COMANCHE PEAK
STEAM ELECTRIC STATION

UNIT 1 and COMMON

CORRECTIVE ACTION PROGRAM

PROJECT STATUS REPORT

MECHANICAL SUPPLEMENT A
SYSTEMS INTERACTION

TU ELECTRIC

Generating Division

Revision 0

TU ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION
UNIT 1 AND COMMON

EBASCO SERVICES INCORPORATED
PROJECT STATUS REPORT

SYSTEMS INTERACTION PROGRAM

SUPPLEMENT A
MECHANICAL PROJECT STATUS REPORT

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EXECUTIVE SUMMARY

The Systems Interaction Program (SIP) consists of evaluations of the interactions with Comanche Peak Steam Electric Station (CPSES) components resulting from pipe breaks, internal missile generation and seismically induceu failures of non-seismic systems, structures and components.

This Project Status Report (PSR) summarizes the systematic validation process for the Systems Interaction Program (SIP) implemented by Ebasco Services Incorporated (Ebasco) at CPSES Unit 1 and Common[1]. This Project Status Report (PSR) presents the results of the design validation and describes the Post Construction Hardware Validation Program (PCHVP). Ebasco's activities are governed by the TU Electric Corrective Action Program (CAP) which required Ebasco to:

1. Establish a consistent set of CPSES systems interaction design criteria that complies with the CPSES licensing commitments.

2. Produce a set of design procedures that assures compliance with the design criteria.

3. Evaluate interactions of systems, structures and components, and direct the corrective actions recommended by the Comanche Peak Response Team (CPRT) and those determined by the Corrective Action Program (CAP) investigations to be necesssary to demonstrate that systems, structures and components are in conformance with the design.

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1 Common refers to areas in CPSES that contain both Unit 1 and Unit 2 systems, structures, and components.

4. Assure that the validation resolves the systems interaction related issues identified by the Comanche Peak Response Team (CPRT), external sources[2], and the Corrective Action Program (CAP).

5. Validate that the design of systems, structures and components addressed in the Systems Interaction Program (SIP) is in conformance with the licensing commitments and that the installed hardware is in conformance with the validated design.

6. Produce a set of consistent and validated design documentation.

Consistent design criteria and engineering methodologies for CPSES Unit 1 and Common systems interaction have been developed and used by Ebasco for the design validation process. These design criteria and engineering methodologies are in conformance with the CPSES licensing commitments. These design criteria have been independently and extensively reviewed by the Comanche Peak Response Team (CPRT).

Ebasco developed design and design control procedures to implement the design criteria and engineering methodologies and to govern the work flow and technical interfaces with other disciplines, for both the design and hardware validation processes. These procedures specify the validation processes that have been implemented throughout the systems interaction portion of the Corrective Action Program (CAP).

Ebasco has performed analyses to validate the design of CPSES Unit 1 and Common systems, structures and components addressed in the Systems Interaction Program (SIP). The as-built hardware related to systems interaction are being validated to the design by the Post Construction Hardware Validation Program (PCHVP).

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2 External sources include:
- NRC Staff Special Review Team (SRT-NRC)
- NRC Staff Special Inspection Team (SIT)
- NRC Staff Construction Appraisal Team (CAT)
- Citizens Association for Sound Energy (CASE)
- Atomic Safety and Licensing Board (ASLB)
- NRC Region IV Inspection Reports
- NRC Staff Technical Review Team (TRT) [SSERs 7-11]
- CYGNA Independent Assessment Program (IAP)

Comanche Peak Response Team (CPRT) issues are identified by the following:
- CPRT Design Adequacy Program (DAP)
- CPRT Quality of Construction Program (QOC)

The systems interaction related design and hardware issues identified by the Comanche Peak Response Team (CPRT) and the Corrective Action Program (CAP) have been resolved by incorporation of engineering methodologies and design criteria into the Systems Interaction Program (SIP) design and design control procedures and the Post Construction Hardware Validation Program (PCHVP) implementation procedures.

The Post Construction Hardware Validation Program (PCHVP) assures that the systems, structures and components addressed in the Systems Interaction Program (SIP) are installed in conformance with the validated design. The Post Construction Hardware Validation Program (PCHVP) for the Systems Interaction Program (SIP), including engineering walkdowns and evaluations, implements the corrective actions identified by the Comanche Peak Response Team (CPRT), as well as those required by Corrective Action Program (CAP) investigations.

Ebasco will provide TU Electric with a complete set of validated design documentation for the Systems Interaction Program (SIP) including calculations, specifications and interaction evaluations. This documentation, in conjunction with the Systems Interaction Program (SIP) procedures, can provide the basis for CPSES configuration control[3] to facilitate maintenance and operation throughout the life of the plant.

In-depth quality and technical audits and surveillances performed by Ebasco Quality Assurance (QA), TU Electric Quality Assurance (QA) and the independent Engineering Functional Evaluation (EFE) verified that the implementation of the validation program was in conformance with 10CFR50, Appendix B, quality assurance requirements. These audits assure that the systems interaction procedures, design criteria, and design comply with the licensing commitment.

The CPSES Unit 1 and Common systems interaction portion of the Corrective Action Program (CAP) conducted by Ebasco as part of the overall CPSES CAP validates that:

- The design for interaction between systems, structures and components complies with the CPSES licensing commitments
- The as-built hardware configuration addressed in the Systems Interaction Program (SIP) complies with the validated design;
- The safety-related systems, structures, and components comply with the systems interaction related CPSES licensing commitments and will perform their safety-related functions.

