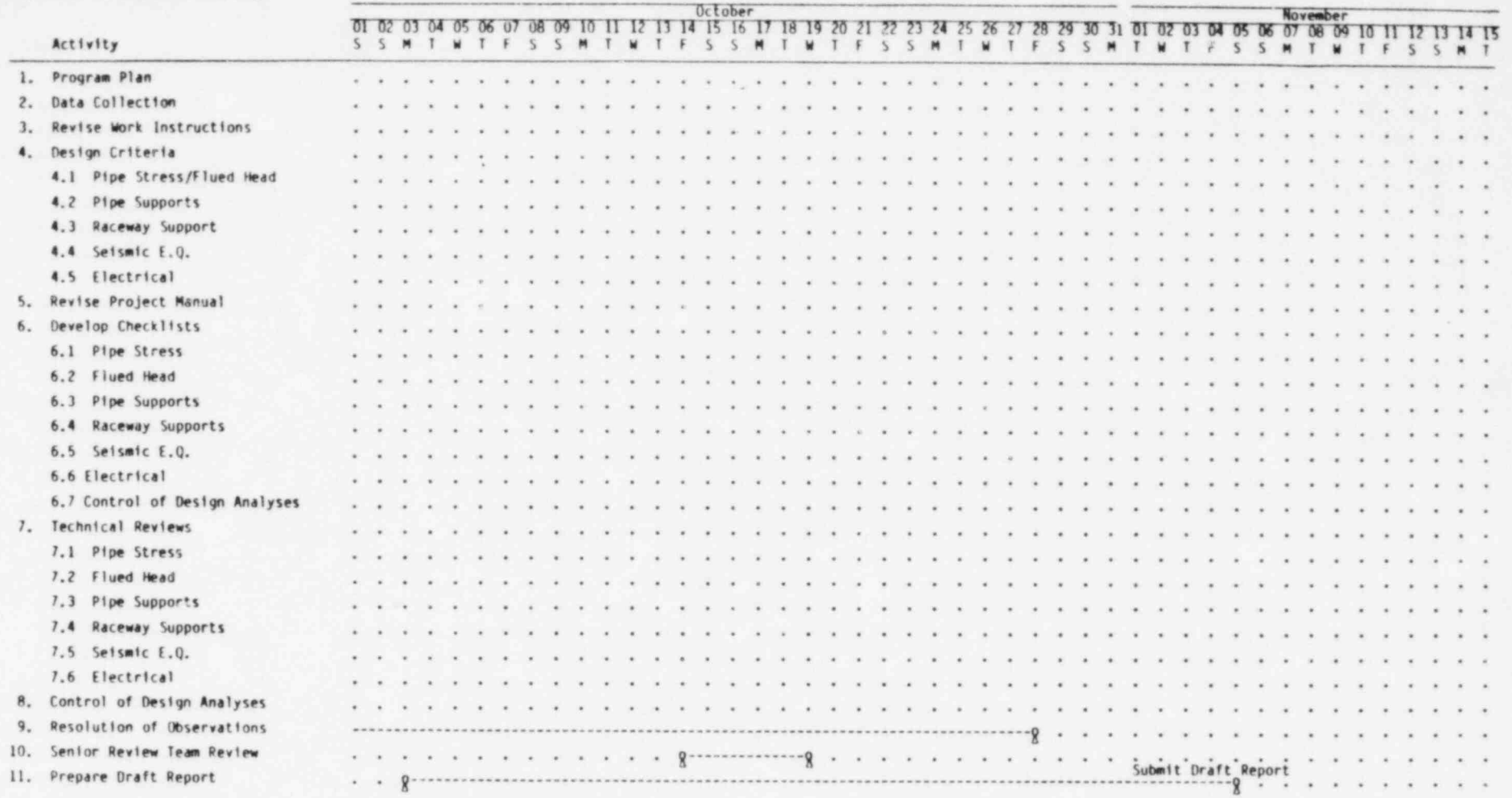
---------- Forecast Line	o Forecast Milestone
********** Progress line	● Completed Milestone

Texas Utilities Services, Inc.
Independent Assessment Program Schedule (Phase 2)
September 6, 1983, Rev. 0, Page 2



NOTATION

. . . . Slip Line	Δ Original Milestone
---------- Forecast Line	o Forecast Milestone
********** Progress line	● Completed Milestone

APPENDIX A

(FORMS)

Independent Design Review Checklist

Reviewer

Checklist No.

Review Date

Date

Item	Satisfactory Yes	Satisfactory No	Comments

Design Control Process Assessment Checklist

Reviewer(s) **Checklist No.** Page of

Organization/Activities Reviewed Review Dates

Personnel Contacted

Item No.	Review Attributes	Reference Document	SAT	UNSAT	NA	Comments

As-Built Assessment Checklist

Reviewer (s)

Checklist No. Page of

Review Date

Item	Satisfactory Yes	Satisfactory No	Comments

Texas Utilities Services, Inc.
Independent Assessment Program; 83090

Observation Record

Checklist No.	Revision No.
Observation No.	Sheet of
Originated By	Date
Reviewed By	Date

Extent

Isolated	Extensive	Other (Specify)

Texas Utilities Services, Inc.
Independent Assessment Program; 83090

Observation Record Review
Attachment A

Checklist No.	Revision No.
Observation No.	Sheet of

	Yes	No
Valid Observation		
Closed		

Comments

III Approvals

Originator	Date
Project Engineer	Date
Project Manager	Date
Senior Review Team	Date

Observation Log

Observation No.	Description	Rev. No.	Date	Classification									
				Valid		Potential Finding		Definite Potential Finding		Closed		Isolated	
				Y	N	Y	N	Y	N	Y	N	Y	N

Potential Finding Report

PFR No.

Revision No.

Sheet 1 of

1 Description

Requirement

Reference Documents

Extent

Isolated	Extensive	Other (Specify)

Texas Utilities Services, Inc.
Independent Assessment Program; 83090

Potential Finding Report

PFR No.

Revision No.

Sheet 2 of

Design Impact

Root Cause

Potential Safety Impact

Potential Finding Report

PFR No.	Revision No.
	Sheet 3 of

II Classification

	Yes	No
Further Review Required		
Valid Observation		
Isolated		
Potential Safety Impact		

III Approvals

Originator	Date
Project Engineer	Date
Project Manager	Date
Senior Review Team	Date

Texas Utilities Services, Inc.
Independent Assessment Program; 83090

APPENDIX B

(RESPONSE TO SUPPLEMENTAL
NRC COMMENTS)

APPENDIX B

RESPONSE TO SUPPLEMENTAL NRC COMMENTS

Reference: Supplemental comments to NRC letter, D.G. Eisenbut to R.J. Gary, "Comanche Peak Steam Electric Station - Independent Assessment Program", dated July 15, 1983.

