Georgia Power Company
Vogtle Project
Readiness Review
Post Office Box 282
Waynesboro, Georgia 30830
Telephone 404 724-8114
404 554-9961

Vogtle Project

April 9, 1986

Mr. D. O. Foster
Vice President
Vogtle Project Support
Waynesboro, Ga. 30830

RE: Readiness Review Program
Module 19
Electrical Supports

LOG: RR-809

FILE: X7BD102

Dear Mr. Foster:

Pursuant to your instructions I am enclosing Module 19 of the Readiness Review Program entitled Electrical Supports. This module reports the work of the Readiness Review Team and has been prepared in order to present you with an accurate picture of the readiness for operations of the Vogtle Project, based upon a close examination of the electrical supports system.

The Readiness Review process included an initial assessment and review of basic licensing documents in order to identify Project commitments within the scope of the module. The Readiness Review Team then verified implementation processes designed to meet those commitments, including programs and controls relating to work within the scope of the module.

The team then engaged in a process designed to verify that implementation programs were operating as described in procedures, policy statements, and other descriptive documents. In concluding this verification process, the team then actually verified that the licensing commitments identified during the process were being fulfilled and met.

9406010267 940512
PDR ADOCK 05000424
P PDR

We are confident that the verification methodology used allowed the Readiness Review Team to properly appraise the actual condition of the electrical supports system and provided a valid means of assessing the quality of the program, having also considered applicable past audits, inspection reports, and problems experienced by other utilities.

Based on the examinations, inspections, and evaluations of the review and the responses and corrective actions committed to by the Project, it is the conclusion of the Readiness Review Team that the design and construction programs that govern the electrical supports system have produced a final product that meets design requirements and licensing commitments. Additionally, none of the findings identified, either individually or collectively, are such that the adequacy of the project electrical supports system is called into question. Therefore, the electrical supports system meets the FSAR commitments.

Members of the Readiness Review Team and I are prepared to discuss this module with you at your convenience. If we can provide you with any further information or assistance regarding this matter, contact me.

Very truly yours,

W. C. Ramsey

William C. Ramsey

WCR/deg

cc: R. E. Conway
Readiness Review Board Members
Reading File
Document Control

0074s/097-6

VOGTLE ELECTRIC GENERATING PLANT

UNIT 1

READINESS REVIEW

MODULE 19 - ELECTRICAL SUPPORTS

READINESS REVIEW - MODULE 19

List of Effective Pages

April 10, 1986

Page	Revised Date
All pages unchanged.	

PREFACE

Georgia Power Company (GPC), in order to gain added assurance of the operational readiness of the Vogtle Electric Generating Plant (VEGP), is conducting a pilot Readiness Review Program. The VEGP pilot Readiness Review Program is a systematic, in-depth self-assessment of work processes and verification of compliance with regulatory commitments. To accomplish the VEGP pilot Readiness Review Program, the work processes and regulatory commitments were divided into manageable segments called modules. There are approximately 20 modules. Each module is a predefined scope of VEGP activities.

Each module is intended to provide a brief description of the method of complying with project licensing commitments pertaining to the module scope and is not intended to make further commitments or to revise in any way prior commitments. If any differences exist between the commitments discussed in this document and the licensing documents, they are unintentional; and the licensing document governs.

Activities common to several modules are provided as General Appendixes. There are approximately 10 appendixes. These appendixes, as appropriate, are referenced in the modules and are augmented in each module with module-scope-specific details as needed.

The VEGP Readiness Review Program is being conducted on a schedule to provide added operational readiness assurance to GPC management in support of the VEGP Unit 1 operating license. However, conclusions reached regarding programmatic and technical adequacy through review of VEGP Unit 1 are indicative of Unit 2, since both units are being designed and constructed together under a single quality assurance program; with like management controls, procedures, etc.; and to the same specifications and criteria.

Stone and Webster Engineering Corporation has been contracted to provide technical management for, and technical personnel to implement, the independent design review as a part of the Readiness Review program.

The VEGP Readiness Review Program is not intended to eliminate or to diminish any authorities or regulatory responsibilities now assigned to or exercised by the Nuclear Regulatory Commission or GPC. Further, the Readiness Review Program is not intended to change the techniques of inspections or assurance of quality program activities. Rather, the VEGP Readiness Review Program is an added program initiated by GPC management to assess the VEGP and to provide additional feedback to management so that they may initiate any needed corrective actions in an orderly and timely manner.

The scope of work processes and regulatory commitment compliance covered by each module will be assessed by, and the module prepared and reviewed by, individuals collectively familiar with the design, construction, and operational processes of nuclear power plants. It is the collective opinion of the Readiness Review Task Force, Readiness Review Board, and GPC management that, based on their experience, the methodology used in the module process will assess, on a programmatic basis, the adequacy of project commitment implementation.

Readiness Review Discrepancy Reports and resulting dispositions are reviewed by the Readiness Review Program quality assurance staff and are input into the normal project process for safety significance and potential reportability evaluations in accordance with regulatory requirements.

EXECUTIVE SUMMARY

Introduction

This module documents a review program conducted to ascertain whether the design and construction aspects of electrical supports comply with licensing commitments and whether compliance is verifiable using existing project documentation. The scope of the module includes the design and construction activities associated with electrical supports located within Seismic Category I areas of the Vogtle Electric Generating Plant.

The program consisted of two separate reviews: a design program verification and a construction program verification. A technical evaluation of design activities is also included in the Independent Design Review (IDR), which will be submitted separately. In the design and construction reviews, project documents such as design criteria, specifications, and procedures were reviewed along with results of past audits, inspections, and recent industry problems. In addition, the Readiness Review Board's technical consultant (from Stone & Webster Engineering Corporation) provided independent technical oversight and concurrence. Readiness Review quality assurance (QA) personnel provided QA surveillance of the review activities. Statements from the technical consultant and QA regarding their involvement and conclusions reached are provided in section 8 of this module. Following evaluation, findings were subjected to categorization, as follows, to indicate their relative importance:

Level I - Violation of licensing commitments, project procedures, or engineering requirements with indication of safety concern.

Level II - Violation of licensing commitments or engineering requirements with no safety concerns.

Level III - Violation of project procedures with no safety concerns.

A brief summary of the two reviews is provided below.

Design Program Verification

The design program verification consisted of a commitment implementation assessment and a design control program assessment.

The design review team was composed of four team members having a cumulative professional experience of 55 years in design engineering.

The commitment implementation assessment was performed to determine whether the 17 design-related licensing commitments were implemented in the design criteria and/or other design documents. Each commitment was found to be properly implemented into appropriate design documents.

The design control program assessment consisted of a review of documentation such as design criteria, drawings, specifications, and design change documents to ascertain the effectiveness of control applied to the design activities. It also included a walkdown of as-built configurations to verify that design requirements were sufficiently clear to enable construction conformance. These reviews resulted in three findings, of which one (19-2) was categorized as Level 1, one (19-23) was Level II, and one (19-4) was Level III.

Finding 19-2 identified a conduit run supported at a single point. This condition was not addressed in the design calculations and was not clearly prohibited by the design drawings. As a result of this finding, the Project identified approximately 2000 conduit runs which could have been similarly installed. These runs were reinspected for single-point support configurations. Twenty-four additional discrepant installations were identified and reported to Engineering for evaluation. Engineering is currently evaluating these discrepancies for reportability and any necessary rework. In addition, Design has revised the drawings to clearly reflect the design for future installations.

Finding 19-23 identified installation of a Class 1E junction box and associated conduit which deviated from the seismically qualified configuration. The junction box was attached to a floor-mounted support, and the first attachment point of the conduit was to a ceiling-mounted support. The raceway support detail, however, stipulates that the junction box attachment and the first attachment point of the conduit should be to a common support. In response to this finding, the Project has performed a reinspection of all similar configurations (68) and has identified 21 additional cases of this discrepant condition. Engineering evaluated the 22 discrepancies and dispositioned 21 of them Use-As-Is. The remaining discrepancy was dispositioned Rework, but was not reportable since the associated electrical circuits are not required for safe shutdown of the plant. The drawing has been revised to more clearly indicate the design requirements, and raceway inspectors and craft personnel have been trained regarding this installation requirement.

Both of the above findings were caused by different interpretations of the drawing requirements by Design and Construction. Project investigation of the broader implications

of these are discussed in the construction program verification section, entitled Drawing Interpretation.

Details of the design program verification are found in section 6.1.

Construction Program Verification

The construction program verification consisted of a commitment implementation assessment and a construction assessment to determine whether construction activities met the design requirements.

The construction review team was composed of three team members having a cumulative experience of 22 years in power plant construction.

The commitment implementation assessment consisted of a review of the one construction commitment identified in the commitment matrix (section 3.4). This commitment was adequately traced to implementing documents.

The construction assessment consisted of a walkdown inspection of 41 electrical support installations to verify compliance with the design and a review of documents associated with the selected hardware to verify compliance with procedural requirements. Approximately 1600 total quality attributes were examined during this assessment. This assessment resulted in 14 findings, of which 2 (19-11 and 19-12) were categorized as Level I, 10 (19-6, 19-8, 19-9, 19-13 through 19-18, and 19-20) as Level II, and 2 (19-10 and 19-19) as Level III.

The 14 findings were arranged by the type of problem encountered and resulted in the following five classifications:

- Installation/documentation discrepancies.
- Drawing interpretation.
- Completion status.
- Spring nut/stud nut discrepancies.
- Inspector certification.

Of these five classifications, two (namely, drawing interpretation and completion status) were considered more significant and are discussed below.

Drawing Interpretation. Findings 19-6; 19-11, item 1; 19-14; 19-16; 19-17, item C; and Findings 19-2 and 19-23 from the design program verification identified concerns with the clarity or interpretation of the electrical support drawings.

The electrical support drawings consist of a support schedule that is used in conjunction with a plan drawing and typical details to custom build a support to the unique field conditions. As a result of the seven findings in this category, there was a concern on the part of Readiness Review that the design may not be reflected in the as-built configuration. Therefore, the Project performed an evaluation of the drawings and their interpretation by assembling a four-man team from Project Engineering, craft, and Quality Control (QC), who reviewed the application of the drawings to identify potential interpretation differences. This team evaluated 135 design details and concluded that, although minor interpretation differences did exist, the review verified that the drawings were adequate for their intended use.

As for the specific Readiness Review Findings, Engineering dispositioned all but three Use-As-Is on Deviation Reports. Finding 19-23 resulted in one discrepancy that was dispositioned Rework, but was not reportable. The two remaining findings (19-2 and 19-11) are being evaluated for reportability and required rework. Finding 19-2 was previously discussed in the Design Program Verification section. Finding 19-11 identified a drawing detail that required longitudinal conduit bracing at 16-ft intervals, but did not clearly indicate that at least one longitudinal bracing was required for conduit runs less than 16 ft long. Consequently, conduit runs less than 16 ft long were not braced.

In response to Finding 19-11, item 1, the Project identified a total population of 40 conduit supports that would require longitudinal bracing. Resultant reinspection of these supports identified 15 supports without the required brace. The 15 specific applications are presently being evaluated, and any necessary rework will be performed.

The evaluation performed by the Project for the drawing interpretation concern has concluded that the specific findings identified by Readiness Review are applicable only to specific details, which will be clarified. Based on evaluation of the identified installed hardware deficiencies, the drawings utilized for electrical support installation are adequate and the installation of supports meets engineering intent.

Completion Status. Finding 19-12 identified a tray support that was missing a stiffener, although the QC inspection report indicated the support was acceptable. Evaluation of the finding identified that past revisions of the raceway support installation and inspection procedure had allowed the installation and inspection of partial tray support assemblies, but had not required tracking of the uninstalled portions. To resolve this finding, Construction will verify the completeness of all installed electrical tray supports; and QC will verify the completeness of inspection. Field procedure ED-T-33,

Electrical Room and Area Turnover, will include a definition of the controls to ensure tray support completeness. Conduit support installation procedures were adequate and required that all supports be completed and inspected prior to raceway acceptance.

The remaining categories contained findings that did not individually or collectively bring into question the acceptability of the raceway support installation program.

Details of the construction program verification are discussed in section 6.2.

Readiness Review Conclusion

Readiness Review has assessed the design control, the construction installation of electrical supports, and the project-committed corrective actions for the identified findings. Readiness Review concludes that implementation of the corrective action will result in an acceptable program for the design and installation of electrical supports, and the completed structures will meet the licensing commitments and design requirements.

MODULE 19
ELECTRICAL SUPPORTS

TABLE OF CONTENTS

1.0 Introduction

1.1 Scope
1.2 Module Organization
1.3 Vogtle Project Status

2.0 Organization and Division of Responsibility

2.1 Design Organization
2.2 Field Construction Organization

2.2.1 Georgia Power Company Electrical Project Section
2.2.2 Georgia Power Company Electrical Quality Control
2.2.3 Georgia Power Company Construction Coordination
2.2.4 Cleveland Consolidated

3.0 Commitments

3.1 Introduction
3.2 Definitions
3.3 Sources
3.4 Commitment Matrix
3.5 Implementation Matrix

4.0 Program Description

4.1 Design

4.1.1 Structures Description and Division Responsibility
4.1.2 Design Process
4.1.3 Design Criteria
4.1.4 Drawings and Documentation
4.1.5 Design Control and Review
4.1.6 Reconciliation of As-Built Condition

4.2 Materials

4.2.1 Supplier Quality Surveillance Program
4.2.2 Supplier Quality Verification Documentation
4.2.3 Supplier Deviations

4.3 Training

4.3.1 Engineers (Design)
4.3.2 Georgia Power Company Electrical Project Section
4.3.3 Contractor Training
4.3.4 Inspectors

4.4 Construction

4.4.1 Work Activities
4.4.2 Specifications, Procedures, and Drawings

5.0 Audits and Special Investigations

5.1 Design

5.1.1 Georgia Power Company Quality Assurance Audits
5.1.2 NRC Inspections
5.1.3 SCS QA Audits
5.1.4 INPO Evaluation
5.1.5 Industry Concerns

5.2 Construction Audits

5.2.1 Project Audits
5.2.2 NRC Inspections

5.3 Past Problem Area

6.0 Program Verification

6.1 Design Program Verification

6.1.1 Summary Evaluation
6.1.2 Part I, Commitment Implementation
6.1.3 Part II, Programmatic Verification of Design Control Process
6.1.4 Part III, Walkdown

6.2 Construction Program Verification

6.2.1 Summary Evaluation
6.2.2 Commitment Implementation Assessment
6.2.3 Construction Assessment

7.0 Independent Design Review

8.0 Program Assessment/Conclusions

8.1 Summary of Open Corrective Actions

8.1.1 Engineering
8.1.2 Construction

8.2 Quality Assurance Statement
8.3 Technical Consultant's Certification
8.4 Readiness Review Board Acceptance
8.5 Project Assessment
8.6 Resumes

1.0 INTRODUCTION

1.1 SCOPE

This module is one in a series of modules that provide an evaluation of the design, procurement, construction, and readiness for operation of the Vogtle Electric Generating Plant (VEGP) Unit 1 and common facilities. It is intended to describe the method of complying with the project commitments found in the Final Safety Analysis Report (FSAR) and is not intended to make further commitments or revise in any way prior commitments. Differences between the commitments discussed in this document and the FSAR, if any, are unintentional. In the unlikely event a difference between this module and the FSAR should occur, the FSAR takes precedence in defining project commitments.

The scope of this module includes an evaluation of the design and construction activities associated with the electrical supports for the VEGP Unit 1 and common facilities. Electrical supports consist of supports and associated lateral bracing for electrical cable trays, conduit, pullboxes, and junction boxes. Also included in this module are unique electrical equipment supports. Electrical equipment directly mounted to building steel or floor embeds is addressed in Module 6. Table 1.1-1 lists the electrical support items included in this module. Figure 1.1-1 is a pictorial representation of Module 19 boundaries and interfaces for a typical conduit or tray support.

The effective date of this module is December 1, 1985. Relevant changes in the included programs, organizations, and commitments occurring after this date are not addressed nor are they expected to impact Module 19 results or conclusions.

TABLE 1.1-1

MODULE HARDWARE

Module 19 - Electrical Supports

- o Cable tray supports.
- o Conduit supports.
- o Electrical equipment supports (pullbox and junction box, transformers, etc.).
- o Raceway support bracing.
- o Supports unique to electrical equipment (i.e., equipment not directly mounted to structural steel or concrete).
- o Drilled-in concrete anchors installed by Cleveland Consolidated.

Not Included in Module 19 are:

Electrical component supports for the nuclear steam supply system (Module 16).

Supports for raceways in Non-Seismic Category I areas.

Embed design for raceway and electrical equipment supports (Module 8).

Electrical equipment directly mounted on structural steel and embedded plates (Module 6).

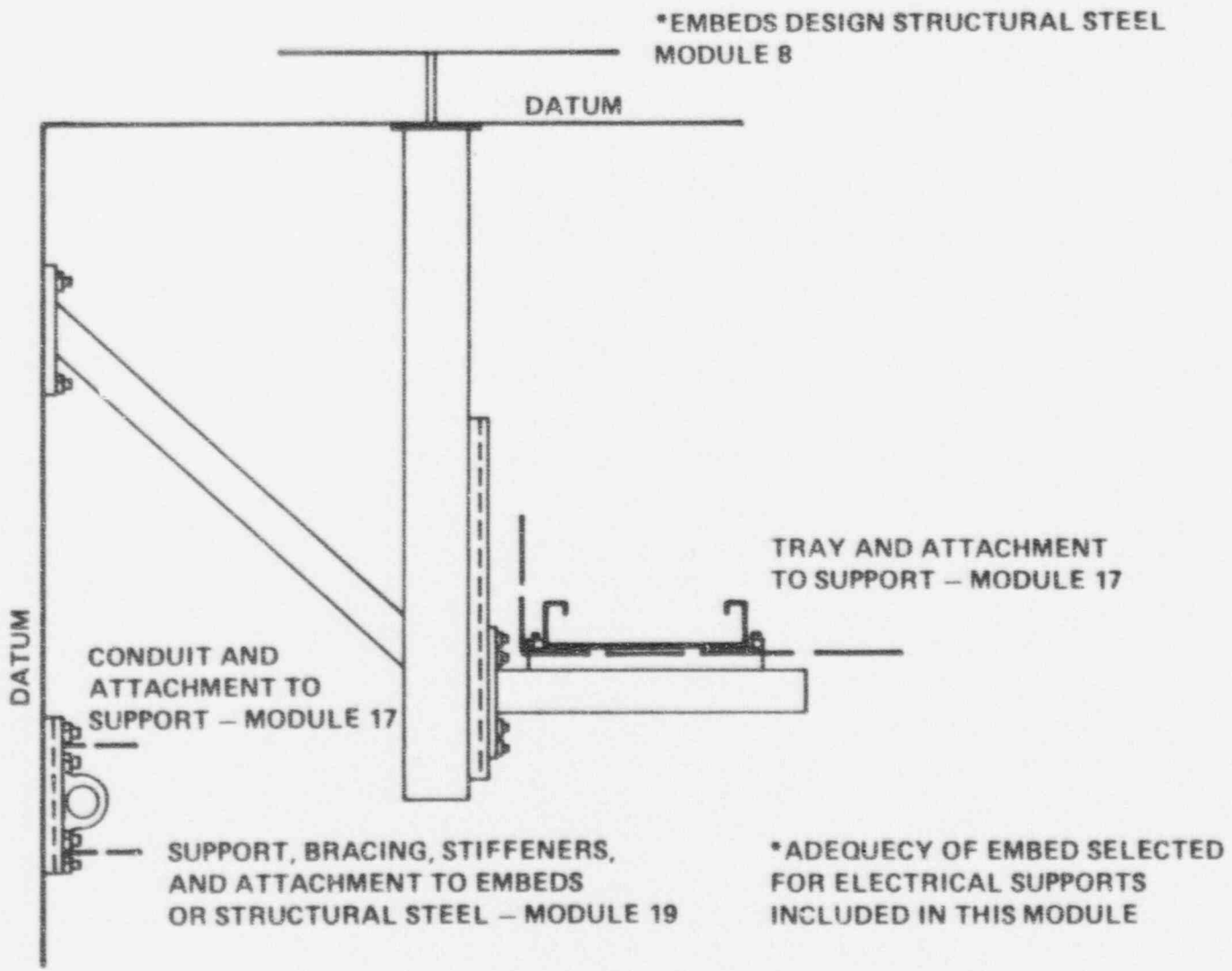


Figure 1.1-1 Module Boundaries and Interfaces

1.2 MODULE ORGANIZATION

This module is divided into the following sections:

1.0 Introduction.

2.0 Organization and Division of Responsibility - A brief description of the project organizations and their division of responsibilities applicable to this module.

3.0 Commitments - This section contains project licensing commitments pertaining to electrical supports within the scope of this module, as found in the Final Safety Analysis Report, generic letters, and other documents. This section also lists documents that demonstrate implementation of these commitments.

4.0 Program Description - A brief description of the processes of design and construction applicable to the scope of this module.

5.0 Audits - A description is given of the audits performed by Quality Assurance and the Nuclear Regulatory Commission as they apply to this module. Also included in this section is a description of any special investigations and/or identified past problems pertaining to work described in this module.

6.0 Program Verification - This is a description of the verification plan, verification performed, and verification results, including corrective actions.

7.0 Independent Design Review - A description of the design process technical review program, its implementation, results, and corrective action.

8.0 Assessment - Evaluations and conclusion of the subject work by the VEGP Readiness Review Board, Readiness Review program quality assurance staff, and Readiness Review Board module expert, are stated in this section. This section also identifies any items still open and the scheduled closure date.

1.3 VOGTLE PROJECT STATUS

Construction began on the first Seismic Category I structure at the Vogtle Electric Generating Plant in the spring of 1978. Fuel load for Unit 1 is scheduled for December 15, 1986. As of December 1985, work associated with electrical supports located in Unit 1 and common structures was approximately 85 percent complete. The estimated completion of hardware installations as of December 1, 1985, is as follows:

Item	Percent Complete as of December 1, 1985
Cable tray supports	92
Conduit supports	83
Pullbox/junction box supports	80 approx.
Electrical equipment supports	80 approx.
Overall electrical supports	85 approx.

2.0 ORGANIZATION AND DIVISION OF RESPONSIBILITY

Georgia Power Company (GPC), acting on its own behalf and as an agent for the Oglethorpe Power Corporation, the Municipal Electric Authority of Georgia, and the City of Dalton, is responsible for the design, procurement, and construction of the Vogtle Electric Generating Plant (VEGP). The Western Power Division of Bechtel Power Corporation (Bechtel) is contracted by GPC to provide architect/engineering services. Bechtel is responsible for the design of all Seismic Category I structures including electrical supports used within Category I structures.

This module section includes a brief description of the organization and responsibilities of GPC and Bechtel starting with the functional group level for design and construction activities related to electrical supports. It also includes the organization and responsibilities of the site contractor involved in the construction process. The section does not describe all organizations and responsibilities, only those pertaining to the content of this module.

2.1 DESIGN ORGANIZATION

Details of organizations involved in the design and construction activities which relate to this module are briefly outlined below:

Bechtel employs the matrix organization concept with an individual assigned as project engineering manager (PEM) who is assisted by a project engineer (PE)-home office, a PE-field office, and functional group heads reporting to the PEM for the performance of functional tasks. Functional group heads receive project direction from the PE, while functional direction is provided to them by discipline chief engineers. The Bechtel PEM has been located at the jobsite since February 1985.

Project engineering for the scope of Seismic Category I electrical supports is composed of Home Office Engineering (HOE) and Project Field Engineering (PFE) organizations. Both HOE and PFE report to the PEM.

The HOE, responsible for the design and analysis of safety-related structures, is supervised by the PE-home office, assisted by the assistant project engineer-design, the civil/structural engineering group supervisor, the civil/structural building engineering group leaders, the drafting group supervisor, and the chief civil/structural engineer.

The PFE is an extension of the HOE and is supervised by the PE-field, assisted by the assistant project engineer-physical design, the civil/structural engineering group supervisor-field, the production group, engineering group leader, the building construction support engineering group leader, and other groups. PFE also supports construction contractor groups in the field. In this effort, the assistant project field engineer-physical design, is assisted by the contractor support supervisor, and raceways and heating, ventilation, and air-conditioning (HVAC) supports engineering group leaders. The PFE assists construction in interpreting drawings and specifications, solving field problems, and coordinating field activities with HOE.

Work associated with electrical supports and related to this module is coordinated through the Civil/Structural HOE and Civil/Structural PFE. Electrical supports within Category I structures were originally designed by Bechtel Civil/Structural discipline in HOE. Currently the production group of the Civil/Structural discipline in PFE is responsible for maintenance of electrical supports design, and for designing supports added in the field. Figure 2.1-1 shows the current Bechtel Vogtle project Civil/Structural Engineering organization (February 1985 to present).

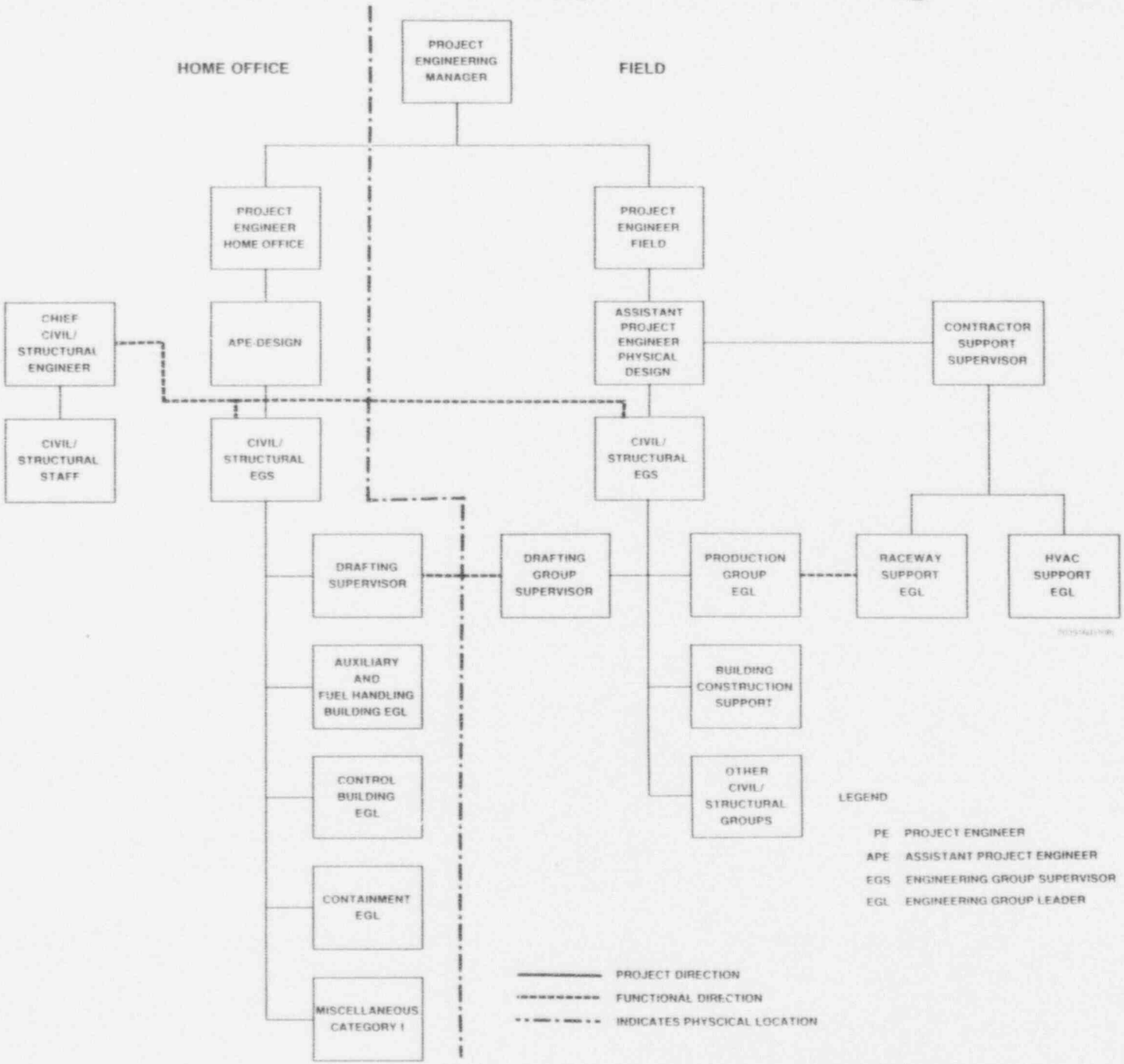


Figure 2.1-1 Bechtel Vogtle Project Civil/Structural Engineering Organization (February 1985 to Present)

2.2 FIELD CONSTRUCTION ORGANIZATION

This section contains descriptions of duties and responsibilities for the portions of the site construction organization involved with electrical support construction and installation.

2.2.1 GEORGIA POWER COMPANY ELECTRICAL PROJECT SECTION

The general responsibilities of the Georgia Power Company (GPC) Electrical Project Section are as follows:

- Provides the onsite contractor with approved material requisitions and initiates purchase orders and releases for material.
- Provides onsite contractor and Quality Control (QC) personnel with cable and raceway tracking and control system information (EE580).
- Provides schedule and budget information to various site organizations.
- Ensures that electrical support installations meet system completion dates and resolves any incomplete items.
- Provides a preplanning effort to remove/resolve restraints in electrical support installation.
- Interfaces with Field Coordination and QC regarding problem identification and resolution.
- Initiates and revises field procedures to support construction activities.

The organization of this section is shown on Figure 2.2-1.

2.2.2 GEORGIA POWER COMPANY ELECTRICAL QUALITY CONTROL

The Electrical Quality Control Section (EQC) verifies that construction activities comply with the Vogtle Quality Assurance (QA) program. EQC is subdivided into specialized groups (Figure 2.2-2) for specific inspection activities. The major groups are:

- Equipment - instrumentation.
- Terminations.
- Cable installation.
- Raceways (includes visual weld inspections).

- o Drilled-in anchor bolts.
- o Rework.

The program description for qualification and certification of QC inspectors is contained in Appendix F. The training program and those requirements that apply to electrical supports are covered in section 4.3.4.

2.2.3 GEORGIA POWER COMPANY CONSTRUCTION COORDINATION

The Field Coordination Group is responsible for assigning contractor personnel to perform housekeeping and access-barrier construction activities, as well as coordinating work activities and scaffolding and/or cribbing construction around or over installed raceways to ensure that protection requirements are maintained during the various installation processes.

2.2.4 CLEVELAND CONSOLIDATED

Cleveland Consolidated is the electrical contractor performing quality-related work on the Vogtle project.

Cleveland is responsible for supplying craft and supervisory personnel for the electrical scope of work, as well as for providing document control and engineering assistance for their craft.

The Cleveland organization is shown on Figure 2.2-3.