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3 Configuration control is a system to assure that the design and hardware remain in compliance with the licensing commitments throughout the life of the plant.

ABBREVIATIONS AND ACRONYMS

ANI	Authorized Nuclear Inspection
ANSI	American National Standards Institute
ASLB	Atomic Safety and Licensing Board
CAP	Corrective Action Program (TU Electric)
CAR	Corrective Action Request
CASE	Citizens Association for Sound Energy
CAT	Construction Appraisal Team (NRC)
CFR	Code of Federal Regulations
CPE	Comanche Peak Engineering (TU Electric)
CPRT	Comanche Peak Response Team (TU Electric)
CPSES	Comanche Peak Steam Electric Station
CYGNA	CYGNA Energy Services
DAP	Design Adequacy Program (CPRT)
DBD	Design Basis Document
DBCP	Design Basis Consolidation Program
DR	Deficiency Report
DVP	Design Validation Package
Ebasco	Ebasco Services Incorporated
ECE	Engineering and Construction - Engineering (TU Electric)
EFE	Engineering Functional Evaluation
EME	Engineering-Mechanical Engineering (TU Electric)
FSAR	Final Safety Analysis Report
FVM	Field Verification Method
GIR	Generic Issues Report
HVAC	Heating, Ventilation and Air Conditioning
HELB	High Energy Line Break
I&E	Inspection and Enforcement (NRC)
IAP	Independent Assessment Program (CYGNA)
Impell	Impell Corporation
IRR	Issue Resolution Report (CPRT)
ISAP	Issues Specific Action Plan (CPRT)
MELB	Moderate Energy Line Break
NCR	Nonconformance Report
NOD	Notice of Deviation (NRC)
NOV	Notice of Violation (NRC)
NRC	United States Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NUREG	NRC Document
OSP	Office of Special Projects (NRC)
PCHVP	Post Construction Hardware Validation Program
PSR	Project Status Report
QA	Quality Assurance
QC	Quality Control
QOC	Quality of Construction and QA/QC Adequacy Program (CPRT)

SDAR	Significant Deficiency Analysis Report (TU Electric)
SER	Safety Evaluation Report (NRC, NUREG-0797)
SIP	Systems Interaction Program
SIT	Special Investigation Team (NRC Staff)
SRP	Standard Review Plan (NRC, NUREG-75/087)
SRT	Senior Review Team (CPRT)
SRT-NRC	Special Review Team (NRC)
SSE	Safe Shutdown Earthquake
SSER	Supplemental Safety Evaluation Report (NRC, NUREG-0797)
SSL	Safe Shutdown Logic
SWEC	Stone & Webster Engineering Corporation
SWEC-PSAS	Stone & Webster Engineering Corporation - Pipe Stress and Support Project
TAP	Technical Audit Program (TU Electric)
TERA	Tenera, L.P.
TRT	Technical Review Team (NRC Staff)

1.0 INTRODUCTION

In October 1984, TU Electric established the Comanche Peak Response Team (CPRT) to evaluate issues that have been raised at CPSES and to prepare a plan for resolving those issues. The Comanche Peak Response Team (CPRT) program plan was developed and submitted to the NRC.

In mid-1986, TU Electric performed a qualitative and quantitative review of the preliminary results of the Comanche Peak Response Team (CPRT) (References 1 and 2). This review identified that the Comanche Peak Response Team (CPRT) findings were broad in scope and included each discipline. TU Electric decided that the appropriate method to correct the issues raised and to identify and correct any other issues that potentially existed at CPSES would be through one integrated program rather than a separate program for each issue. TU Electric decided to initiate a comprehensive Corrective Action Program (CAP) to validate the entirety of CPSES safety-related designs[1,2]. The Corrective Action Program (CAP) has the following objectives:

- Demonstrate that the design of safety-related systems, structures and components complies with licensing commitments.
- Demonstrate that the existing systems, structures and components are in compliance with the design or develop modifications which will bring systems, structures and components into compliance with design.
- Develop procedures, an organizational plan, and documentation to maintain compliance with licensing commitments throughout the life of CPSES.

The Corrective Action Program (CAP) is thus a comprehensive program to validate both the design and the hardware at CPSES, including resolution of specific Comanche Peak Response Team (CPRT) and external issues.

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1 Portions of selected non-safety-related systems, structures and components are included in the Corrective Action Program (CAP). These are Seismic Category II systems, structures, and components, and fire protection systems.

2 NSSS design and vendor hardware design and their respective QA/QC programs are reviewed by the NRC independently of CPSES and are not included in the Corrective Action Program (CAP) as noted in SSER 13; however, the design interface is validated by the CAP.

TU Electric contracted and provided overall management to Stone & Webster Engineering Corporation (SWEC), Ebasco Services Incorporated (Ebasco), and Impell Corporation (Impell) to implement the Corrective Action Program (CAP), and divided the CAP into eleven disciplines as follows:

Discipline	Responsible Contractor
Mechanical	SWEC
- Systems Interaction	Ebasco
- Fire Protection	Impell
Civil/Structural	SWEC
Electrical	SWEC
Instrumentation and Control	SWEC
Large Bore Piping and Pipe Supports	SWEC-PSAS
Cable Tray & Cable Tray Hangers	Ebasco/Impell
Conduit Supports Trains A,B,&C>2"	Ebasco
Conduit Supports Train C ≤2"	Impell
Small Bore Piping and Pipe Supports	SWEC-PSAS
Heating, Ventilation and Air Conditioning (HVAC)	Ebasco
Equipment Qualification	Impell

A Design Basis Consolidation Program (DBCP) (Reference 37) was developed to define the methodology by which Ebasco performed the design and hardware validation. The approach of this Design Basis Consolidation Program (DBCP) is consistent with other contractors' efforts and products.