COMMENT #1:

On page 1, line 23 and on page 4, line 3, the proposal uses the broad term" important to safety" to describe the selection of the system to be evaluated. Since the system chosen for review, the Spent Fuel Pool Cooling System, is "safety -related" the proposal should use the proper term for clarity. These terms are defined in Appendix A to 10 CFR Part 50 and in Part 50.49(b) (1).

Response:

The proposal has been revised to substitute "safety-related for the more general term "important to safety".

COMMENT #2:

The proposal should include a verification of the as-built documentation regarding the system chosen for review, i.e., the drawings should conform to the as-built component, and the component should conform to the drawing. While this may result from the proposed scope of work, we believe it should be stated as an objective of the IAP.

Response:

One objective of the proposed program is to verify a selected as-built configuration. Section 4 of the proposal states that the verification is intended to assure that the systems, components and structures have been installed in conformance with the design documents.

COMMENT #3:

The Cygna Organization and responsibilities for IAP need clarification. Page 5 of the proposal described the project team and the senior project team. In the methodology section, page 11, the assignment of responsibilities to the review teams are described. It is not clear which of these teams is responsible to develop the review criteria, the matrices and the checklists, nor which team reviews and approves them.

Response:

The Cygna Project team is responsible for preparation, review and approval of all project documentation, including the criteria, matrices, checklists and final report. The Senior Review Team provides an additional level of review and approval of observations, potential findings and the final report.

COMMENT #4:

The proposal uses the term "selective" at the bottom of page 3 and "selected" at the middle of page 11. The meaning of these words should be clarified in the proposal.

Response:

Section 4 of the proposed plan describes the scope selection process and defines the selected scope.

COMMENT #5:

We believe the originator of each observation should be required to comment on its final disposition.

Response:

Section 3 has been revised to incorporate this comment.

COMMENT #6:

On pages 4 and 14, there is a list of criteria used for system selection. The fourth criteria states "the design should have undergone changes during this period of time." This criteria is not definitive enough since design changes are common on all systems. Additional background on the amount of design change on the Spent Fuel Pool Cooling System relative to other systems should be provided.

Response:

This particular criterion is included in the system selection process to ensure that there have been design changes during the selected time period. Although it's true that changes are common to all systems, it is possible to select a time period during which there were no changes to the system. This criterion is intended to prevent that possibility. The key, therefore, to this criterion is not the number of design changes but, rather, that there were design changes. Accordingly, a quantitative assessment of the number of

design changes to the Spent Fuel Pool Cooling System relative to other systems would not be appropriate.

COMMENT #7:

There does not apear to be an adequate definition for a finding as distinguished from an observation. There is no discussion on the classification that will be used for a discrepancy that is not significant but has generic implications. The generic implications of each discrepancy must be addressed in order that the conclusions of a program such as this can be valid and useful.

Response:

Findings and other key terms are defined in Exhibit 3.1.

Observations are written for discrepancies with the review checklists, regardless of their significance. Determining the significance of each observation in the charter of the Project Team and Senior Review Team. The Project Team is responsible for documenting all discrepancies and determining the root cause of each observation. During their review of the final documentation, the Senior Review Team evaluates each discrepancy and observation for generic implications.

COMMENT #8:

It would be useful for our review for Cygna to expand on the level of detail they intend for their "configuration" check denoted on page 22.

Response:

The configuration review of the Spent Fuel Pool Cooling pipe supports and supporting structures includes the following checks:

Approximate location and orientation with respect to the piping system.
Type, size and adjustment of components such as springs and snubbers.
Approximate dimensions of critical members of the support assemblies.
Miscellaneous considerations such as clearances between pipe and restraint steel and gaps between baseplates and concrete surfaces.
General workmanship of the supporting concrete structures, including such things as cracking and voids.

COMMENT #9:

Criteria for selection of sample elements should be provided in the program.

Response:

Scope and system selection criteria are provided in the proposal.

COMMENT #10:

Acceptance criteria for verification should be provided in the program.

Response:

The as-built verification is performed using checklists which are a compilation of key design elements selected from the design drawings and specifications. Acceptability is based on conformance to these checklists.

APPENDIX C

(RESUMES)

RESUMES

Ben K. Kacyra
John E. Ward
Eugene F. Trainor
Larry L. Kammerzell
Nancy H. Williams
John C. Minichiello
R. Hess
Chuan Liu
James P. Toner
Paul DiDonato
Alan Moersfelder
Andrew Cowell
Lennox D. Barnes
John P. Bonner
A. Patrick McCarthy
Ted T. Wittig
P. Foley

BEN K. KACYRA

EDUCATION:

M.S., Structural Engineering, University of Illinois, Urbana, IL

B.S., Civil Engineering, University of Illinois, Urbana, IL

PROFESSIONAL REGISTRATION:

Registered Civil Engineer, California

Registered Structural Engineer, California

Registered Structural Engineer, Ohio

PROFESSIONAL AFFILIATIONS:

Member, American Nuclear Society

Member, Seismological Society of America

Member, American Society of Civil Engineers

Member, American Concrete Institute

Member, Structural Engineers Association of California

Expert Examiner, Structural Examination, California State Board of Registration for Professional Engineers

PROFESSIONAL EXPERIENCE:

Mr. Kacyra has been practicing structural engineering for more than eighteen years, more than twelve of which have been in the field of structural analysis and earthquake engineering. His major expertise is in the fields of structural criteria development and seismic risk analysis. He has also gained broad experience in the development and application of advanced analytical techniques essential in the achievement of imaginative engineering designs.

As Chief Executive Officer of Cygna since 1973, he has been personally involved in all Cygna projects. His work includes problem definition, determination of criteria, establishment of procedures and evaluation of results.

Some of the significant projects he has worked on as Principal-in-Charge during the past two years are:

- Seismic evaluation of the Yankee Rowe Nuclear Station in response to the NRC Systematic Evaluation Program (SEP). This project requires a wide spectrum of involvement from cost evaluation, criteria development, and analysis, to implementation of design fixes.

- Methodology for structural performance criteria determination for thermal electric generation and transmission facilities, for California Energy Resources Conservation and Development Commission.

- Feasibility of a rational approach to damage mitigation in existing structures exposed to earthquakes, for the National Science Foundation.

- Seismic requalification of the Humboldt Bay Nuclear Power Plant structures and equipment systems which included the development of fixes for the structures and equipment.

- Structural engineering and seismic risk analysis on a $80,000,000 federal complex in Anchorage, Alaska.

- Seismic design criteria and structural review of the Yerba Buena Convention Center, San Francisco.

PUBLICATIONS:

"Seismic Risk Analysis Optimizes Life Cycle Costs," presented at the ASCE National Structural Engineering Conference, Madison, Wisconsin, August 1976.

"Dynamic Response of a Four Storied Building to Changes in Its Configuration," ASCE/SEAONC New Earthquake Design Provisions Seminar, November 1975.

"Application of Dynamic Analysis," with Sanford Tandowsky, ASCE/SEAONC New Earthquake Design Provisions Seminar, November 1975.

"Computer Methods vs. Hand Methods in the Lateral Analysis of Multistory Shear Wall Buildings," with Ashraf Habibullah, presented to the Advisory Board of the California State Office of Architecture and Construction, November 1975.