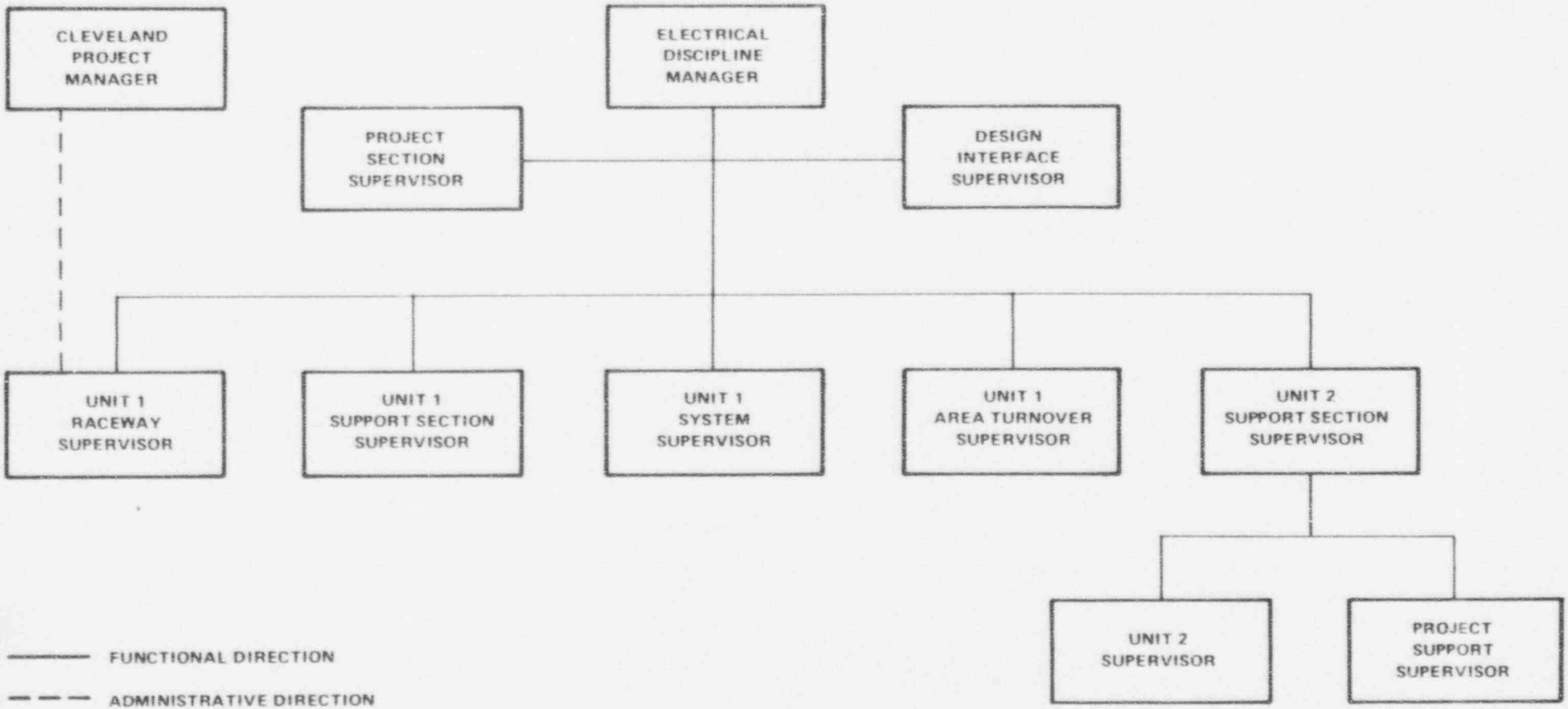
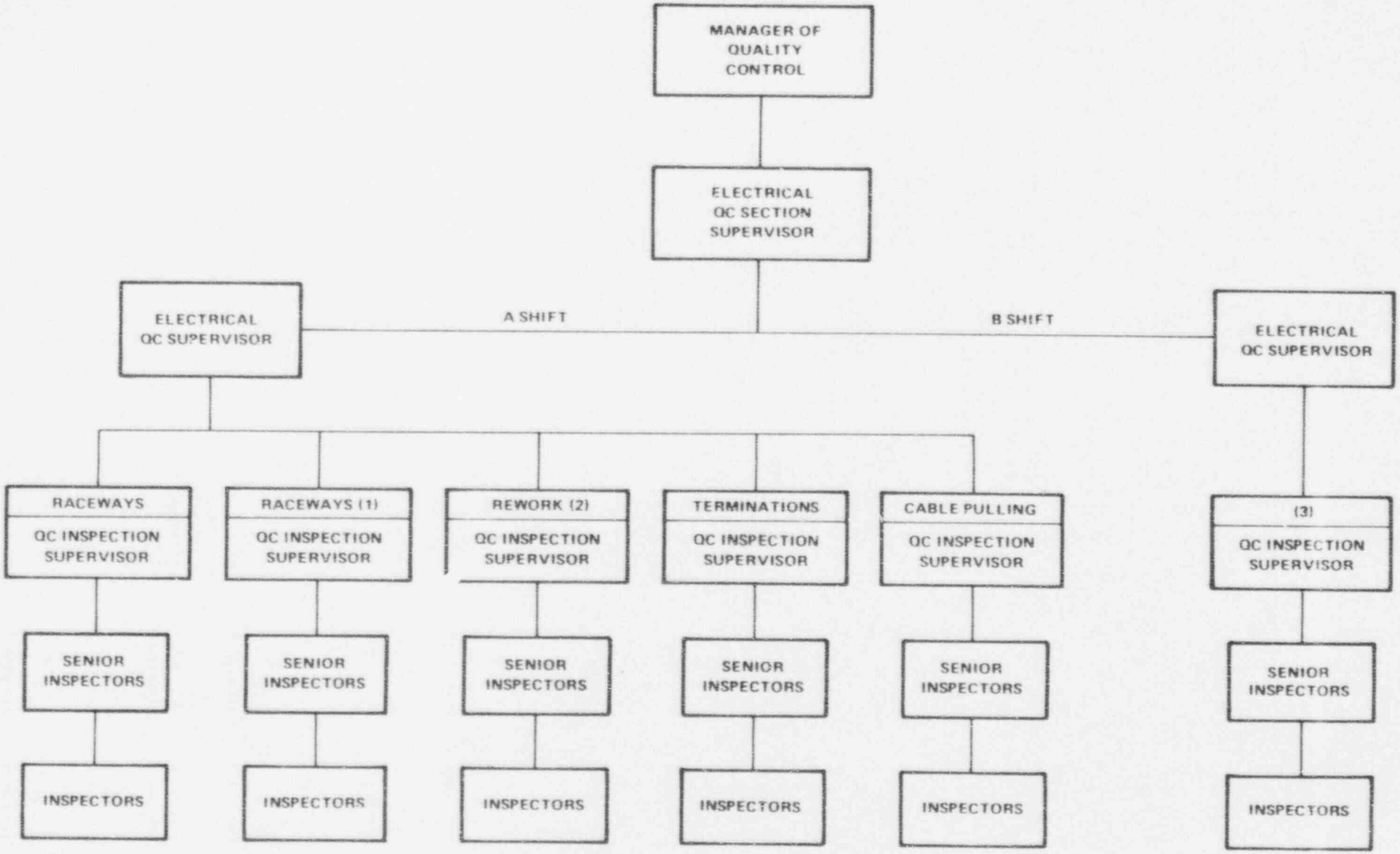


Figure 2.2-1 Electrical Project Section Organization



(1) INCLUDES EXPANSION ANCHOR BOLTS
(2) INCLUDES EQUIPMENT AND INSTRUMENTATION
(3) B SHIFT PERFORMS INSPECTION IN ALL GROUPS AS REQUIRED

Figure 2.2-2 Electrical Quality Control Organization

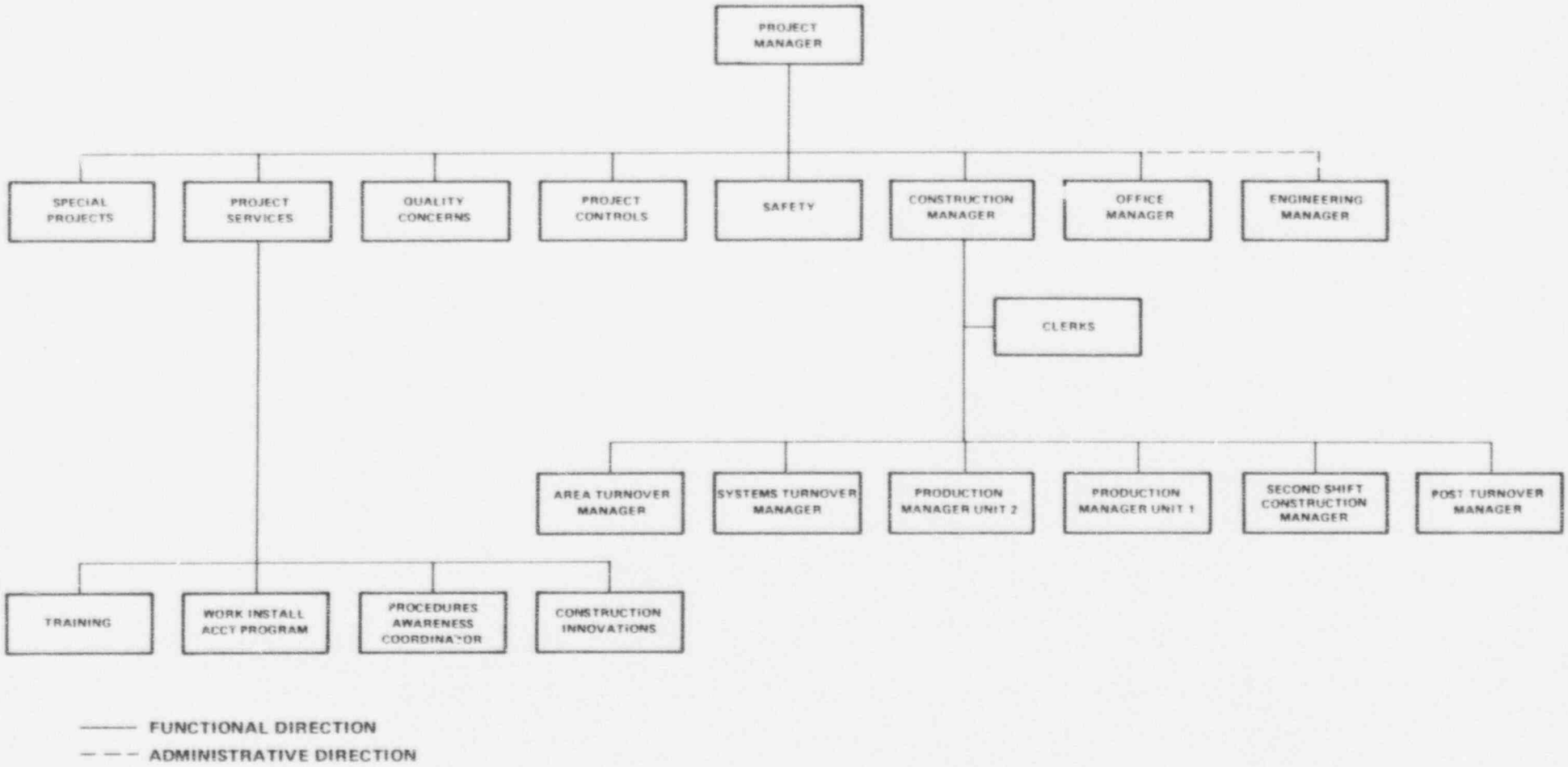


Figure 2.2-3 Cleveland Consolidated Organization

3.0 COMMITMENTS

3.1 INTRODUCTION

This section contains a listing of licensing commitments and corresponding implementing documents applicable to electrical supports. These commitments are presented in two matrixes, the commitment matrix and the implementation matrix. A brief explanation of the development process for each matrix is included.

Additionally, the Project has a commitment to comply with 10 CFR 50, Appendix B, Quality Assurance Criteria, and other commitments such as American National Standards Institute (ANSI) N45.2 and N45.2.11. Although they were not identified as specific commitments in this module, Readiness Review considered the applicable requirements of these types of commitments in preparing and assessing the scope of work represented by this module.

Differences, if any, between the commitments discussed in this section and the Final Safety Analysis Report (FSAR) are unintentional and the commitments in the FSAR take precedence.

3.2 DEFINITIONS

A commitment is an obligation to comply with an industry standard, Regulatory Guide, Branch Technical Position, or owner plan of specific action. For the purpose of the Readiness Review Program, commitments will be identified from the Vogtle Electric Generating Plant Final Safety Analysis Report, the Technical Specifications, responses to Generic Letters, and responses to Inspection and Enforcement Bulletins.

An implementing document is a working level document, either program control or test procedure, that fulfills a commitment applied to a specific activity.

3.3 SOURCES

Commitments covered by this module are typically identified from the following sources:

- Final Safety Analysis Report (FSAR), including responses to Nuclear Regulatory Commission (NRC) questions.
- Responses to Inspection and Enforcement (I&E) Bulletins.
- Responses to generic letters.

These sources are reviewed for commitments based upon guidelines developed from the definition.

Implementation of commitments stated in the commitment matrix is typically contained in:

- Design criteria.
- Material specifications.
- Technical specifications.
- Construction specifications.
- Construction procedures.
- Operations procedures.

3.4 COMMITMENT MATRIX

Once identified by the Readiness Review Team, the commitments are placed on the commitment matrix. Information identifying the source, source section, subject, and module are also listed on the matrix. Any relevant comments concerning the commitments or subject of the section are indicated in the remarks column.

The commitment matrix is presented at the end of this section. Commitments on the matrix are accurate as of December 1, 1985. This represents Amendment 19 of the Final Safety Analysis Report.

COMMITMENTS

SORTED BY SOURCE AND SECTION

COMMITMENT SOURCE	COMMITMENT SECTION	COMMITMENT SUBJECT	DOCUMENT/ FEATURE	RESPONSIBILITY DESIGN	RESPONSIBILITY CONST	REMARKS	REF NO.

EXPLANATION OF FIELDS

COMMITMENT SOURCE - The document containing the commitment (FSAR, Generic Letter, I.E. Bulletin Response, etc.)

COMMITMENT SECTION - Identifies the FSAR section, letter number, or question number

COMMITMENT SUBJECT - The subject of the FSAR section or Generic Letter

DOCUMENT/FEATURE - The document discussed in the FSAR section or the plant feature described in the FSAR section

RESPONSIBILITY - An X is placed under the heading for the organization responsible for implementation of the commitment

REF. NO. - A reference number that corresponds to the appropriate line entry in the implementation matrix

COMMITMENTS

MODULE 19 - SORTED BY SOURCE & SECTION

COMMITMENT SOURCE	COMMITMENT SECTION	COMMITMENT SUBJECT	DOCUMENT/ FEATURE	RESPONSIBILITY DESIGN	RESPONSIBILITY CONST	REMARKS	REF NO
FSAR	1. 5. 9	GENERIC PROGRAMS OF BECHTEL	DAMPING VALUE OF CABLE TRAY SUPPORTS IN VEGP IS VERIFIED BY THE RESULTS OF BECHTEL TEST PROGRAM.	X			109
FSAR	1. 9. 29	SEISMIC DESIGN CLASSIFICATION	RG 1.29, REV. 3, 9/78	X		REF. TABLE 3.2.2-1	126
FSAR	1. 9. 61	DAMPING VALUES FOR SEISMIC DESIGN	RG 1.61, 10/73	X			2188
FSAR	1. 9. 92	COMBINING MODAL RESPONSES AND SPATIAL COMPONENTS IN SEISMIC RESPONSE ANALYSIS	RG 1.92, REV. 1, 12/76	X		SEE SECTION 3.7.B.2.7	174
FSAR	3. 2. 2-1	CLASSIFICATION OF STRUCTURES, COMPONENTS, SYSTEMS	NOTE (e): SEISMIC CATEGORY RG-1.29	X		TABLE 3.2.2-1	843
FSAR	3. 2. 2-1	PRINCIPAL CONSTRUCTION CODE FOR TABLE 3.2.2-1	AISC-69	X		TABLE 3.2.2-1, NOTE (g)	886
FSAR	3. 2. 2-1	PRINCIPAL CODES AND STANDARDS FOR T.3.2.2-1	AISI-68	X			893
FSAR	3. 7. B. 1. 3	DAMPING VALUES USED IN THE DESIGN OF CABLE TRAY SUPPORT	MAXIMUM 15% DAMPING	X		REFER TO FIGURE 3.7.B.1-7	1497
FSAR	3. 7.B. 1-1	DAMPING VALUES FOR FIXED BASE STRUCTURES AND COMPONENTS	SEISMIC PERCENT OF CRITICAL DAMPING PER MODE	X		FIGURE 3.7.B.1-7 FOR CABLE TRAYS AND SUPPORTS, RG 1.61 FOR OTHERS	4370
FSAR	3. 7.B. 1-7	DAMPING VALUES FOR CABLE TRAYS AND SUPPORT SYSTEM	DAMPING VALUES FOR CABLE TRAYS AND SUPPORTS	X		REFER TO FIGURE 3.7.B.1-7	4371

COMMITMENTS

MODULE 19 - SORTED BY SOURCE & SECTION

COMMITMENT SOURCE	COMMITMENT SECTION	COMMITMENT SUBJECT	DOCUMENT/ FEATURE	RESPONSIBILITY DESIGN	RESPONSIBILITY CONST	REMARKS	REF NO
FSAR	3. 7.B. 1. 3	SEISMIC DAMPING VALUES FOR ITEMS OTHER THAN CABLE TRAYS AND SUPPORT SYSTEM	RG 1.61	X		REFER TO REF. NO. 4370	981
FSAR	3. 7.B. 3. 5	SEISMIC SUBSYSTEM ANALYSIS, USE OF EQUIVALENT STATIC LOAD METHOD OF ANALYSIS	EQUIVALENT STATIC LOAD METHOD OF ANALYSIS	X		USED FOR PLATFORMS, CABLE TRAY SUP'T, CONDUIT SUP'TS, HVAC DUCT, SUP'TS & OTHER SUBSTR.	1013
FSAR	3.10.B. 1	SEISMIC QUALIF. AND DOCUMENTATION FOR SAFETY RELATED EQUIPMENT AND SUPPORTS	IEEE 344-1975	X			2283
FSAR	3.10.B. 1	SEISMIC QUALIF. AND DOCUMENTATION FOR SAFETY RELATED EQUIPMENT AND SUPPORTS	RG 1.100	X			2284
FSAR	3.10.B. 4. 2	SRP EVALUATION - BOP EQUIP. SEISMIC QUAL. - GUIDANCE FOR COMBINATION OF MULTIMODAL RESPONSES	BC-TOP-4A	X		MEETS INTENT OF RG 1.92	2285
FSAR	3.10.N. 4. 2	STANDARD REVIEW PLAN EVALUATION COMB. OF MULTI-MODEL RESPONSES FOR BOP EQUIP.	BC-TOP-4A	X		MEETS INTENT OF RG 1.92, SEE REF. NO. 2285	1249
GENERIC LETTER CORR.	C-85/04/29	VISUAL WELDING ACCEPTANCE CRITERIA	AWS D1.1		X	THE CONTENTS OF THIS GENERIC LETTER WERE INCORPORATED IN THE FSAR SECTION 1.9.94.2	4973

COMMITMENTS

MODULE 19 - SORTED BY SOURCE & SECTION

COMMITMENT SOURCE	COMMITMENT SECTION	COMMITMENT SUBJECT	DOCUMENT/ FEATURE	RESPONSIBILITY DESIGN	RESPONSIBILITY CONST	REMARKS	REF NO
NRC QUEST. CORRES.	Q430. 5-1	MAIN CONTROL ROOM & REMOTE SHUTDOWN ROOM ILLUMINATION LEVELS	FIXTURES MOUNTED PER SEISMIC CAT. I REQUIREMENTS	X		RESPONSE TO NRC QUESTION Q430.5-1	4273

3.5 IMPLEMENTATION MATRIX

After the commitments are identified, each team reviews the documents governing its areas of responsibility to ensure compliance with commitment requirements. The depth of verification is to the next level of detail below that stated in the commitment matrix. As an example, if a code is stated as a commitment, the verification will be to the sections within the code. If a code chapter is stated, the verification will be to the subchapters.

IMPLEMENTATION

SORTED BY REFERENCE NUMBER

DOCUMENT/FEATURE	SECTION	DESIGN LAST	DESIGN FIRST	CONST LAST	CONST FIRST	REMARKS	REF NO.

EXPLANATION OF FIELDS

DOCUMENT/FEATURE - The document discussed in the FSAR section or the plant feature described in the FSAR section. (See Commitment Matrix.)

SECTION - The section of the document/feature that is being discussed

DESIGN LAST, CONST LAST - "Last" indicates the project document currently containing the information found in the commitment

DESIGN FIRST, CONST FIRST - "First" indicates the project document that contained the information found in the commitment when the activities governed by the document first began.

REF NO. - A reference number that corresponds to the appropriate line entry in the commitment matrix.

IMPLEMENTATION

MODULE 19 - SORTED BY REFERENCE NUMBER

DOCUMENT/FEATURE	SECTION	DESIGN LAST	DESIGN FIRST	CONST LAST	CONST FIRST	REMARKS	REF NO
DAMPING VALUE OF CABLE TRAY SUPPORTS IN VEGP IS VERIFIED BY THE RESULTS OF BECHTEL TEST PROGRAM		DC-2166, REV. 1, 8-9-83, SECT. 3.2.3, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1, TABLE 5, NOTE 2, REF. 13, NRC LETTER	DC-2166, REV. 1, 8-9-83, SECT. 3.2.3, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1, TABLE 5, NOTE 2, REF. 13, NRC LETTER				109.00
RG 1.29, REV. 3, 9/78		DC-2166, REV. 1, 8-9-83, SECT. 1.0	DC-2166, REV. 0, 3-6-78, SECT. 1.0				126.00
RG 1.92, REV. 1, 12/76		DC-2166, REV. 1, 8-9-83, SECT. 3.2.3, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1	DC-2166, REV. 0, 3-6-78, SECT. 3.2.4, DC-1000-C, REV. 0, 2-28-74, SECT. 5.6			BC-TOP-4-A	174.00
NOTE (e): SEISMIC CATEGORY RG 1.29		DC-2166, REV. 1, 8-9-83, SECT. 1.0	DC-2166. REV. 0, 3-6-78, SECT. 1.0				843.00
AISC-69		DC-2166, REV. 1, 8-9-83, SECT. 2.0, DC-1000-C, REV. 3, 9-30-83, SECT. 2.1	DC-2166, REV. 0, 3-6-78, SECT. 2.1, DC-1000-C, REV. 0, 2-28-74, SECT. 2.1			RACEWAY SUPPORTS	886.00
AISI-68		DC-2166, REV. 1, 8-9-83, SECT. 2.0, DC-1000-C, REV. 3, 9-30-83, SECT. 2.1	DC-2166, REV. 0, 3-6-78, SECT. 2.1, DC-1000-C, REV. 0, 2-28-74, SECT. 2.1			RACEWAY SUPPORTS AISC-68 (TYPO SHOULD BE AISI-68) SAR CHANGE NOTICE NO. 211	893.00

IMPLEMENTATION

MODULE 19 - SORTED BY REFERENCE NUMBER

DOCUMENT/FEATURE	SECTION	DESIGN LAST	DESIGN FIRST	CONST LAST	CONST FIRST	REMARKS	REF NO
RG 1.61		DC-2166, REV. 1, 8-9-83, SECT. 1.0 & SECT. 3.2.3, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1, TABLE 5 & FIG. 12	DC-2166, REV. 0, 3-6-78, SECT. 1.0, DC-1000-C, REV. 2, 12-29-81, SECT. 5.6.1, TABLE 5 & FIG. A			TRAY SUPPORTS	981.01
RG 1.61		DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1, DC-2166, REV. 1, 8-9-83, SECT. 3.2.3, DC-1005, REV. 0, 3-10-80, SECT. 3.7.2	DC-1000-C, REV. 1, 11-22-74, SECT. 5.6.1, DC-1005, REV. 0, 3-10-80, SECT. 3.7.2			CONDUIT SUPPORTS	981.02
EQUIVALENT STATIC LOAD METHOD OF ANALYSIS		DC-2166, REV. 1, 8-9-83, SECT. 2.0, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.8	DC-2166, REV. 1, 8-9-83, SECT. 2.0, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.8			RACEWAY SUPPORTS	1013.00
BC-TOP-4A	4.3	REFER TO REFERENCE NO. 2285	REFER TO REFERENCE NO. 2285				1249.00
MAXIMUM 15% DAMPING		DC-2166, REV. 1, 8-9-83, SECT. 3.2.3, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1, TABLE 5, NOTE 2, REF. 13, NRC LETTER	DC-2166. REV. 1, 8-9-83, SECT. 3.2.3, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1, TABLE 5, NOTE 2, REF. 13, NRC LETTER			TRAY SUPPORTS	1497.00

IMPLEMENTATION

MODULE 19 - SORTED BY REFERENCE NUMBER

DOCUMENT/FEATURE	SECTION	DESIGN LAST	DESIGN FIRST	CONST LAST	CONST FIRST	REMARKS	REF NO
RG 1.61, 10/73		DC-2166, REV. 1, 8-9-83, SECT. 1.0	DC-2166, REV. 0, 3-6-78, SECT. 1.0			TRAY SUPPORTS	2188.01
RG 1.61, 10/73		DC-1000-C, REV.3, 9-30-83, SECT.5.6.1, DC-2166, REV. 1, 8-9-83, SECT. 3.2.3, DC-1005, REV. 0, 3-10-80, SECT. 3.7.2	DC-1000-C, REV. 1, 11-22-74, SECT. 5.6.1, DC-1005, REV. 0, 3-10-80, SECT. 3.7.2			CONDUIT SUPPORTS	2188.02
IEEE-344, 1975		CALC. X2CK2.7.1.1, REV. 0, 7-30-85	CALC. X2CK2.7.1.1, REV. 0, 7-30-85			ELECTRICAL EQUIPMENT SUPPORTS - REFER TO MODULE SECTION 6.1.2.1	2283.00
RG 1.100		CALC. X2CK2.7.1.1, REV. 0, 7-30-85	CALC. X2CK2.7.1.1, REV. 0, 7-30-85			ELECTRICAL EQUIPMENT SUPPORTS - REFER TO MODULE SECTION 6.1.2.1	2284.00
BC-TOP-4A	4.3	CALC. X2CK2.7.1.1, REV. 0, 7-30-85	CALC. X2CK2.7.1.1, REV. 0, 7-30-85			ELECTRICAL EQUIPMENT SUPPORTS - REFER TO MODULE SECTION 6.1.2.1	2285.00

IMPLEMENTATION

MODULE 19 - SORTED BY REFERENCE NUMBER

DOCUMENT/FEATURE	SECTION	DESIGN LAST	DESIGN FIRST	CONST LAST	CONST FIRST	REMARKS	REF NO
FIXTURES MOUNTED PER SEISMIC CAT. I REQUIREMENTS		CALC. X2CQ6.6, REV. 0, IN PROCESS	CALC. X2CQ6.6, REV. 0, IN PROCESS			LIGHTING SUPPORTS, CALC. TO BE ISSUED 6-30-86 - REFER TO MODULE SECTION 6.1.2.1	4273.00
SEISMIC PERCENT OF CRITICAL DAMPING PER MODE		DC-2166, REV. 1, 8-9-83, SECT. 3.2.3, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1, TABLE 5 & FIG. 12	DC-2166, REV. 0, 3-6-78, SECT. 3.2.4, DC-1000-C, REV. 2, 12-29-81, SECT. 5.6.1, TABLE 5 & FIG. A			TRAY SUPPORTS	4370.01
SEISMIC PERCENT OF CRITICAL DAMPING PER MODE		DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1, DC-2166, REV. 1, 8-9-83, SECT. 3.2.3, DC-1005, REV. 0, 3-10-80, SECT. 3.7.2	DC-1000-C, REV. 1, 11-22-74, SECT. 5.6.1, DC-1005, REV. 0, 3-10-80, SECT. 3.7.2			CONDUIT SUPPORTS	4370.02
DAMPING VALUES FOR CABLE TRAYS AND SUPPORTS		DC-2166, REV. 1, 8-9-83, SECT. 3.2.3, DC-1000-C, REV. 3, 9-30-83, SECT. 5.6.1, TABLE 5, FIG. 12	DC-2166, REV. 0, 3-6-78, SECT. 3.2.4, DC-1000-C, REV. 2, 12-29-81, SECT. 5.6.1, TABLE 5, FIG. A				4371.00

IMPLEMENTATION

MODULE 19 - SORTED BY REFERENCE NUMBER

DOCUMENT/FEATURE	SECTION	DESIGN LAST	DESIGN FIRST	CONST LAST	CONST FIRST	REMARKS	REF NO
AWS D1.1				X3AR01-88, REV. 19, 9-6-85, REF. TO APP. "VC", REV. 9, 1-23-85	X3AR01-88.4, REV. 4, 3-5-81, APP. A (CSCN NO. 20, 4-2-81)	DURING ASSESSMENT PROCESS: X3AR01-88 REV. 20, 11-11-85 AND APP. "VC", REV. 11, 12-11-85, WERE ISSUED AND FACTORED INTO ASSESSMENT	4973.00

4.0 PROGRAM DESCRIPTION

4.1 DESIGN

This section describes the design engineering scope, work flow, documentation, design control, and as-built activities related to the design of Seismic Category I cable tray supports, conduit supports, and electrical equipment supports within the scope of the Bechtel Power Corporation (Bechtel) Civil/Structural Design Group. The scope of this section is limited to Category I electrical raceway supports and electrical equipment supports, and all non-Category I electrical raceway and equipment supports located in Category I and Category II/I areas. Electrical equipment supports are structures which have been designed and installed for the purpose of supporting the electrical equipment. Direct mounting of electrical equipment to floors, walls, and/or embeds is discussed in Module 8.

4.1.1 STRUCTURES DESCRIPTION AND DIVISION RESPONSIBILITY

The following Category I structures contain electrical raceway and/or equipment supports within the scope of this module:

- Containment building.
- Auxiliary building.
- Fuel handling building.
- Control building.
- Diesel generator building.
- Auxiliary feedwater pumphouse.
- Nuclear service cooling water tower and valve house.
- Category I electrical tunnels.

The hardware items included in the scope of this module are provided in Table 1.1-1 of section 1.1.

4.1.2 DESIGN PROCESS

The design of Category I raceway and electrical equipment supports is based upon the design loads and acceptance criteria delineated in the Design Manual and described in the Final Safety Analysis Report (FSAR). The design work flow process consisted of the following four phases:

- o Development of design criteria.
- o Layouts (raceway routing, equipment locations, identification of concrete penetrations, initial support location and type selection, and 3-dimensional interference check).
- o Design of raceway supports (final support location and type selection, and design development of engineering drawings).
- o Construction support and interface [dispositioning of Field Change Request (FCRs) Deviation Reports (DRs), etc.].

4.1.2.1 Design Criteria Development

The initial criteria for the design of Category I raceway and electrical equipment supports are contained in the Preliminary Safety Analysis Report (PSAR), submitted to the Nuclear Regulatory Commission (NRC) in August 1972. Detailed design criteria (DC) were developed and issued in the Design Manual (DM) for VEGP. The Civil/Structural General Design Criteria (DM, section DC-1000-C) were first issued in February 1974. The Civil/Structural Electrical Cable Tray and Supports Design Criteria (DM, section DC-2166) were first issued in March 1978. The Civil/Structural Seismic-Interdiscipline Design Criteria (DM, section DC-1005) were first issued in March 1980.

4.1.2.2 Layouts

4.1.2.2.1 Cable Tray Supports

Cable tray routing is provided by the Electrical Group. The tray routing is depicted on DK series electrical design drawings. Initial routing is coordinated with Plant Design, Mechanical, and other disciplines to ensure no interferences exist. Concrete wall and floor cable tray penetrations are identified by Electrical Engineering, coordinating this effort with Plant Design and Civil/Structural Engineering. Final penetration locations are depicted on civil/structural concrete drawings.

The cable trays are purchased by Georgia Power Company (GPC). The vendor statically tests the cable trays to determine their physical (strength) properties. Using the vendor-supplied test results, Bechtel Civil/Structural verifies that the trays meet plant seismic requirements.

Using the cable tray routing drawings, Civil/Structural prepares the cable tray support location drawings. The location and

standard support type of each support is then determined and assigned a unique sequence number, which is depicted on the location drawings by the civil/structural designer. A three-dimensional interference check of the support is performed at this time.

4.1.2.2.2 Conduit Supports

Bechtel Electrical Engineering provides the conduit size and a schematic routing of conduit. This routing is depicted on F series electrical design drawings. Concrete floor and wall conduit penetrations are identified by Electrical Engineering, who coordinates this effort with Plant Design and Civil/Structural Engineering. Final conduit penetration locations are depicted on civil/structural concrete drawings.