The design validation portion of the Corrective Action Program (CAP) identified the design-related licensing commitments. The design criteria were established from the licensing commitments and consolidated in the Design Basis Documents (DBDs). The DBDs identify the design criteria for the design validation effort. If the existing design did not satisfy the design criteria, it was modified to satisfy the criteria. The design validation efforts for each of the eleven Corrective Action Program (CAP) disciplines are documented in Design Validation Packages (DVPs). The DVPs provide the documented assurance (e.g., calculations and drawings) that the validated design meets the licensing commitments, including resolution of all Comanche Peak Response Team (CPRT) and external issues.

The hardware validation portion of the Corrective Action Program (CAP) is being implemented by the Post Construction Hardware Validation Program (PCHVP), which demonstrates that existing systems, structures and components are in compliance with the validated design, or identifies modifications that are necessary to bring the hardware into compliance with the validated design.

The results of the performance of the Corrective Action Program (CAP) for each discipline are described in a Project Status Report (PSR). This PSR describes the results of the Corrective Action Program (CAP) for the Systems Interaction Program (SIP).

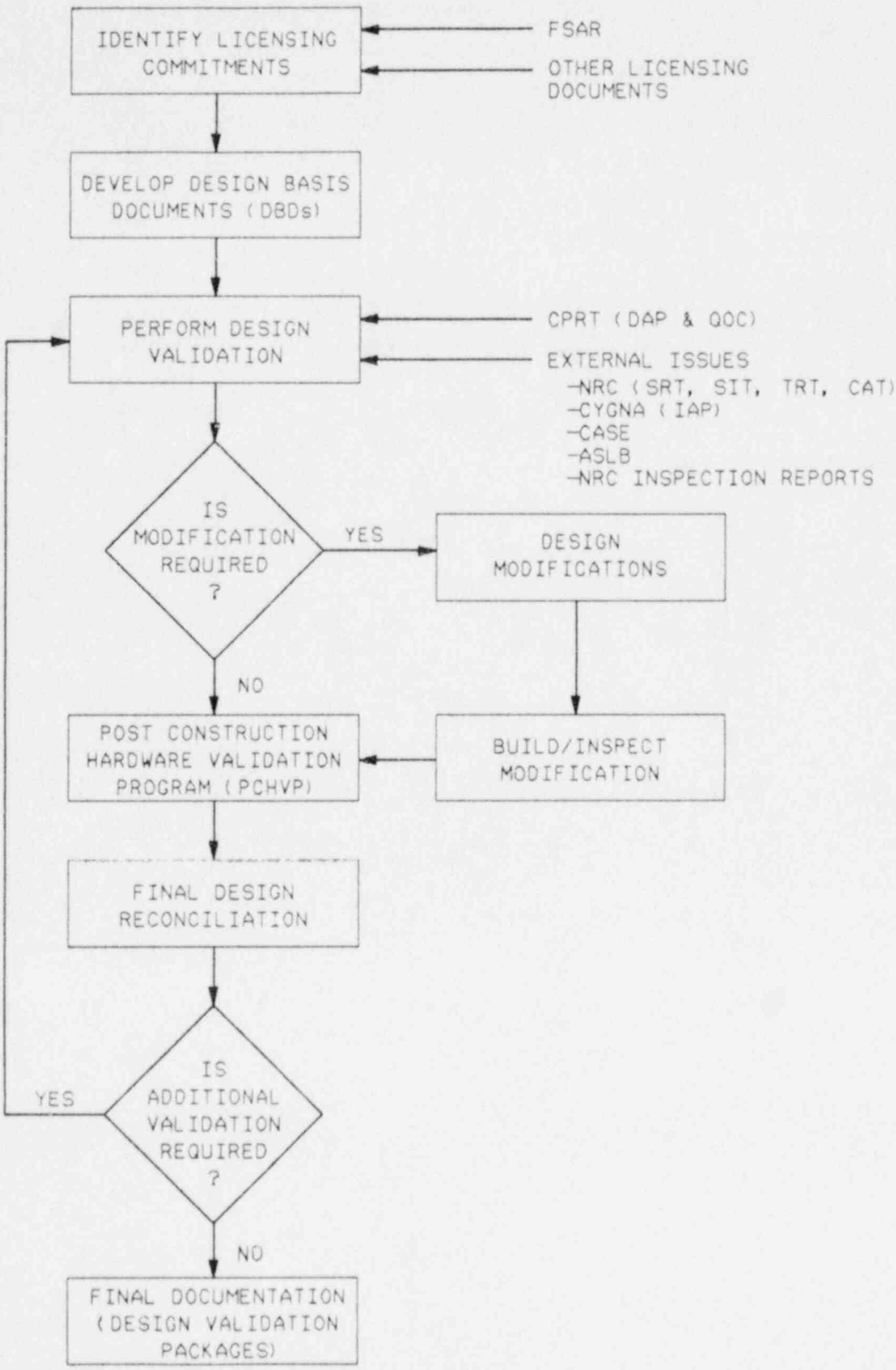
The Systems Interaction Program (SIP) portion of the Corrective Action Program (CAP) consists of activities carried out by Ebasco and is shown schematically in Figure 1-1. The Systems Interaction Program (SIP) consists of evaluations of the interactions with CPSES Unit 1 and Common components resulting from postulated pipe breaks, internal missile generation and seismically induced failures of non-seismic systems, structures, or components. Ebasco has performed a comprehensive design validation and is performing the hardware validation.