"Behaviour of Structures Under Earthquake Motion," presented at the Seminar of the Hospital Council of Northern California, December 1974.

BEN K. KACYRA
(continued)

Reports to the Seismology Committee of SEAONC:

"Report of the Overturning and Load Factor Subcommittee," 1970.

"Report of the Overturning Subcommittee," 1971.

"Report of the Vertical Acceleration Subcommittee," 1972.

"In-Situ Testing for Seismic Evaluation of Humboldt Bay Nuclear Power Plant for Pacific Gas and Electric Company," with N. Chauhan, Transactions of the Fourth International Conference on Structural Mechanics in Reactor Technology, San Francisco, California, August 1977.

"Seismic Evaluation and Modification of the Humboldt Nuclear Power Plant, Unit 3," with N. Chauhan et al, accepted for presentation at the Third ASCE Specialty Conference on Structural Design of Nuclear Plant Facilities, Boston, Massachusetts, April 1979.

"A Methodology for the Determination of Seismic Resistant Design Criteria," with J. Vallenas, presented at the Second U.S. National Conference on Earthquake Engineering, Stanford, California, August 1979.

JOHN E. WARD

EDUCATION:

M.S., Nuclear Physics, University of California, Berkeley, California

B.S., Naval Engineering, U.S. Naval Academy

PROFESSIONAL REGISTRATION:

Registered Professional Mechanical Engineer, California

Registered Professional Nuclear Engineer, California

PROFESSIONAL AFFILIATIONS:

Member, American Nuclear Society

Member, American Society of Mechanical Engineers

Member, Atomic Industrial Forum

Member, California Society of Professional Engineers

Member, National Society of Professional Engineers

Institutional Representative to the Pacific Coast Electrical Association

Institutional Representative to the North West Electric Light and Power Association

Institutional Representative to the Rocky Mountain Electric Association

Chairman, Reactor Licensing and Safety Committee, AIF

PROFESSIONAL EXPERIENCE:

Mr. Ward is the former Chairman and Chief Executive Officer of Cygna Energy Services with responsibility for the overall operation and performance of the Company.

Prior to joining Cygna, Mr. Ward held the position of Vice President at Sargent and Lundy. In this capacity, Mr. Ward was responsible for Sargent and Lundy's Los Angeles office, as well as for business development on a firmwide basis for the organization. Mr. Ward played an active role in the nuclear industry by chairing the Atomic Industrial Forum's Committee on Reactor Licensing and Safety. In this capacity, he was instrumental in the development of several NRC/Industry task force approaches to solving licensing issues. This work resulted in his being named the first recipient of the

AIF's Clyde A. Lilly Award. This award, named for the former AIF Chairman of the Board, is given annually to an individual who is judged to have made an "outstanding contribution to the technical development, regulatory climate or public acceptance of nuclear energy. The quality of such service is measured by: leadership demonstrated by formulating, reconciling and advancing industry position on nuclear policy, time and effort devoted to Forum programs, and effectiveness in bringing key issues to nuclear development closer to resolution."

In 1973, Mr. Ward was named General Manager of Sargent and Lundy's Los Angeles affiliate, S&L Engineers, when it was first established. He was active in establishing the facilities and procedures for this new affiliate, as well as engaging the principal staff. He was responsible for directing the administrative and engineering program, as well as business development in the western United States.

In 1968, Mr. Ward joined Sargent and Lundy as a Nuclear Project Engineer. As a Nuclear Project Engineer his principal responsibilities included the Zion Nuclear Station and the William H. Zimmer Nuclear Station.

In 1967, Mr. Ward joined the Commonwealth Edison Company in Chicago as Project Engineer on their Zion Station.

Prior to joining Commonwealth Edison, Mr. Ward spent 15 years in the Navy. His primary experience involved command-at-sea, as well as administrative assignments in the areas of practical research, development, and test and evaluation procedures for surface weapons systems.

EUGENE F. TRAINOR

EDUCATION:

M.S., Management, Rensselaer Polytechnical Institute, Troy, NY

B.S., General Engineering, U.S. Coast Guard Academy, New London, CN

Naval Nuclear Reactor Testing and Operations, Mare Island Naval Shipyard, Vallejo, CA

Executive Management, Center for Management Development, Northeastern University, Boston, MA

Production, Planning and Control, Massachusetts Institute of Technology, Cambridge, MA

Government Contract Law, Marshall Wythe School of Law, College of William and Mary, Williamsburg, VA

PROFESSIONAL REGISTRATION:

Registered Quality Engineer, California

Registered Mechanical Engineer, Massachusetts

PROFESSIONAL AFFILIATION:

Senior Member, American Society for Quality Control

Member, American Society of Mechanical Engineers

Member, ASME Main Committee on Nuclear Quality Assurance

Vice Chairman, Subcommittee on Personnel Qualifications

PROFESSIONAL EXPERIENCE:

Mr. Trainor, Vice President, Quality Assurance, has in excess of 20 years of extensive experience in quality assurance, construction, engineering, and project management of fossil and nuclear power generation projects. Prior to his association with Cygna, he was associated with a major architect/engineer for eight years serving as Manager of their Quality Assurance Department and Chief Engineer of the Engineering Assurance Division. During this period, he developed the first Quality Assurance Program approved by the then Atomic Energy Commission for an engineer-constructor. Additionally, he developed management systems needed for the effective management of a multi-faceted

EUGENE F. TRAINOR
(continued)

domestic and international quality assurance organization.

Mr. Trainor was previously associated with the shipbuilding industry in Quincy, Massachusetts, for thirteen years. At that time he was responsible for the establishment of an S5W Submarine Reactor Plant Test Program and the development and management of the DLG(N)25 Nuclear Power Unit installation program. Other assignments held by Mr. Trainor included Project Manager - Special Projects, Process Engineering Manager with responsibilities for manufacturing and industrial engineering, applied research and development and industrial laboratories, and Manager, Nuclear Quality Control, with responsibility for all aspects of quality assurance and control in the design, construction and overhaul of naval Nuclear Power Plants and Facilities.

Prior to his association with the shipbuilding industry, Mr. Trainor was employed by a chemical company complex in Springfield, MA, where he designed and constructed steam generating and chemical processing facilities.

LARRY L. KAMMERZELL

EDUCATION:

M.B.A., National University (in progress)

B.B.A., National University

Third Year Industrial Engineering, Drexel Institute of Technology

SPECIALTY COURSES:

Business Management Seminars at General Atomic Company

Naval Training:

- Navy Nuclear Power School
- Advanced Submarine Engineering School
- Nuclear Deep Submersible Pilot and Power Plant Training

PROFESSIONAL REGISTRATION:

Professional Engineer (Nuclear), California

PROFESSIONAL AFFILIATIONS:

Member, American Nuclear Society (Past Chairman of San Diego Section)

Member, National Management Association (Past President, General Atomic Chapter)

PROFESSIONAL EXPERIENCE:

Mr. Kammerzell has twenty years of nuclear-related experience covering a broad spectrum of Nuclear Power Plant risk assessment, analysis, testing, construction, and operations. At Cygna he is in the position of Vice President of the Western Region operations, which includes the San Francisco, San Diego, and Richland offices.