4.1.2.2.3 Equipment Supports

The Electrical Engineering layout drawings identifying electrical equipment supports were provided to Civil/Structural with the location of the equipment and vendor support requirements.

4.1.2.3 Design of Raceway Supports

4.1.2.3.1 Cable Tray Supports

Civil/Structural develops a schedule drawing along with the cable tray support location drawing. The schedule drawing lists the support type and all related dimensions corresponding to each sequence-numbered support depicted on the location drawing. Civil/structural engineers design standard (typical) cable tray support types to meet the seismic requirements specified in DC-2166. The standard cable tray support is of the tube-steel braced-cantilever type.

The final support type is determined by the Civil/Structural designer using such information as the size, number, and relative elevations of the trays. Special supports (deviations from the standards) are reviewed by the engineer for compliance with the design criteria.

The equivalent static analysis method was employed in the analyses of cable tray supports.

The NRC-approved damping values up to 15 percent [NRC letter (docket Nos. 50-424 and 50-425), dated February 12, 1982] were used in the design. The percent damping used is dependent on the support anchor point (floor) acceleration and the percent loading of the cable tray. Required seismic bracing is field located to suit field conditions using standard details.

The support location drawings, schedule drawings, and calculations are reviewed and approved, and the drawings are issued for construction.

4.1.2.3.2 Conduit Supports

Civil/structural engineers design standard (typical) conduit and junction box support types to meet the seismic requirements specified in the design criteria (DC-2166). The equivalent static analysis method was employed in the analysis of conduit supports. Design inputs such as conduit and junction box size and weight are provided to Civil/Structural by Electrical Engineering. The standard conduit support consists of direct attachment to embedded strut, strut trapeze, and tube-steel propped-cantilevers.

The support type calculations and drawings are reviewed and approved, and the drawings are issued for construction.

Cleveland Electric field routes the conduits and associated junction boxes in accordance with the specifications, using the schematic routing drawings and the standard support drawings issued for construction by Bechtel. As the need develops, a special (new and/or deviations from the standards) support type is requested by Cleveland Electric and is designed, reviewed, approved, and issued for construction by Bechtel.

4.1.2.3.3 Equipment Supports

Final design of electrical equipment supports consists of field determination of the equipment's final location, taking into consideration available space, actual conduit routing, etc. The design input and acceptance criteria are dictated by the vendor/supplier of the equipment. Support details are evaluated, reviewed, and approved in the form of calculations. The drawings are developed, reviewed, approved, and issued for construction.

4.1.2.4 Construction and Supplier Support

During construction, the engineering group provides technical support for dispositioning documents such as FCRs, supplier deviation disposition requests (SDDRs), field DRs, and calculation revisions incorporating approved changes. These activities, which ensure the reconciliation of changes with the original design requirements, are described in more detail elsewhere in this module.

4.1.2.5 Current Activities

The design phase of raceway and electrical equipment supports is substantially complete. It included the issue of engineering drawings, construction specifications, and material specifications. Current activity of the design engineering group, with respect to raceway and electrical equipment supports, includes the processing of field FCRs, DRs, construction specification change notices (CSCNs), and material specification change notices (MSCNs).

4.1.3 DESIGN CRITERIA

An early design engineering activity was the development of the design criteria. This involved the implementation of the PSAR commitments and included the definition of functional requirements, identification of applicable codes and standards, and determination of loading requirements for raceway support design. Functional requirements are defined in terms of load and performance.

The applicable design criteria for raceway supports are listed in Table 4.1-1. These criteria are contained in the Design Manual (reference 1). The Design Manual invokes applicable industry codes and standards and NRC regulatory requirements. These codes and standards provide allowable stress limits as well as design techniques which are used in the design.

The following sections describe loads and loading combinations and acceptance criteria that were used in the design of Category I electrical supports.

4.1.3.1 Loads and Load Combinations

The applicable loads and loading combinations for raceways and supports are specified in DC-2166 and DC-1000-C. Typical loads are:

- Dead load, which includes tray and cable loads.
- Seismic load, both operating basis-earthquake (OBE) and safe shutdown-earthquake (SSE).

Methods of seismic modal combination and the combination of the effects of three simultaneous orthogonal seismic events used in the design process for raceway supports are described in BC-TOP-4-A, Revision 3, Seismic Analysis of Structures and Equipment for Nuclear Power Plants, November 1974. Typically, the governing load combination is that of the effects of dead load service and OBE seismic load applied to the raceway support.

4.1.3.2 Applicable Codes and Stand rds

The major codes and standards used by Civil/Structural for methods of design and structural acceptance criteria for raceway supports are as follows:

- o American Institute of Steel Construction (AISC) Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, adopted February 12, 1969, and supplement Nos. 1, 2, and 3.
- o American Welding Society [AWS] Structural Welding Code - AWS D1.1.
- o American Iron and Steel Institute (AISI), Specification for the Design of Light Gage Cold-Formed Steel Structural Members, 1968 Edition.

4.1.4 DRAWINGS AND DOCUMENTATION

The documentation produced in the design phase for Category I raceway supports includes:

- o Calculations.
- o Drawings
  - General notes.
  - Support locations.
  - Standard support types.
  - Special support types.
  - Fabrication details.
- o Specifications
  - Material (procurement)
  - Construction (installation)

These design documents are tracked using the computer program, Control of Engineering Budgets and Schedules (CEBUS), which maintains a control log of design documents of Bechtel engineering work. The following sections describe these documents and indicate their current status.

4.1.4.1 Calculations

The Vogtle Project Reference Manual (PRM), part C, section 9, describes the procedure for preparing, checking, reviewing, approving, issuing, and revising calculations. Calculations for electrical raceway supports have been prepared in accordance with these procedures. The calculations are identified,

scheduled, and updated on the Project Calculations Control Log, which is maintained by the project document control group.

Procedures require that the supporting calculations be prepared by an originating engineer, checked by an engineer designated by the engineering group leader (EGL), reviewed by the EGL, and approved the engineering group supervisor (EGS) or his designee. In addition, certain calculations were designated by the EGS to be included in the Design Control Check List (DCCL). The DCCL is a listing, approved by the chief engineer and maintained by the EGS, of design documents that require the chief engineer's approval prior to issue. Calculations are selected because of their uniqueness, the importance of the design to safety, or the significance of potential impact on the cost or schedule of the construction. The calculations identified on the DCCL were submitted to the chief engineer for review and approval.

Calculation packages listed in the DCCL were maintained within the Civil/Structural discipline until they were approved by the EGS or the chief engineer. After calculations are approved for the first time, they are issued as Revision 0 to the Document Control Group for microfilming and record retention. Since the design process is iterative, the calculations may require subsequent revisions. Revisions to the calculations are originated, checked, approved, and issued to Drawing and Document Control for microfilming and record retention in a manner consistent with the original calculation. An exception to this is that revisions to calculations listed on the DCCL are also reviewed by the chief engineer at the discretion of the EGS, based on the significance of the change.

Raceway supports were designed as a single span support based upon applicable tributary load. The seismic loads were developed by equivalent static analysis, combining the effects of the three orthogonal seismic components by the square root of the sum of the squares (SRSS) method. Cable tray supports were designed to support 55 lb/ft using damping values provided in (Civil/Structural) DC-1000-C and as committed to in FSAR Table 3.7.B.1-1. Conduit supports were designed to support a given number of conduits using a 2 percent OBE damping. Both cable tray and conduit supports employ AISC-69 and AISI-68 for design methodology and acceptance criteria. Electrical equipment supports are designed to reflect vendor requirements.

4.1.4.2 Drawings

The electrical support design drawings listed below were developed by the Bechtel Civil/Structural Discipline.

- Support location drawings.
- Support schedule drawings.
- Support detail standard design drawings.
- Support detail special design drawings.
- Support detail shop fabrication drawings.

Certain drawings are included on the DCCL and submitted to the chief engineer for review and signature.

The initial issue of design drawings for construction is designated Revision 0, signed by an originator and a checker, reviewed and signed by the EGS, reviewed by the chief engineer (if required by the DCCL), and stamped by a licensed professional engineer in the State of Georgia (usually the EGS). Subsequent revisions, if made under a supervisor other than the originating EGS, are stamped by the licensed professional engineer under whose direction the changes are put into effect. Revisions receive the same checks as the original issue-for-construction drawing. For drawings on the DCCL, the EGS determines whether the revision is significant enough to warrant an additional review and signature by the chief civil/structural engineer.

4.1.4.3 Specifications

As a part of the design process, the Bechtel Home Office Engineering (HOE) Civil/Structural and Electrical Engineering disciplines developed the required specifications for construction and procurement of the material used in construction and installation of electrical supports.

The applicable civil/structural specifications describing Engineering requirements for the fabrication and installation of electrical supports are described in civil/structural specification X2AP01. The applicable sections are as follows:

- Division C5, section C5.2 - Civil/Structural Construction Specification for Erecting Miscellaneous Steel.
- Division C9, section C9.1 - Civil/Structural Construction Specification for Field Fabricated Miscellaneous Q Class Steel.
- Division C9, section C9.7 - Civil/Structural Construction Specification for Furnishing, Installation, and Testing of Concrete Anchors.

The electrical specification describing engineering requirements for the fabrication and installation of electrical supports is X3AR01. The applicable sections are as follows:

- Section E8 - Electrical Construction Specification for Raceway Systems.
- Section E12 - Electrical Construction Specification for Installation Procedures for Electrical Equipment.

Material specifications have been prepared to describe the requirements for materials and fabrication of steel items used for electrical supports. The material specifications for these items are listed in section 4.2 of this module.

The material specifications prepared by Bechtel Home Office and Field Engineering Civil/Structural and Electrical disciplines include:

- Instructions to bidders.
- Technical provisions.
- A proposal form.
- Quality requirements.

These specifications provide the requirements for furnishing plant labor, supervision, material, equipment, and transportation, and for the completion of the operations and incidentals necessary to furnish and deliver the specified materials to the jobsite.

4.1.5 DESIGN CONTROL AND REVIEW

The primary responsibility for the design of electrical supports is assigned to the civil/structural EGL through the civil/structural EGS. The group leader supervises the working level engineers and designers and reports to the EGS. The engineering design is controlled by the technical criteria set forth in the project Design Manual and PRM procedures, and is monitored using various control tools such as CEBUS, discipline desk instructions, interdiscipline reviews, and chief civil/structural engineers' reviews.

During the design process, periodic technical reviews of design documents took place. These reviews involved interdisciplinary coordination and approval of design documents by the Bechtel chief civil/structural engineer, as applicable.

The following sections describe in detail the various design reviews and interdiscipline coordination.

4.1.5.1 Interdiscipline Design Review

The interdiscipline concurrent design review uses design criteria, drawings, vendor prints, and other documents. Information is transmitted among discipline groups in the form of coordination prints, Document Review Notices (DRNs), etc.

These reviews take place concurrently within the discipline groups and comments are transmitted to the originating discipline for resolution and incorporation.

Interdiscipline concurrent reviews are performed for design criteria, vendor packages, and other design data. The following paragraphs describe interdiscipline coordination and review in these three areas.

4.1.5.1.1 Interdiscipline Interface and Review of Criteria

Interdiscipline review of design criteria takes place in accordance with the DRN procedure. The discipline issuing the criteria is responsible for resolving comments and obtaining approval signatures. When the discipline criteria are issued, the cover sheet is signed by reviewing disciplines.

Design manual change notices (DMCNs) are issued for minor changes to the design criteria. The responsible discipline EGS and the nuclear EGS review and approve.

In addition to the individual discipline criteria, certain criteria are designated as interdiscipline criteria. These criteria are originated by input from the affected disciplines. These criteria are reviewed, approved, and issued in the same manner as the discipline criteria.

An example of interdiscipline criteria which is applicable to raceway supports is DC-1005, Seismic - Interdiscipline.

4.1.5.1.2 Interdiscipline Interface and Review of Vendor Data

Vendor packages are received by the discipline responsible for the equipment, and they are routed through the document control group to the affected disciplines. The Civil/Structural Group reviews these documents for compatibility with the civil design. Review comments are provided to the originating/ responsible discipline. The responsible discipline reviews and resolves comments and initiates needed changes. These types of reviews are conducted as needed.

4.1.5.1.3 Interdiscipline Interface and Review of Design Data

Design data developed by one discipline for use by another discipline also go through an interdisciplinary review prior to transfer.

4.1.5.2 Off-project Chief Engineer's Review

Off-project technical reviews of the design of raceway supports and structural supports required for electrical equipment are primarily the responsibility of Bechtel engineering. Electrical equipment mounted on the floors or structural steel of building structures is designed to the requirements of the building structure design criteria. These types of equipment are addressed in Modules 1 and 8.

The chief engineer reviews and approves certain specific engineering documents, which are identified on the DCCL. In addition to the review and approval of specific documents, the chief engineer and his staff conduct technical reviews during the design process. The presentation and status of project team work were reviewed. Reviews were generally performed for the preliminary design, interim design, and the final design stage of the design process.

The chief civil/structural engineer's review of electrical raceway supports was conducted on August 3, 1983 (final). A supplemental review by the Project Field Engineering (PFE), including electrical supports, was conducted on May 1, 1985. Action items identified during the preliminary and interim design reviews were reviewed again for completion at subsequent design reviews. Action items from the final design reviews were closed in a followup meeting that is also documented by meeting minutes. Design review and followup meeting minutes are filed together.

In addition to formal reviews, the chief engineer and his staff conduct informal reviews and consultations, as requested, when specific items arise that necessitate either special consideration or contact with other Bechtel entities.

As part of his project technical review and supervisory responsibilities, the chief engineer also issues problem alerts describing problems encountered on Bechtel projects. The problem alerts require a project response concerning the applicability of the particular problem and the specific project action taken to prevent occurrence at Plant Vogtle or to ensure corrective action is taken if it does occur.

4.1.6 RECONCILIATION OF AS-BUILT CONDITION

The processes by which changes are controlled, approved, and documented are described below:

Design Engineering supports Construction by preparing design changes and in taking action on deviations. Subsequent to the Revision 0 issue of design documents, changes may be made through approved FCRs, through Design Change Notices (DCNs) against the design documents, by directly revising documents generated by responsible design groups, and by taking action on DRs.

The following documents, when evaluated and approved, may result in changes to the design:

- FCR - Initiated by the field, approved by the Bechtel PFE civil/structural EGS and the project engineer (PE)-field.
- DCN - Initiated by the Civil/Structural Group, approved by the civil EGS and the PE or the PE-field.
- DR - Initiated by field. A recommended disposition is provided by field personnel and evaluated by the PFE civil/structural EGS.

These changes, considered part of the design documentation, are logged, tracked, and approved by the discipline EGSs. Changes affecting design are coordinated with the HOE civil/structural EGS. Approval of FCRs by the Bechtel PE-field is sufficient to implement changes; however, a followup coordination with the HOE EGS is performed on those items for which Bechtel HOE maintains design control.

The processing of reviews and approvals for FCRs was primarily an HOE activity during the earlier phase of construction; however, in mid-1983, it became primarily a PFE activity. Since that time, however, the basic approval requirements have not changed; i.e., FCRs are approved by the PE-field or his designee.

Changes to construction or procurement specifications are made by either a CSCN or by an MSCN. CSCNs or MSCNs may be initiated by engineering or construction personnel. CSCNs or MSCNs pertaining to electrical support work require the approval of the responsible discipline EGS and the PE. Once approved, these changes are considered part of the parent document and are incorporated into a revised specification subsequent to their approval.

TABLE 4.1-1

APPLICABLE DESIGN CRITERIA FOR CATEGORY I ELECTRICAL SUPPORTS

Document	Section	Current Revision[a]	Date	Description
Design Manual	DC-1000-C	3	09-30-83	General civil criteria
Design Manual	DC-1005	1	04-04-83	Seismic - interdiscipline
Design Manual	DC-2166	1	08-09-83	Electrical raceway supports

a. Includes applicable DMCN issued on this revision.

4.2 MATERIALS

The materials used in the construction of Vogtle Electric Generating Plant (VEGP) electrical supports are procured through a group of specifications written and controlled by Bechtel Power Corporation (Bechtel). These specifications are prepared in accordance with the Design Criteria prepared by Bechtel and contained in the VEGP Design Manual. These criteria incorporate commitments of the Final Safety Analysis Report (FSAR) and 10 CFR 50.

The materials used in the construction of the electrical supports are: tube steel, strut, channel, angle, cable tray, conduit, junction boxes, and associated hardware (nuts, bolts, straps, etc.)

The materials specifications pertaining to Seismic Category I electrical supports are shown in Table 4.2-1. Several material specifications have been addressed in other modules, as noted in Table 4.2-1. The remainder of this section will pertain to only those specifications not previously addressed.

As for all permanent plant materials and items, Georgia Power Company (GPC) is the purchasing agent for Category I electrical supports material. GPC awards purchase orders to the contractors or suppliers for installation or for delivery of materials. The supports are fabricated and installed by the contractors under the direction of GPC.

Detailed descriptions of the procurement process and receipt and document review are contained in General Appendixes C and E, respectively.

4.2.1 SUPPLIER QUALITY SURVEILLANCE PROGRAM

Specifications in this module require that a supplier of material and fabricated items for electrical supports implement a quality assurance (QA) program which satisfies American National Standards Institute (ANSI) N45.2-71 requirements. The Quality Program Manual describes the supplier's program submitted to Bechtel for review and approval. Quality surveillance of the supplier's work is based upon this manual (after Bechtel approval has been given) along with the technical requirements of the specification and the codes and standards referenced therein.

An outline of the procedures that a supplier must follow to comply with ANSI N45.2-71 in implementing requirements of the QA program is provided at the end of the Proposal Form in each specification. Supplier quality surveillance is implemented and records of the surveillance activities are maintained by Southern Company Services (SCS) for GPC in accordance with

project procedures, as identified in General Appendix I. These procedures are in accordance with Bechtel standards.

The electrical support items, components, and material covered in the specifications listed in Table 4.2-1 require supplier quality surveillance. Table 4.2-2 shows the level of activity which has occurred in the Vogtle quality surveillance program for electrical support items and material. Although SCS manages the supplier surveillance program, the Bechtel Home Office Engineering Civil/Structural Group maintains responsibility for reviewing electrical support material quality surveillance reports and for taking action when required.

4.2.2 SUPPLIER QUALITY VERIFICATION DOCUMENTATION

Each supplier must produce certified documentation when executing his QA program. Requirements for this documentation were established by Bechtel and were based, in part, on the experience of Bechtel in interpreting and applying the 10 CFR 50, Appendix B, criteria. These criteria require documented evidence that material and equipment conform to procurement requirements, and that this evidence be available at the site prior to installation or use of the item. VEGP is committed to meeting the requirements of ANSI N45.2.13-1976 and Regulatory Guide 1.123, to the extent stated in section 1.9.123 of the FSAR. In general, this requires the types of reports shown in Table 4.2-3.

4.2.3 SUPPLIER DEVIATIONS

Vendor requests for approval to deviate from the requirements of a material specification are submitted on a Supplier Deviation Disposition Request (SDDR) form. These requests are reviewed and approved (or rejected) by the Bechtel Civil/Structural engineering group supervisor (EGS). In addition, the SDDRs approved by the EGS are reviewed and approved by Bechtel Quality Engineering, the Bechtel project engineer, and Bechtel Quality Assurance. The approval disposition of each request is categorized as one of the following: Accept-As-Is (Use-As-Is), Repair, or Modify Buyer's Requirement. Table 4.2-4 summarizes the number of SDDRs which have been processed for the specification included in this module.

Deviations or deficiencies can also be discovered during normal surveillance visits, full scope quality program audits, or progressive audits of the supplier's quality program. Such inspections and audits were conducted by Bechtel on electrical support items and material covered by this module. A deviation discovered during a normal surveillance visit is documented on a Quality Surveillance Deficiency Report (QSDR) when it involves a violation of procedures, nonconforming hardware, and/or deficiencies noted in the documentation that can be related to a

single item, group of materials, or a programmatic audit finding report (AFR). Table 4.2-5 shows the number of QSDRs written, the number of audits and reaudits conducted, and the AFRs submitted. Reaudit reports were written until the programmatic audit findings were closed. The number of audit findings identified in the table have been closed in accordance with the applicable procedures.

TABLE 4.2-1

MATERIAL SPECIFICATIONS

Specification Number	Description	Project Class	Previous Module
X2AH01	Miscellaneous Category I Steel	01C	8
X2AH17	Category I Electrical Cable Tray Supports	01C	
X2AP01	Civil-Structural Construction Specification		
Section 9.1	Field Fabricated Miscellaneous "Q" Class Steel	01C	8
Section 9.7	Furnish, Install, and Test of Concrete Anchors	01C	
X2AH06	Category I and Non-Category I Anchor Bolt Assemblies	01C	8
X3AH01	Cable Tray and Fittings	11E	17
X3AH02	Metallic Conduit and Fittings	11E	17
X3AH03	Non-Metallic Conduit and Fittings	11E	17
X3AH05	Junction Boxes (Class 1E)	11E	17

TABLE 4.2-2

SUPPLIER QUALITY SURVEILLANCE PROGRAM (UNIT 1)

Specification Number	Name of Supplier	Surveillance Level	80	81	82	83	84	85
X2AH17 (issue date 9/8/80)	Florida Steel Tampa, Florida	3	3	34	40	45	15	0

TABLE 4.2-3

SUPPLIER QUALITY VERIFICATION DOCUMENTATION LIST

Description	Shop Details	List of Sub-vendors	Welding Procedures	Weld Repair Procedures	Special Process Procedures	QA Program	Non-Dest. Exam. Procedures	SDDRs	List of Codes & Standards	Coating Procedures	Major Repair Verification Reports	Certificate of Conformance
Cat. I Elec. X2AH17 Cable Tray Supports	X	X	X	X	X	X	X	X	X	X	X	X

TABLE 4.2-4

SUMMARY OF SUPPLIER DEVIATION REQUESTS (SDDRs)

Specification Number	Supplier	Disposition		Required Revision to Specification or Drawings
		Accepted Use-As-Is	Repair or Reject	
X2AH17	Florida Steel Tampa, Florida	14	1	4

TABLE 4.2-5

SUMMARY OF QUALITY SURVEILLANCE DEFICIENCY REPORTS
AND SUPPLIER QUALITY PROGRAM AUDITS

Specification Number	Name of Supplier	Surveillance Level	QSDR	Audits	Reaudits	Findings
X2AH17	Florida Steel Tampa, Florida	3	9	4	2	9

4.3 TRAINING

This section describes training and qualification requirements and programs for construction personnel performing activities contained within the scope of this module.

4.3.1 ENGINEERS (DESIGN)

Engineering personnel assigned to the Home Office Engineering (HOE) organization and the Project Field Engineering (PFE) organization receive training to familiarize them with project procedures governing their assigned responsibilities. Section 6, part A, of the Project Reference Manual (PRM) establishes the program structure and requirements for indoctrination and training of Bechtel Power Corporation (Bechtel) personnel assigned to the Vogtle Electric Generating Plant project. It defines procedures, responsibilities, documentation, and records maintenance for the Bechtel project training program. Participation in the program is mandatory for permanently assigned home office and jobsite personnel.

The overall training program includes training in the following subject areas:

- Quality Program.
- Engineering Indoctrination Program.
- PRM.
- Technical and specialized training.
- New arrival orientation.
- Quality Concern Program.

The project engineering manager or his designees are responsible for the formulation and implementation of the training program. The civil engineering group supervisor (EGS) is responsible for ensuring that assigned personnel attend mandatory training classes, receive training in the requirements and the use of the PRM, and learn the unique technical aspects of their work. The civil EGS identifies the training requirements for each individual in the Civil Engineering Group commensurate with assigned tasks, and maintains records of training in accordance with the PRM, part A, section 6. The project administrator receives and stores training records of personnel no longer assigned to the project.

4.3.2 GEORGIA POWER COMPANY ELECTRICAL PROJECT SECTION

The Electrical Project Section of Vogtle Construction conducts in-house orientation and training of engineering personnel. Most of the training is informal, with the section or engineering supervisor holding procedure or specification refresher classes.

Periodically, formal training is held offsite or at the simulator building near Plant Wilson. During available working hours, the PRM or the Project Policy Manual may be assigned as required reading by an engineering supervisor to aid in performance of the engineers' assigned duties. These documents provide an overview of project commitments and site policies.

Orientation for new engineers (either newly hired or newly transferred) is accomplished as follows. New engineers are given copies of the project and site safety rules, information concerning the Quality Concerns Program, and other information intended to introduce the new employee to the site. Each person is tested on his understanding of the safety rules; further instruction is given in weak areas. Newly assigned engineers normally are given, or informed of, a listing of the applicable specifications and procedures that govern their working area. These engineers, based on available training facilities, are indoctrinated into their specialty (raceways, terminations, cables, etc.) through required reading and testing in the applicable specifications and procedures. An exam is then given by the Training Department, the project section, or the engineering supervisor. If any areas of concern are noted in the exam results, they are discussed with the engineer, or are used as an indication of a need for further training in order to ensure an understanding of assigned duties.

Either after completion of testing or after a portion of the testing is completed, the new engineer is assigned to work concurrently with an experienced engineer on a particular work area or activity. The experienced engineer provides guidance in the use of procedures, specifications, and drawings. If the new engineer has sufficient difficulty to warrant training, a drawing refresher course is available onsite. The experienced engineer will also introduce the new engineer to the responsible craft, quality control (QC), and design personnel. New engineers are given increased responsibilities as they are capable of accepting them.

4.3.3 CONTRACTOR TRAINING

Cleveland Consolidated provides training for general orientation and also provides skills training for craftsmen as required by the Georgia Power Company (GPC) procedures, site safety organization, and project correspondence/commitments. The

procedure awareness coordinator (PAC) program was established to ensure craft knowledge of procedures and procedure changes.

Cleveland's Training Group develops and revises training courses corresponding to procedure issue and revision. They maintain a course outline and description which describes course content, testing method, and certification requirements. The Cleveland Training Group provides the quality assurance (QA) vault with lists of personnel who are currently certified/qualified based on training received. This information is available to QC/QA when verifying that the field installations were performed by qualified craft personnel.

Cleveland also has a procedure awareness coordinator who distributes information on procedure changes to craft supervisory personnel so that the craft maintains current knowledge of procedural requirements.

GPC certifies welders and maintains the certification records. Whenever the need arises, GPC provides staff and craft specialized training.

4.3.4 INSPECTORS

The QC inspection program for the inspection and acceptance of electrical supports, as identified in this module, is conducted by the GPC Electrical QC Section. This section is composed of inspectors employed by GPC, Butler Service Group, Daniels International Corp., Bechtel, and Continental Technical Services (CTS). Butler, Bechtel, Daniels, and CTS are agencies that provide inspectors who work under GPC supervision.

The training and certification program for electrical inspectors is developed and administered onsite by the GPC Training Department. Appendix F contains a detailed explanation of the overall site certification program.

Certification for electrical support inspection is awarded in either or both of the areas of Raceway/Embedded Items and Drilled-In Anchors. The primary training course is Raceway/Embedded Items, which is 40 hours in length and provides the inspector with direction, instruction, and reference material for methods of installing raceways. The inspector is also trained in the use of drawings, specifications, procedures, and the proper use of forms and their routing. Tables 4.3-1 and 4.3-2 define the activities that the inspector is qualified to perform and the required training courses.

A Level I inspector records inspections, examinations, and testing data along with implementing inspections, examinations, and testing procedures. The Level II inspector performs the actual evaluation of the validity and acceptability of

inspections, examinations, and testing results, in addition to documenting them. An uncertified inspector is not allowed to independently inspect for acceptance, but is used in data-collecting or inspection assignments, provided he is supervised by a certified inspector who is participating in the inspection, examination, or test.

TABLE 4.3-1

DETAILS OF RACEWAY/EMBEDDED ITEMS CERTIFICATION

Certification in this activity qualifies the inspector to perform in the following areas:

- o Grounding (embedded and exposed).
- o Raceway inspection.
- o Raceway support inspection.
- o Calvert-bus inspection.
- o Calvert-bus support inspection.

The following courses are required for certification:

- o Basic Math I.
- o Basic Blueprint.
- o Raceway/Embedded Items[a]

  Includes: Drawings

  Codes/Standards/Specifications/Procedures Raceways

  Grounding

  Supports

  Equipment/Tools

a. Certification in Visual Inspection or an American Welding Society (AWS) certification is required if weld inspection is performed.

TABLE 4.3-2

DRILLED-IN ANCHOR CERTIFICATION

Certification in this activity qualifies the inspector to perform in the following areas:

Drilled-In Anchors[a]

Courses required to fulfill the academic requirements are:

Basic Math I
Basic Blueprint Reading
Drilled-In Anchor Bolts

a. Includes wedge anchors, maxi bolts, rock bolts. This certification excludes preplaced anchors of all types.

4.4 CONSTRUCTION

This portion of the module contains a brief description of the processes that are used for installation and inspection of electrical supports. It addresses the applicable electrical construction specifications, field procedures, design drawings, and construction codes which govern each installation and inspection process.

4.4.1 WORK ACTIVITIES

Figures 4.4-1, -2, and -3 illustrate the fabrication, installation, inspection, and documentation activities associated with electrical supports. The flowcharts contain nodes which represent points where preceding activities must be completed in order to continue the process. The interface between support installation and raceways (Module 17) is shown to note at which point integration of the two installation processes takes place.

Figure 4.4-1 covers the work processes and documentation flows for support installation. The major flow paths indicate preinstallation construction activities, inprocess installation and inspection, and postinstallation inspection and acceptance. Documentation is retained by Electrical Quality Control until area turnover.

Figure 4.4-2 covers the onsite fabrication activities performed in the fabrication shop and the interface between shop and field activities.

Figure 4.4-3 covers the installation of concrete expansion anchors and the interface with other groups during the installation process.

4.4.2 SPECIFICATIONS, PROCEDURES, AND DRAWINGS

The specifications, significant procedures, and design drawings applicable to the installation of electrical supports in seismic areas are as follows:

- Specification X3AR01, section E8, Raceway Systems

  This specification gives design engineering requirements for material types, train separation, hot pipe separation, and general installation of conduit, trays, pullboxes, junction boxes, and electrical supports.

- Specification X3AP01

  This specification is referenced, as applicable, through the various field procedures and specification X3AR01

section E8, that are used for the installation and fabrication of electrical supports. Section C9.7 contains requirements for concrete expansion anchor installation and section C9.1 contains specific material requirements for electrical support fabrication.

- Procedure ED-T-02, Raceway Installation

  This field procedure takes the general requirements of specification X3AR01-E8 and provides the site construction group with detailed installation, inspection, and documentation requirements.

- Procedure ED-T-26, Electrical Fabrication

  This field procedure establishes the requirements and controls for receiving and storage of materials, heat number tracking, and fabrication and inspection of items produced at the site electrical fabrication facility (fab-shop).

- GD-A-04, Calibration and Control

  This procedure establishes the requirements for the calibration, recalibration, maintenance, and inventory of measuring and test equipment (M&TE), and specifies the method and control measures used to verify the quality of work accomplished by the individuals performing the equipment calibration.

- GD-T-27, Installation of Concrete Expansion Anchors

  This procedure establishes guidelines for installation of wedge type concrete expansion anchors. This procedure also provides instructions for the inspection, testing, and documentation related to these anchors.

- ED-T-17, Electrical Rework Request

  This procedure establishes the method for notification of rework to electrical Class 1E systems and items which have been previously accepted (partially or completely) by Electrical Quality Control (EQC). Rework requests are generated to track and detail the work to be accomplished, the procedures governing that work, and the subsequent inspection by EQC.

- Support type and detail drawings for tray supports:

  - AX2D66N - Series drawings.