This Systems Interaction Program (SIP) Project Status Report (PSR) describes the validation effort from the early stages of design criteria establishment through the development and implementation of the detailed design and design control procedures. The report traces the implementation of the Post Construction Hardware Validation Program (PCHVP) to validate that the as-built systems, structures and components comply with the systems interaction related design and the completion of the CPSES Unit 1 and Common Design Validation Packages (DVPs).

FIGURE 1-1

CORRECTIVE ACTION PROGRAM (CAP)

SYSTEMS INTERACTION



QS4:[050,012]SICAP.DGN;1

2.0 PURPOSE

The purpose of this Project Status Report (PSR) is to demonstrate that the systems, structures and components of CPSES Unit 1 and Common comply with the systems interaction design criteria, are in conformance with the CPSES licensing commitments, and that safety-related systems, structures and components will satisfactorily perform their safety-related functions.

3.0 SCOPE

The scope of the systems interaction portion of the Corrective Action Program (CAP) includes:

1. The identification and protection of essential systems, structures and components (targets) which are those required to shut down the reactor and mitigate the consequences of the following postulated events:

   - High energy line breaks (HELBs)
   - Moderate energy line breaks (MELBs)
   - Flooding resulting from inadvertent operation of fire suppression systems
   - Internally generated missiles

2. The identification and protection of Seismic Category I[1] systems, structures and components (targets) and the protection of Control Room occupants from consequences of the failure of non-seismic[2] systems, structures and components during a postulated earthquake as required by Regulatory Guide 1.29 (Reference 24).

   Compliance with the requirements of Regulatory Guide 1.29 for Train C Conduit 2-inch diameter and less was validated by Train C Conduit 2-inch diameter and less portion of the Corrective Action Program (CAP). This validation is described in the associated Project Status Report (PSR) (Reference 46).

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1 Systems, structures and components that are designed and constructed to withstand the effects of the Safe Shutdown Earthquake (SSE) and remain functional are designated as Seismic Category I in accordance with the requirements of NRC Regulatory Guide 1.29.

2 Those portions of systems, structures, or components whose continued function is not required, and whose failure will not reduce the functioning of any Seismic Category I system, structure or component required to satisfy the requirements of Regulatory Guide 1.29 to an unacceptable safety level and will not result in incapacitating injury to occupants of the control room, are designated as non-seismic.

Compliance with the requirement of Regulatory Guide 1.29 for clearances between Seismic Category I components and Seismic Category I/Seismic Category II[3] components is validated by the mechanical portion of the Corrective Action Program (CAP) (References 38, 39 and 42).

The systems interaction portion of the Corrective Action Program (CAP) is shown schematically in Figure 1-1 and discussed below. The program required:

- Establishment of systems interaction design criteria which comply with licensing commitments;
- Development of systems interaction Design Basis Documents (DBDs) for CPSES, which contain the design criteria;
- Implementation of design and hardware validation consisting of analyses, identification and implementation of necessary modifications, and field verifications as identified in the Post Construction Hardware Validation Program (PCHVP). The as-built configuration of systems, structures and components is validated to comply with the systems interaction design criteria by engineering walkdowns and engineering evaluations. The results of the validation are documented in CPSES Unit 1 and Common Design Validation Packages (DVPs);
- Resolution of the systems interaction design and hardware issues and implementation of a Corrective Action Program (CAP) for closure of these issues. These issues include Comanche Peak Response Team (CPRT) issues and issues identified during the performance of the Corrective Action Program (CAP) (See Section 4.0);

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3 Those portions of structures, systems, or components whose continued function is not required, but whose failure could reduce the functioning of any Seismic Category I system, structure, or component required to satisfy the requirements of Regulatory Guide 1.29 to an unacceptable safety level or could result in incapacitating injury to occupants of the control room, are designated as Seismic Category II and are designed and constructed so that the Safe Shutdown Earthquake (SSE) would not cause such failure.

- Development of validated design documentation to form the basis for systems interaction configuration control. The validated design documentation and updated procedures/ specifications will be provided to TU Electric and can be utilized to facilitate operation, maintenance, and future modifications following issuance of an operating license.

Section 5.1.1 describes the methodology by which the CPSES systems interaction licensing commitments were identified, the design criteria were established and consolidated in the Design Basis Documents (DBDs), and the technical and design control procedures were developed.

Section 5.1.2 describes the design validation process, including the indentification of potential targets, development of calculations and determination of zones of influence.

Section 5.1.3 describes the Post Construction Hardware Validation Program (PCHVP) process and the procedures for engineering walkdowns and engineering evaluations required to be implemented to validate that the as-built systems, structures and components are in conformance with systems interaction design documentation.

Section 5.2 presents a summary of the systems interaction portion of the Corrective Action Program (CAP) results. It includes design validation and Post Construction Hardware Validation Program (PCHVP) results.

Section 5.3 describes the quality assurance program implemented for the validation process, including the Ebasco Quality Assurance (QA) audits, TU Electric Quality Assurance (QA) audits and the Engineering Functional Evaluation (EFE) audits.

Section 5.4 describes the corrective and preventive actions.