In Mr. Kammerzell's position as Vice President, he has total responsibility for the performance and administration of the Western Regional offices. This includes executive cognizance over the schedule and cost performance of projects assigned to the Western Region offices; he also assumes an overall commitment to the technical expertise of the office personnel. As Principal-In-Charge of all projects, Mr. Kammerzell provides direct executive participation in active projects of the Western Region. One of his primary

tasks at Cygna has been to broaden the character and technical make-up of the assigned offices and staff to enable Cygna to provide a broader range of services to the western regional utilities and other clients.

Prior to joining Cygna, Mr. Kammerzell held responsible engineering and management positions with Stone & Webster Engineering Corp., United Engineers and Constructors, General Atomic Company and the U.S. Navy. The following summarizes his activities over the past 20 years.

- At General Atomic Company Mr. Kammerzell was Manager of Systems Engineering, responsible for the coordination and technical integration of the various systems and component designs into an optimum plant design and to organize, direct and administer overall systems engineering efforts on HTGR plants including Safety Analysis, Probabilistic Risk Assessment programs, and Economic Study Evaluations.

  In other positions held at General Atomic, Mr. Kammerzell was responsible for plant thermal performance evaluations including the development of analytical techniques to determine the thermal performance risk associated with the specific plant design.

- As lead nuclear engineer at United Engineers and Constructors, he was responsible for the preparation of the safety analysis report for systems and facilities supporting the nuclear steam supply. These included the radwaste, core cooling, and fuel storage systems and the associated building arrangements.

- At Stone and Webster, Mr. Kammerzell was responsible for evaluation of vendor test and weld procedures. He was also responsible for the design, specification, and field erection of nuclear power plant pumps, vessels and heat exchanges.

- Mr. Kammerzell held several positions in the United States Navy. Representative of this period is his assignment as Nuclear power plant prototype instructor and assignment as M/A division officer on board the NR-1 during the construction, testing, seatrials and initial service. The NR-1 is a Nuclear Powered Deep Submersible research submarine. Mr. Kammerzell had responsibility for: all phases of testing, trouble shooting, calibration and maintenance of reactor, propulsion, and turbine generating equipment; all power plant evolutions; and all underwater evolutions. He was the duty officer during power range testing and was responsible for testing during initial criticality.

NANCY H. WILLIAMS

EDUCATION:

B.S., Civil Engineering, Carnegie-Mellon University, Pittsburgh, PA

Boiling Water Reactor Course, General Electric BWR Training Center

Finite Element Methods and Application, Ohio State University, Columbus, OH

Management Courses, Harvard University, Extension Program, Cambridge, MA

PROFESSIONAL EXPERIENCE:

Ms. Williams has extensive experience in the management of nuclear power facility retrofit programs. In this capacity she has been responsible for the planning, coordination, and timely implementation of all project phases from conceptual engineering to documentation of modifications. She has provided expert testimony on the management of major modification projects during the Pilgrim Station Unit 1 Utilities Commission hearings. As a project manager at Cygna she is responsible for the timely, accurate, and cost effective completion of projects. In this position, she has worked on the independent design reviews of Enrico Fermi Unit 2 and Comanche Peak. Prior to joining Cygna, Ms. Williams held increasingly responsible positions with Boston Edison Company including:

- Project Manager of Pilgrim Nuclear Power Station's Equipment Qualification Program. Developed a Project 2 seven year program to qualify all safety related equipment for design basis events such as high energy line breaks, LOCA and earthquakes. Initiated the project organization, manual, and priorities necessary to comply with existing and future regulations.

- Manager of several projects involving the seismic analysis of all category 1 piping systems, pipe supports, base plates and building steel for an operating nuclear plant. In this capacity her responsibilities included: the development and implementation of comprehensive technical, schedule, and cost plans, the assignment of tasks; the development of cost and manhour estimates for each task; the procurement of resources; the interpretation of regulatory requirements; the development of data control systems to process project information; contract administration; cost and schedule reporting; coordination of construction, engineering, operations, licensing, purchasing, and quality assurance groups; refueling outage planning for implementation.

- Project Engineer responsible for the content and coordination of

technical activities of a multi-milion dollar structural evaluation project. Formulated entire evaluation program consisting of selection of acceptance criteria, analytical methodology, and determination of loading data through the use of building seismic and pressure flow models. Elected member of Owner's Group committee of the development of a new masonry wall structural analysis criteria. Developed procedures for the collection of field data necessary for the structural analysis. Organized and coordinated field survey teams. Provided final technical review of project activities for compliance with codes, standards, and regulatory requirements.

- Lead engineer responsible for the design and implementation of a sanitary disposal system including: two pumping stations, gravity and forced main piping layout, and leaching field. Functioned as the field engineer for the construction of:

  (1) $300,000 sanitary system
  (2) $1,000,000 training/office building

- Structural and civil engineering functions including: seismic analysis of structures using computer codes such as ANSYS, STRUDL, and STARDYNE; seismic and thermal analysis of piping systems and pipe supports; computer program development for data reduction, information management, pipe support base plate analysis; providing construction/engineering interface for field modifications; review and approved of engineering specifications. Responsible for noise data acquisition system located on site boundaries near residential zones. Developed a computer program and user's manual to statistically analyze noise level data and assess its impact on the community. Wrote and documented a computer program currently used to analyze meterological data including the calculation of atmospheric stability factors and the output of joint wind frequency distribution tables.

Ms. Williams was employed by Stone & Webster Engineering Corporation where she designed pipe supports, and resolved interferences between plant layout, piping layout and support design on Millstone Unit 3.

As a structural engineer for General Dynamics, Inc. Electric Boat division she was responsible for the construction of various tanks and foundations in the reactor compartment and engine room of the Trident Class Submarines. Provided direction for the trades and engineering resolutions for construction problems. Selected to work on the development of a construction planning program for the reactor compartment of the 688 Class Submarines.

NANCY H. WILLIAMS
(continued)

PUBLICATIONS:

"Operational Analysis: An Approach to safety and Planning," International Meeting on Thermal Nuclear Reactor Safety, ANS/ENS, August 29 - September 2, 1982.

JOHN C. MINICHIELLO

EDUCATION:

M.S., Applied Mechanics, Harvard University, Cambridge, MA

B.S., Mechanical Engineering, Tufts University, Boston, MA

PROFESSIONAL REGISTRATION:

Professional Engineer, Mechanical, Massachussetts and California

PROFESSIONAL EXPERIENCE:

Mr. Minichiello is assigned as the Manager of the Engineering Design Division at Cygna. His responsibilities include technical direction of all project within the division, staffing and budget preparation, and proposal generation.