- Lighting and communications mounting details:

  - AX3DG032 through G039.

- o Typical wall-mounted equipment details:
  - AX2D94V045 through V049.
- o Conduit support detail drawings:
  - AX2D94V050 through V056.

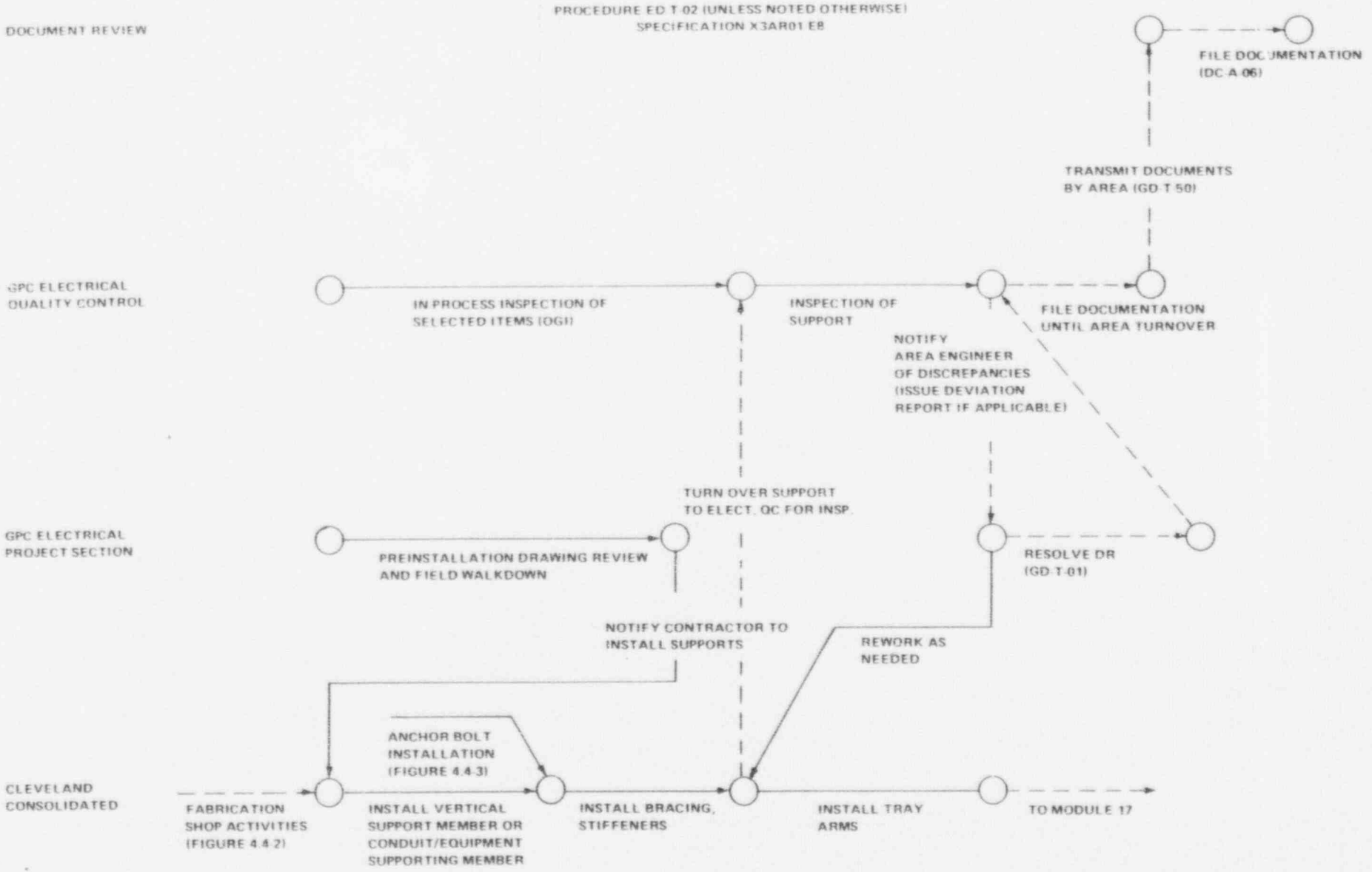


Figure 4.4-1 Raceway Support Installation

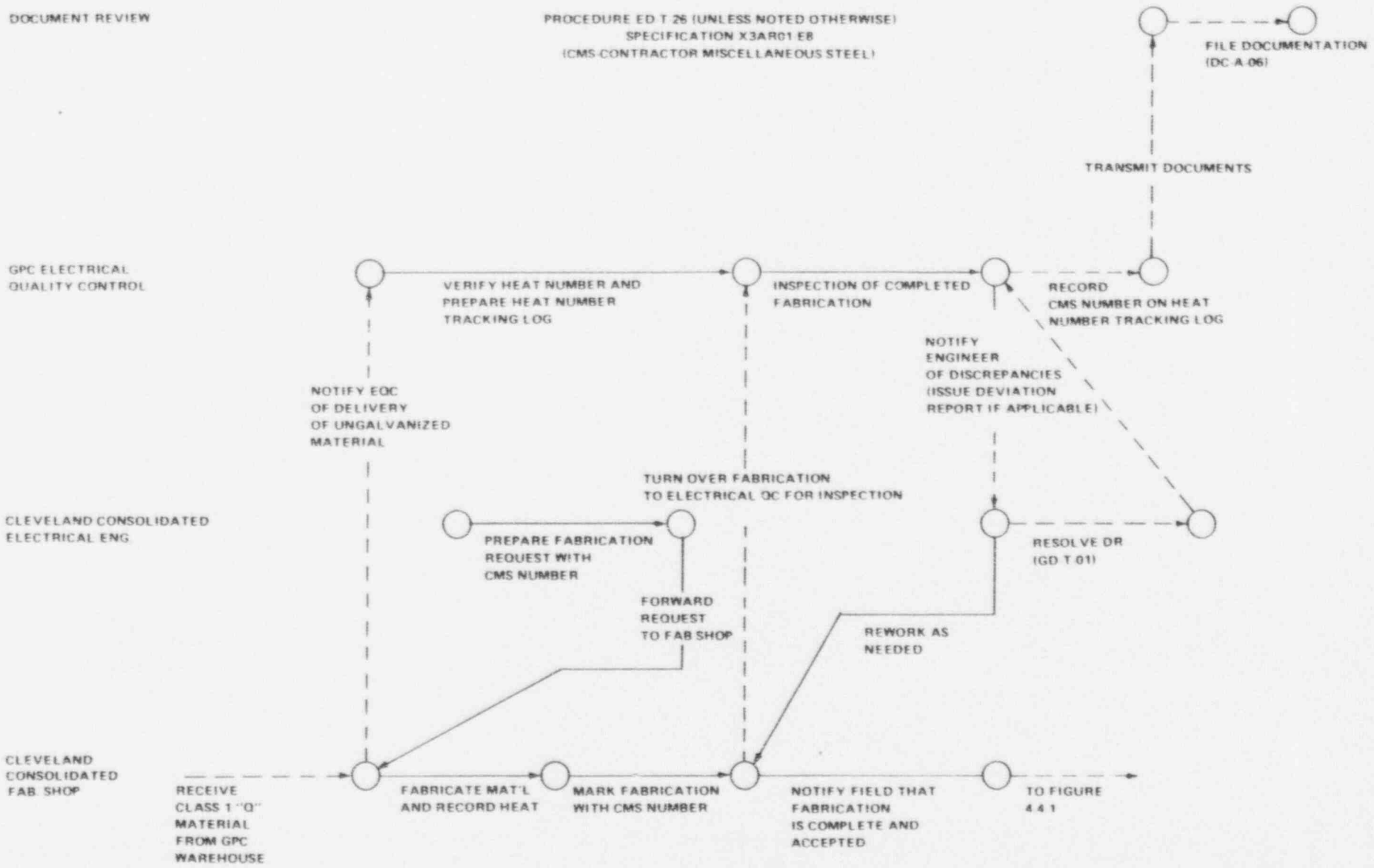
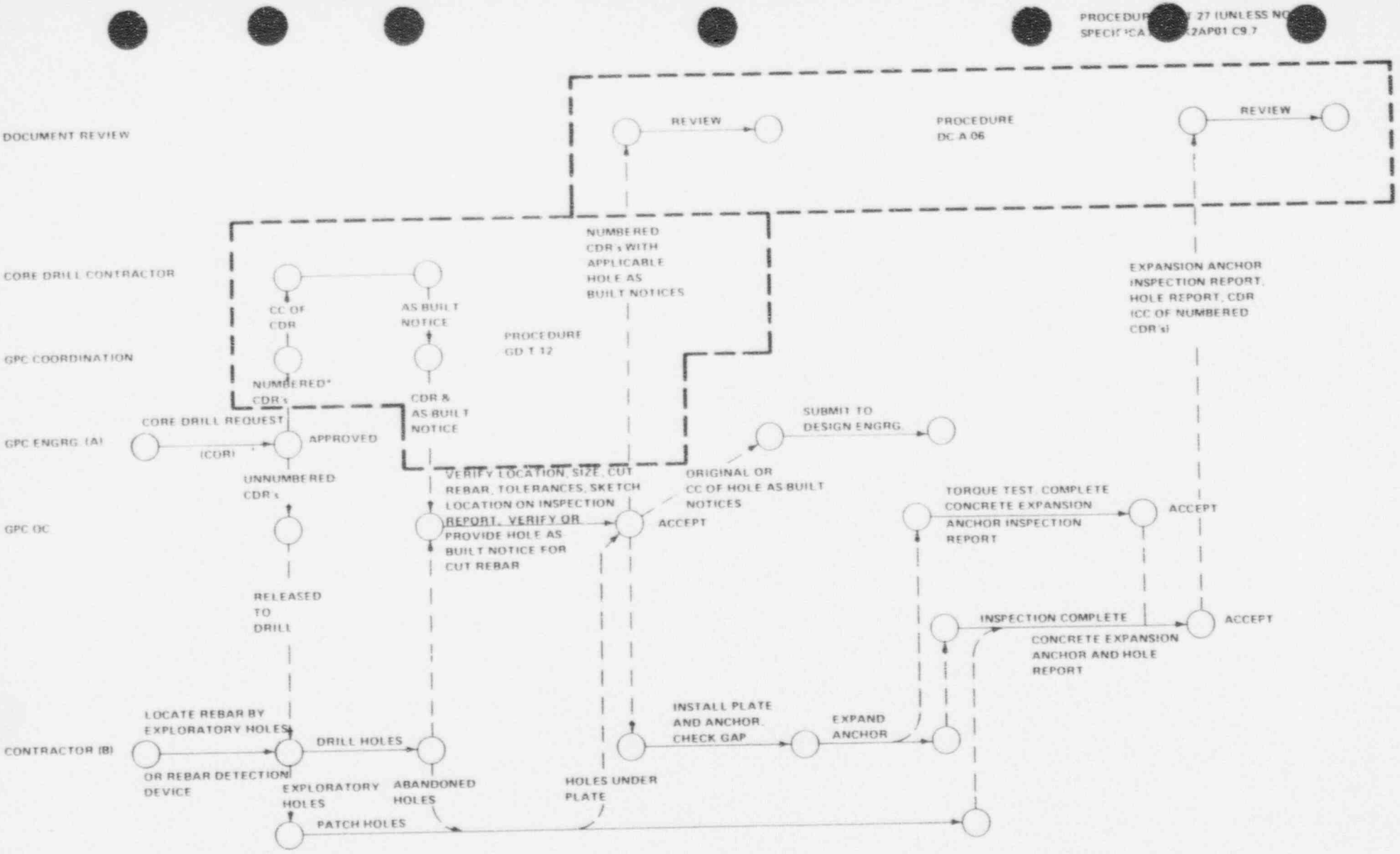


Figure 4.4-2 Electrical Fabrication



(A) CORE DRILL REQUEST IS REQUIRED IF HOLE DEPTH IS TO EXCEED 6 INCHES (REFER TO MODULE 1).

(B) IF HOLE DEPTH IS TO BE LESS THAN 6 INCHES, THIS WORK IS PERFORMED DIRECTLY BY THE ELECTRICAL CONTRACTOR.

Figure 4.4-3 Drilled-In Anchors Activity Flow, Concrete Expansion Anchors

5.0 AUDITS AND SPECIAL INVESTIGATIONS

This module section contains a discussion of the Quality Assurance (QA) audit process, Nuclear Regulatory Commission (NRC) inspections, and special evaluations performed in the area of electrical supports. This section summarizes the results of a Readiness Review evaluation of audit findings to determine their impact on the programs assessed, and to ensure inclusion of significant issues into the verification process. These audits have been performed throughout the Plant Vogtle design and construction program by QA organizations. These onsite audits have been performed by Georgia Power Company QA, Bechtel Power Corporation QA, and Southern Company Services QA. Also, regularly scheduled and periodic NRC inspections and investigations, including the Systematic Assessment of Licensee Performance (SALP) evaluations and a special investigation by the regional Construction Assessment Team (CAT), have been conducted. Plant Vogtle was also 1 of 22 utility sites that initially participated in the onsite investigations and evaluations of the Institute of Nuclear Power Operations (INPO). An offshoot of the pilot INPO program and the subsequent followup onsite investigation was the Self-Initiated Evaluation (SIE) program.

This section is divided into two parts: section 5.1 is limited to discussion of audits pertaining to design-related items; section 5.2 is limited to discussion of audits pertaining to construction-related items. These subsections briefly explain organizations, programs, investigations, evaluations, and audits and list findings or violations that are applicable to this module.

5.1 DESIGN

The Vogtle program for design of electrical supports has been audited by Georgia Power Company (GPC), Bechtel Power Corporation (BPC), and Southern Company Services (SCS) as well as being reviewed by Nuclear Regulatory Commission (NRC) inspection teams. In addition to these audits, special evaluations were performed by the Institute of Nuclear Power Operations (INPO) at the request of GPC.

The Readiness Review design verification team reviewed these past audits and related findings to determine which areas of the design program indicated a need for additional review. The audits and the associated findings were categorized into one or more of 12 areas of design activities in order to determine the areas with recurring findings. The audits and the category of each finding are summarized in the design audit matrix at the end of this section. Areas of design activities that were reviewed without a finding being identified are represented by an X in the appropriate column of the matrix.

If a finding or deficiency occurred in construction because the construction specifications requirements were not met, a construction finding, not a design finding, was issued. However, if the construction specification requirements did not accurately reflect codes or standards or if it required clarification through revision, the finding was considered related to design, even if originally, the deficiency was discovered during a review of construction activities.

5.1.1 GEORGIA POWER QUALITY ASSURANCE AUDITS

Applicability of audits to this module was determined by establishing specific considerations. Only those audit findings applicable to the design of electrical supports are noted below.

There were six audits conducted by GPC which resulted in six findings. The following is a summary of GPC Quality Assurance (QA) audits that pertain to design activities:

Audit Number	Date	Number of Findings
ED-01-81/42	06-30-81	2
MD14-82/36	04-01-82	1
MD14-82/145	01-10-83	1
MD14-83/15	03-21-83	0
ED01-83/26	05-25-83	1
CP01-85/29	04-19-85	1

Five of the findings are related to conflicts on drawings or related to drawings that did not have sufficient information for construction. One finding was issued against a specification for rock bolts, in that it did not provide enough information for construction and testing. The related drawings and specification were corrected.

GPC reported to the NRC one potentially reportable condition in accordance with the criteria of parts 10 CFR 50.55(e) and 10 CFR 21. This potential reportable condition was on the installation of electrical junction boxes. As-built conditions as allowed by the drawings were different from the configuration used in the testing of boxes. An evaluation based upon as-built conditions found them to be adequate. Two details shown on the design drawing were not consistent with the vendor test data. In this case, the drawing was revised to meet the seismic qualification requirements. This item was specifically checked by the Readiness Review Team as part of design verification. The noted revised details were found to reflect the qualification requirements.

The noted deficiencies were corrected and QA audit findings were closed.

5.1.2 NRC INSPECTIONS

Three NRC inspections at VEGP in which the drawings, specifications, and previous QA audits occurring at the jobsite were reviewed, resulted in two findings. The following inspection reports address electrical supports:

Inspection Number	Date	Number of Findings
82-25	11-02-82	0
83-13	10-14-83	2
84-29	11-27-84	0

The two findings were related to the complexities of the cable tray and conduit support drawings. After a thorough investigation by the Project, which included interviews with the construction crew and field inspectors, it was determined that the drawings were adequate for construction and inspection.

There are no unresolved design problems identified by NRC audits.

5.1.3 SCS QA AUDITS

SCS conducted several quality assurance/technical assessment audits of Bechtel. Two findings were related to this module in the audit dated February 24, 1984. One was related to interdiscipline coordination and the other addressed the lack of

review of calculations by the Bechtel civil/structural chief engineer. Steps were taken to correct the problem.

In addition to the SCS QA audits, a review of engineering design controls of VEGP work completed by Bechtel and Westinghouse was conducted in February 1982 by SCS in response to a Vogtle project management request. As a result of this review, three findings related to this module were issued. All three findings were related to the damping value used in the design of cable tray supports. Subsequently, licensing documents, design criteria, and calculations were revised to match a maximum damping value of 15 percent that was approved by the NRC. The Readiness Review Team specifically checked this item as a part of design verification, and concluded that the design now conforms to the approved damping value.

5.1.4 INPO EVALUATION

The Vogtle Project participated in two INPO construction project evaluations, one in 1982 and the other in 1984. During the 1984 evaluation one finding related to this module was issued. This finding stated that the calculations for cable tray supports with stepped tube connections did not address punching shear. The existing calculations were revised and the engineers involved in this work were instructed to ensure that identified design requirements are addressed in the calculations. The Readiness Review Team checked a sample of calculations for compliance with the noted criteria and confirmed that this problem has been addressed in the design calculations.

5.1.5 INDUSTRY CONCERNS

This section identifies several industry concerns applicable to electrical supports. These concerns are reviewed by the Readiness Review Team to determine the impact on Vogtle electrical support design. The following items were specifically checked during the design program verification:

- Documentation of support adequacy by the Civil/Structural discipline for the actual tray load (monitored by the Electrical discipline) when it exceeds the initial design load. Review of electrical desk instructions and civil/structural cable tray support calculations provided documentation for confirming that this concern has been adequately addressed.

- Traceability of support calculations to the detail drawings. Review of the calculations and drawings confirmed traceability.

- Transfer of vendor-supplied information into applicable calculations. Review of vendor test reports and design calculations confirmed transfer of data.

- Transfer of vendor-required engineered conditions into applicable specifications and inspection requirements. Review of vendor documentation, the construction specifications, and field procedures confirmed transfer of data.

- Use of worst case capacities of vendor-specific hardware when more than one vendor supplies the hardware. Documentation provided by the Project demonstrated a study for worst case combination of vendor-specific hardware capacities.

As a result of this review, it was determined that the above industry issues have been addressed in the VEGP design process for the design of electrical supports.

In conclusion, the Readiness Review Team has determined that the design problems that were identified by previous audits, evaluations, or NRC inspections have been resolved by the Project.

DESIGN AUDITS

SORTED BY INITIATING ORGANIZATION AND AUDIT NUMBER

EDIT NO.	INIT ORGAN	AUDIT NUMBER	DATE	DESIGN CRIT	CALCU-LATIONS	DRAW-INGS	SPEC	SUPPLR DATA	DEVIAT. REPORTS	TRAIN PRGM	DESIGN REVIEW	DESIGN DOC CNT	DESIGN CHANGES	MISC	WEST. SCOPE

EXPLANATION OF FIELDS

For convenience, categories were combined where appropriate. The following is a listing of combinations and explanations:

EDIT NO.	- Used for complete entry/corrections
INIT ORGAN	- Initiating or responsible organization: BPC, GPC, NRC, SCS
AUDIT NUMBER	- Number applicable to specific audit
DATE	- Date of audit, finding, or report
DESIGN CRIT	- Design Criteria, FSAR
CALCULATIONS	- Calculations, Failure Modes and Effects Analyses (FMEAs), engineering studies
DRAWINGS	- (Self-explanatory)
SPEC	- Design specifications, procurement specs, construction specs, bid evaluations
SUPPLR DATA	- Supplier data includes expediting, inspections, Supplier Deviation Disposition Requests (SDDRs)
	- Supplier data package problems
DEVIAT. REPORTS	- Deviation Reports, Nonconformance Reports, reportable items
TRAIN PRGM	- Training program for design personnel
DESIGN REVIEW	- Design reviews of engineering documents, Design Review Notices (DRNs), and interface between engineering disciplines
DESIGN DOC CNT	- Document Control - records, correspondence, design control (of design documents), manual control Project Reference Manual (PRM)
DESIGN CHANGES	- Field Change Requests (FCRs), Design Change Notices (DCNs), greenlining, Field Engineering Change Orders (FECOs)
MISC	- Licensing deviation disposition requests procedures, miscellaneous design audits
WEST. SCOPE	- NSSS and activities specific to Module 16

DESIGN AUDITS

MODULE 19 - SORTED BY INIT. ORGANIZATION & AUDIT NUMBER

EDIT NO	INIT ORGAN	AUDIT NUMBER	DATE	DESIGN CRIT	CALCUL ATIONS	DRAW-INGS	SPEC	SUPPLR DATA	DEVIAT. REPORTS	TRAIN PRGM	DESIGN REVIEW	DESIGN DOC CNT	DESIGN CHANGES	MISC	WEST. SCOPE
348	GPC-QA	CP01-85/29	04-19-85			789									
350	GPC-QA	ED01-81/42	06-30-81			213,215	213,215								
907	GPC-QA	ED01-83/26	05-25-83			431							431		
559	GPC-QA	MD14-82/145	01-10-83	288			288								
562	GPC-QA	MD14-82/36	04-01-82	287			287								
566	GPC-QA	MD14-83/15	03-21-83	X			X								
715	NRC-INS	82-25	11-02-82			X									
741	NRC-INS	83-13	10-14-83			83-13-08,83-13-05	X								
832	NRC-INS	84-29	11-27-84	X								X			
948	SCS-QA	N/A	03-09-84			X					84-1 84-8	X	X		

5.2 CONSTRUCTION AUDITS

5.2.1 PROJECT AUDITS

5.2.1.1 Georgia Power Audit Findings

The Georgia Power Company (GPC) Quality Assurance (QA) Department conducts regularly scheduled audits to verify project compliance with the applicable project documents. Findings are reported to the management of the audited organization for corrective action.

The QA audits discussed in this section provide in-depth reviews of electrical support installations while these activities have been in process at Plant Vogtle. The audits focused on the activities as they were conducted in the construction process including fabrication, field work, and QA documentation.

The audit matrix at the end of this section outlines the specific areas covered and the types of issues that were raised and resolved.

Audit findings have been tracked in four ways by QA. These methods are Audit Finding Reports (AFRs), Observations (OBSs), Deficiencies (DEFs), and Corrective Action Requests (CARs). Of the four methods, only two AFRs and CARs are currently being used on the project. A more detailed explanation of the audit process is found in Appendix I.

Eighteen audits addressed the program involving electrical raceways. Those 19 audits resulted in 28 findings that are listed in the finding matrix (section 5.1).

Each audit was reviewed and classified into one or more of the eight categories listed below:

Category	Audit Frequency[a]	No. of Findings[b]
Materials	4	3
Training/qualification	0	0
Fabrication	9	9
Inspection	8	7

a. The frequency column includes findings, observations, and other references to the subject categories within audit reports.

b. The findings column includes findings, observations, and deficiencies and reflects multiple listings of the same finding if more than one category is affected.

Category	Audit Frequency[a]	No. of Findings[b]
Testing	1	1
M&TE	3	2
Document control	3	4
QA records	8	8

Each finding was reported to project management for evaluation of its impact on the project, corrective action, and action to preclude recurrence.

The findings, observations,and deficiencies were evaluated by the Readiness Review construction team who used them in developing the plan for assessment of electrical supports by Readiness Review.

5.2.1.2 Self-Initiated Evaluation

During September and October 1982, the project initiated an evaluation of design and construction activities that was conducted by a team of nonproject senior technical and management personnel from GPC, Southern Company Services, and Bechtel Power Corporation. The evaluation assessed many of the programs and activities on the project using the Institute of Nuclear Power Organizations (INPO) criteria for construction project evaluation. There were two findings in the area of electrical supports. They are listed in the finding matrix (section 5.1).

5.2.2 NRC INSPECTIONS

The Nuclear Regulatory Commission (NRC) has addressed electrical supports in two inspections that resulted in the issuing of six findings.

The NRC inspections and findings were reviewed and similarly classified into one or more of eight different categories. The results are summarized in the table below:

a. The frequency column includes findings, observations, and other references to the subject categories within audit reports.

b. The findings column includes findings, observations, and deficiencies and reflects multiple listings of the same finding if more than one category is affected.

Category	Audit Frequency	No. of Findings
Materials	1	0
Training/qualification	0	0
Fabrication	3	2
Inspection	3	2
Testing	1	1
M&TE	0	0
Document control	1	0
QA records	4	1

The NRC findings were evaluated by the Construction Team and incorporated into the assessment of electrical supports by Readiness Review.

CONSTRUCTION AUDITS

EDIT NO.	INITIATING ORGANIZATION	AUDIT NUMBER	DATE	MATE-RIAL	TRAIN/ QUAL	FABRI-CATION	INSPEC-TION	TEST-ING	MEASURE &TEST EQ	DOCUMENT CONTROL	QA RECORDS	REMARKS

EXPLANATION OF FIELDS

EDIT NO. – Internal reference numbers

INITIATING ORGANIZATION – The organization performing audit or inspection:

- GPC - QA = Georgia Power Company QA Department
- HART-N-616 = Hartford Steam Boiler and Inspection Company
- NISCO = Nuclear Installation Service Company
- NRC-INS = Nuclear Regulatory Commission Inspection Report
- West = Westinghouse
- BPC = Bechtel Power Corporation
- SCS = Southern Company Services
- INPO = Institute of Nuclear Power Operations

AUDIT NUMBER – Identification number of audit or inspection assigned by initiating organization

DATE – Date of audit or report receipt date

MATERIAL – Material, storage, damage, handling, cleanliness, etc.

TRAIN/QUAL – Training and qualification of personnel

FABRICATION – Manufacturing/installation activities

INSPECTION – Inspection and nondestructive examination

TESTING – Pressure tests, flow tests, load tests, etc.

MEASURE & TEST EQ – Measurement and test equipment

DOCUMENT CONTROL – Document control

QA RECORDS – Quality Assurance records

CONSTRUCTION AUDITS

MODULE 19 - SORTED BY INIT. ORGANIZATION & AUDIT NUMBER

EDIT NO	INITIATING ORGANIZATION	AUDIT NUMBER	DATE	MATERIAL	TRAIN/ QUAL	FABRIC- ATION	INSPECT- ION	TESTING	MEASURE &TEST EQ	DOCUMENT CONTROL	QA RECORDS	REMARKS
158	GPC-QA	CP01-85/29	04-19-85				783,788			789	783,790	
1718	GPC-QA	CP09-85/86	12-18-85				878					
1587	GPC-QA	CP17-85/71	09-27-85	X		849	X		X		X	
1765	GPC-QA	CP20-85/76	10-21-85	856			855	856			X	
188	GPC-QA	ED01-81/42	06-30-81	217,214		215,217 ,216	213			215,217	217	213 IS FOR DESIGN, 214 IS VENDOR REQUIREMENTS
190	GPC-QA	ED01-82/136	01-18-83								384, 040-DEF	
192	GPC-QA	ED01-82/73	06-24-82			003-OBS						
196	GPC-QA	ED01-83/107	12-20-83						532			
197	GPC-QA	ED01-83/26	05-25-83							431		
200	GPC-QA	ED01-33/60	08-09-83			483,485						
202	GPC-QA	ED01-84/73	09-12-84			X						
257	GPC-QA	ED05-83/107	12-20-83						532			
1724	GPC-QA	GD06-83/107	12-20-83						532			
1723	GPC-QA	GD06-83/40	05-31-83						432			
375	GPC-QA	GD08-84/87	12-03-84				737				738,739	
399	GPC-QA	GD11-84/72	09-12-84								707	
658	GPC-QA	MD14-81/17	03-31-81			X						
662	GPC-QA	MD14-82/145	01-10-83			X						REF: MD14-82/36, AFR'S 287 & 288

CONSTRUCTION AUDITS

MODULE 19 - SORTED BY INIT. ORGANIZATION & AUDIT NUMBER

EDIT NO	INITIATING ORGANIZATION	AUDIT NUMBER	DATE	MATERIAL	TRAIN/ QUAL	FABRIC- ATION	INSPECT- ION	TESTING	MEASURE &TEST EQ	DOCUMENT CONTROL	QA RECORDS	REMARKS
1409	GPC-QA	MD14-82/36	03-11-82	X		287,288						MD14-82/145
673	GPC-QA	MD14-83/15	03-21-83			X	X				X	REF: MD14-82/36, AFR'S 287 & 288
1725	GPC-QA	MD14-84/65	08-17-84				701					
1047	NRC-INS	82-13	07-12-82			X	X				82-13-03	
1084	NRC-INS	82-21	09-15-82							X	X	
1154	NRC-INS	83-13	10-14-83	X		83-13-05	X				X	83-13-08
1196	NRC-INS	84-02	02-23-84					84-02-01				
1600	NRC-INS	84-04	01-30-84				84-04-01 84-04-02					
1328	NRC-INS	84-36	03-04-85			84-36-10					X	
1740	NRC-INS	85-60	12-20-85									
1726	SIE		1982			CC.4-1, CC.4-3						

5.3 PAST PROBLEM AREA

This section contains a brief description of a past constructibility problem, an evaluation of the problem, and the corrective action taken to prevent recurrence. This section is not intended to serve as an in-depth description of all problems associated with electrical support installation, but is instead an overview of a major program difficulty and the effect on the installation effort.

In July and August 1983, site Quality Assurance, while performing a review of installed strut channel nuts, found that some nuts were not fully engaged in the strut channels on cable tray supports. As a result, a larger sample of installed nuts was examined. Results confirmed that not all nuts were properly seated in the strut channel. Subsequently, Project Engineering developed a statistical sampling scheme to determine the extent of the problem and to evaluate the "as found" condition of the strut nuts. Project Engineering requested that the strut channel vendors provide data attesting to the available load capacity of their product in varying engagement configurations. Based on the results of the sampling and evaluation, it was concluded that the "as found" conditions were adequate to meet their design purpose. To ensure proper installation of future strut channel nuts, the construction specification and field procedure addressing the installation requirements of raceway systems were revised to specifically address the requirement for proper engagement of the strut nut grooves with the in-turned edges of the strut channel. The results of the evaluation program are reported in Correspondence File No. X7BG03-M50. Readiness Review included, as a part of its assessment, another sampling of supports using strut channel/strut nuts. The results of this assessment are documented in section 6.2 of this module.