Appendix A of this Project Status Report (PSR) describes the details of the Corrective Action Program (CAP) resolution of Comanche Peak Response Team (CPRT) issues.

Appendix B of this Project Status Report (PSR) describes the details of the resolution of issues identified during the performance of this systems interaction Corrective Action Program (CAP). These are issues that have been determined to be reportable under the provisions of 10CFR50.55(e). These issues are identified in Significant Deficiency Analysis Reports (SDARs) initiated by TU Electric.

4.0 SPECIFIC ISSUES

The systems interaction portion of the Corrective Action Program (CAP) resolved all of the systems interaction related Comanche Peak Response Team (CPRT) issues and issues identified during the performance of the CAP. This section presents a listing of all systems interaction related issues addressed in this Project Status Report (PSR). Technical review, resolution, and corrective and preventive actions for all Comanche Peak Response Team (CPRT) issues are described in Appendix A. Technical review, resolution, and corrective and preventive action for all issues identified during the performance of the Corrective Action Program (CAP) are described in Appendix B.

Issue A1 came from Issue Resolution Report (IRR), DAP-E-M-501 (Reference 3) related to High Energy Line Breaks (HELBs). Issue A2 came from Issue Resolution Report (IRR), DAP-E-M-507 (Reference 4) related to internally generated missile evaluations. Issue A3 came from the Issue Specific Action Plan (ISAP) related to Control Room Ceiling, ISAP II.d (Reference 40). Issue A4 came from Issue Resolution Report (IRR), DAP-E-EIC-505 (Reference 44) related to Fire Protection.

Comanche Peak Response Team (CPRT) issues are listed as follows with issue numbers corresponding to the subappendix number in Appendix A which addresses the issue:

Issue No.	Issue Title
A1	High Energy Line Break Protection
A2	Missile Hazards
A3	Seismic Design of Control Room Ceiling Elements
A4	Fire Protection Systems Interaction

Issues identified during the performance of the Corrective Action Program (CAP) which have been determined to be reportable under the provisions of 10CFR50.55(e) are listed below with issue numbers corresponding to the subappendix number in Appendix B which addresses the issue:

Issue No.	Issue Title
B1	SDAR CP-87-57, Computer Modeling Error: COMPARE MOD 1A
B2	SDAR CP-87-58, Computer Modeling Error: RELAP-3

5.0 CORRECTIVE ACTION PROGRAM (CAP) METHODOLOGY AND RESULTS

This section of the Project Status Report (PSR) addresses the methodology and results of the systems interaction portion of the Corrective Action Program (CAP).

5.1 METHODOLOGY AND WORK PERFORMED

The Systems Interaction Program (SIP) evaluates interactions between CPSES Unit 1 and Common systems, structures and components resulting from pipe breaks, internal missile generation and seismically induced failures of non-seismic CPSES Unit 1 and Common systems, structures and components. The objective of the Systems Interaction Program (SIP) activities is to assure that these postulated interactions cannot prevent safe shutdown of the reactor nor prevent mitigation of the consequences of the event.

The validation activities of the Systems Interaction Program (SIP) are categorized into five (5) groups: high energy line break (HELB), moderate energy line break (MELB), environmental and flooding, internally generated missiles, and seismic/non-seismic interactions.

The methodology and work performed by Ebasco in implementing the systems interaction portion of the Corrective Action Program (CAP) for these five groups are discussed in Section 5.1.2.

5.1.1 Licensing Commitments, Design Criteria and Procedures

Ebasco reviewed the CPSES licensing documentation to identify licensing commitments related to systems interaction. The documentation reviewed included the FSAR, SER, SSERs, NRC Regulatory Guides, NRC Inspection and Enforcement (I&E) Bulletins, and TU Electric/NRC correspondence. Ebasco established design criteria to assure compliance with the identified licensing commitments. The design criteria are documented in Design Basis Documents (DBDs) (Reference 5, 6, 7 and 36). Ebasco then developed procedures which encompass the following:

- Design criteria;
- Resolution of Comanche Peak Response Team (CPRT) issues;
- Ebasco's experience gained through developing and implementing systems interaction programs for several recently licensed and operating United States nuclear power plants;
- Regulatory and professional society guidance.

The governing procedures implementing the Corrective Action Program (CAP) for systems interaction are shown in Figure 5-1. These procedures assure compliance with the design criteria and the resolution of the Comanche Peak Response Team (CPRT) issues. These procedures are used by the systems interaction Corrective Action Program (CAP) personnel to perform engineering walkdowns, analyses, evaluations, calculations and to obtain and document as-built data.

5.1.1.1 Verification of Design Criteria, Procedures and Resolution of Issues

Technical audits, surveillances and Third Party review have been performed to provide additional assurance that the design criteria are technically correct and embody the systems interaction licensing commitments and that all Commanche Peak Response Team (CPRT) and systems interaction Corrective Action Program (CAP) identified issues have been resolved. To assure that the licensing commitments related to systems interaction have been identified, and appropriate design criteria have been established, the TU Electric Quality Assurance (QA) Program and the Comanche Peak Response Team (CPRT) conducted overviews. TU Electric Quality Assurance (QA) audits were performed as described in Section 5.3. The Comanche Peak Response Team (CPRT) overview is being performed by the TU Electric Engineering Functional Evaluation (EFE) and the TU Electric Technical Audit Program (TAP) as described in Section 5.3. Tenera, L. P. (TERA) is reviewing Ebasco's resolution of the Comanche Peak Response Team (CPRT) issues, resolved in Subappendix A3.