As part of his present assignment, Mr. Minichiello is the project engineer for the dynamic requalification of Mechanical Equipment for the Washington Public Power Supply System Unit 2 nuclear plant. This work involves upgrading the previous work to the new hydrodynamic loads and the new criteria (IEEE-344P1975). Other projects within his division include: the stress analysis and support design for the control and drive piping for the LaSalle station; reanalysis of piping and pipe support for Diablo Canyon Unit 1; and design of new pipe supports to upgrade the seismic capability of the Yankee Nuclear Station at Rowe, Massachusetts.

As Section Manager for stress analysis at Brown and Root, Inc., Mr. Minichiello's responsibilities encompassed the overall direction of all mechanical analysis and design activities for the company's nuclear and fossil projects. Activities included: a full range of piping analyses for the South Texas Nuclear Project; computer aided structural analysis of electric substation insulating posts under 3 phase short circuit dynamic loading; and development of stress analysis standards for Brown and Root as pressure vessel analysis.

As lead of the component analysis section at NUS Corporation, he was responsible for proposal generation, direction and completion of the analysis (thermal, stress, and dynamic) of components in accordance with ASME, ANSI, and AISC codes. Projects included direction of the analysis of a fuel pool skimmer tank for dynamic loading, the dynamic analysis of vacuum relief valve, and the stress analysis of heat exchangers. He was also responsible for technical direction for a team of 25 engineers performing the piping analysis of 200 sub-systems for the Wm. H. Zimmer Nuclear Station.

JOHN C. MINICHIELLO
(continued)

Mr. Minichiello also generated proposals for linear and non-linear (gapping) analysis of heat exchanger component parts. His past work also includes dynamic analysis of high radiation sampling systems (panels and piping), fracture analysis of pipe welds, and analysis of various pressure vessels.

As Lead Senior Engineer with EDS Nuclear, he was responsible for the piping analysis for safety-related piping systems for the McGuire Nuclear Station. This effort involved the thermal transient and fatigue analysis required for ASME Class I systems and the identification of postulated break locations per MEB 3-1 criteria for design of pipe whip and jet restraints. Other projects included finite element analysis of penetration head fittings for thermal and structural loads and verification of the SUPERPIPE program per EDS QA standards.

Mr. Minichiello's previous experience at NUS Corporation includes thermal and structural analysis of nuclear systems and components using finite element codes such as ANSYS, STARDYNE and PIPESD. These analyses included such evaluations as the dynamic response of the auxiliary cooling piping for a reactor coolant pump test loop, the dynamic response of centrifugal chiller assemblies, the dynamic response of high density spent fuel racks and the high temperature response of spent fuel shipping casks. He has performed complete stress and thermal analysis of the LOFT reactor vessel, including comparison of results to ASME code allowables and generation of the final stress report, and was responsible for the computer code generation used to pre- and post-process finite element stress output to aid in the evaluation of ASME code requirements. As a stress engineer, Mr. Minichiello performed thermal and stress analysis of a Navy purification filter using finite-difference and shell computer codes. He performed the stress analysis of electrical plug plates per ASME Class III criteria.

Earlier, at RAYTHEON Co., Mr. Minichiello worked as a design engineer and was in charge of fabrication of prototype analog-digital computer interface device. He designed components of control board for missile tracking systems.

PROFESSIONAL AFFILIATIONS:

Member, American Society of Mechanical Engineers

Member Tau Beta Pi Engineering Society

ROBERT W. HESS

EDUCATION:

B.S., Engineering, University of Maryland

Graduate course work in Engineering Administration, George Washington University

Basic Project Management Course, American Management Association

Air Conditioning and Refrigeration, Brevard Junior College,

Cryogenics, Genesy's Extension of University of Florida

PROFESSIONAL REGISTRATION:

Professional Engineer, Mechanical, State of California

PROFESSIONAL EXPERIENCE:

Mr. Hess has more than seventeen years of experience in engineering and management. He is currently assigned as Engineering Manager-Systems Engineering. In this capacity he is responsible for the supervision of multiple discipline groups including electrical, instrumentation and control, and mechanical, in the performance of systems analysis and design, systems modification, computer applications, and regulatory compliance projects.

Formerly associated with NUS as General Manager of its Western Engineering Office, he was responsible for the management, direction and staffing requirements of all engineering and design projects. In an earlier position as Manager, Plant Engineering with this firm, his duties included technical direction and administrative activities associated with process development and system design of modifications to nuclear and fossil fueled generating facilities. This included supervision of site investigations to determine system design requirements based on plant operations and site-specific constraints, technical approval of conceptual and detail design and management of assigned discipline engineers and designers to meet schedule and budget requirements. Specific projects included NUREG 0612 compliance reports for Trojan and Crystal River Power Plants, ATWS modification requirements study for BWR's, preparation of emergency implementing procedures for a PWR, and modification of a pH control system for a fossil unit cooling tower.

As Project Engineer for the design of large waste treatment facilities for two fossil generating facilities, Mr. Hess was responsible for directing and sequencing project tasks to accomplish the work scope within budget and schedule and maintaining formal communications with the client. This assign-

ROBERT W. HESS
(continued)

Other assignments with this firm included responsibilites for conceptual and detail design of make-up water and wastewater treatment systems for both nuclear and fossil power plants. Mr. Hess supervised engineers and designers in performance of discipline work scope within schedule and budget constraints; established system design criteria and coordinated inputs with other disciplines; prepared and supervised preparation of equipment specifications, construction bid packages, proposal bid evaluations, P&ID's, equipment and piping layout drawings and engineering manhour estimates. Various other project experience includes engineering design and analysis of radioactive waste treatment systems for nuclear power plants, design and review of RCP oil enclosure systems, fossil plant fire water system modifications, and addition of fire suppression systems to cable spreading rooms. While assigned to a core spray system modification project, he coordinated field engineering efforts and client inputs during analysis and modification design, in addition to being responsible for preparation of specifications and drawings and construction work packages for installation of mechanical modifications. Also prepared conceptual mechanical designs and weight analyses of shippings casks for solid waste generated by nuclear fuel reprocessing plants (concepts included both rail and truck-mounted casks for high- and low-level wastes).

At Newport News Shipbuilding, Mr. Hess was responsible for design and review of various fluid systems required for operation and support of naval nuclear power plant. Participated in formulation and composition of technical documents detailing and justifying system design characteristics, operating principles and maintenance requirements for primary shield water, reactor plant air and evacuation and nitrogen purge systems.

As Lead Systems Engineer with Grumman Aerospace Corporation, Mr. Hess was responsible for systems checkout and launch operations on Lunar Module Propulsion Subsystems. Position required consideration of such items as test scheduling, manpower planning, review and approval of test procedures and direct supervision of engineers and technicians during pre-launch and launch operations.

As Systems Engineer, he prepared and performed test procedures for fluid systems checkout, directed troubleshooting and repair of ground support and flight equipment, participated in development and site start-up of high pressure gas and cryogenic loading equipment.