FINDINGS

MODULE 19 - SORTED BY INIT. ORG. & FINDING NUMBER

INIT ORG	AUDIT NUMBER	FINDING NUMBER	LEVEL	DATE	SUBJECT	REMARKS	NUM BER
DES CON		B14		1982	INADEQUATE SEISMIC ANALYSIS OF CABLE TRAYS		354
DES CON		B15		1982	ORGANIZATION RESPONSIBILITIES NOT CLEAR		373
DES CON		B16		1982	USE OF INCORRECT DAMPING VALUES		368
GPC-QA	RD01-82/73	003-OBS		06-22-82	FAB. & INST. - INADEQUATE METHOD OF REMOVING CONCRETE EXPANSION ANCHORS. ANCHOR BOLTS - WRONG SIZE INSTALLED FOR SUPPORT	ED-T-02, REV. 3, SECT. VI.B.6, GD-T-02, SECT. V.A.1., DWG AX2D94V080	458
GPC-QA	RD01-82/136	040-DEF		12-22-82	INSPECTION Q.A. RECORDS - INSPECTION REPORT FORMS ARE NOT COMPLETELY FILLED OUT.	GD-T-02, REV. 4, SECT. 11.0, DC-A-06, REV. 5, SECT VII.B.1	568
GPC-QA	RD01-81/42	213		06-30-81	RACEWAYS-SUPPORTS	10CFR50, APP. B, CRITERIA III	770
GPC-QA	RD01-81/42	214		06-30-81	WELDING - MATERIALS - PURCHASED EQUIPMENT HAS WELDS OF QUESTIONABLE QUALITY.	10CFR50, APP. B, CRITERIA VII	771
GPC-QA	RD01-81/42	215		06-30-81	WELDING - DOCUMENT CONTROL - WELDING SPEC. NOT SHOWN ON DETAIL DRAWING.	SPEC. X3AR01R5, SECT. E8.7.1.L	772
GPC-QA	RD01-81/42	216		06-30-81	WELDING - FAB. & INSTALLATION - DETERMINE CAUSE OF DEFECTIVE WELDING.	SPEC. X3AR01R5, SECT. E8,ATT.A, PARA 2.5.B	773
GPC-QA	RD01-81/42	217		06-30-81	WELDING - DOCUMENT CONTROL - NO APPROVED DRAWINGS FOR WORK FABRICATED ON SITE.	FIELD PROC. GD-T-07, R2 SECT. VI. G.2	774
GPC-QA	MD14-82/36	287		04-01-82	EMBEDS - MISC. STEEL - DESIGN - ROCK BOLT PROCEDURES.	SPEC. X2AP01,C9.7.5.D, REV. 2, 10CFR50, APP. B, CRITERIA III.	844
GPC-QA	MD14-82/36	288		04-01-82	EMBEDS - DESIGN	SPEC. X2AP01, DIV. C9.7. R/2, 10CFR50, APP. B, CRITERIA III.	845

FINDINGS

MODULE 19 - SORTED BY INIT. ORG. & FINDING NUMBER

INIT ORG	AUDIT NUMBER	FINDING NUMBER	LEVEL	DATE	SUBJECT	REMARKS	NUM BER
GPC-QA	ED01-82/136	384		01-18-83	RACEWAYS - INSPECTION REPORTS/RECORDS	10CFR50, APP. B, CRITERION XVII	941
GPC-QA	ED01-83/26	431	II	05-26-83	ELECTRICAL - RACEWAYS SUPPORTS	10CFR50, APP. B, CRITERIA V	988
GPC-QA	GD06-83/40	432	II	05-31-83	INADEQUACIES IN RESOLUTION OF ELECTRICAL DR'e ASSOCIATED WITH M&TE	REF. AUDITS ED01/ED05/GD06-83/107	2430
GPC-QA	ED01-83-60	483	II	08-09-83	RACEWAYS - DESIGN/INSTALLATION ERRORS IN SUPPORTS.	SPEC. X3AR01-E8, REV. 9, SECT. E8.7, ED-T-02, REV. 4, SEC. 4.3.1	1040
GPC-QA	ED01-83/60	485	II	08-09-83	ELECTRICAL - RACEWAYS - FAB. & INSTALLATION	VNP DESIGN MANUAL DC-1810, PAR. 3.2.2.C	1042
GPC-QA	ED01/ED05/GD06-83/107	532	II	12-20-83	FAILURE TO PRECLUDE RECURRENCE OF PAST PROBLEMS	ANSI N45.2, SECT. 17, IEEE STANDARD 498 MANUFACTURES INSTRUCTIONS	1089
GPC-QA	MD14-84/65	701	III	09-25-84	MISCELLANEOUS STEEL - DESIGN AND INSPECTION RECORDS	SPEC. X2AP01, C9.7, ATTACH. 1,2,3, CLOSED 09-27-85	1259
GPC-QA	GD11-84/72	707	III	10-10-84	INSP. REPORTS DO NOT CONTAIN PROPER REFERENCES.	GD-T-22, REV. 1, SECT. 6.6.3.	1265
GPC-QA	GD08-84/87	737	II	01-15-85	INSPECTION - INSPECTION AT CLEVELAND FAB SHOP NOT PROPERLY DOCUMENTED	ANSI N45.2, SECT. 7.	1293
GPC-QA	GD08-84/87	738	II	01-15-85	Q.A. RECORDS - 55 CLEVELAND RECORDS MISSING QC SIGNATURE.	10CFR50, APP. B, CRITERIA XVII.	1294
GPC-QA	GD08-84/87	739	II	01-15-85	Q.A. RECORDS - VISUAL WELDING INSPECTION REP. USED BY GPC QA NOT STORED PER REMARKS.	ANSI N45.2.9, DRAFT 11, REV. 0, MARCH, 1973, SUB. 5.6.	1295
GPC-QA	CP01-85/29	783	I	04-19-85	INADEQUATE Q.C. COVERAGE INCONSISTENT DOCUMENTATION	10CFR50, APP. B, CRITERION V	2431

FINDINGS

MODULE 19 - SORTED BY INIT. ORG. & FINDING NUMBER

INIT ORG	AUDIT NUMBER	FINDING NUMBER	LEVEL	DATE	SUBJECT	REMARKS	NUM BER
GPC-QA	CP01-85/29	788	II	04-19-85	NO REWORK ISSUED FOR WORK ON COMPLETED SUPPORT.	CLOSED 10-04-85	2335
GPC-QA	CP01-85/29	789	II	04-19-85	DESIGN DRAWINGS DEFICIENT OR DO NOT CONFORM TO APPROVED STANDARDS		2069
GPC-QA	CP01-85/29	790	II	04-19-85	INADEQUATE RETRIEVABILITY OF RACEWAY SUPPORT INSPECTION RECORDS.		2055
GPC-QA	CP17-85/71	849	II	09-27-85	CABLE TRAYS 1NE50TNBGA AND 1NE50BTNBG AND SUPPORTS FOR TRAYS 1NE51BTLBE AND 1NE51BTMBE IN VIOLATION OF SEPARATION CRITERIA. SUPPORT FOR TRAY 1BE50ZTRAA IN CONTACT WITH LINER PLATE UNISTRUT		2344
GPC-QA	CP20-85/76	855	II	10-21-85	MINIMUM SEPERATION CRITERIA NOT MET BETWEEN CLASS 1E EQUIPMENT AND RACEWAY SUPPORTS		2473
GPC-QA	CP20-85/76	856	III	10-21-85	CORRELATION BETWEEN TORQUE AND TENSION NOT AS REQUIRED BY IEB 79-02		2474
INPO		CC.4-5		1985	GOOD PRACTICE		2449
INPO		DC.3-1		1984	PREPARATION AND VERIFICATION OF CALCULATIONS		1426
NRC-INS	83-13	83-13-08 83-13-05	IFU	10-14-83	GPC QA AUDIT ED01-83/26: ITEM CONCERNING DESIGN DRAWINGS FOR CABLE TRAY SUPPORTS	CAT	1643
NRC-INS	84-02	84-02-01	URI	01-30-84	ED-T-04 TORQUE VERIFICATION SAMPLING SYSTEM		1654
NRC-INS	84-04	84-04-02	URI	02-21-84	INSPECTORS NOT FAMILIAR WITH ANCHOR BOLT SPACING REQUIREMENTS		1488
NRC-INS	84-36	84-36-10	IFU	03-04-85	CONTROL OF WELDING ACROSS FLANGES OF LOAD BEARING BEAMS.	(CLOSED 06-21-85) REF. 85-22	1961

FINDINGS

MODULE 19 - SORTED BY INIT. ORG. & FINDING NUMBER

INIT ORG	AUDIT NUMBER	FINDING NUMBER	LEVEL	DATE	SUBJECT	REMARKS	NUMBER
NRC-INS	85-60	85-60-01	VIOL	12-20-85	FAILURE TO COMPLY WITH WELDING REQUIREMENTS		2479
SCS-QA		84-01		03-09-84	NO CABLE TRAY SUPPORTS ON CIVIL DWGS.	PRM C-4, PARA. 4.7.5, DWGS. 1X3DK413B, REV. 6, 1X3DK414, REV. 6.	1808
SIE		CC.4-01		1982	ATTACHING SUPPORTS TO STRUCTURAL STEEL		1889
SIE		CC.4-3		1982	WORKING WITH DRAWINGS NOT APPROVED FOR CONSTRUCTION		2433

6.0 PROGRAM VERIFICATION

This section describes the activities undertaken to ascertain whether the design and construction work processes have been adequately controlled to ensure implementation of licensing commitments and that the work processes conform to project procedures and design requirements.

This section is divided into two subsections, 6.1 and 6.2. Subsection 6.1 describes activities related to design program verification; 6.2 addresses construction program verification.

Resulting findings were subjected to categorization as follows:

I - Violation of licensing commitments, project procedures, or engineering requirements with indication of safety concern.

II - Violation of licensing commitments or engineering requirements with no safety concerns.

III - Violation of project procedures with no safety concerns.

6.1 DESIGN PROGRAM VERIFICATION

The following sections describe the design program verification, resultant findings, and corrective actions. Approximately 400 manhours were expended by the Readiness Review design program verification team during the actual verification. The four members of the team have a cumulative professional experience of 55 years in design engineering.

Design program verification focused on the programmatic aspects of design. The objective of the programmatic verification was to determine whether the design control process has functioned effectively and whether it ensures proper implementation of licensing commitments (i.e., the inclusion of commitments in criteria or design base documents).

Design program verification took place in three parts. Part I consisted of verifying implementation of technical commitments identified within the scope of this module. Commitments were first reviewed for implementation into project design basis documents (i.e., criteria or other applicable design documents). Selected commitments were further reviewed for implementation into second-order design documents (i.e., calculations, drawings, specifications).

Part II consisted of a review of design documents for compliance with project procedures and industry standards for quality [i.e., American National Standards Institute (ANSI) N45.2.11] as committed in the Final Safety Analysis Report (FSAR). The details of the verification program are further discussed in section 6.1.2.

Part III consisted of a walkdown of installed electrical supports to ascertain whether construction conformed to design requirements.

A sample of 194 documents was reviewed out of a population in excess of 8100 documents. Table 6.1-1 shows the types and the sample size of documents reviewed. In addition, four electric supports were reviewed.

6.1.1 SUMMARY EVALUATION

Three findings were identified as a result of the design verification program. The Readiness Review Design Verification Team assessed the impact of the findings on the project. The findings were classified, based upon the type of design documents, to the following categories:

- Design criteria (no findings).
- Design calculations (Finding 19-4).

- o Design drawings (Findings 19-2 and 19-23).
- o Design and construction specifications (no findings).
- o Design interface control (no findings).

The findings and their level of importance are summarized in Table 6.1-2. All three findings were identified during part II of the programmatic verification of the design control process.

Findings 19-2 and 19-23 were classified Level I and Level II, respectively. These findings dealt with a misinterpretation of design drawing requirements by both Construction and Electrical Quality Control (QC).

Finding 19-2 identified a conduit run supported at a single point. This condition was not addressed in the design calculations and was not clearly prohibited by the design drawings. As a result of this finding, the Project identified approximately 2000 conduit runs which could have been similarly installed. These runs were reinspected for single-point support configurations. Twenty-four additional discrepant installations were identified and reported to Project Engineering for evaluation. Project Engineering is currently evaluating these discrepancies for reportability and any necessary rework. In addition, Design has revised the drawings to clearly reflect the design for future installations.

Finding 19-23 identified installation of a Class 1E junction box and associated conduit which deviated from the seismically qualified configuration. The junction box was attached to a floor-mounted support. The first attachment point of the conduit was to a ceiling-mounted support, whereas the raceway support detail stipulated that the junction box attachment and the first attachment point of the conduit should be to a common support to agree with the seismic qualification configuration. As a result of this finding, Project Construction performed a reinspection of all similar configurations (68) and identified 21 additional cases with this discrepant condition. Project Engineering evaluated the 22 discrepancies and dispositioned 21 of them Use-As-Is. The remaining discrepancy was dispositioned Rework; but it was not reportable, since the associated electrical circuits are not required for safe shutdown of the plant. The drawing has been revised to more clearly indicate the design requirements, and raceway inspectors and craft personnel have been trained to this installation requirement.

The collective importance of these findings was grouped with the construction finding relative to drawing interpretation and is discussed in section 6.2.1, Summary Evaluation.

With the exception of the drawing clarity/interpretation issue discussed in section 6.2, the design program verification team concludes that the design program for electrical supports is functioning adequately and is in compliance with project commitments.

6.1.2 PART I, COMMITMENT IMPLEMENTATION

During part I of the design program verification, the licensing commitments were reviewed to ensure that each commitment was included in a design basis document (design criteria). Selected commitments were then reviewed to ensure that they had been incorporated into the next level of design documents (e.g., calculations, drawings, and specifications). These reviews were accomplished as follows:

6.1.2.1 Commitments in Design Criteria

Seventeen design-specific commitments listed in the FSAR are applicable to electrical supports. They are listed in the commitment matrix in section 3.4 of this module.

Based upon the identified commitments, an implementation matrix (section 3.5) was developed that identifies the design document in which the commitment is incorporated. The following three design criteria sections in the Design Manual were reviewed, including previous revisions:

- DC-1000-C, General Design Criteria Civil/Structural.
- DC-1005, Seismic - Interdiscipline.
- DC-2166, Electrical Cable Tray and Supports.

The implementation of four commitments was not readily apparent in first-order design documents. The Project was requested to provide clarification as to the implementation of these commitments. This process was documented and dispositioned using the Readiness Information Request (RIR) described in the following paragraphs.

RIR 112 dealt with the implementation of the following commitment: "the emergency lighting system components, including raceways and lighting fixtures, have been mounted to seismic category requirements" as stated in the FSAR.

Per Project Engineering, the electrical design criteria document DC-1808, Lighting System, requires that emergency lighting systems be designed to allow for the safe shutdown of the plant. The Civil/Structural Group is in the process of completing calculation X2CQ6.6, Lighting and Communication

Supports. This calculation, scheduled for completion by June 30, 1986, documents the seismic design of the lighting supports/ fixtures.

RIR 113 dealt with the general implementation of the following three commitments. FSAR paragraph 3.10.B.1 requires the seismic qualification of electrical equipment supports to be in conformance to Institute of Electrical and Electronics Engineers (IEEE) 344-1975 and Regulatory Guide 1.100, which for supports uses Bechtel Topical Report BC-TOP-4-A as guidance for the combination of multimodal response, thus meeting the intent of Regulatory Guide 1.92 (FSAR paragraph 3.10.B.4.2). While implementation of these commitments was not apparent in a first-order document, it was observed in calculation X2CK2.7.1.1.

The Project response states that platforms and any other structural steel items on which equipment may be mounted are considered part of the building structure and are therefore designed in accordance with Design Criteria document DC-1000-C, section 5.6, Seismic Loads. This section references BC-TOP-4-A and DC-1005, Seismic Design Criteria. Structural design in accordance with the requirements specified in DC-1000-C (e.g., combination of response from different modes and combination of three-component earthquake effects) satisfies the seismic commitments made in FSAR section 3.7.B and thus meets the intent of IEEE-344.

Based upon the responses provided for the RIRs, it was concluded that each identified commitment documented in the FSAR is properly implemented in the design documents.

6.1.2.2. Implementation in Detail Design

A sample of 14 design commitments, from a total of 17, was selected for a review to ascertain whether the commitments had been consistently implemented in the design. This was accomplished by identifying and reviewing related second-order design documents to ensure that the selected commitments had been included as design input to calculations. These commitments had been selected based on their technical significance and their broad cross-section of the design of electrical supports accomplished on the VEGP. Three Bechtel calculations were reviewed (Table 6.1-3). The summary of the commitment verification is depicted in Table 6.1-4.

No deficiencies were found, and it was concluded that the design is in compliance with the commitments made in the FSAR and the applicable regulatory guides.

6.1.3 PART II, PROGRAMMATIC VERIFICATION OF DESIGN CONTROL PROCESS

In part II, a sample of design documents was reviewed for conformance to project procedures to ascertain whether the design processes had been adequately controlled in accordance with the intent of ANSI N45.2.11. The Design Verification Team reviewed the design process to ensure that technical requirements had been adequately incorporated into the design, coordination among entities participating in the design had adequately taken place, and that changes in the design have been controlled in the design process. This programmatic verification of the design control process was accomplished as described in the paragraphs that follow.

Selected design documents were reviewed to ensure compliance with the design control requirements. Checklists identifying the elements of the design program were developed for the verification review. Calculations, drawings, specifications, vendor documents, and design change documentation were included in this review. Tables 6.1-3 and 6.1-5 through 6.1-10 list the documents reviewed. The guidelines used for review and the results of these verification reviews are described below.

6.1.3.1 Bechtel Design Calculations and Drawings

Tables 6.1-3 and 6.1-5 list the design calculations and drawings reviewed. These documents were reviewed to verify that they were processed and controlled in accordance with project procedures and industry standards. The Design Verification Team also verified that the results from these calculations had been implemented correctly into the design drawings. The following items were specifically checked:

- Calculations were approved and revised in accordance with the Project Reference Manual (PRM), part C, section 9.
- Applicable design input and loading conditions were addressed.
- Selected input is consistent with the references.
- Selected output data incorporated into affected drawings.
- Drawings were prepared, checked, approved, and revised in accordance with the PRM, part C, section 4.
- Interdiscipline input/output were coordinated properly.
- Computer programs are properly identified.

As a result of the programmatic verification of the design control process, one finding (19-4) was issued.

- Finding 19-4 (Level III)

  Description: The PRM, part C, section 4.7, requires that the drawings conform to the design calculations. Contrary to this, conduit and cable tray support drawings show details where supports are welded to the existing embed plates; but the calculations do not address whether the existing embeds can resist the imposed loads.

  Project Response: Finding 19-4 is associated with the comparison of the reaction forces from cable tray supports and conduit supports with the capacity of the associated embeds they are attached to. These supports use generic embeds.

  Until about mid-1980, individual embeds were custom specified on the design drawings. In 1980, a modular embed concept using a single embed type (type TT) was developed to simplify the design process and facilitate construction. Subsequently, this embed, together with the embedded strut channel, was used in a modular pattern in all buildings. The strut channel was provided for attachment of conduit supports. Conduit supports with provision for attachment to strut channels are designed so that loads on strut channels are within the design capacity of the strut channel.

  Based on an engineering survey of the reaction forces from heating, ventilation, and air-conditioning (HVAC) duct supports, cable tray supports, and other commodity supports, embed type TT was designed for use in commodity supports. Conduit supports had not been designed at that time. Since the TT embed was designed to accommodate reactions from all existing support types, it was deemed unnecessary to check the actual reactions in subsequent applications; therefore, this check was not always documented.

  During the time the TT embed was developed, the capacity of embeds other than type TT was evaluated. An evaluation of the cable tray support embeds at the time showed that for floor- or ceiling-mounted support types, which have relatively significant reactions (i.e., support types using X, Y, and AA embeds), the comparison of support reactions with the capacity of the embeds was documented in calculation X2CQ2.4. An engineering judgment was made that the capacity of embed types other than X, Y, and AA is adequate because of the relatively small reactions. This engineering judgment was also not documented.

For broadness, the methodology used for embeds associated with structural steel members and equipment was reviewed. In these cases, wherever the reactions are significant, they have been documented in the associated calculations.

In the case of pipe supports, the Civil/Structural Group provided the embed load capacity tables for each embed type to the Plant Design Group for its use. Using these load tables, the Plant Design Group, as part of the pipe support calculation, provided a comparison of the calculated embed load with the allowable embed load. Adequate instructions for proper use of the load tables were provided to Plant Design Group engineers in plant design desk instructions issued as Group 3, Instruction Memorandum 10.

In response to this finding, the reactions from cable tray supports were reviewed. This review confirms the 1980 evaluation and the conclusion therefrom that the embed capacity is adequate. Most of the conduit supports attached to embeds are routed close to the walls. The review of conduit support reactions shows that, for these support types, the reactions are small.

Furthermore, conduit supports with provision for attachment to embedded strut channels are designed so that the applied loading on the strut channels is within their design capacity. Therefore, this item is considered to have no impact on the safety of the plant, and no hardware or design changes are required.

To provide formal documentation, the applicable calculations will be reviewed and revised as necessary by April 25, 1986 to document the following:

In the building levels where the modular embed concept is used, the maximum loads from cable tray supports and conduit supports will be compared to the capacity of type TT embeds. In the remaining building levels, the support loads will be compared to the capacity of the associated embeds for types other than type TT.

This finding relates to inadequate documentation of some design details and undocumented use of engineering judgment, which resulted from the engineer's familiarity with the design process and his intimate knowledge of the subject matter.

Readiness Review Conclusion: The project response is acceptable. The Project has committed to review and revise calculations as necessary. Readiness Review has concluded that the revision of the calculations will provide the necessary documentation to address the

adequacy of the embeds to support conduit/cable tray supports.

6.1.3.2 Procurement Specifications

Three procurement specifications (Table 6.1-3) were reviewed. They were checked for the following:

- Preparation, approval, interdiscipline review, and control of revisions in accordance with the PRM, part C, section 8.
- Quality verification document requirements.
- Incorporation of specification change notices.
- Compliance with design criteria, design calculations, and FSAR commitments.
- Quality assurance requirements.
- Drawing and data submittals.
- Control of supplier deviation disposition requests.

No deficiencies were observed. The Design Verification Team concluded that specification preparation and control are adequate, are in compliance with project procedures, and meet the intent of the ANSI N45.2.11 requirements.

6.1.3.3 Construction Specifications

Two installation specifications (Table 6.1-3) were reviewed for compliance with project procedures. They were checked for the following:

- Preparation, approval, interdiscipline review, and control of revisions in accordance with the PRM, part C, section 8.
- Incorporation of design/vendor requirements.
- Defining safety-related systems and components.
- Incorporation of Construction Specification Change Notices.

No deficiencies were observed. The Design Verification Team concluded that the preparation and control of specifications are adequate, are in compliance with project procedures, and meet the intent of ANSI N45.2.11 requirements.

6.1.3.4 Vendor Drawings and Documents

Vendor drawings and documents (Table 6.1-6) were checked for the following:

- Compliance of test data with specification requirements.
- Compliance of data and material specifications with FSAR commitments.
- Conformance of vendor design to input given in Bechtel drawings and specifications.
- Compliance of Project Engineering approval of vendor documents with the PRM, part C, section 5.
- Verification that selected data from the supplier has been properly incorporated in Bechtel documents.
- Verification that the supplier's codes and standards list also includes the applicable revision date of each document.

No deficiencies were observed. The Design Verification Team concluded that the review and control of vendor documentation are adequate, in compliance with project procedures, and meet the intent of ANSI N45.2.11 requirements.

6.1.3.5 Field Change Requests

Field Change Requests (FCRs) reviewed for programmatic implementation (Table 6.1-7) were checked for the following items:

- Preparation, approval, and interdiscipline review in accordance with the PRM, part C, section 17.
- Providing engineering rationale for the change; revising existing calculations or preparing new calculations as needed.
- Incorporation of changes into drawings or specifications, as required.
- Preparation of Licensing Deviation Document (LDDs), where applicable.
- Preparation of a Deviation Report (DR), if the FCR was initiated with authorization to continue work and it was disapproved or revised after work was begun.

No deficiencies were observed. The Design Verification Team concluded that FCRs are being processed in compliance with applicable project procedures and meet the intent of ANSI N45.2.11 requirements.

6.1.3.6 Deviation Reports

DRs reviewed for programmatic implementation (Table 6.1-8) were only those DRs dispositioned Use-As-Is, Repair, or Acceptable. These DRs were checked for the following items:

- o Preparation, approval, and interdiscipline review in accordance with the PRM, part C, section 18.
- o Justification for dispositions of Use-As-Is, Repair, or Acceptable.
- o Preparation of calculations for the deviation, if needed.
- o Any effect on licensing commitments; initiation of LDDs or reportability of deviations under 10 CFR 50.55(e) or 10 CFR 21.

No deficiencies were observed. The Design Verification Team concluded that DRs are being processed in compliance with applicable project procedures and meet the intent of ANSI N45.2.11 requirements.

6.1.3.7 Supplier Deviation Disposition Requests

The Supplier Deviation Disposition Requests (SDDRs) reviewed for programmatic implementation (Table 6.1-9) were checked for the following items:

- o Preparation, approval, and interdiscipline review in accordance with the PRM, part C, section 23.
- o Any effect on licensing commitments; initiation of LDD, if required.
- o Technical justification for accepted SDDRs.
- o Effect of deviation on previously shipped items.

No deficiencies were observed. The Design Verification Team concluded that SDDRs are being processed in compliance with applicable project procedures and meet the intent of ANSI N45.2.11 requirements.

6.1.3.8 Construction Specification Change Notices

Construction Specification Change Notices (CSCNs) reviewed for programmatic implementation (Table 6.1-10) were checked for the following:

- Preparation, interdiscipline review, and approval in accordance with the PRM, part C, section 26.
- Revision of affected design documents, when required.
- Any effect on licensing commitments; initiation of LDD, if needed.
- Effect of the change on work already performed, if any.

No deficiencies were observed. The Design Verification Team concluded that CSCNs are being processed in compliance with applicable project procedures and meet the intent of ANSI N45.2.11 requirements.

6.1.4 PART III, WALKDOWN

A walkdown of the electrical supports was performed by the Readiness Review design verification team to determine whether selected features of the design are reflected in the as-built installations. Safety-related electrical supports located in the containment, the auxiliary building, and the cable spreading room of the control building were selected by the Design Verification Team for this review. The selected supports were visually checked against issued drawings to verify proper connections, member sizes, member configuration, location, and marking/identification requirements. Additionally, other cable tray and conduit supports located in the area of the selected supports and those in the diesel generator building were checked for design anomalies.

In general, the walkdown confirmed that the as-built condition reflected compliance with the design intent as shown in the design documents. However, two findings (19-2 and 19-23) were issued against conduit supports. These findings are discussed below:

- Finding 19-2 (Level I)

  Description: Conduit 1AE301RL066, 4-in. diameter, about 5 ft long, was supported by only one support, located about 6 in. from one end. Calculations do not consider a condition where conduit is supported by only one support.

Project Response: Detail 3 of drawing CX3DF002 provides installation requirements for unsupported length extending beyond a conduit support. The design installation detail depicts an unsupported length of conduit extending beyond the conduit support, with a continuous conduit run shown on the opposite side of the support.

The condition noted in the finding is a 4-in. diameter conduit, 5 ft 0 in. total length, with an unsupported length extending to either side of a single conduit support. This type of installation does not meet the intended requirements for conduit support provided on the installation design detail.

The condition noted in the finding was inspected and accepted by Electrical QC based on the criteria provided in detail 3 of drawing CX3DF002. The unsupported length criterion was used to independently inspect the conduit extending beyond each side of the support. The presentation of this detail on the design drawing did provide the potential for misunderstanding the design requirements, in that the detail did not explicitly state what was not allowed.

Approximately 2000 conduit runs with characteristics indicating that they could have been installed in a condition similar to the one noted in the finding were identified using the EE-580 system. A walkdown reinspection of the conduit runs by QC in accordance with ED-12048 identified 24 additional deficient installations. Project Engineering is evaluating these for reportability on Deficiency Evaluation Report (DER) 144 and DR ED-12048.

Detail 3 of drawing CX3DF002 has been clarified by E-FCRB-3335F, which was issued on February 6, 1986, to prevent future misinterpretation.

Readiness Review Conclusion: The corrective actions taken satisfactorily resolve the issue identified by this finding.

- Finding 19-23 (Level II)

  Description: ANSI N45.2.11-1974, section 4.1, states that design activities shall be prescribed and accomplished in accordance with procedures of a type sufficient to ensure that applicable design inputs are correctly transferred into specifications, drawings, procedures, or instructions.

Contrary to this, junction box 1ARJB4870, located in the containment at elevation 210 ft, is supported by a floor-mounted tubular steel cantilever support; and conduit 1AE51BRW219 exits said junction box and is supported by a ceiling-mounted tube steel cantilever support. This configuration, as installed, does not conform to the junction box qualification report seismic testing configuration (AX3AH05-30-5). The testing configuration supported both the Class IE junction box and the first support of the associated conduit on the same frame, thus having a common reference point to the input motion.

Project Response: Electrical QC has investigated Readiness Review Finding 19-23 concerning the requirement for a common support for conduit and box. Reinspection of the reported condition found this concern to be valid. Electrical QC performed a preliminary walkdown inspection of box supports accepted in accordance with detail 4 on drawing AX2D94V052. This inspection was to determine whether the rigid conduit was supported on the same datum as the box. Twelve installations were identified in which the rigid conduit connected to the box was not supported on the same support as the box. DR ED-12278 was written on February 15, 1986, to resolve the violations found in the walkdown and by Readiness Review.

DR ED-12278 interim disposition required QC to identify all accepted box support installations with this discrepancy. The walkdown reinspection of all of this type box support (90) identified 9 additional discrepant cases for a total of 22 discrepancies (including the one identified by Readiness Review). Project Engineering evaluated each of these discrepant cases, and the results of this review are as follows.

As stated in the finding, the Junction Box Qualification Report (AX3AH05-30-5) seismic testing configuration supported both the Class 1E junction box and the associated rigid conduits first support at a common reference point to the input motion. The inservice mounting conditions which satisfy this requirement are:

A. Freestanding floor-mounted supports for junction boxes with the first conduit support attached to the floor or adjacent wall.

B. Ceiling-mounted supports for junction boxes with the first conduit support attached to the ceiling or adjacent wall.

C. Wall-mounted supports for junction boxes with the first conduit support attached to the wall, floor, or ceiling.

In addition, any inservice junction box mounting with flexible conduit or free-air cable to decouple the junction box from the associated rigid conduit will also satisfy this requirement. The flexible connection (shown as detail 5 on drawing CX3DF006) isolates the junction box to respond independently of the associated rigid conduit. The test report photos show this type of configuration with the cables going "free air" to a connection independent of the shake table.

The only mounting condition which would not satisfy the test requirements is a freestanding floor (ceiling)-mounted junction box support with the first conduit support attached to the ceiling (floor). DR ED-12278 identified 22 conditions for which the associated conduit's first support was not on the same support as the junction box. The condition noted in the finding is the only inservice mounting condition on the DR which does not satisfy the test requirements. The remaining 21 conditions have been dispositioned Use-As-Is, since the junction box and associated conduit's first support are at a common reference point to the input motion.

For the condition noted in the finding, where the first conduit support was mounted on the ceiling with the next rigid conduit connection to a junction box mounted on a freestanding support, the conduit will be reworked per DR ED-12278 to provide a flexible connection to decouple the rigid conduit and the junction box. However, review of the electrical circuits installed indicated that the associated electrical systems involved are not required for safe shutdown of the plant. Accordingly, since no existing installations would have affected the capability for safe shutdown, this item is not considered for reportability.

The presentation of the details on the design drawing provided the potential for misunderstanding of the design requirements. Detail 5 on drawing CX3DF006 was revised by DCN 40 on April 7, 1986, to provide additional information to Construction for installation of flexible connections.

Craft and QC personnel have been retrained and made aware of the new requirements.

Readiness Review Conclusion: The corrective actions by the Project satisfactorily address the concerns identified by this finding.

The summary discussion in section 6.2 addresses the issue of drawing interpretation.

TABLE 6.1-1

SAMPLE SIZE AND NUMBER OF DOCUMENTS REVIEWED

Document Type	Number Reviewed	Total(a) Documents
Bechtel Design Documents		
Calculations	14	71
Specifications - Procurement	3	6
Specifications - Construction	2	2
Drawings	66	194
Vendor Documents		
Calculations	2	2
Reports and Documents	9	43
Drawings	2	14
Design Change/Nonconformance Documentation		
Field Change Requests	38	3800 (approx.)
Deviation Reports	30	3000 (approx.)
Supplier Deviation Disposition Requests	8	15 (approx.)
Construction Specification Change Notices	20	1000 (approx.)

a. Number of total documents applicable to this module.