The TU Electric Technical Audit Program (TAP) is auditing the systems interaction portion of the Corrective Action Program (CAP) to assure that the design criteria are reconciled with the licensing commitments.

Ebasco's resolution of the Comanche Peak Response Team (CPRT) issues is described in Appendix A of this Project Status Report (PSR). Ebasco's resolution of issues identified during the performance of the systems interaction portion of the Corrective Action Program (CAP) is described in Appendix B of this Project Status Report (PSR).

5.1.2 Design Validation Process

The Ebasco systems interaction design validation process validated that the design of systems, structures and components complies with the design criteria specified in the Design Basis Documents (DBDs) and provides assurance that the essential systems, structures and components will continue to perform their essential functions when subjected to systems interactions.

The design validation activities were 1) identify potential interaction sources, 2) identify potential interaction targets, 3) determine if the design meets the established design criteria and 4) if the design does not meet the design criteria, develop modifications so that the design conforms to the design criteria.

TABLE 5-1

POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP)
SYSTEMS INTERACTION

Construction Work Category	Final Acceptance Attribute	PCHVP Attribute Validation Method
Piping	Identify break location	CPE-EB-FVM-SI-28, 34 (References 12 and 19)
	Identify structures that can effect the zone of influence	CPE-EB-FVM-SI-31 (Reference 15)
Essential Electrical Equipment	Identify location	CPE-EB-FVM-SI-28, 67 (References 12 and 27)
Rotating Equipment	Identify location	CPE-EB-FVM-SI-28, 67 (Reference 12 and 27)
	Identify essential components and Seismic Category I structures within the zone of influence	CPE-EB-FVM-SI-67
Valves	Identify location	CPE-EB-FVM-SI-28, 67
	Identify essential components and Seismic Category I structures within the zone of influence	CPE-EB-FVM-SI-28
Non-Seismic Structure/Components	Identify location	CPE-EB-FVM-SI-40 (Reference 26)
	Identify Seismic Category I components within the zone of influence	CPE-EB-FVM-SI-40
Walls, Floors, Ceilings	Identify rooms and free volumes	CPE-EB-FVM-SI-35, 39 (References 20 and 23)
	Identify vent areas between rooms	CPE-EB-FVM-SI-35, 39

The design validation process included review of original design documentation such as engineering walkdown data, calculations, design documents and specifications and development of new documentation as required to demonstrate that the design complies with the design criteria.

The design validation process was categorized into five (5) groups and corresponding Design Validation Packages (DVPs) as identified below:

1. High Energy Line Breaks (HELBs)
    - Safe Shutdown Logics[1]
    - Calculations
2. Moderate Energy Line Breaks (MELBs)
    - Safe Shutdown Logics
    - Calculations
3. Environmental and Flooding Analyses Outside Containment
    - Calculations
    - Engineering Walkdowns for Flow Path Data
4. Seismic/Non-Seismic Interactions
    - Calculations
5. Internally Generated Missiles
    - Calculations

Each Design Validation Package (DVP) contains or references the following items:

- Design Basis Documents (DBDs) which serve as the primary basis of design validations
- Procedures

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1. Safe Shutdown Logics (SSLs) are methods of modeling by sketches the various ways which a system can achieve its design function. These sketches can be utilized to determine how postulated component faults (i.e., failure or postulated malfunction of a component because of a system interaction) can be evaluated to assure the system will achieve its design function.

- Design Documents (e.g., calculations, specifications, engineering walkdowns and evaluations)

- Other related documents (e.g., Significant Deficiency Analysis Reports (SDARs))

5.1.2.1 High Energy Line Breaks (HELBs)

High energy line breaks (HELBs)[2] may result in the displacement of the pipe (pipe whip) and the discharge of high pressure/temperature fluid (jet impingement). High energy line breaks (HELBs) may also result in increased area temperature, pressure and humidity and may also result in local flooding which is discussed in Section 5.1.2.3.

Safe Shutdown Logics (SSLs)

Safe shutdown logics (SSLs) were developed for the identification of those systems, structures and components required to safely shut down the reactor and to mitigate the consequences of a postulated pipe break. Safe shutdown logics (SSLs) were reviewed and concurred with by the Corrective Action Program (CAP) organization responsible for validating the system, structure or component design. The Safe Shutdown Logics (SSLs) were developed based on the criteria in the Design Basis Document (DBD) (Reference 6) and in accordance with Systems Interaction Program (SIP) procedure (Reference 13).

Calculations

The postulation of breaks in high energy lines results in systems interaction considerations due to the jet forces emanating from the break. These forces can make the pipe whip and impact objects or the jets can impact objects in their zones of influence. Postulated pipe break locations were obtained from SWEC-PSAS and the NSSS vendor. Additional postulated pipe break locations were developed based on the criteria in the Design Basis Document (DBD) (Reference 6).

Pipe whip and jet impingement zones of influence and pipe whip restraint designs were validated by developing new calculations or by validating orignal calculations to the design criteria in the Design Basis Documents (DBDs) (References 6 and 36) and in accordance with System Interaction Program (SIP) procedures (References 9, 10, 12, 13, 14 and 15).

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2 A pipe break in a piping system in which the operating temperature is greater than 200°F or operating pressure is greater than 275 psig.

5.1.2.2 Moderate Energy Line Breaks (MELBs)

Moderate energy line breaks (MELBs)[3] may result in the discharge of process fluid (fluid spray). Moderate energy line breaks (MELBs) may also result in increased area temperature, humidity and local flooding which are discussed in Section 5.1.2.3.