PROFESSIONAL AFFILIATIONS:
Member, American Nuclear Society
Member, American Institute of Aeronautics and Astronautics
Member, California Radioactive Materials Management Forum

ROBERT W. HESS
(continued)

ment required close coordination of design, procurement and construction follow-up efforts of process, mechanical, electrical, I&C, and civil/structural engineers.

CHUAN LIU

EDUCATION:

M.S., Civil Engineering, San Jose State University

B.S., Civil Engineering, Chung-Yuan College, Taipei, Taiwan

PROFESSIONAL REGISTRATION:

Registered Civil Engineer, State of California

PROFESSIONAL EXPERIENCE:

Mr. Liu is currently a Senior Lead Engineer at Cygna's Engineering Design Division. He is presently the Project Engineer in charge of the pipe support redesign for Diablo Canyon Unit 1 due to the Hosgri earthquake and latest criteria.

Previously, Mr. Liu was Project Engineer (pipe supports) for the Independent Design Review of the Grand Gulf Nuclear Plant. This included development of review criteria, walkdown of piping, and review of as built designs.

Other experience includes the design of pipe supports for the Yankee Rowe SEP modifications; development of criteria and work instructions, for Vermont Yankee, Mr. Liu established 79- 14 evaluation criteria and work instruction for pipe support group and supervised and directed the pipe support group to perform pipe support design review base on AS-BUILT data.

At Cygna, Mr. Lui also worked on the Palo Verde project, leading an eight-member group, working as independent group performing pipe support design.

Other projects include: La Salle; Millstone; for which be performed the environmental enclosure design to protect electrical equipment from steam due to piping failure, the ventiliation duct support design, and design verification for selected problems; and Susquehanna where he was responsible for pipe support design review, component hardware design review and stress and stiffness calculations, as well as providing modifications for over-stressed supports.

Prior to joining Cygna, Mr. Liu was responsible for structural design and analysis for high rise and parking structures and office buildings at Skidmore Owings & Merrill.

CHUAN LIU
(continued)

Mr. Liu's experience also includes assignments with: S. K. Noravian & Associates - responsible for structural analysis and design for wood, concrete masonry and pre-cast and various structures; Engineering Decision Analysis Corporation - responsible for dynamic analysis of power plants and buildings, seismicity evaluation and rehabilitation checking for existing buildings; and Consoer, Townsend and Associates - responsible for structural design of facilities for sewage treatment plants.

JAMES P. TONER

EDUCATION:

B.S., Marine and Electrical Engineering, Massachusetts Maritime Academy, Buzzards Bay, MA

Quality Assurance Management, Northeastern University, Boston, MA

PROFESSIONAL REGISTRATION:

Registered Quality Engineer, California

Registered Mechanical Engineer, Massachusetts

Third Engineers License, Steam and Diesel, U.S. Coast Guard

PROFESSIONAL AFFILIATIONS:

Senior Member, American Society for Quality Control

Member, American Society for Nondestructive Testing

PROFESSIONAL EXPERIENCE:

Mr. Toner has had approximately 20 years of extensive experience in quality assurance production engineering, cost and estimating, and construction management aspects of nuclear and conventional marine and commercial power plant construction.

Recently Mr. Toner practiced as a private quality assurance consultant. Previous to that he had been the Chief Engineer of the Cost and Auditing Division of the Quality Assurance Department of Stone & Webster where he was responsible for the establishment and administration of the system for internal auditing of site construction activities and quality assurance operations.

Prior to joining Stone & Webster in 1972, he was associated with the Quincy Shipbuilding Divison of both the General Dynamics Corporation and Bethlehem Steel Corporation in a variety of increasingly responsible management positions. As Engineering Manager (MARAD Project), he was responsible for the development and marketing of four R&D projects related to coatings application.

Other assignments included management of the pipe fabrication shop and five years in the Nuclear Quality Control Department, rising from the position of engineer at the time of department formation through various assignments to

JAMES P. TONER
(continued)

Chief of Nuclear Quality control. The Quincy shipbuilding Divison activities were associated with the design and construction of nuclear and conventionally powered ocean going vessels.

PAUL D. DIDONATO

EDUCATION:

B.S., Business Administration, Industrial Technology, Northeastern University, Boston, MA

A.S., Civil and Highway Engineering Technology, Wentworth Institute of Technology, Boston, MA

PROFESSIONAL AFFILIATIONS:

Member, American Society for Quality Control

PROFESSIONAL EXPERIENCE:

Mr. DiDonato has over nine years of experience in the nuclear industry. Presently, he is assigned as the Quality Assurance Operations Supervisor, Western Region, and is responsible for the implementation of the Cygna Quality Assurance Program for all west coast area offices. In addition, some of Mr. DiDonato's recent assignments were acting as Project Leader for the quality assurance evaluation portions of the Grand Gulf Unit 1 and Enrico Fermi Unit 2 Power Plant independent design reviews. Previous work at Cygna has included various assignments in auditing, management diagnostics, and training program development and presentation.

Prior to joining Cygna, Mr. DiDonato worked as a Quality Assurance Engineer for Stone & Webster Engineering Corporation. His initial responsibilities included the development and presentation of Quality Assurance training programs, specializing in the requirements of ASME III Division 1, Industry Auditing Standards and Regulatory Guides, as they relate to nuclear power plant construction. Subsequent to this, he was assigned to the Quality Assurance Auditing Division. In that capacity, he was responsible for the preparation and conduct of headquarters, site and sub-contractor quality assurance audits during pre-construction and construction phases of all active nuclear power plant projects. Mr. DiDonato is certified as a lead auditor in accordance with the requirements of ANSI N45.2.23.

Prior to joining Stone & Webster, Mr. DiDonato was employed by Chicago Bridge and Iron Company working in the field of Nuclear Quality Assurance.

PUBLICATIONS:

"Techniques of Quality Auditing," a paper presented at the ASQC Idaho Falls Spring Conference, May, 1981.

ALAN E. MOERSFELDER

EDUCATION:

B.S. Electrical Engineering, Milwaukee School of Engineering

PROFESSIONAL REGISTRATION:

Registered Professional Engineer in Illinois, Wisconsin, Michigan and Minnesota

PROFESSIONAL ACTIVITIES:

Member, Institute of Electrical and Electronic Engineers (IEEE)

Member, American Nuclear Society

Senior Member, Instrument Society of America (ISA)

PROFESSIONAL EXPERIENCE:

Mr. MM has more than 13 years of experience in the power industry. He has contributed to the successful completion of numerous new and retrofit design proejcts as a Project Manger, Engineering Manager, and Project Engineer. His expertise has been demonstrated on both fossil and nuclear projects.

Among the projects he managed were Safety Parameters Display Systems and other backfit modifications with control room impact which resulted from the TMI incident.