TABLE 6.1-2

READINESS REVIEW FINDING SUMMARY

Finding Number	Finding	Level
19-2	Calculations do not consider a condition where conduit is supported by only one support, as found in the field.	I
19-4	Cable tray and conduit support calculations do not address the adequacy of embeds to resist imposed loads.	III
19-23	Junction box support was installed such that it does not conform to the junction box qualification report seismic test configuration.	I

TABLE 6.1-3 (SHEET 1 OF 2)

BECHTEL DESIGN CALCULATIONS AND SPECIFICATIONS

CALCULATIONS

Document Number	Title/Description	Reviewed For Part I	Reviewed For Part II	Associated Findings
X2CJ4.7.1	Cable Tray Supports Level C (Containment)		X	
X2CJ4.7.3	Cable Tray Supports Level A (Containment)		X	
X2CK2.7.1.1	Control Building Category I Equipment Supports Level B	X		
X2CK2.9.3	Non-Standard Tray Supports Electrical Tunnel		X	
X2CK2.09.15	Auxiliary Building Level C Non-Standard Tray Supports		X	
X2CQ1.0	Seismic Analysis and Design of Single Tray System		X	
X2CQ2.4	Design of Cable Tray Supports (Standard Supports)	X	X	19-4
X2CQ2.7	Design of Cable Tray Supports (Standard Supports)		X	
X2CQ2.7.005	Cable Tray Support Bracing for FCR E-3023		X	
X2CQ2.7.015	Cable Tray Support Bracing for FCR E-3370		X	
X2CQ2.7.025	Control Building Level A Support Number 301-92 for FCR E-3236		X	
X2CQ2.7.040	Control Building Level 2 Support for FCR E-3950		X	

TABLE 6.1-3 (SHEET 2 OF 2)

CALCULATIONS

Document Number	Title/Description	Reviewed For Part I	Reviewed For Part II	Associated Findings
X2CQ6.0	Design of Conduit Supports (Standard Supports)	X	X	19-4
X2CQ6.3	Design of Conduit Supports (Standard Supports)		X	
Procurement Specifications				
X2AH17	Category I Electrical Cable Tray Supports		X	
X3AH01	Cable Tray and Fittings		X	
X3AH05	Junction Boxes (Class 1E)		X	
Construction Specifications				
X2AP01				
Section C9.1	Field Fabricated Miscellaneous Q Class Steel		X	
Section C9.7	Furnishing, Installation, and Testing of Concrete Anchors		X	
X3AR01				
Section E8	Electrical Raceway Systems		X	
Section E12	Installation of Electrical Equipment		X	

TABLE 6.1-4 (SHEET 1 OF 2)

COMMITMENT VERIFICATION MATRIX IN SECOND-ORDER DESIGN DOCUMENTS

Subject Description	FSAR Section	Commitment Number	Design Criteria Section	Design Document Type	Design Document Number	Notes	Remarks
RG 1.29	1.9.29	126	DC-2166	Calc	X2CQ2.4	2	
				Calc	X2CQ6.0	2	
RG 1.61	1.9.61	2188	DC-2166	Calc	X2CQ2.4	2	
				Calc	X2CQ6.0	2	RIR No. 114
RG 1.92	1.9.92	174	DC-2166	Calc	X2CQ2.4	2	
			DC-1000-C	Calc	X2CQ6.0	2	
RG 1.29	3.2.2-1	843	DC-2166	Calc	X2CQ2.4	2	
				Calc	X2CQ6.0	2	
AISC-69	3.2.2-1	886	DC-2166	Calc	X2CQ2.4	2	
				Calc	X2CQ6.0	2	
AISI-68	3.2.2-1	893	DC-2166	Calc	X2CQ2.4	2	
			DC-1000-C	Calc	X2CQ6.0	2	
Seismic Percent of Critical Damping per Mode	3.7.B.1-1	4370	DC-2166	Calc	X2CQ2.4	2	
			DC-1000-C	Calc	X2CQ6.0	2	RIR No. 114
Damping Values for Cable Trays and Supports	3.7.B.1-7	4371	DC-2166	Calc	X2CQ2.4	2	
			DC-1000-C				

NOTES: 1. Reviewed for Part I, commitment in criteria.
2. Reviewed for Part I, commitment in second order document, and Part II.

TABLE 6.1-4 (SHEET 2 OF 2)

Subject Description	FSAR Section	Commitment Number	Design Criteria Section	Design Document Type	Design Document Number	Notes	Remarks
RG 1.61	3.7.B.1.3	981	DC-2166	Calc	X2CQ2.4	2	
			DC-1000-C	Calc	X2CQ6.0	2	RIR No. 114
Seismic Subsystem Analysis, Use of Equivalent Static Load Method	3.7.B.3.5	1013	DC-2166 DC-1000-C	Calc	X2CQ2.4	2	
IEEE-344-1975	3.10.B.1	2283	-	Calc	X2CK2.7.1.1	1	RIR No. 113
RG 1.100	3.10.B.1	2284	-	Calc	X2CK2.7.1.1	1	RIR No. 113
BC-TOP-4A	3.10.B.4.2	2285	-	Calc	X2CK2.7.1.1	1	RIR No. 113
BC-TOP-4A	3.10.N.4.2	1249	-	Calc	X2CK2.7.1.1	1	RIR No. 113

NOTES: 1. Reviewed for Part I, commitment in criteria.
2. Reviewed for Part I, commitment in second-order document, and Part II.

TABLE 6.1-5 (SHEET 1 OF 6)

DESIGN PROGRAM VERIFICATION
PART II BECHTEL DRAWINGS

Document Number	Title/Description
1X2D05N100-3	NSCW Tower and Valve House 1A Electrical Tray Supports Location
1X2D05N101-3	NSCW Tower and Valve House 1A Electrical Tray Supports Schedule
1X2D07N100-5	Diesel Generator Building Electrical Tray Support Plan (Location)
1X2D07N101-4	Diesel Generator Building Electrical Tray Support Schedule
1X2D44N100-1	Outside Area Tunnels 1T2A and 1T5A Cable Tray Support Location Plan
1X2D44N101-3	Outside Area Tunnels 1T2A and 1T5A Cable Tray Support Schedule
1X2D44N110-2	Outside Area Tunnels 1T2B and 1T5B Cable Tray Support Location
1X2D44N111-2	Outside Area Tunnels 1T2B and 1T5B Cable Tray Support Schedule
1X2D48N002-8	Containment Internals - Cable Tray Support Plan Area 4A1, 4D1 Level C (Location)
1X2D48N005-7	Containment Internals - Cable Tray Support Plan Area 4C1, 4B1 Level A El. 197'6 to El 210'9
1X2D48N009-3	Containment Internals - Cable Tray Support Plant Area 4B1, 4C1 Level 1 El 220' to El 238'
1X2D48N012-1	Containment Internals - Cable Tray Support Plan Area 4A1, 4D1 Level 2 El 238' to El 261'
1X2D48N102-8	Containment Internals Cable Tray Support Schedule Sheet 2

Document Number	Title/Description
1X2D48N105-8	Containment Internals Cable Tray Support Schedule Sheet 5
1X2D48N109-2	Containment Internals Cable Tray Support Schedule Sheet 9
1X2D48N112-1	Containment Internals Cable Tray SUpport Schedule Sheet 12
1X3DK411-12	Conduit and Tray Support Plan Area 41 El 119'3 Level D Auxiliary Building Unit 1
1X3DK412-10	Conduit and Tray Support Plan Area 1 El 143'6 Level C Auxiliary Building Unit 1
1X3DK413B-10	Conduit and Tray Support Plan Area 1 El 170'6 Level B Auxiliary Building Unit 1
AX2D08N100-8	Auxiliary Building Unit 1 Area 3G1 Level A Electrical Tray Support Location
AX2D08N101-7	Auxiliary Building Unit 1 Area 3G1 Level A Electrical Tray Support Schedule
AX2D08N104-7	Auxiliary Building Unit 1 Area 3E1, 3B1 Level A Electrical Tray Support Location
AX2D08N105-9	Auxiliary Building Unit 1 Area 3E1, 3B1 Level A Electrical Tray Support Schedule
AX2D08N120-7	Auxiliary Building Unit 1 Area 3E1, 3B1 Level 1 Electrical Tray Support Location
AX2D08N121-7	Auxiliary Building Unit 1 Area 3E1, 3B1 Level 1 Electrical Tray Support Schedule

TABLE 6.1-5 (SHEET 3 OF 6)

Document Number	Title/Description
AX2D08N132-2	Auxiliary Building Unit 1 Area 3G1, 3H1 Level 2 Electrical Tray Support Location
AX2D08N133-3	Auxiliary Building Unit 1 Area 3G1, 3H1 Level 2 Electrical Tray Support Schedule
AX2D08N138-4	Auxiliary Building Unit 1 Area 3C1, 3F1 Level 2 Electrical Tray Support Location
AX2D08N139-6	Auxiliary Building Unit 1 Area 3C1, 3F1 Level 2 Electrical Tray Support Schedule
AX2D08N178-2	Auxiliary Building Unit 1 Area 1 Level C Electrical Tray Support (Schedule)
AX2D08N190-5	Tray Support Schedule Area 41 El 119'3 Level D Auxiliary Building Unit 1 Sheet 2
AX2D08N198-8	Auxiliary Building Unit 1 Special Tray Support Schedule
AX2D11N110-16	Control Building Unit 1 Area 2B1, 2C1 Level A Electrical Tray Support Location
AX2D11N112-14	Control Building Unit 1 Area 2B1, 2C1 Level A Electrical Tray Support Schedule
AX2D11N117-6	Control Building Unit 1 Area 2E1, 2F1 Level B Electrical Tray Support Location
AX2D11N118-7	Control Building Unit 1 Area 2E1, 2F1 Level B Electrical Tray Support Schedule
AX2D11N121-12	Control Building Unit 1 Area 2E1 Level A Electrical Tray Support Location

TABLE 6.1-5 (SHEET 4 OF 6)

Document Number	Title/Description
AX2D11N122-11	Control Building Unit 1 Area 2E1 Level A Electrical Tray Support Schedule
AX2D11N125-7	Control Building Unit 1 Area 2A1 Level A Electrical Tray Support Location
AX2D11N126-7	Control Building Unit 1 Area 2A1 Level 1 Electrical Tray Support Schedule
AX2D11N133-9	Control Building Unit 1 Area 2B1 Level 2 Electrical Tray Support Location
AX2D11N134-8	Control Building Unit 1 Area 2B1 Level 2 Electrical Tray Support Schedule
AX2D11N137-9	Control Building Unit 1 Area 2A Level 3 Electrical Tray Support Location
AX2D11N139-7	Control Building Unit 1 Area 2A Level 3 Electrical Tray Support Schedule
AX2D11N142-8	Control Building Unit 1 Area 2B1 Level 4 Electrical Tray Support Location
AX2D11N143-8	Control Building Unit 1 Area 2B1 Level 4 Electrical Tray Support Schedule
AX2D66N009-9	Category I Cable Tray Supports Basic Tray Support Types Sheet 9
AX2D66N011-20	Category I Cable Tray Supports Basic Tray Support Types Sheet 11

TABLE 6.1-5 (SHEET 5 OF 6)

Document Number	Title/Description
AX2D66N013-15	Category I Cable Tray Supports Basic Tray Support Types Sheet 13
AX2D66N014-10	Category I Cable Tray Supports Basic Tray Support Types Sheet 14
AX2D66N018-3	Category I Cable Tray Supports Basic Tray Support Types Sheet 18
AX2D66N023-6	Category I Cable Tray Supports Basic Tray Support Types Sheet 23
AX2D66N024-6	Category I Cable Tray Supports Basic Tray Support Types Sheet 24
AX2D66N027-8	Category I Cable Tray Supports Basic Tray Support Types Sheet 27
AX2D66N033-7	Category I Cable Tray Supports Basic Tray Support Types Sheet 33
AX2D66N035-2	Category I Cable Tray Supports Basic Tray Support Types Sheet 35
AX2D66N036-4	Category I Cable Tray Supports Basic Tray Support Types Sheet 36
AX2D66N040-4	Category I Cable Tray Supports Basic Tray Support Types Sheet 40
AX2D66N046-3	Category I Cable Tray Supports Basic Tray Support Types Sheet 46

TABLE 6.1-5 (SHEET 6 OF 6)

Document Number	Title/Description
AX2D94V050-15	Category I Typical Conduit Support Details Sheet 1
AX2D94V051-10	Category I Typical Conduit Support Details Sheet 2
AX2D94V052-10	Category I Typical Conduit Support Details Sheet 3[a]
AX2D94V053-12	Category I Typical Conduit Support Details Sheet 4
AX2D94V054-8	Category I Typical Conduit Support Details Sheet 5
AX2D94V055-7	Category I Typical Conduit Support Details Sheet 6
AX2D94V056-4	Category I Typical Conduit Support Details Sheet 7

a. Refer to Finding 19-4.

TABLE 6.1-6

DESIGN PROGRAM VERIFICATION
PART II VENDOR DOCUMENTS AND DRAWINGS

Document Number	Title/Description
AX3AH01-1-1	Cable Tray Load/Deflection Test Report
AX3AH01-2-1	Test for Physical Properties of Cable Trays
AX3AH01-4-0	Cable Tray - Applicable Codes and Standards
AX3AH01-13-1	Cable Tray Four Inch Outline Dimensions
AX3AH01-18-2	Four Inch Deep Cable Tray Fittings - Punched Bottom
AX3AH01-23-1	Six Inch Deep Punched Bottom and Solid Bottom Trays Test Report
AX3AH01-24-1	Six Inch Deep Trays Physical Properties Test Report
AX3AH01-25-2	Determination of Effective Moment of Inertia of Three Inch Wide Channel
AX3AH01-26-1	Torque Testing of Connector Bolts
AX3AH02A-2-0	Certificate of Compliance - Triangle PWC Inc. (Rigid Steel Conduit)
AX3AH03-6-1	Rigid Polyvinyl Chloride (PVC) Conduit - Data Sheet
AX3AH05-30-5	Junction Box Qualification Report
AX3AH05-35-2	Response to Comments on Environmental and Seismic Qualification Procedure for Junction Boxes

TABLE 6.1-7 (SHEET 1 OF 3)

DESIGN PROGRAM VERIFICATION
PART II FIELD CHANGE REQUEST

Document Number	Title/Description
E-FCRB-603	Drawing AX3D66N010 Revision 11, Weld of ARM to tube cannot be made due to Unistrut interference
E-FCRB-829	Drawing AX2D66N011 Revision 7, Shop welds do not allow required flexibility for field installation
E-FCRB-1552	Drawing AX2D08N190 Revision 1, Revision of support is required
E-FCRB-1560	Drawing AX2D11N122 Revision 2, Relocation of tray support is required
E-FCRB-2291	Drawing AX2D66N018 Revision 2, Request to use P1281 in lieu of P1282 Unistrut angle
E-FCRB-2668	Drawing AX2D66N013 Revision 6, Request revision of cap plate for support type 16
E-FCRB-2789	Drawing AX2D66N014 Revision 5, Require minimum dimension to bottom of support for brace
E-FCRB-3339	Drawing AX2D66N001 Revision 1, Not enough tolerance in the installation of horizontal support arms
E-FCRB-3941	Drawing AX2D94V054 Revision 1, Additional flexibility required for support type 22
E-FCRB-3971	Drawing AX2D66N011 Revision 13, Flexibility required for attaching tray clips to support arm
E-FCRB-4149	Drawing AX2D66N023 Revision 3, Additional tolerance required for detail 6

TABLE 6.1-7 (SHEET 2 OF 3)

Document Number	Title/Description
E-FCRB-4209	Drawing AX2D66N040 Revision 0, Require new support type
E-FCRB-4470	Drawing 1X2D05N101 Revision 0, Request to delete three tray supports
E-FCRB-4662	Drawing AX2D94V052 Revision 5, Request junction box mounting details in containment
E-FCRB-5366	Drawing AX2D94V056 Revision 0, Request junction box mounting details, side by side on structural steel
E-FCRB-5430	Drawing AX2D66N036 Revision 1, Requires weld symbols for support type 281
E-FCRB-5805	Drawing AX2D66N001 Revision 12, Clarification of Note 31
E-FCRB-6161	Drawing AX2D66N027 Revision 4, Stiffener connections do not match
E-FCRB-6309	Drawing AX2D66N035 Revision 0, Incorrect weld symbol
E-FCRB-6397	Drawing AX2D94V055 Revision 2, Required to support more conduit on support type 28
E-FCRB-6569	Drawing 1X2D48N005 Revision 3, Request to relocate support arm
E-FCRB-6606	Drawing AX2D084138 Revision 3, Revise bracing requirements
E-FCRB-7246	Drawing AX2D66N010 Revision 20, Flexibility required to accommondate skewed support arm - detail 16
E-FCRB-7797	Drawing AX2D94V055 Revision 4, Clarification of notes for support type 35
E-FCRB-7966	Drawing AX2D94V050 Revision 12, Request to relax conduit span requirements

TABLE 6.1-7 (SHEET 3 OF 3)

Document Number	Title/Description
E-FCRB-7967	Drawing AX2D94V053 Revision 8, Request special support type
E-FCRB-8305	Drawing AX2D94V051 Revision 9, Additional flexibility required for support type 14
E-FCRB-9721	Drawing AX2D094V056 Revision 2, Request special support type
E-FCRB-10115	Drawing AX2D94V050 Revision 14, Request to relax conduit span requirements
E-FCRB-11897	Drawing AX2D94V052 Revision 10, Request to relax conduit span requirement from junction box
E-FCRB-309F	Drawing AX2D66N046 Revision 2, Zone clarifications for support types 324 and 336
E-FCRB-988F	Drawing AX2D94V050 Revision 13, Request special support type
E-FCRB-1018F	Drawing AX2D94V054 Revision 6, Request special support type
E-FCRB-1114F	Drawing lX2D07N101 Revision 4, Request bracing modification
E-FCRB-1229F	Drawing AX2D66N011 Revision 19, Request additional flexibility for support type 21D
E-FCRB-1440F	Drawing AX2D94V052 Revision 10, Request to relax conduit span requirements from junction box
E-FCRB-1570F	Drawing AX2D94V056 Revision 3, Request mounting details for junction boxes
E-FCRB-1655F	Drawing AX2D66N009 Revision 9, Clarification of support type 15A is required

TABLE 6.1-8 (SHEET 1 OF 3)

DESIGN PROGRAM VERIFICATION
PART II DEVIATION REPORTS

Document Number	Title/Description
ED-144	Specification X3AR01-E8 Drawing 1X3DF411, Conduit stub above finish floor in violation of specification requirement
ED-593	Specification X3AR01-E8 Drawings AX2D11N301 and AX2D11N311, Additional welds applied to tray supports
ED-797	Specification X3AR01-E8 Drawing AX2D94V050, Supports installed without details
ED-1529	Specification X3AR01-E8 Drawings 1X3DG505 and 1X3DG515, Conduit supports not installed within 3 ft of junction box
ED-1975	Specification X3AR01-E8 Drawing AX2D11N110, Support installed with improper welds
ED-2501	Specification X2AP01-C9.7 Drawings AX2094V051 and 2X3DF441, Concrete anchor minimum embedment not achieved
ED-2748	Specification X3AR01-E8 Drawing AX2D11N113, Support installed with weld undercut and improper bolt spacing
ED-2974	Specification X2AP01-C9.7 Drawing 1X3DF301, Improper installation location of concrete anchor; also, torque cannot be achieved
ED-3166	Specification X3AR01-E8 Drawings AX2D11N121, AX2D66N014 and AX2D66N032, Improper installation of support brace on embed plate
ED-3310	Specification X3AR01-E8 Drawings AX2D11N321, AX2D66009 and AX2D66N011, Support installed with improper welds

TABLE 6.1-8 (SHEET 2 OF 3)

Document Number	Title/Description
ED-3653	Specification X3AR01-E8 Drawings 1X3DF302 and AX2D94V055, Conduit support installed with improper welds
ED-3695	Specification X3AR01-E8 Drawings 1X3DK302, AX2D66N001 and AX2D66N010, Improper installation of tray connection to supports
ED-3802	Specification X3AR01-E8 Drawing AX2D11N113, Improper installation of tray support (welds and brace location)
ED-4080	Specification X3AR01-E8 Drawing 1X3DF316, Improper installation of conduit support type (welds and tube size)
ED-4531	Specification X2AP01-C9.7 Drawings AX2D94V050 and AX2D94V054 Improper installation of conduit support (welds and member size)
ED-4844	Specification X2AP01-C9.7 Drawings 1X3DH402 and AX2D94V052, Improper installation of concrete anchor bolts; improper modification of junction box
ED-4868	Specification X3AR01-E8 Drawings 1X2D05N120, AX2D66N001, AX2D66N010, Improper installation location of tray support arm
ED-5056	Specification X3AR01-E8 Drawings 1X3DF414 and AX2D94V053, Improper installation of welds for conduit support
ED-5550	Specification X3AR01-E8 Drawing 1X3DF302, Improper installation of conduit support (welds, length, stiffeners)
ED-5581	Specification X3AR01-E8 Drawings 1X2D48N005, 1X3DF503, and 1X3DF513, Bracing not installed
ED-5606	Specification X3AR01-E8 Drawing 1X3DF502, Improper installation of conduit support (welds)

TABLE 6.1-8 (SHEET 3 OF 3)

Document Number	Title/Description
ED-5825	Specification X3AR01-E8 Drawings AX2D94V050, AX2D94V054, and AX2D94V055, Improper installation of conduit supports (stiffeners, welds, location)
ED-6097	Specification X3AR01-E8 Drawings 1X3DF502, AX2D94V050, and AX2D94V055, Stiffener omitted for conduit support
ED-6591	Specification X3AR01-E8 Drawings AX2D11N129, AX2D11N133, and AX2D66N032, Tray support brace not installed
ED-7157	Specification X3AR01-E8 Drawing 1X2D48N012, Improper welding and Unistrut damage on seven tray supports
ED-7344	Specification X3AR01-E8 Drawings AX2D11N311, AX2D11N314, and AX2D66N018, Improper installation of tray support (welds, lack of detail, location, brace)
ED-8567	Specification X3AR01-E8 Drawings 1X2D48N007 and AX2D66N035, Improper installation of brace for tray support
ED-8579	Specification X2AP01-C9.7 Procedure GD-T-01, Incorrect disposition of eight previous Deviation Reports
ED-9175	Specification X3AR01-E8 Drawings 1X2D07N100 and AX2D66N047, Improper installation of tray support (connection, embed plate)
ED-9602	Specification X3AR01-E8 Drawings 1X2D48N005, 1X3DF503, and AX2D66N027, Improper installation of tray support (welds)

TABLE 6.1-9

DESIGN PROGRAM VERIFICATION
PART II SUPPLIER DEVIATION DISPOSITION REQUEST

Document Number	Title/Description
0241	Purchase Order PAV-5116 Specification X2AH17, Request to modify end plate details
0283	Purchase Order PAV-5116 Specification X2AH17, Material size substitution
0289	Purchase Order PAV-5116 Specification X2AH17, Material size substitution
0291	Purchase Order PAV-5116 Specification X2AH17, Request tolerance on weep hole location
0381	Purchase Order PAV-5116 Specification X2AH17, Improper welds and weld procedures not qualified by Bechtel
0602	Purchase Order PAV-5116 Specification X2AH17, Clarification of zinc coating requirements
0844	Purchase Order PAV-5116 Specification X2AH17, Request revision of stiffener plate
0992	Purchase Order PAV-5116 Specification X2AH17, Increase of shipping tack weld size

TABLE 6.1-10 (SHEET 1 OF 2)

DESIGN PROGRAM VERIFICATION
PART II CONSTRUCTION SPECIFICATION CHANGE NOTICE

Document Number	Title/Description
30	Specification X3AR01-E8-6, Clarification of junction box sizes and use of conduits
47	Specification X3AR01-E8-8, Clarification for use of conduit fittings
79	Specification X2AP01-C9.1-6, Addition of ASTM standards
106	Specification X3AR01-E8-11, Qualification of aluminum conduit as a solid barrier
115	Specification X3AR01-E8-11, Clarification for use of 90o conduit fittings with junction boxes
138	Specification X2AP01-C9.1-7, Addition of ASTM standard for strut
140	Specification X3AR01-E8-11, Modification of conduit to hot pipe separation requirements
160	Specification X2AP01-C9.1-8, Clarification of ASTM standard for strut
165	Specification X2AP01-C9.1-8, Clarification for use of welding code
169	Specification X2AP01-C9.1-8, Revise strut material requirements
240	Specification X3AR01-E8-14, Clarification of raceway support to electrical equipment clearance

TABLE 6.1-10 (SHEET 2 OF 2)

Document Number	Title/Description
249	Specification X2AP01-C9.1-10, Clarification of ASTM standard for nuts
284	Specification X3AR01-E8-15, Require additional means of labeling rigid steel conduit
348	Specification X2AP01-C9.1-11, Revision of tray support tube steel material requirements
379	Specification X3AR01-E8-18, Clarification of field pull boxes installed in containment
380	Specification X3AR01-E8-18, Request interchangability of conduit fittings of like manufacturers
398	Specification X3AR01-E8-19, Installation direction of tray covers for instrument trays after placement of sealant
500	Specification X2AP01-C9.7-9, Clarification of thread engagement for wedge type anchor
547	Specification X2AP01-C9.7-12, Revision of inspection requirements when concrete anchors are used with conduit straps
548	Specification X2AP01-C9.7-12, Clarification of concrete anchor in-process inspection requirements

6.2 CONSTRUCTION PROGRAM VERIFICATION

Construction program verification was performed to determine whether construction is complying with the applicable licensing commitments and whether the completed electrical supports complied with the design requirements.

To perform this assessment, a three-man team with 22 years of cumulative experience in power plant construction was assembled. The team expended approximately 700 hours in the verification.

Construction program verification was performed in two parts: commitment implementation assessment and construction assessment.

During commitment assessment, the licensing commitments applicable to construction were assessed for implementation into the applicable construction procedures. Construction assessment verified the compliance of 41 electrical supports and their associated quality assurance (QA) records, representing approximately 1600 total quality attributes to design and licensing requirements.

6.2.1 SUMMARY EVALUATION

The construction program verification resulted in 14 findings. These 14 findings were categorized as 2 Level I (19-11 and 19-12), 10 Level II (19-6, 19-8, 19-9, 19-13 through 19-18, and 19-20), and 2 Level III (19-10 and 19-19). Table 6.2-1 contains an overall listing of these findings and their categories.

The 14 findings were arranged by type of problem encountered and resulted in five classifications:

- Installation/documentation discrepancies.
- Drawing interpretation.
- Completion status.
- Spring nut/stud nut discrepancies.
- Inspector certification.

Each classification is described below and is listed along with associated findings on Table 6.2-2. Findings 19-2 and 19-23 from the Design Program Verification involved construction installation activities and are addressed briefly as appropriate.

6.2.1.1 Installation/Documentation Discrepancies

Findings 19-9; 19-10; 19-11, items 2 through 5; 19-15; 19-18; and 19-19 identified minor discrepant hardware installations or documentation inconsistencies from failure to comply with design and procedure requirements. These findings were evaluated through reinspections, which determined the discrepancies to be isolated, and/or through engineering review, which determined the discrepancies to be technically acceptable as is and to meet the design function. Retraining for craft and Quality Control (QC) was conducted, when appropriate, to prevent recurrence. The discrepancies were minor and reflect no safety concerns or impact on design.

6.2.1.2 Drawing Interpretation

Findings 19-6; 19-11, item 1; 19-14; 19-16; 19-17, item C; and Findings 19-2 and 19-23 from the design program verification identified concerns with the clarity or interpretation of the electrical support drawings.

The electrical support drawings consist of a support schedule that is used in conjunction with a plan drawing and typical details to custom build a support to the unique field conditions. As a result of the seven findings in this category, there was concern on the part of Readiness Review that the design intent may not be reflected in the as-built configuration.

To investigate this concern, the Project performed an evaluation of the drawings and their interpretation by assembling a team of project engineers, craft, and QC inspectors who reviewed the drawings to identify potential interpretation differences. This review evaluated 135 design details and concluded that, although minor interpretation differences did exist, the review verified that, with noted exceptions, the drawings were adequate for intended use. Additionally, Project Engineering performed an overall evaluation including the results of an evaluation of a 1983 investigation and the results of the Structural Integrated Verification and Evaluation (STRIVE) program. This gave added assurance that design intent was being achieved in installation.

Project Engineering dispositioned all but three of these specific Readiness Review Findings Use-As-Is on Deviation Reports (DRs). Finding 19-23 resulted in one discrepancy that was dispositioned Rework, but was not reportable. The two remaining findings (19-2 and 19-11) are being evaluated for reportability and any required rework. Finding 19-2 was previously discussed in section 6.1. Finding 19-11 identified a drawing detail that required longitudinal conduit bracing at 16-ft intervals, but did not clearly indicate that at least one longitudinal brace was required for conduit runs less than 16 ft long. Consequently, conduit runs less than 16 ft long may not

have been braced. In response to Finding 19-11, the Project identified 40 conduit supports that would require longitudinal bracing. Results of reinspection of these supports have identified 15 supports that are missing the required brace and are presently being evaluated for acceptability or rework.

The evaluation performed by the Project for the drawing interpretation concern has concluded that the specific finding identified by Readiness Review is isolated to specific details which will be clarified. Based on Design evaluation of the installed hardware deficiencies, the drawings utilized for electrical support installation are adequate and the installation of supports meets the engineering intent.

6.2.1.3 Completion Status

Finding 19-12 identified a tray support that was missing a stiffener, although the QC inspection report indicated the support was acceptable. Evaluation of the finding identified that past revisions of the raceway support installation and inspection procedure allowed partial installation and inspection of tray supports, but did not establish a means of tracking the the uninstalled portions.

As a result of this finding, it has been established that Construction will verify the completeness of all installed electrical tray supports and QC will verify that all installed items have been inspected and are documented. Field procedure ED-T-33, Electrical Room and Area Turnover, will be revised to define the controls to ensure tray support completeness.

Conduit support installation procedures were adequate and required all supports to be complete and inspected prior to inspection of the attached conduit.

6.2.1.4 Spring Nut/Stud Nut Installation Discrepancies

Findings 19-8 and 19-13 identified installation errors with the use of spring nuts or studs as installed in the strut channel. Finding 19-8 identified bolts that were too long for the channel and bottomed out prior to bringing the channel nut into full contact with the channel. Finding 19-13 identified indicator lines that indicate stud nut orientation not perpendicular to the channel as defined in the applicable procedure.

For both findings, Project Engineering has concluded that the as-found conditions are technically acceptable and meet the design function. The hardware identified in Finding 19-8 was reworked as a matter of expediency and the procedure that defines the use of the stud-nut indicator line will be clarified to give a tolerance for indicator line acceptance.

6.2.1.5 Inspector Certification

The inspector certification category consists of one finding (19-20, Level II) which identified an inspector who signed documentation as a Level II inspector, but who did not possess Level II raceway certification. Investigation by Electrical QC determined that the inspector possessed a Level II visual certification and that 10 other inspectors who also possessed only visual certification were utilized for raceway support acceptance. QC management determined that the visual certification training requirements are equivalent in the area of support inspection attributes to the training requirements for raceway certification and concluded that the inspectors were qualified to accept welded raceway supports. The use of Level II visual inspectors to accept raceway supports was discontinued in mid-1985.

The Construction Team concludes that with the identified evaluations, any necessary hardware corrections, drawing revisions to clarify engineering intent, and the procedure for verification of tray support completion, an acceptable program for electrical support installation will exist and the completed structures will meet the licensing commitments and design requirements.