Safe Shutdown Logics (SSLs)

Safe shutdown logics (SSLs) were developed for the identification of the electrical equipment which is required to safely shut down the reactor and to mitigate the consequences of a postulated pipe break. Safe shutdown logics (SSLs) were reviewed and concurred with by the Corrective Action Program (CAP) organization responsible for validating the electrical equipment design. The safe shutdown logics (SSLs) were developed based on the criteria in the Design Basis Document (DBD) (Reference 6) and in accordance with Systems Interaction Program (SIP) procedures (References 8, 9, 10, 11, 12 and 13).

Calculations

Fluid spray zones of influence were validated by developing new calculations to the design criteria in the Design Basis Document (DBD) (Reference 6) in accordance with System Interaction Program (SIP) procedure (Reference 13).

5.1.2.3 Environmental and Flooding Analyses Outside Containment

Environmental and flooding analyses are required in those areas outside containment subject to increases in local temperature, pressure, humidity and in those areas subject to flooding[4]. These interactions may result from high energy line breaks (HELBs), moderate energy line breaks (MELBs), seismic failure of non-seismic pipe and tanks and from inadvertent operation of fire suppression systems.

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3 A pipe break in a piping system in which the operating temperature during normal plant conditions is less than or equal to 200°F and pressure is less than or equal to 275 psig. Those systems that operate less than 2% of their operating time above either of these limits are considered to be moderate energy systems.

4 The validation of the enviornmental and flooding analyses inside containment was performed by SWEC as part of the mechanical portion of the Corrective Action Program (CAP) (Reference 42)

Calculations

Outside containment temperature, pressure, humidity and flood levels were validated by developing new calculations or by validating original calculations. The calculations were based on the design criteria in the Design Basis Document (DBD) (Reference 6) in accordance with Systems Interaction Program (SIP) procedures (References 13, 21 and 22).

Engineering Walkdowns for Flow Path Data

Engineering walkdowns were performed to obtain as-built data used in validating environmental calculations. The as-built data was used to determine flow paths for water, heat (temperature) and pressure venting within plant areas. Engineering walkdowns were based on the design criteria in the Design Basis Document (DBD) (Reference 6) and were performed in accordance with Systems Interaction Program (SIP) procedures (References 8, 13, 20 and 23).

5.1.2.4 Seismic/Non-Seismic Interactions

Seismic events may cause failures in non-seismic systems, structures and components. As a result of such failures, non-seismic systems, structures or components may interact with Seismic Category I and Seismic Category II systems, structures and components.

Calculations

New calculations were performed to validate the zones of influence that could result from the failure of non-seismic systems, structures or components. The calculations were based on the design criteria in the Design Basis Document (DBD) (Reference 5) and were performed in accordance with the Systems Interaction Program (SIP) procedure (Reference 13).

Engineering Walkdowns and Evaluations

Engineering walkdowns and evaluations were performed to identify potential non-seismic sources which could cause interactions with Seismic Category I and Seismic Category II systems, structures or components. These potential non-seismic sources were evaluated using historical seismic data obtained subsequent to actual earthquakes to determine if these sources will maintain their structural integrity following a Safe Shutdown Earthquake (SSE). These engineering walkdowns and evaluations were based on the design criteria in the Design Basis Document (DBD) (Reference 5) and were performed in accordance with the Systems Interaction Program (SIP) procedures (References 13, 25, and 26).

5.1.2.5 Internally Generated Missiles

Internally generated missiles may be ejected from rotating equipment and components in high pressure systems. Potential sources include components such as pumps, motors, fans, valve stems and bonnets, thermowells and turbines (including the main turbine generator).

Calculations

Calculations were performed on appropriate missile sources to evaluate the potential for missile ejection. These calculations were based on the design criteria in the Design Basis Document (DBD) (Reference 7) and were performed in accordance with a Systems Interaction Program (SIP) procedure (Reference 13).

5.1.2.6 Interfaces

The validation process involves interfaces with TU Electric and with other organizations involved in the Corrective Action Program (CAP). Organizational interfaces as shown in Figure 5-2 include those with SWEC, SWEC-PSAS, TU Electric, Westinghouse, Ebasco and Impell. Interfaces with these organizations are procedurally controlled to assure:

- Consistency of design criteria
- Completeness of the information incorporated in each Design Validation Package (DVP)
- Proper transfer of design data between interfacing organizations
- Uniform application of design control procedures
- Coordination of corrective and preventive actions

5.1.2.7 Final Reconciliation Process

The purpose of the final reconciliation process is to consolidate design validation analyses, hardware modification and inspection documentation to assure consistency of the systems interaction design documentation with the hardware installation. The final reconciliation of the systems interaction design incorporates the following:

- The Post Construction Hardware Validation Program (PCHVP) results
- Resolution of systems interaction related Comanche Peak Response Team (CPRT) issues

Final reconciliation includes confirmation that the interfacing organizations have accepted the Systems Interaction Program (SIP) results as compatible with their validated design. Interfacing organizations are depicted on Figure 5-2.

In addition, open items, observations and deviations related to the systems interaction portion of the Corrective Action Program (CAP) that were identified by the TU Electric Technical Audit Program (TAP) and the Engineering Functional Evaluation (EFE) are resolved prior to the completion of the reconciliation phase. Open items from TU Electric Significant Deficiency Analysis Reports (SDARs) (10CFR50.55(e)) are resolved during the final reconciliation process. At the conclusion of final reconciliation, the CPSES Unit 1 and Common Design Validation Packages (DVPs) are compiled.