Prior to that, his responsibilities included the technical direction of engineers involved in the design of two nuclear power plant control complex facilities. Design tasks included participating in the sizing and physical arrangement of equipment in the main control room, auxiliary electrical equipment room, and comptuer room; cable routing and separation considerations; lighting and communciations provisions; panel construction and component procurement activities, annunciator system design and procurement, and utilization of the process computer system. While at Sargent & Lundy, he was appointed Procurement Specialist in the areas of main control panels and electrical analog meters. The responsibilities of a specialist include coordinating the company's generic review to qualify vendors who wish to bid on project procurement specifications.

Mr. Moersfelder has participated in the design activities associated with implementing the miniaturization concepts of General Electric's Nuclenet

ALAN E. MOERSFELDER
(Continued)

control room. He has coordinated the layout of the BOP components, applying human factors principles to systems and equipment.

As a result of his working experience, Mr. Moersfelder has a thorough understanding of utility practices, industry standards, and NRC regulations.

ANDREW D. COWELL

EDUCATION:

M.Engr., Structural Engineering, University of California, Berkeley, CA

B.S.C.E., Civil Engineering, California State Polytechnic University, San Luis Obispo, CA

PROFESSIONAL REGISTRATION:

E.I.T. (California)

PROFESSIONAL EXPERIENCE:

Mr. Cowell's experience at Cygna includes work on nonlinear analysis for the Yankee Rowe Nuclear Power Plant, piping stress analysis for Diablo Canyon, and a field assignment at the Washington Public Power Supply System involving equipment qualification.

Before joining Cygna, Mr. Cowell worked on static and dynamic testing of piping large structural models. He has several years of experience using mechanical and electronic testing equipment. Models tested include a multiple-support piping system, base isolation devices, and reinforced concrete subassemblages. This experience includes writing and modification of nonlinear analysis computer programs.

PUBLICATIONS:

Cowell, A.D., V.V. Bertero, and E.P. Popov, "Local Bond-Slip Under Variation of Specimen Parameters," Report No. UCB-EERC 82-17, Earthquake Engineering Research Center, University of California, Berkeley.

Popov, E.P., V.V. Bertero, A.D. Cowell, and S. Vivathanatepa, "Epoxy Repair of Bond in Reinforced Concrete," Eastern European Earthquake Conference, Dubrovnic, 1978.

Cowell, A.D., E.P. Popov, and V.V. Bertero, "Reinforcing Steel Bond Under Monotonic and Cyclic Loading," SEOC Convention, Sept. 1978.

LENNOX D. BARNES

EDUCATION:

M.S., Nuclear Engineering, University of California at Berkeley

B.S., Mechanical Engineering, University of New Hampshire

PROFESSIONAL REGISTRATION:

Professional Engineer, Massachusetts

Professional Engineer, California

Professional Engineer, New York

NRC Senior BWR Operator's License

PROFESSIONAL EXPERIENCE:

Mr. Barnes has over 20 years experience in the nuclear industry, including senior levels of responsibility for plant engineering, design, licensing, start-up, and plant operation. He is currently the Manager of Cygna's Training Services Division.

Previously, Mr. Barnes was assigned as the Manager of the Systems Engineering Division in the Boston office of Cygna. He was responsible for all engineering activities associated with the electrical, mechanical, nuclear, and instrumentation and control disciplines. Concurrently, Mr. Barnes was the Project Manager on various projects within his division. In this capacity, he was directly responsible for manpower planning, technical direction, project execution, and fiscal performance of the projects.

In a previous assignment, Mr. Barnes served as Project Engineer for the James A. FitzPatrick Nuclear Power Plant. In this capacity he was directly responsible for the engineering, design, and licensing activities associated with retrofit packages. He was also responsible for maintaining project management liaison with the client.

Prior to joining Cygna, Mr. Barnes was the Assistant Chief Engineer of the Engineering Assurance Division of Stone & Webster Engineering Corporation. In this position he directed the development and implementation of engineering quality standards which applied to all project activities.

His experience also includes asisgnmetns with the General Electric company in their Nuclear Energy Division. He has supervised the construction, start-up testing, and initial operation of a number of BWR reactors including the Peach Bottom Nuclear Power Plant. At the Dresden Nuclear Power Station Unit 2, he was assigned as Shift Supervisor, responsible for monitoring all activities during a refueling outage. Othe rresponsibilities included fuel loading, CRD replacement, field design changes, and operational testing.

LENNOX D. BARNES
(continued)

Prior to his general Electric employment, Mr. Barnes spent six years in the U.S. Navy Submarine Program.

PROFESSIONAL AFFILIATION:

Member, American Society of Mechanical Engineers

JOHN P. BONNER

SPECIALTIES:

Electrical Engineering

Environmental Qualification

Fire Protection

EDUCATION:

B.S., Electrical Engineering, Northeastern University, Boston, MA

PROFESSIONAL REGISTRATION:

Professional Engineer, Massachusetts

PROFESSIONAL EXPERIENCE:

Mr. Bonner has over ten years of experience in electrical engineering and design for nuclear and non-nuclear power plants. He is currently a Supervising Electrical Engineer with Cygna, responsible for the analysis, design, and specification of electrical systems. He also serves as an Electrical Systems Specialist, to assure compliance with all applicable requirements of industry codes and standards such as IEEE, ANSI, NEC, and NEMA.

Mr. Bonner is currently providing detailed designs for modifications required to comply with Appendix R modifications on Nine Mile Point 1 including development of new logic systems for the Automatic Depressurization System (ADS). He is also developing a conceptual design for the low-low-set fix to the pressure-relief system to protect against SRV loads and cold-shutdown repair procedures needed for Appendix R. This includes diagnostics of system damage as a result of fire and detailed procedures for repairs that are needed to put plant in safe cold-shutdown state. He is also providing consulting services for environmental qualification and seismic qualification of control systems associated with the ADS and low-low-set modifications.

Earlier, he was part of the task force which developed the Appendix R response for Niagara Mohawk Power Corporation's Nine Mile Point - Unit 1. The effort included the analysis of fire zones, fire suppression and detection systems, associated circuits, and breaker coordination to determine the plant's capability to safely shutdown under various postulated fires.

Prior to joining Cygna, Mr. Bonner was employed by Stone and Webster

JOHN P. BONNER
(continued)

Engineering Corporation as Principal Electrical Engineer for all VEPCO projects. In this capacity he was responsible for the coordination of all electrical activities in support of design change packages for station modifications at Surry Power Station Units 1 & 2. Those modifications included the implementation of Appendix R requirements, the replacement and upgrading of electrical equipment due to an environmental qualification review; addition and modification of plant safety and post-accident monitoring systems, and engineering of the plant emergency power degraded voltage modifications.

For Unit 2 of the North Anna Nuclear Power Station, Mr. Bonner coordinated the review of electrical equipment environmental qualification per NRC NUREG-0588 and IE Bulletin 79-01(B). He also provided technical support at the NRC pre-full power license audit of Unit 2. A full power license was issued upon satisfactory completion of the audit.

While assigned to Millstone 3 for the Northeast Utilities Service Company, Mr. Bonner was responsible for the design supervision of raceway, wiring and cable scheduling, and manpower estimating. He also recommended a means by which a reduction of 50% of the isolation relays could be made, and still maintain the requirements of NRC Regulatory Guide 1.75 in the area of associated circuits.