6.2.2 COMMITMENT IMPLEMENTATION ASSESSMENT

Section 3.4 contains the commitment matrix for the commitments identified by the Final Safety Analysis Report (FSAR) that are applicable to this module. The commitment indicating construction responsibility for implementation was tracked to the working level document (that project document that interprets and specifies action to be taken).

For this module, a single commitment, American Welding Society (AWS) D1.1-75, was identified as being applicable to construction and was incorporated in the applicable implementing documents.

6.2.3 CONSTRUCTION ASSESSMENT

Construction assessment was structured to ascertain whether the installed hardware complied with design requirements and whether the associated documentation was initiated and completed in accordance with specification and procedural requirements. To accomplish this, the assessment plan was developed and implemented to provide a visual walkdown of the electrical supports, as installed, and to provide an evaluation of the documentation associated with fabrication, installation and erection of electrical supports. The assessment plan consisted of separate evaluations of conduit/box/equipment supports and

tray supports. Each evaluation consisted of a hardware walkdown and a documentation assessment.

Verification checklists were developed using the general attributes listed in Table 6.2-3. These attributes were compiled from site procedures, specifications, general notes, drawings, project audits, and Nuclear Regulatory Commission (NRC) assessments of other sites. A set of instructions (Figure 6.2-1) was developed to guide team members through the checklists.

6.2.3.1. Assessment Item Selection

The assessment items selected included installed electrical supports and programmatic activities supporting and controlling the electrical support construction program.

Hardware items were selected based on the following criteria:

- o Unit 1 structures.
- o Category I or II/I area.
- o Representation of seismic accelerations zones.
- o Representation of time frame/structures.
- o Raceway construction complete.
- o Inclusion of details assessed during design verification.

Programmatic items were selected from data obtained during the assessment of the hardware documentation. The type and quantity of hardware items and programmatic activities assessed are as follows:

- o Hardware Items
  - Conduit supports (18).
  - Box supports (4).
  - Equipment supports (1).
  - Tray supports (18).
- o Programmatic Activities
  - Inspector certification (40).
  - Welder qualification (39).
  - DRs (40).
  - Measuring and test equipment (17).
  - Material Traceability (22).

6.2.3.2 Assessment of Hardware Items

The selected hardware items were assessed by a visual walkdown examination of the items and a review of the installation documentation for compliance with specification, drawing, and procedure requirements. The assessment methods utilized and the results of the assessment follow.

6.2.3.2.1 Conduit/Box/Equipment Supports

The installation of conduit/box/equipment supports were assessed to evaluate the hardware configuration, welding, and related documentation requirements for 18 conduit supports and 5 box/equipment supports to ensure compliance with design and procedural requirements. This assessment used the checklist of Figure 6.2-2. The hardware items assessed are listed on Table 6.2-4.

The assessment ascertained that box and equipment supports were installed and documented in compliance with specification, drawing, and procedure requirements, except that box supports had problems with stud nut installation (see Finding 19-8). The assessment ascertained, with the exception of minor isolated problems as noted by Findings 19-9, 19-10, 19-15, and 19-19, that conduit supports were installed and documented in compliance with specifications, drawings, and procedure requirements. Finding 19-11 identified a problem with the Construction and QC interpretation of Design's intent; although the resultant as-installed condition is not per design intent, it does not represent a program deficiency or breakdown.

Approximately 80 associated QC records were assessed and 10 design drawings were used during the walkdown and documentation review. Six Readiness Review Findings (RRFs) were initiated as a result of this review and are discussed below:

- Readiness Review Finding 19-8 (Level II)

  Description: For 72 bolted strut connections examined, a strut nut was improperly inserted into the strut channel conduit support (CS) 507-111-026, and 12 bolts on 2 electrical box supports (BS) 302-44-055 and BS-512-B03-062 were bearing on the inside of the strut channels.

  Project Response: For the strut nut not engaged, DR ED-11958 was written January 24, 1986, and dispositioned Rework. This portion of Finding 19-8 is similar in nature to Finding 19-13. See Finding 19-13 for additional information.

  For the bolts bearing on the back face of the strut channels, DRs ED-11957 and ED-11959 were written

January 24, 1986, and were dispositioned Rework. An additional 85 box supports, with 624 bolts, were inspected and 6 supports were found with bolts bearing on the back of the channel. DR ED-12286 was written February 16, 1986, to rework the bolts on these supports. In addition, during the box support inspection, 5 strut-nuts of the 624 connections on these supports, were found to be improperly seated. This deficiency (improperly seated) is addressed on DR ED-12147, as stated in Finding 19-13.

The Project conclusion, based on the additional items reinspected and corrective action in addition to resolution of the DRs, is that the above discrepancies are limited to application. Project Engineering evaluation determined that these installations would still have performed their intended design function prior to being reworked. A Procedure Awareness Coordinator (PAC) flyer has been issued to enhance craft awareness of these requirements.

Readiness Review Conclusion: Readiness Review concurs with the project response as stated for this finding and with the additional information given in the project response to Finding 19-13.

- Readiness Review Finding 19-9 (Level II)

  Description: A damaged stud nut was found on 1 of 18 conduit supports (CS-302-70-009), which resulted in the conduit not being attached to the support.

  Project Response: Investigation by Field Engineering found the conduit strap stud nut broken. The arm of support CS-302-70-009 was not installed at the same elevation as the conduit. This resulted in a gap between the arm and the conduit. A spacer was not used to fill this gap and allow normal installation of the stud nut. The stud nut was over-torqued in an attempt to close the gap, causing subsequent failure of the stud nut. DR ED-1984, written January 25, 1986, was dispositioned Rework to correct this deficiency. Additional conduit supports in the control building were inspected to determine whether spacers were being installed, where needed; and all were found to have the necessary spacers. This deficiency is considered an isolated case caused by craft not using the option to install a spacer when needed. No action to prevent recurrence is required. Project Engineering has evaluated this item and determined that no structural inadequacy existed even when the support had not been reworked.

Readiness Review Conclusion: Readiness Review concurs with the above response.

- Readiness Review Finding 19-10 (Level III)

  Description: Three of 18 conduit supports (CS-302-70-008, -009, and -010) were not correctly identified. One of 18 conduit supports (CS-411-53-084) had two inspection reports for different configurations, possibly indicating number duplication on different supports. One sampled transformer support (1-1808-T3-064) was not numbered.

  Project Response: Procedure ED-T-02 requires the last three numbers of the layout drawing to be included in the support. Field Engineering investigation found these supports were numbered from the wrong layout drawing. The portion of the room in which these supports are located is shown on drawings 1X3DF302 and 1X3DF120. Drawing 1X3DF302 references this portion of the room as being shown on drawing 1X3DF120. The use of 302, rather than 120, as part of the support number was an oversight. DR ED-11962, written January 23, 1986, was dispositioned Rework to correct the numbering of the supports. The layout drawings for the floor above and below this area were reviewed and the supports were randomly reinspected for this condition. No errors were found in the numbering of these additional supports. No other plant areas were found with the same layout on different drawings.

  The cause was craft error in the use of the layout drawings and will be corrected through the DR. This error was further determined to be an isolated case that will require no further corrective action.

  The Electrical Quality Control (EQC) Group investigated the duplicate numbers and found the following:

  - Support CS-411-53-084, a type 15 support, was documented as CS-411-53-084.
  - Support CS-411-53-085 (as identified in the field), a type 14 support, was documented as CS-411-53-084 (QC error recording support number).
  - A type 7 was also numbered CS-411-53-085, was installed after the type 14 support identified above, and was documented as CS-411-053-085 (craft error using duplicate numbers).

  To correct the above discrepancies, ED-11955 was issued January 24, 1986, and was dispositioned as follows:

- The type 14 support was renumbered 084 to match the inspector record.

- The type 15 support was renumbered 242, and a new inspection record was generated.

- The type 7 support was left as 085.

Prior to issuance of this finding, QC initiated the process of entering, by support number, all support inspection documents into a computerized tracking system. This has now been completed for existing supports. Duplicate numbers are easily identifiable with this system and will be corrected as they are detected.

The unnumbered transformer support was not construction complete and had not been turned over to QC for acceptance. QC investigation of this finding determined that supports of this type, previously turned over to QC, have lacked numbers.

The root cause was craft not understanding the requirements of procedure ED-T-02, paragraph 4.1.1. The craft raceway foremen and crews have been trained to this requirement through the Procedure Awareness Program to prevent recurrence.

Readiness Review Conclusion: Readiness Review concurs with the above response.

- Readiness Review Finding 19-11, (Level I)

Description: Four of 18 conduit supports and 1 of 4 electrical box supports were found to differ from the design drawings and details, as listed below. No prior design approval could be located.

A. One conduit support (CS-411-053-030) did not have the required brace installed.

B. One conduit support (CS-507-111-026) and one electrical box support (BS-51B-B03-040) did not have the correct size supporting members installed; and an incorrect detail was used, according to the detail notes, for the box support installation.

C. One conduit support (CS-302-70-008) attachment did not agree with any design details.

D. One conduit support (CS-302-44-167) had welds not shown on the design details.

Project Response:

A. Support CS-411-053-030 was accepted January 27, 1983. At that time drawing AX2D94V051, detail 6, stated, "Longitudinal bracing at every 16'-0" of conduit." This statement did not clearly indicate that a brace was required when the conduit was less than 16 ft 0 in. in length. Detail 6 was clarified on July 22, 1983, by Design Change Notice (DCN) 22, which added, "When total length of conduit is less than 16'-0, at least one longitudinal brace shall be provided." DCN 22 was noted as a clarification and was not marked for retrofit. The missing brace condition was reported on DR ED-12001 on January 24, 1986.

Electrical Field Engineering performed an initial walkdown examination of the supports for 56 conduits accepted prior to the drawing clarification. This examination was specifically directed toward the type 4 and type 5 supports requiring this brace. Three supports of this type were examined and all lacked the required brace. DR ED-12183, issued February 8, 1986, resulted in an additional walkdown of all type 4 and 5 supports. The walkdown identified 15 supports, all installed prior to July 22, 1983, of the total accepted population of 40 supports, that lacked the required braces. These 15 will be evaluated as a part of the resolution of Deficiency Evaluation Report (DER) 145.

The root cause was determined to be DCN 22, which was issued for clarification of an existing requirement with retrofit not indicated; however, the brace had not been installed on previously completed supports. This is considered a unique instance in which a DCN issued for clarification also called for rework.

B. A 3 in. x 3 in.x 1/4 in. angle was required by E-FCRB-3498 to drawing AX2D94V053, whereas a 2-1/2 in. x 2-1/2 in. x 1/4 in. angle was installed. This type support is applicable only to the containment building polar crane power feed conduit. All supports on this conduit run were inspected and an additional deviation was found. The two deviations are documented on DR ED-12002, issued January 31, 1986.

Drawing AX2D94V052, detail 4, requires 4 in. x 4 in. x 1/4 in. tubular steel for the box support, but 3-1/2 in. x 3-1/2 in. x 1/4 in. tubular steel was used for support BS-518-B03-040. This deviation was

reported on ED-12002 and was approved Use-As-Is by Project Engineering.

The random walkdown investigation found two additional supports with 3-1/2 in. x 3-1/2 in. x 1/4 in. tubular steel installed. These supports are documented on ED-12133 for resolution.

Additionally, it was found that note 5 of drawing AX2D94V052 disallows use of detail 4 when the box has an electrical conductor seal assembly (ECSA) connector. Note 5 of detail 4 reads, "When ECSA is connected to a junction box, this detail, in conjunction with Section L shall not be used to support the junction box." Design Change Notice-Resident (DCN-R) 61 to Revision 9 of the drawing added this limitation on July 12, 1985. This DCN-R is marked "Retrofit required."

Procedure ED-T-17 requires the electrical field engineer to initiate a Rework Request to identify existing accepted construction when retrofit is required. A Rework Request had not been initiated for this retrofit DCN. Design has determined that this requirement is not necessary, as the junction box ECSA assembly has been qualified for this type of attachment. Note 5 has been removed from the drawing.

The root cause for the conduit support was craft and QC error, which was considered to be an isolated case with all discrepancies identified and corrected. The box support error was caused by the addition of Note 5 to drawing AX2D94V052 by DCN-R 61. All deviation cases have been identified and accepted Use-As-Is. The requirement of procedure ED-T-17 has been brought to the attention of all area engineering supervisors.

C. The Quality Control Acceptance Report indicated that a stud nut was used in the original installation but had been replaced with a spring nut and bolt to make a conduit attachment. No detail existed for the initial configuration, and no Rework Request or DR was found to authorize the rework. This violation was reported on DR ED-11961, dated January 24, 1986, and was dispositioned Use-As-Is. Additionally, Project Engineering determined that this type of connection would be acceptable if used elsewhere.

The root cause was craft error. Corrective Action Request 0003 has addressed unauthorized reworks (see Finding 19-15).

D. CS-302-44-167 and the adjacent support, CS-302-44-007, were found to have the same deviation. A random walkdown on levels A, B, 1, and 2 of the control building found no additional deviations of this type. DR ED-11960 was issued January 24, 1986, and was dispositioned Use-As-Is. This condition was isolated to the two supports found.

The root cause was craft error in not adhering to approved drawing detail and is considered limited to the two identified supports.

Additionally, items 2, 3, and 4 collectively indicate that craft and QC sometimes encounter difficulties in determining the appropriate detail. Item 3 indicates a problem of unidentified unauthorized reworks. Although these findings indicate some isolated violations of the installation and inspection programs, the Electrical section feels adequate overall controls are and have been in place.

Readiness Review Conclusion: Based on the collective information given for each item, Readiness Review concurs with the project response.

o Readiness Review Finding 19-15 (Level II)

Description: One conduit support (CS-314-48-081) of 18 sampled had hardware added after release to EQC with no Rework Request or DR evident. This is a violation of Field procedure ED-T-17.

Project Response: Investigation by Electrical Field Engineering determined that no Rework Request or DR had been written. The addition of a strut to the support was for the installation of a conduit. DR ED-12000 was written January 27, 1986, to document this procedure violation and was disposition Hardware-Not-Affected.

A sample of 15 conduit supports accepted by QC was pulled at random from the QC vault. Reinspection of the 15 supports showed no unauthorized rework. This finding was a result of the craft not following procedure ED-T-17. This procedure prohibits new work on turned-over items without a Rework Request.

Corrective Action Request (CAR) 0003, initiated November 25, 1985, was written to resolve violations of the electrical Rework Request procedure. Although the CAR documents examples of rework being performed without QC notification, the Electrical Section determined that

controls to detect this are and have been in effect as evidenced by the DRs referenced on the CAR.

Readiness Review Conclusion: Readiness Review concurs with this response.

- Readiness Review Finding 19-19 (Level III)

  Description: Review of QA records for the electrical supports sampled as part of the assessment disclosed varying problems with these records, such as:

  - Not being in agreement with the as-built condition.

  - Not reflecting complete inspection of the support.

  - Incomplete forms or records which could not be located.

  Project Response: Some of the records did show a small number of inconsistent individual entries though no hardware deficiencies were found. A random sampling of 663 documents was done, and although isolated inconsistencies were found, QC supervision has determined that the overall quality of the records and information contained therein adequately demonstrates inspection of the supports for the required quality related attributes. It was determined that the documentation had been adequately filled out by the QC inspectors. Several DRs were written to correct minor errors on the records and individual instruction was given to the EQC inspectors regarding use of proper forms and proper documentation of their inspections. The remainder of the documents were corrected in accordance with field procedure DC-A-06.

  Readiness Review Conclusion: Readiness Review concurs with the response.

6.2.3.2.2 Tray Supports

The installation of tray supports were assessed to evaluate the hardware configurations and related documentation requirements for 18 tray support assemblies to ensure compliance with design and procedural requirements. The checklist of Figure 6.2-3 was used in this assessment. The hardware items assessed are listed on Table 6.2-3.

The assessment ascertained that the documentation, which had been completed for tray supports and was available for review, was in accordance with the procedure requirements. The assessment ascertained that the installed hardware did reflect the proper location, identification, material size, dimensions, orientation, and bolting in accordance with specifications,

drawings, and procedure requirements. There were minor problems noted with the welding and configuration that were addressed by Readiness Review Findings. Finding 19-12 (Level I) identified that some portions of the tray support assemblies have not yet been completed or inspected, and no program existed to ensure completion of these portions.

Approximately 120 associated QC records were assessed and 50 design drawings were used during the walkdown and documentation review.

Seven RRFs were initiated as a result of this review and are discussed below:

- Readiness Review Finding 19-6 (Level II)

  Description: There was one isolated instance of incomplete design information found in the details (detail 15 on drawing AX2066N010) out of approximately 41 detail drawings used in the assessment of electrical supports.

  Project Response: Note 2 on drawing AX2D94V019 provides a tolerance for miscellaneous structural steel erection of ±1/4 in., unless noted otherwise. The 1-in. gap specified in detail 15 on drawing AX2D66N010 is a nominal dimension. However, since no tolerance was specified for the 1-in. dimension, Design intended that the above tolerance of ±1/4 in. be used, while the field interpreted the drawing to allow a tolerance of ±1 in.

  A review on the basis for the gap has determined that a gap from 1/8 to 2 in. is acceptable. Approximately 400 floor-to-ceiling cable tray supports have been installed which may have used this detail. This condition was identified February 12, 1986, for evaluation on DR ED-12225. These supports were reinspected by EQC, and eight were found to deviate from the acceptable criteria. These eight supports were evaluated and were dispositioned Use-As-Is. The drawing detail has been revised to indicate the above expanded tolerance range.

  The root cause was determined to be incomplete design information.

  Readiness Review Conclusion: Based on the Project review of the design calculation and the above stated actions, Readiness Review concurs with the response.

- Readiness Review Finding 19-12 (Level I)

  Description: One tray support (TS) (012-33) of 18 was missing the required stiffener.

Project Response: Review of the design drawings for TS-012-33 indicated the stiffener should have been installed. DR ED-11964 was written and dispositioned to install the missing stiffener. The stiffener was then installed.

Further investigation disclosed that some past revisions of procedure ED-T-02 allowed acceptance of supports (prior to the attached raceway acceptance) without the bracing and stiffeners being installed and that the stiffener identified above had not yet been turned over for inspection.

During the investigation of this finding, it was also noted that there was no procedural control to ensure that the stiffeners and bracing on electrical supports would be installed at a later date. To correct this, procedure ED-T-33 Electrical Room and Area Turnover, will be used to require all supports to be inspected for configuration prior to room or area turnover. This procedure is scheduled for issue by April 15, 1986.

For the bracing and stiffeners, a number of steps were taken to avoid past inconsistencies in the way in which Inspection Reports are being filled out. The present Inspection Reports (a two-part Weld Inspection Form and a Support Turnover/Inspection Form) have more specific inspection attributes included, than in the past, to better depict exactly what part of a support was inspected.

In addition, tray support documentation will be reviewed for completeness by EQC prior to area turnover as required by field procedures GD-A-50 and GD-A-31. This review will encompass a walkdown of the tray support configuration to determine what documentation is required and whether that documentation exists and/or is adequate. If any documentation is deficient or nonexistent, the problem will be corrected by the inspector in accordance with applicable procedures and/or by reinspection. Additionally, field procedure ED-T-02, Revision 9, Field Procedure Change Notice (FPCN) 60, requires that the two-part inspection form for each support be filled out in two parts. The first part covers the support and stiffeners, and the second part covers the bracing. This will serve to indicate whether the support is complete and also serve as a readily available tracking mechanism.

Readiness Review Conclusion: Readiness Review concurs with the response and the action to prevent recurrence.

- Readiness Review Finding 19-13 (Level II)

  Description: For tray supports, 32 of 216 stud nuts were not properly engaged in the strut channel, 6 of 24 spring nuts were not properly engaged in the strut channel, 13 of 56 stud nuts did not have the indicator lines perpendicular to the strut channel, and 3 of 240 bolted connections were under-torqued. These conditions do not conform to specification X3AR01 and field procedure ED-T-02.

  Project Response: The construction investigation included a review of past evaluations of strut connections and a walkdown examination of present installations. Project Engineering evaluated discrepant eight-bolt connections for tray support arms in July 1984. This evaluation addressed tray supports installed to that time. The discrepancies noted in this finding were evaluated by Project Engineering during January 1986.

  These evaluations are contained in DER-045 and DER-106. Their conclusion, as stated in DER-106, is based on an evaluation of the most critical case in the random sample and Readiness Review Finding as applied to plant envelope cases. The results of these evaluations determined that plant safety was not impaired.

  Construction field personnel performed a walkdown examination of strut connections on the various levels of the control, containment, auxiliary, and fuel handling buildings. This walkdown examination, directed toward conduit and box supports, was based on the small percentage of discrepant tray support connections found in Finding 19-13 and in the sample inspection evaluated by DER-045. This decision was further based in the fact that box and conduit supports were not sampled for consideration during previous evaluations.

  A total of 289 spring nuts was examined and 4 were determined to deviate from installation requirements.

  This is an error of less than 2 percent of the population examined. Six hundred thirty spring stud nuts were examined and one was determined to deviate from installation requirements. This is an error of less than 1 percent of the population examined. The three spring stud nuts with reduced torque represent less than 2 percent of the population examined by Readiness Review. The percentage of items deviating from the installation requirements is considered to be within the acceptable level of quality. These items are considered to be isolated craft errors.

The discrepant spring stud nuts and spring nuts identified by Readiness Review and Electrical Field Engineering were reported on DR ED-12147 and ED-12268 and were reworked in accordance with the approved disposition. Subsequent review by Design concluded that these installations would still have performed their intended function had they not been reworked.

Readiness Review Conclusion: Readiness review concurs with the response.

- Readiness Review Finding 19-14 (Level II)

  Description: Two instances of support-to-embed welding edge violations were found, one each for conduit (CS-302-44-184) and tray (TS-129-214) supports. This condition violates the 1-in. border where no attachments are to be made, as shown on drawing AX2D95V006, detail 11 and note 3.

  Project Response: Electrical Field Engineering found that the welds for attachments have been placed within the 1-in. edge boundary of the plates. These deficiencies were reported on DRs ED-11976 and ED-12108 on January 24, 1986, and were dispositioned Use-As-Is. A random walkdown examination, using the criteria of drawing AX2D94V006, detail 11 and note 3, identified 10 additional violations, of which 4 had been previously reported on DRs and 3 had not been accepted by QC. ED-12108 reported the violation. This walkdown examination was conducted in the containment, fuel handling, control, and auxiliary buildings.

  DR ED-12108 was given an interim disposition of Use-As-Is for raceway support attachments to embed plates in all areas of Category I and II structures except the following:

  A. Auxiliary building level C and D.

  B. Control building level C.

  C. Control building electrical tunnels and shafts as shown on drawings AX2D11A044, 46, 47, and 51.

  The interim disposition also required QC to reinspect these areas in a walkdown. The inspectors identified one deviating support attachment in these areas. This was evaluated by Project Engineering, and the final disposition for all cases was Use-As-Is.

  The cause of the violations was determined to be misinterpretation, by the craft and QC, of detail 11 and note 3 on drawing AX2D94V006. Craft personnel and QC

inspectors have been reinformed of the drawing requirements. The drawing has been clarified to clearly indicate the design intent. Project Engineering has evaluated and accepted all existing deviations.

Readiness Review Response: Readiness Review concurs with the response and corrective action.

- Readiness Review Finding 19-16 (Level II)

  Description: Six out of six tray supports (using the type of weld joint shown on details 8, 13, and 16 on drawing AX2D66N032; detail 2C, section N, on drawing AX2D66N033; and section AA on drawing AX2D66N010) exhibited undersized, skewed welds (included angles between 60° and 30°) when evaluated using the specified weld symbol.

  Project Response: Further investigation and inspection by EQC determined that the welds on the skewed joints were undersized when evaluated to the weld symbol shown. DR ED-12157 was written on February 6, 1986, to provide resolution for the six tray supports identified by Readiness Review and to address the generic deficiency of undersize welds on skewed joints associated with the weld symbols used on the above details.

  The cause of this finding was a weld symbol on the drawing that did not provide sufficient information, coupled with incorrect interpretation of the specified weld symbol by QC and craft personnel. Project Engineering analysis indicated that the weld used was acceptable, the drawings were revised to clarify the requirements, and ED-12157 was dispositioned Use-As-Is. Training classes have been held to reinstruct all Visual Certified Inspectors on the proper method of measurement and type of weld required. The welders have received training for this through PAC flyer 10-85-16 and PAC flyer 1-86-34.

  Readiness Review Conclusion: Readiness Review concurs with the response and corrective action.

- Readiness Review Finding 19-17 (Level II)

  Description: The following weld discrepancies were found:

  A. One tray support connection to structural steel was missing the required end return welds on the connection angles.

B. One tray support arm was missing the required alternate weld when the specified weld length could not be achieved.

C. One weld on a tray support (TS-002-6) and one on a conduit support (CS-51A-B03-38) was undersize.

D. One instance of the last segment of an intermittent weld not being located at a member termination was found (strut to tubular steel on TS-129-214) with a point of loading in the unwelded area.

E. Two instances of excessive undercut (greater than 1/16 in.) were found, one on a tray support (TS-123-71) and one on a conduit support (CS-504-111-046).

These conditions are not in accordance with the applicable design drawings, specifications, field procedures, and the welding code.

Project Response:

A. The missing weld end returns for this support were documented for resolution February 2, 1986, on DR ED-12086. Detail 12 of drawing AX2D66N001 has a very limited application. QC performed a walkdown inspection of Category I buildings to determine the extent of use of this detail. The only two supports found which were installed according to this detail are in the Unit 1 diesel generator building. Both of these supports were inspected and determined to be acceptable. This deviation from design was considered to be an isolated case caused by craft and inspection error.

B. The missing welds for TS-110-222 were reported January 24, 1986, on DR ED-11975 which was disposition Rework. Only seven type 216 supports are required by the support schedule drawing. The remaining six supports were reinspected for missing welds and one support (TS-133-379) was found to be unacceptable. This additional support was reported February 8, 1986, on DR ED-12182, which was dispositioned Use-As-Is. These deviations from design requirements were caused by a difference in interpretation of drawing requirements between design and construction personnel. All such instances have been identified and corrected per DRs ED-11975 and ED-12182. The results of an additional review by Design indicated that the installed condition prior to rework would still have performed its intended function. Detail 216 on drawing

AX2D66N029 was revised to more clearly indicate the design intent.

C. The tray support weld is undersized according to drawing AX2D66N013, detail 19. DR ED-12086 was written February 2, 1986, for this discrepancy and was dispositioned Rework. Four supports with plates attached to curved surfaces were reinspected and the welds were found to be undersized on all four supports. This condition was determined to be generic to supports where detail 19 had been used. DR ED-12184 was written February 4, 1986, to identify this discrepancy on past installations. The DR was dispositioned Use-As-Is based on the amount of weld installed, the method used for weld inspection, and the available design margin. Detail 19 of drawing AX2D66N013 was revised to facilitate implementation of the design requirements.

For the conduit support weld, the support plate was cut too short to span the beam from flange to flange and to allow placement of a full-size weld. DR ED-12175 was written February 7, 1986, and the support was reworked. A sample lot of 50 supports was selected for reinspection to determine the extent of this deviation from design requirements. This sample was selected from 262 supports accepted by the inspector who accepted CS-51A-803-038. No additional deviations were found in the reinspection of the 50 supports.

The undersize tray support weld was caused by craft and inspector error in the use of detail 19. The craft welders were reinstructed through issue of a PAC flyer. The raceway inspectors were retrained through their training program.

The undersize conduit support weld has been determined to be an isolated case of craft and inspector error. The QC inspector has been retrained to this requirement. The hardware discrepancies have been resolved by ED-12175, which was dispositioned Use-As-Is.

D. There is no drawing detail that allows the load attachment to be made beyond the last intermittent fillet weld on the strut. DR ED-12151 was written on February 6, 1986, and was dispositioned Use-As-Is. The craft personnel have been reinstructed by PAC flyer 2-86-7.

The QC raceway inspectors have received training on the requirements for acceptance of supports with intermittent fillet welds. Included in this

training was the requirement for the last weld to be beyond the load attachment point. The craft crew and foreman have been reinstructed through the Work Accountability Program.

E. EQC has reinspected TS-123-71 and CS-504-111-046. The weld undercuts exceeding the 1/16-in. maximum on these supports were reported February 14, 1986, on DR ED-12180 and were reworked in accordance with the disposition. The EQC inspectors are inspecting for undercut as evidenced by the DRs on file (ED-9248, ED-5023, ED-5057, ED-5326, ED-5426, ED-7758, ED-8261, ED-7555, ED-7054, and ED-6929). These discrepancies are considered to be isolated cases. The craft personnel were reinstructed February 7, 1986, by PAC 2-86-7.

The discrepancies identified above, based on the walkdown inspections, are isolated instances and show no overall deficiencies in the quality of the installation program.

Readiness Review Conclusion: Readiness Review concurs with the response.

o Readiness Review Finding 19-18 (Level II)

Description:

A. One tray support (TS-123-71) was found to have the incorrect bridging detail used, and one of the attached lateral braces exceeded the allowable angularity tolerance.

B. One tray support (TS-123-66) had bracing installed exceeding the allowable angularity tolerance.

C. One tray support (TS-129-214) had a tray-to-support angularity which exceeded a specific detail requirement.

Project Response:

A. TS-123-71 is a type 7 support of which there are 194 for Unit 1. Electrical Field Engineering examined 19 of these supports (10 percent) selected at random from each building. No additional deviations were found in this sample. DR ED-12151 was written February 6, 1985, and approved Use-As-Is for TS-123-71.

B. The braces on TS-123-66 violate the allowed maximum and were reported on DR ED-12151, which was disposition Use-As-Is. These supports are type 2A

of which there are 46 for Unit 1. Electrical Field Engineering examined six of these supports (13 percent) selected at random from each building. No deviations were found in the sample examined.

C. Examination of TS-129-214 found the angle of tray to the support exceeded the 30° allowed by drawing AX3D66N029. This deviation was reported on ED-12151 for resolution. This is the only support of this type installed in Unit 1. No further investigation is required to determine the extent of this finding. This condition was approved by a Use-As-Is disposition on DR-12151.

The root cause for all the above items was determined to be craft error. Since the additional sampling identified no additional discrepancies, these concerns are considered isolated cases and do not indicate any deficiencies in the program for installation of tray supports.

Readiness Review Conclusion: Readiness Review concurs with the response.

6.2.3.3 Programmatic Activities

Programmatic activities associated with electrical supports were assessed to determine whether the activities were in compliance with specification and procedure requirements. The assessment consisted of a review of the documentation required by the applicable procedure or by the specification. The specific programs reviewed, the method of assessment used, and the results are contained in the following paragraphs.

6.2.3.3.1 Measuring and Testing Equipment

Seventeen calibrated tools were identified on documentation related to the hardware items assessed. All were reviewed and met the requirement of procedure GD-A-04. No discrepancies were identified as a result of this part of the assessment.

6.2.3.3.2 Deviation Reports

Forty DRs were written against the hardware item assessed. The DRs were reviewed for proper disposition, QC inspector signoff, and were compared with the as-built condition of the related support. No discrepancies were identified as a result of this part of the assessment.

6.2.3.3.3. Inspector Certification

Forty inspectors who signed the inspection documents or DRs reviewed during the hardware item assessment were identified during this part of the assessment. Each inspectors' certifications were reviewed to ensure that the inspector was properly certified to perform the inspection at the time performed. All but one were found to be properly certified. The following finding was issued:

- Readiness Review Finding 19-20 (Level II)

  Description: Two conduit support QA records were signed by a Level I raceway certified inspector who signed the records as a Level II raceway inspector. This deviates from field procedures QC-A-01 and QC-A-02.

  Project Response: Electrical QC has identified 10 other inspectors who have inspected raceway supports and do not possess a Level II Raceway Certification. This lack of proper certification was determined to be limited to raceway support scope inspection.