Other duties at Stone and Webster included developing specifications, bid evaluations, and calculations for power systems analysis.

A. PATRICK McCARTHY

EDUCATION:

B.S., Marine Engineering, Maine Maritime Academy

PROFESSIONAL LICENSE:

3rd Assistant Engineer, Issued by U.S. Coast Guard

PROFESSIONAL AFFILIATIONS:

Senior Member, Instrument Society of America

Member, ISA SP67.10 Committee, Sample Line Piping and Tubing Standards for Use in Nuclear Power Plants

PROFESSIONAL EXPERIENCE:

Mr. McCarthy has over fourteen years of experience including engineering, design, licensing, and operation of power plants. Mr. McCarthy is the Supervisor of Instrumentation and Controls and a Project Manager on several jobs.

While with Cygna, Mr. McCarthy has been assigned as Project Manager of an Appendix R Fire Hazards Evaluation for a Radwaste Incineration System and the seismic qualification of a series of vacuum pumps to be used in processing uranium fuel.

Prior to joining Cygna, Mr. McCarthy was employed by a major East#Evaluation for a Radwaste Incineration System and the seismic qualification of a series of vacuum pumps to be used in processing uranium fuel.

Prior to joining Cygna, Mr. McCarthy was employed by a major East coast architect/ engineer for seven years, and held positions of increasing responsibility within the Controls System Division. His last assignment was as the Lead Control Engineer on the Millstone 3 Project, an 1150 MWe PWR currently under construction for Northeast Utilities. As a Lead Control Engineer, Mr. McCarthy, with his staff of principal and support engineers, was responsible for all aspects of engineering, design, procurement, licensing, and field construction support activities relating to instrumentation and controls for the project.

During this time, Mr. McCarthy also held the positions of both Principal and Support Instrumentation Applications Engineer, on the Shoreham Nuclear

A. PATRICK McCARTHY
(continued)

Project, an 820 MWe BWR, currently under construction for the Long Island Lighting Company.

As both of the above plants were under construction, the area of equipment qualification was continuously changing due to revisions in NRC guidelines. As a result, much time was spent working with vendors to qualify their equipment to plant specific environmental and seismic profiles.

In addition, he held the position as Controls Systems Division Specialist for safety and relief valves and installation of instrumentation and tubing on a company-wide basis.

Mr. McCarthy's previous industry experience includes employment with an industrial equipment engineering firm. Mr. McCarthy was initially hired as a Field Service Engineer and ultimately attained the position of Project Engineer assigned to special projects. As Project Engineer and as a Field Service Engineer, Mr. McCarthy was responsible for all phases of safety and relief valve design, fabrication, test, and installation including the assurance of compliance to the ASME Boiler and Pressure Vessel Code, Section III, and other applicable codes, the resolution of fabrication problems, the specification of appropriate non-destructive testing, research and development of new product lines, and trouble-shooting of field-related problems.

Prior to the above, Mr. McCarthy sailed for Grace Lines as a Third and Second Assistant Engineer.

TED T. WITTIG

EDUCATION:

B.S., Civil/Structural Engineering, Michigan Technological University, Houghton, MI

PROFESSIONAL REGISTRATION:

Civil Engineer, California

PROFESSIONAL EXPERIENCE:

Mr. Wittig has over thirteen years of experience in structural engineering, including Containment Building design, structural analysis, equipment qualification, seismic modeling and analysis, licensing, quality, engineering and PSAR preparation. As Manager of Projects in the San Francisco Office, Mr. Wittig is directly responsible for all project management and engineering activities on projects at this Office. In addition, Mr. Wittig acted as project engineer for the Independent Design Verification for Detroit Edison Company and project manager for the Mississippi Power & Light Independent Design Review.

Prior to joining Cygna, he was employed by a major architect/engineer. As the Civil/ Structural Group Supervisor and Assistant Project Engineer for an LMFBR Study, he was responsible for the conceptual analysis and design of all structures. Prior to that he acted as liaison between the home office and client, and served as technical reviewer on the client's staff.

Mr. Wittig also functioned as the civil licensing engineer responsible for the PSAR for a commercial PWR nuclear power plant. In this assignment, he was additionally responsible for the civil/structural design criteria, soil-structure interaction seismic analysis, the seismic specification for mechanical equipment, tornado and turbine missile impact studies, and liquefaction study, as well as design and analysis for the circulating water system intake structures. The licensing, quality control, seismic and missile impact tasks required frequent interfacing with other disciplines during the design of safety systems.

Mr. Wittig's previous experience has included design of roads, railroads, and structures for a major project, including Containment Building shell and basemat design using the axisymmetric finite element program FINEL. This experience also included seismic modeling and analysis for the Reactor Containment Building plus analysis and design of the reactor cavity, reactor, and guard vessel support structures.

JAMES P. FOLEY

EDUCATION:

B.S., Nuclear Engineering, Lowell Technological Institute, Lowell, Massachusetts
Graduate courses in advanced mathematics and mechanical engineering, Northeastern University, Boston, Massachusetts
Nuclear Reactor Safety Course, Massachusetts Institute of Technology, Cambridge, Massachusetts
Applications of Reliability and Risk Technology, George Washington University, Washington, D.C.

PROFESSIONAL ACTIVITIES:

Member AIF Committee on Systems Interaction

PROFESSIONAL EXPERIENCE:

Mr. Foley has over 13 years experience in the nuclear industry, including assignments in engineering design, licensing, and safety evaluations of both BWR and PWR nuclear plants.

He is presently assigned as project engineer on the Control Room Habitiblity Study on the Robert E. Ginna Nuclear Power Plant, and is acting licensing manager for Cygna.

Mr. Foley has been a key member in developing Cygna's Systems Interactions Analysis Program, and is coordinating Boston office activities relative to PRA and Systems Interaction Analysis.

Prior to joining Cygna, Mr. Foley held various postions with a large East coast architect/engineer. Most recently he was Senior Licensing Engineer responsible for performance of the Fire Hazard Analysis for the James A. FitzPatrick Nuclear Power Plant, including suppression and protection of the plant. Modifications resulting from this analysis were implemented to the NRC's "defense in depth" approach to fire protection. He has also had responsiblity for following and developing corporate recommendations on several licensing issues, including Systems Interaction Analysis, foreign licensing, BWR pool swell, and determination of safety classes for BWR systems.

Mr. Foley served as plant arrangement coordinator for the Conceptual Engineering Group. In this capacity, he was the coordinator for the early conceptual design effort of serveral BWR and PWR units, including Nine Mile Point 2, River Bend 1 and 2, Montague and Green County. While in Conceptual Engineering, he served as the group BWR specialist.

Mr. Foley was lead Licensing Engineer for the developement of the FitzPatrick Final Safety Analysis Report. This included preparation of schedules, directing stenographics and reproduction activities, drafting text, coordinating reviews, and participating in AEC reviews.