  Although the inspectors who signed raceway support reports were not certified Level II raceway inspectors, they were certified Level II in visual testing. This practice was acceptable to EQC management during the period in question, because the qualifications required for an inspector to visually accept welds are nearly equivalent to those required to accept the entire support. For example, use of both certifications in the raceway group require the inspector to be knowledgeable of the raceway support drawings, the same material types, and the proper use of measuring devices. The only knowledge needed to complete their qualifications was the bolted assembly requirements (i.e., bolt/nut sizes, torque requirements). This knowledge was provided by in-house training.

  In summary, the same basic inspection techniques, qualifications, in-house training, and knowledge are identical for both certifications when used in the raceway group to inspect supports and welds; therefore, these 11 inspectors were qualified to accept raceway supports. No correction of existing documentation is required. No further corrective action is required since this practice was stopped in June 1985.

  Readiness Review Conclusion: Readiness Review concurs with the response.

6.2.3.3.4. Welder Qualification

During the hardware item assessment, the welders stamp adjacent to the weld were recorded and checked against those recorded on the inspection reports and the welder certification list to ensure that the welder was qualified to perform the work. Thirty-nine welders were identified and each welder was found to be properly qualified.

6.2.3.3.5 Material Traceability

Support components or assemblies that are fabricated in the site contractor shop are stamped with a Contractor Miscellaneous Steel (CMS) number. During the hardware assessment, 22 CMS numbers stamped on the support assemblies were identified and the associated documentation was reviewed to ensure compliance with the appropriate procedures. No discrepancies were noted during this part of the assessment.

TABLE 6.2-1 (SHEET 1 OF 3)

SUMMARY OF CONSTRUCTION ASSESSMENT FINDINGS

RRF Number	Description	Level of Significance[a]
19-6	The following are isolated cases of incomplete design information: 1. Detail does not specify the orientation of the connection angles and no alternate weld detail are specified for skewed connections. 2. Detail specifies "1±" as a tolerance without stating an actual "±" allowance.	II
19-8	1. One out of four strut nuts attaching CS-507-111-026 to channel is not engaged. 2. Four of 16 bolts attaching CS-302-44-005 to channel are bearing on the back of the channel. 3. Eight of 12 bolts attaching CS-512-B03-062 to channel are bearing on the back of the channel.	II
19-9	The strap attaching the conduit to CS-302-70-009 is not attached to the support (stud nut is damaged).	II
19-10	1. CS-302-70-008, -009, -010 are numbered with the incorrect drawing number (1X3DF302 vs. 1X3DF120). 2. CS-411-53-084 has two inspection reports for different configurations which indicates a duplication of numbers on different supports.	III
19-11	The following supports differ in configuration from the allowable details: 1. CS-411-053-030 was missing a required brace. 2. CS-507-111-026 had smaller size material installed (2 1/2 X 2 1/2 in. angle vs. 3 X 3 in.). 3. BS-51B-B03-040 detail used was not permitted with installed ECSA connector. Also, smaller size material was installed (3 1/2 X 3 1/2 in. tube sheet vs. 4 X 4 in.). 4. CS-302-70-008 was attached to embedded strut with bolt through hole in an exposed strut. There was no detail for this configuration. 5. CS-302-44-167 has added welds between tube steel arms and tube steel cross members.	I

TABLE 6.2-1 (SHEET 2 OF 3)

RRF Number	Description	Level of Significance[a]
19-12	TS-012-33 missing is stiffener plate.	I
19-13	1. Thirteen out of 56 spring stud nuts (with indicator lines) do not have the indicator line perpendicular to the face of the strut channel. 2. Thirty-two of 216 spring stud nuts and 6 out of 24 spring nuts do not have both grooves fully engaged with the strut channel. 3. Three out of 240 spring/stud nuts were not properly torqued.	II
19-14	CS-302-44-184 and TS-129-214 are welded into the 1-in. edge boundary of the embedded plate.	II
19-15	A strut was added to CS-314-48-081 after QC inspection without a rework request or DR.	II
19-16	Undersized skewed welds exist on the following: TS-421-127, TS-123-66, TS-123-71, TS-110-222, TS-012-32, and TS-007-20.	II
19-17	1. TS-002-6 is missing the required end return welds. 2. TS-110-222 is missing the additional welds required when the minimum length is not met. 3. TS-002-6 plate to tube steel weld is undersized by 1/16 to 3/32 in. on the obtuse side. 4. CS-51A-B03-38 plate to flange edge weld is undersized up to 3/16 in. 5. Bolted connection was made beyond last segment of intermittent fillet weld attaching Unistrut to tray support vertical member. 6. Undercut is greater than 1/16 in. on TS-123-71 and CD-504-111-046.	II
19-18	1. For TS-123-71, the field used an inappropriate detail for bridging. 2. For TS-123-66, bracing exceeds allowable angle tolerances. 3. For TS-123-71, the angle between the brace and bolted strut/plate exceeds allowable tolerance. 4. For TS-129-214, tray to support angle exceeds tolerance.	II

TABLE 6.2-1 (SHEET 3 OF 3)

RRF Number	Description	Level of Significance[a]
19-19	1. For conduit/equipment/tray support the associated inspection documentation: a. is not in agreement with the installed hardware and/or b. reflects inspections of only portions of the complete assembly, or c. could not be located, or d. is incompletely filled out. 2. For supports whose associated raceways were accepted between 12/14/81 and 12/10/82 without associated bracing and stiffeners, no assurance exists that the bracing or stiffeners would have been installed and/or inspected.	III
19-20	Inspection reports for CS-503-B10-028 and CS-51A-B03-038 were completed by an inappropriately certified inspector.	II

a. Level I - Violation of licensing commitments, project procedures, or engineering requirements with indication of safety concern.
Level II - Violation of licensing commitments or engineering requirements with no safety concerns.
Level III - Violation of project procedures with no safety concerns.

TABLE 6.2-2 (SHEET 1 OF 2)

FINDINGS GROUPED BY PROBLEM CATEGORIES

Finding	Level	Description
		Installation/Documentation Discrepancies
19-9	II	Broken conduit strap attachment bolt.
19-10	III	1. Duplicated support numbers. 2. Unnumbered support.
19-11	II	2. Incorrect supporting member size. 3. Incorrect attachment method. 4. Added welds.
19-15	II	Support reworked without Rework Request.
19-17	II	1. Missing end return weld. 2. Missing alternate weld. 4. Incorrect intermittent weld. 5. Excessive undercut on two welds.
19-19	III	Documentation incomplete/incorrect.
		Drawing Interpretation
19-2	II	Single-support conduits.
19-6	II	Tolerance for end connection.
19-11	I	1. Missing brace on type 4 and 5 conduit supports.
19-14	II	Welding into the 1-in. border on embed plates.
19-16	II	Skewed weld undersized.
19-17	II	3. Undersized welds.
19-23	II	Junction box support/conduit attachment.
		Completion Status
19-12	I	Tray supports only partially turned over/accepted.

TABLE 6.2-2 (SHEET 2 OF 2)

Finding	Level	Description
		Spring/Stud Nuts
19-8	II	1. Strut nut not engaged. 2. Strut nut bottomed out against channel.
19-13	II	Indicator line not perpendicular.
		Inspector Certification
19-20	II	Inspectors not certified as Level II.

TABLE 6.2-3

ASSESSMENT ATTRIBUTES

Hardware	Programmatic
o Inspection Attributes	o Inspector Certification
- Location.	- Certified at time of inspection.
- Identification.	- Certification appropriate for inspection activity.
- Configuration.	o Welder Qualification
- Material.	- Qualification current.
- Dimensions.	- Qualified for process.
- Orientation.	o Measuring and Test Equipment
- Bolting.	- Traceability.
- Welds.	- Calibration current.
o Documentation Attributes	- Used in correct range.
- Completeness.	o Record Storage
- Item identification.	- Retrievability.
- Drawing/procedure identification.	- Completeness.
- Calibrated tools Recorded.	
- Procedure conformance.	

TABLE 6.2-4

VERIFICATION SAMPLE LISTING

Tray Supports

TS-002-6
TS-002-54
TS-007-20
TS-008-1
TS-012-32
TS-012-33
TS-110-222
TS-110-286
TS-110-287
TS-110-401
TS-123-66
TS-123-71
TS-129-214
TS-133-16
TS-415-115
TS-415-155
TS-421-102
TS-421-127

Conduit Supports

CS-302-44-167
CS-302-44-184
CS-302-70-008
CS-302-70-009
CS-302-70-010
CS-304-25-006
CS-304-25-018
CS-314-48-038
CS-314-48-081
CS-411-053-30
CS-411-053-084
CS-421-105-001
CS-50B-B10-155
CS-51A-B03-038
CS-51A-B03-246
CS-503-B10-028
CS-504-111-046
CS-507-111-026

Electrical Box Supports

BS-302-44-005
BS-51B-B03-040
BS-504-111-023
BS-512-B03-062

Transformer Support

Equipment No.
1-1808-T3-064

CHECKLIST COMPLETION INSTRUCTIONS

- Checklists will be completely filled out
  - Items acceptable checked and initialed
  - Items not applicable marked N/A
  - Items not verified (not visible or unreachable) marked NV and the reason indicated in remarks
  - Items unacceptable marked NO and discrepant condition noted in remarks. Finding numbers will be noted when issued.
- Checklist cover sheets will be signed and dated on the day the item was assessed
- Changes to completed checklists will be initialed and date
- If necessary to clearly identify items assessed, a sketch will be attached to the checklist

0064s/041-6

Figure 6.2-1 Checklist Completion Instructions

VERIFICATION PLAN CHECKLIST

MODULE 19
CONDUIT/BOX SUPPORTS

Conduit/Box Support Number _____

Building/Room Number _____

Layout Drawing _____

PROCEDURE/SPECIFICATION	REVISION/DATE
ED-T-02	_____
X3AR01-F8	_____
X2AP01-C9	_____
_____	_____
_____	_____

VERIFICATION TEAM MEMBERS

NAME	DATE
_____	_____
_____	_____
_____	_____

REMARKS:

0018s/063-6/2

Figure 6.2-2 Conduit/Box Supports Checklist (Sheet 1 of 5)

VERIFICATION PLAN CHECKLIST

MODULE 19
CONDUIT/BOX SUPPORTS

CHECKLIST ITEM	REF. DOC.	RESULTS/REMARKS
1. Identified per procedure o Support identification _____	ED-T-02 4.1.1 Exhibit 12	Acceptable _____
2. Located per drawing and/ or spec. requirement o Detail drawings _____ _____ _____ _____ _____ o Maximum Span _____	X3AR01-E8 8.7.M 8.7.2.M 8.7.2.R Attach. B 1.2.1.L AX2D94V050 Note 9 AX2D94V052 Note 2 ED-T-02 Exhibit 12	Acceptable _____
3. Material o Proper type & size o Galvanized/coated o Shop/field fabricated material identified CMS number _____ _____	X3AR01-E8 8.6.C ED-T-02 3.5.1 4.1 X2AP01-C9.1 9.1.4.8 9.1.4.9	Acceptable _____
onfiguration per design drawing details o Bracing o Stiffners o Work points o No unauthorized attachments o Embed attachment guidelines adhered to	AX2D94V05X Notes and details AX2D94V006 ED-T-02 Exhibit 12	Acceptable _____

0018s/063-6/3

Figure 6.2-2 Conduit/Box Supports Checklist (Sheet 2 of 5)

VERIFICATION PLAN CHECKLIST

MODULE 19
CONDUIT/BOX SUPPORTS

CHECKLIST ITEM	REF. DOC.	RESULTS/REMARKS
5. Welding o Located per detail o Correct size & length o Visual acceptance per Appendix "VC" o No unspecified welds added Welder IDs _____ _____	AX2D94V05X Notes and details Appendix "VC" QC-T-05 GD-T-13 AX2D94V002	Acceptable _____
6. Bolted assemblies o Bolt size _____ o Bolt torque _____ o Locking devices o Full bearing against surfaces o Thread engagement o Stud nuts oriented correctly o bolts into strut channel not bearing against back of channel	X3AR01-E8 8.7.2 8.7.1.M ED-T-02 4.1 Exhibit 12 X2AP01-C9.1 C9.1.4.9 AX2D94V05X Notes and details	Acceptable _____
7. Expansion anchors/ maxi-bolts o Size _____ o Torque _____ o Spacing o Edge distance	X2AP01-C9 Att #1 Att #3 Att #5 GD-T-27 GD-T-24	Acceptable _____

0018s/063-6/4

Figure 6.2-2 Conduit/Box Supports Checklist (Sheet 3 of 5)

VERIFICATION PLAN CHECKLIST

MODULE 19
CONDUIT/BOX SUPPORTS

CHECKLIST ITEM	REF. DOC.	RESULTS/REMARKS
8. Review documentation and verify the following records are complete and on file (as applicable):		Acceptable _____
A. Elec. contractor fab. request	ED-T-26	
B. Elec. raceway support turnover/inspection	ED-T-02	
C. Raceway support weld inspection report	QC-T-05	
D. Mis. daily inspection form	QC-T-05	
E. Punchlist	GD-T-01	
F. Concrete expansion anchor inspection report	GD-T-27	
G. Concrete expansion anchor and hole report	GD-T-27	
H. Maxi-bolt expansion anchor inspection report	GD-T-24	
I. Maxi-bolt expansion anchor and hole report	GD-T-24	
J. Rework request	ED-T-17	
9. Qualification		Acceptable _____
o QC inspectors	QC A-01	
Name Level Date		
_____		
_____		
_____		
_____		
o Welders	WG-T-01	
Name Proc Date		
_____		
_____		
_____		
_____		

0018s/063-6/5

Figure 6.2-2 Conduit/Box Supports Checklist (Sheet 4 of 5)

VERIFICATION PLAN CHECKLIST

MODULE 19
CONDUIT/BOX SUPPORTS

CHECKLIST ITEM	REF. DOC.	RESULTS/REMARKS
10. Calibrated equipment o Torque wrench Number Date _____ _____ _____ o Hydraulic tensioner Number Date _____ _____ _____	GD-A-04	Acceptable _____
11. Material traceability CMS HT# COC/COM/CMTR (Y/N) _____ _____ _____	ED-T-26 QC-T-05 X2AP01 X2AH17	Acceptable _____

0018s/063 6/6

Figure 6.2-2 Conduit/Box Supports Checklist (Sheet 5 of 5)

VERIFICATION PLAN CHECKLIST

MODULE 19

CABLE TRAY SUPPORTS

Tray Support Number _____

Building/Room Number _____

Layout Drawing _____

Schedule Drawing _____

Procedure/ Specification	Revision/Date
ED-T-02	_____
X3AR01-E8	_____
X2AP01-C9	_____
_____	_____
_____	_____

VERIFICATION TEAM MEMBERS

Name	Date
_____	_____
_____	_____
_____	_____

0016s/063-6/2

Figure 6.2-3 Cable Tray Supports Checklist (Sheet 1 of 5)

VERIFICATION PLAN CHECKLIST

MODULE 19

CABLE TRAY SUPPORTS

CHECKLIST ITEM	REF. DOC.	RESULTS/REMARKS
1. Located per location drawing and/or specification requirements. o Support Type _____ o Layout Dwg. _____ o Schedule Dwg. _____ o Detail Dwgs. _____ _____ _____ _____ o Maximum Spacing _____	o X3AR01 E8 8.7.M Attachment B 1.2.1.L o X2AP01 C5 5.1.6.A.3 o ED T 02 Exhibit 12 1.4.a 2.5.d o AX2D66N001 Note 16 Note 35	Acceptable _____
2. Orientation and configuration per design drawing(s) o Bracing o Stiffeners o Work Points o Eccentricity o No Unauthorized Attachments o Embed Attachment Guidelines Adhered To	o X3AR01 E8 8.7.1.L Attachment A 1.2.6.C o ED T 02 Exhibit 12 1.4.c o AX2D66N001 o AX2D94V006	Acceptable _____
3. Material o Proper Type and Size o Galvanized/Coated o Shop/Field Fabricated Material Identified CMS No. _____ o No Unapproved Alterations o No Visible Damage	o X2AP01 C9.1.4.8 C9.1.4.9 o X3AR01 E8.7.L o AX2D66N001 o ED T 02 Exhibit 12 1.1a,b,e	Acceptable _____
4. Dimensions o Lengths Within Tolerances o Clearances Acceptable	o ED T 02 Exhibit 12 1.4b,d o AX2D66N001	Acceptable _____

0016s/063-6/3

Figure 6.2-3 Cable Tray Supports Checklist (Sheet 2 of 5)

VERIFICATION PLAN CHECKLIST

MODULE 19

CABLE TRAY SUPPORTS

CHECKLIST ITEM	REF. DOC.	RESULTS/REMARKS
5. Welding o Located per Design o Correct Size and Length o Visual Acceptance per Appendix VC o No Unspecified Welds o Welder ID _____	o AX2D66N001 o AX2D66N013 o AX2D66N032 o AX3D94V002 o AX2D94V006 o Appendix VC o GD-T-13 - 3.3 o QC-T-05 - 5.8.5	Acceptable _____
6. Bolted Assemblies o Bolt Size _____ o Bolt Torque _____ o Locking Devices o Full Bearing Against Surfaces o Thread Engagement o Spring Nuts Oriented/ Engaged Correctly o Bolts not Bearing on Back Surface of Strut or Insert	o X3AR01 - E.8.7.1M,N,R o X2AP01 - C9.7.4.9 o ED-T-02 - Exhibit 12 o AX2D66N001	Acceptable _____
7. Expansion Anchors/Maxi-Bolts o Size _____ o Torque _____ o Spacing o Edge Distance	o X2AP01-C9.7 - Attachments 1,2,3 o GD-T-27 o GD-T-24	Acceptable _____

0016s/063-6/4

Figure 6.2-3 Cable Tray Supports Checklist (Sheet 3 of 5)

VERIFICATION PLAN CHECKLIST

MODULE 19

CABLE TRAY SUPPORTS

CHECKLIST ITEM	REF. DOC.	RESULTS/REMARKS
8. Review documentation and verify the following records are complete and on file (as applicable):		Acceptable _____
a. Electrical contractor fabracation request	ED T 26	
b. Electrical raceway support turnover/ inspection	ED T 02	
c. Raceway support weld inspection report	QC T 05	
d. Miscellaneous daily inspection form	QC T 05	
e. Punchlist	GD T 01	
f. Concrete expansion anchor inspection report	GD T 27	
g. Concrete expansion anchor and hole report	GD T 27	
h. Maxi bolt expansion anchor inspection report	GD T 24	
i. Maxi bolt expansion anchor and hole report	GD T 24	
j. Rework request	ED T 17	
9. Qualification o QC Inspectors Name Level Date _____ _____ _____ _____	QC A 01	Acceptable _____

0016s/063-6/5

Figure 6.2-3 Cable Tray Supports Checklist (Sheet 4 of 5)

VERIFICATION PLAN CHECKLIST

MODULE 19

CABLE TRAY SUPPORTS

CHECKLIST ITEM	REF. DOC.	RESULTS/REMARKS
o Welders Name Proc. Date _____ _____ _____ _____ _____	WG T-01	
10. Calibrated Equipment o Torque Wrench Number Date _____ _____ _____ o Hydraulic Tensioner Number Date _____ _____ _____	GD A-04	Acceptable _____
11. Material Traceability CMS HT # COPCM/CMTR (Y/N) _____ _____ _____ _____	X2AP01 X2AH17 ED-T-26 QC-T-05	Acceptable _____

0016s/063-6/6

Figure 6.2-3 Cable Tray Supports Checklist (Sheet 5 of 5)

7.0 INDEPENDENT DESIGN REVIEW

The Readiness Review process includes an independent review of design documents, such as system design criteria, calculations, specifications, and drawings, to ascertain whether proper design requirements were considered and whether design documents correctly implement licensing commitments. This review is being conducted by Stone & Webster Engineering Corporation and includes a team of technical and professional experts to assess the technical adequacy of the design of the work covered by this and other modules. This Independent Design Review (IDR) ensures that the design technically meets commitments and that the electrical supports within the scope of this module are in fact adequate. The results of the IDR will be provided as a separate report.

The IDR is conducted in two parts. One is an integrated evaluation of selected systems across all disciplines; the second is an evaluation of the structural aspects [reinforced concrete structures (Module 1), structural steel (Module 8), foundation materials and backfill (Module 13A), etc.] of the project design. The integrated IDR (including electrical supports) will be issued as a separate report; the structural reviews will be issued with the applicable structural modules.

8.0 PROGRAM ASSESSMENT/CONCLUSION

8.1 SUMMARY OF OPEN CORRECTIVE ACTIONS

8.1.1 ENGINEERING

- Readiness Review Information Request 112

  Action: Complete calculation X2CQ6.6, Lighting and Communication Supports.

  Responsible Organization: Project Engineering.

  Completion Date: June 30, 1986.

- Finding 19-2

  Action:

  A. Disposition Deviation Report (DR) ED-12048, which deals with identified discrepant installations.

  B. Process Deficiency Evaluation Report (DER) 144 in accordance with project procedures.

  Responsible Organization: Project Engineering.

  Completion Date: April 15, 1986.

- Finding 19-4

  Action: Review and revise cable tray and conduit support calculations to provide comparison of support reactions and embed capacities.

  Responsible Organization: Project Engineering.

  Completion Date: April 30, 1985.

8.1.2 CONSTRUCTION

- Finding 19-11

  Action:

  A. Evaluate missing braces on DR-ED-12183.

  B. Evaluate DER-145.

Responsible Organization: Project Engineering.

Completion Date: April 15, 1986.

- Finding 19-12

  Action: Issue Field Procedure ED-T-33.

  Responsible Organization: Project Construction.

  Completion Date: April 25, 1986.

- Finding 19-14

  Action: Revise drawing AX2D94V006, detail 11 and note 3 to more clearly indicate requirements for 1-in. border.

  Responsible Organization: Project Design/Project Construction.

  Completion Date: April 18, 1986.

8.2 QUALITY ASSURANCE STATEMENT

The process for the development of Module 19 was monitored by the Readiness Review quality assurance (QA) staff for general adequacy.

The primary focus of the monitoring effort was the identification, documentation, analysis, and resolution of Readiness Review Findings. The finding reports issued by the Readiness Review Team and their responses were reviewed, individually and collectively, for root causes and generic issues; i.e., trends. Based upon review of the responses and commitments to individual finding reports and generic concerns, the resolutions were determined to be adequate. All findings were initially distributed to project QA for review for reportability [10 CFR 21, 10 CFR 50.55(e)] in accordance with existing QA procedures. In addition, findings were screened by Readiness Review to determine whether any required additional evaluation by the Project for reportability. Nine were so identified, but subsequently only two were determined to be reportable by the Project as of April 7, 1986.

Other monitoring activities consisted of reviewing personnel qualification and training records for the team members, reviewing the verification plan, and reviewing completed checklists to ensure adequate identification of findings. Additionally, an independent reverification was performed on a sampling basis under Readiness Review QA overview to determine the adequacy of the commitment/implementation matrixes and the Design/Construction verification efforts.

Based upon these monitoring efforts, this module and the Readiness Review Team conclusions are judged to be acceptable.

John H. Draggs
Readiness Review Team
Quality Assurance Representative

April 10, 1986

VOGTLE ELECTRIC GENERATING PLANT

TECHNICAL CONSULTANT REPORT
ROBERT C. WIESEL

MODULE 19 - ELECTRICAL SUPPORTS

Module 19 addresses the design and construction activities associated with electrical supports located within Seismic Category I areas of the plant. My assignment has been to provide independent technical oversight of the Readiness Review team's assessment of these activities.

To become familiar with the work that has been performed for Plant Vogtle, I reviewed applicable sections of the Final Safety Analysis Report, applicable sections of the General Civil Design Criteria, the Interdiscipline Seismic Design Criteria, the Raceway Supports design criteria, and applicable sections of the specifications and field procedures. Several trips were made to the site to meet with the responsible Discipline Manager, Team Leaders, and the Team Members who performed the Construction Verification and programmatic Design Verification. Discussions with members of the Independent Design Review Team were also held in Boston.

During the course of implementing Module 19, I performed the following specific activities:

- Provided input to the preparation of the review plans for the Construction Verification and programmatic Design Verification. Input included discussion of current industry problems based upon experience at other projects and NRC bulletins.

- Reviewed the various findings, project responses, and final resolution of the findings.

- Reverified, on a sample basis, the commitment implementation matrix and the construction records that were reviewed during the Construction Verification.

- Reviewed and commented on the Module 19 Report.

- Attended applicable Meetings of the Readiness Review Board.

It is my assessment that the Readiness Review effort adequately and accurately assessed the work related to Module 19. As evidenced by the matrices presented in Section 3 of the module report, all commitments appear to have been properly incorporated into implementing documents. The documentation selected for review was sufficiently extensive to verify adequate control of the design and construction efforts related to this module.

The findings and corrective actions are identified in Section 6 of this module report. Of the three Level I findings identified, two findings (19-2 and 19-11) required rework of the installed hardware and are being evaluated for reportability. The findings involved misinterpretation of drawings

resulting in a number of conduit runs being supported by a single support (Finding 19-2) and a number of conduit runs being installed without the required bracing (Finding 19-11). The corrective action committed to by the project included clarification of the misinterpreted drawing details including review for retrofit applicability.

The third Level I finding (19-12) identified a missing tray support stiffener. Upon review of this finding, it was determined that procedures allowed the turnover and inspection of partially completed tray supports but did not require tracking of the uninstalled hardware. The corrective action that was committed to include field procedure implementation to control and ensure tray support completeness.

I concur with the corrective action and resolution of all findings as described in Section 6 of the module report. I conclude that with the committed corrective action, adequate controls exist to ensure the quality of work and the implementation of licensing commitments within the scope of Module 19. Furthermore, the design and construction programs that govern the electrical supports have produced a final product that meets design requirements and licensing commitments.

R C Wiesel

Robert C. Wiesel

Electrical Supports - Module 19

Readiness Review Board Acceptance

The Readiness Review Board has been apprised of the scope and content of Module 19, Electrical Supports.

The Board has reviewed the program verification, as well as corrective actions, both proposed and implemented, by the Vogtle Project. Based upon this review and based upon the collective experience and professional judgement of the members, the Readiness Review Board is of the opinion that the corrective actions proposed are acceptable, and that the electrical supports system at Plant Vogtle is sound and complies with commitments set forth in the FSAR and acceptable practices.

APPROVED: Doug Dutton DATE: 4-8-86

Doug Dutton
Chairman, Readiness Review Board
Vogtle Electric Generating Plant

0073s/063-6

Georgia Power Company
Project Management
Post Office Box 282
Waynesboro, Georgia 30830
Telephone 404 724-8114
404 554-9961

Southern Company Services, Inc.
Post Office Box 2625
Birmingham, Alabama 35202
Telephone 205 870-6011

Vogtle Project

Date: April 9, 1986

Re: Plant Vogtle - Units 1 & 2
Readiness Review Module 19
File: X7BD102 Log: SS-5491

From: O. Batum

To: W. C. Ramsey

Engineering has reviewed Module 19, Electrical Supports, for general accuracy and completeness. To the best of our knowledge and belief, the module is a complete and accurate representation of the Electrical Supports, and the engineering process and commitments related thereto.

Ozen Batum
Deputy to Vice President
Project Engineering

xc: Project File

Interoffice Correspondence

Georgia Power

April 10, 1986

MEMO TO: W.C. Ramsey

SUBJECT: Plant Vogtle - Units 1 & 2
Readiness Review Module 19

FILE NO: X7BD102

CORRESPONDENCE NO: TSG - 034

SECURITY CODE: NC

Nuclear construction has reviewed Module 19. To the best of our knowledge and belief, the Module is a complete and accurate representation of the site Electrical Support program and commitments related thereto.

M.H. GOOGE
Project Construction Manager

MSG/GB/rp

700026A

8.6 RESUMES

The following resumes present a brief professional history of the personnel involved in the development of Module 19.

JOSEPH ARBAIZA, Senior Quality Engineer, Team Member

Mr. Arbaiza has been employed by Bechtel Power Corporation since 1973.

Mr. Arbaiza has held the positions of project quality engineer (PQE) on Grand Gulf Nuclear Station (GGNS), Unit 2, and deputy PQE on GGNS, Unit 1. His duties included reviewing project engineering and vendor documents for compliance with engineering and quality program requirements, preparing and revising project engineering procedures, and representing the project engineer on matters related to quality (audits, training, etc.).

Education:

Finlay College
B.S., Mechanical Engineering

P.E., State of California

DAVID L. EDENFIELD, Engineering Supervisor, Construction Team Leader

Mr. Edenfield has been employed by Georgia Power Company at the Vogtle site for over 7 years. His responsibilities have included electrical design, construction, and maintenance of site construction support facilities, construction interface activities between craft and design for raceway and raceway supports, and supervision of construction interface activities for cable pulling and termination. His most recent assignment was supervision of electrical construction interface for balance of plant areas.

Education:

Georgia Institute of Technology
Bachelor of Electrical Engineering

THOMAS W. GEORGE, Quality Control Engineer, Team Member

Mr. George has been employed by Bechtel Power Corporation since 1981. He has 5 years experience in inspection and documentation of the welding of structural steel and piping in nuclear power plants. His work history includes an assignment to the Hope Creek Nuclear Power Plant.

ERIC W. JOHNSTON, Engineer, Team Member

Mr. Johnston has been employed by Stone & Webster Engineering Corporation since 1982. He was assigned to the Millstone Nuclear Power Plant Unit 3, where he supervised the Cable Tray Support Verification Group and confirmed the structural integrity of tray support systems. He was responsible for the structural integrity of safety-related cable tray supports and, as an earlier assignment, for designing electrical supports using conventional and computer-aided design methods.

Prior to joining Stone & Webster Engineering Corporation, Mr. Johnston was a senior structural engineer for Newport News Shipbuilding where he designed equipment and facilities needed for refueling nuclear naval vessels.

Education:

Southeastern Massachusetts University
B.S., Civil Engineering

P.E., State of Connecticut

MICHAEL A. NORM, Senior Quality Control Engineer, Team Member

Mr. Norm has been employed by Bechtel Power Corporation since 1977 and has 10 years experience inspecting welds, piping, and tanks during nuclear power plant construction projects. His work history includes assignments to the Calvert Cliffs; Limerick; Zimmer; Hope Creek; and Washington Public Power Supply System Units 1, 2, and 4 nuclear power plants.

VEERABHADRA R. TADIKONDA, Engineering Supervisor, Team Member

Mr. Tadikonda began his employment with Bechtel Power Corporation in 1973 and has 12 years experience in the civil/structural design of nuclear power plants.

He is currently assigned to the San Onofre Nuclear Generating Station where he assists the Civil/Structural Design Team. Prior to this assignment, he worked at the site office of the Korea Nuclear Power Plant Units 5 and 6, where his duties included evaluating and resolving design conflicts and construction deviations. Mr. Tadikonda also has experience at the Kuosheng Nuclear Power Plant and was responsible for assisting in the design of the auxiliary and fuel handling building. Prior to joining Bechtel Power Corporation, he worked in several industrial plants.

Education:

Andhra University
B.S., Civil Engineering

I.I.T., Kharagpur, India
M.S., Civil Engineering

M. R. THAKAR, Project Engineer, Team Leader

Mr. Thakar has been employed by Bechtel Power Corporation since 1965.

He has over 15 years of nuclear power construction experience and has held supervisory and engineering management positions at San Onofre Nuclear Generating Station, Vogtle Electric Generating Plant, Palo Verde Nuclear Generating Station, and the South Texas Nuclear Project.

Other engineering experience involves fossil fuel electric generating plants and various industrial construction projects.

Education:

Sardar Vallabhbhai University (Gujarat State, India)
B.S., Civil Engineering

University of Iowa
M.S., Civil Engineering

Pepperdine University, Los Angeles, California
Master of Business Administration

P.E., State of California
P.E., State of Georgia

0081s/094-6