5.1.3 Post Construction Hardware Validation Program (PCHVP)

The Post Construction Hardware Validation Program (PCHVP) (Reference 43) is the portion of TU Electric's Corrective Action Program (CAP) which validates the final acceptance attributes for safety-related hardware. The Post Construction Hardware Validation Program (PCHVP) process is shown diagrammatically in Figure 5-3.

The input to the Post Construction Hardware Validation Program (PCHVP) for the system interaction portion of the Corrective Action Program (CAP) is based on the Design Basis Documents (DBDs)[5].The DBDs, which were developed during the Corrective Action Program (CAP) design validation process, incorporate the licensing commitments and design criteria.

Final acceptance inspection requirements based on the Design Basis Documents (DBDs) were used to develop the Post Construction Hardware Validation Program (PCHVP) attribute matrix. This matrix will form a complete set of final acceptance attributes identified for installed hardware. The Post Construction Hardware Validation Program (PCHVP), by

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5 The systems interaction discipline is responsible for validating that systems, structures and components, which are installed in accordance with other disciplines' installation specifications, can accommodate the interactions described in Section 3.0. The systems interaction discipline is not responsible for the specification of installation requirements for systems, structures or components. Therefore, there are no systems interaction specific installation specifications. The systems interaction final acceptance attributes that are validated during the systems interaction Post Construction Hardware Validation Program (PCHVP) are contained in the systems interaction Design Basis Documents (DBDs).

either physical validations or through an engineering evaluation methodology, assures that each of the attributes defined in the attribute matrix is validated.

Physical validation of an attribute is performed by engineering walkdown, for accessible components. Engineering walkdowns are controlled by appropriate Field Verification Method (FVM) procedures (References 12, 15, 18, 19, 20, 23, 26 and 27).

The Post Construction Hardware Validation Program (PCHVP) engineering evaluation depicted in Figure 5-3 is procedurally controlled to guide the Corrective Action Program (CAP) responsible engineer through the evaluation of each item on the attribute matrix to be dispositioned by the engineering evaluation method. Disposition of each attribute will be clearly documented. If the technical disposition of the final acceptance attribute is "not acceptable" or the attribute cannot be dispositioned based on available information, an alternate plan consisting of additional evaluations, testing, inspections/walkdowns or modifications, as necessary, will be developed to demonstrate and document the acceptability of the attribute.

Recommendations from the Comanche Peak Response Team (CPRT) effort comprise a portion of the evaluation. A major component of the Comanche Peak Response Team (CPRT) program has been the inspection of a comprehensive, random sample of existing hardware using an independently derived set of inspection attributes. The inspection was performed and the results were evaluated by Third Party personnel in accordance with Appendix E to the Comanche Peak Response Team (CPRT) Program Plan. The scope of the inspection covered the installed safety-related hardware by segregating the hardware into homogeneous populations (by virtue of the work activities which produced the finished product). Samples of these populations were inspected to provide reasonable assurance of hardware acceptability in accordance with Appendix D to the Comanche Peak Response Team (CPRT) Program Plan.

Corrective action recommendations were made to TU Electric based on the evaluated findings when a Construction Deficiency existed, an Adverse Trend existed, or an Unclassified Trend existed as defined in accordance with Appendix E to the Comanche Peak Response Team (CPRT) Program Plan.

The Post Construction Hardware Validation Program (PCHVP) assures that all Comanche Peak Response Team (CPRT) recommendations are properly dispositioned.

Figure 5-3 illustrates that during the evaluation of a given attribute from the Post Construction Hardware Validation Program (PCHVP) attribute matrix, the initial task of the Corrective Action Program (CAP) responsible engineer is to determine if any of the following statements are true:

a. The attribute was recommended for reinspection by the Comanche Peak Response Team (CPRT).

b. Design validation resulted in a change to design or to a hardware final acceptance attribute that is more stringent than the original acceptance attribute, or Comanche Peak Response Team (CPRT) did not inspect the attribute.

c. Design validation resulted in new work, including modification of the existing hardware.

If the Comanche Peak Response Team (CPRT) had no recommendations and items b or c above do not apply, the attribute under consideration will be accepted. This conclusion is justified by the comprehensive coverage of the Comanche Peak Response Team (CPRT) reinspection and the consistently conservative evaluation of each finding from both a statistical and adverse trend perspective. The attribute matrix is then updated to indicate that neither the engineering walkdown nor Quality Control (QC) inspection of the attribute is necessary. A completed evaluation package is prepared and forwarded to the Comanche Peak Engineering (CPE) organization for concurrence. The evaluation package becomes part of the Design Validation Package (DVP) after Comanche Peak Engineering (CPE) concurrence is obtained.

If any of the three statements are true, it is assumed that the final acceptance attribute must be further evaluated as follows:

<u>Determine Attribute Accessibility</u>

The Corrective Action Program (CAP) responsible engineer will determine if the attribute is accessible. If the attribute is accessible, a field validation of the item's acceptability will be performed and documented in accordance with an approved Field Verification Method (FVM).

If the Corrective Action Program (CAP) responsible engineer reaches the conclusion that the attribute is inaccessible, an engineering evaluation will be conducted by technical disposition of available information.

After completing the attribute accessibility review, the responsible engineer will update the attribute matrix as necessary to reflect the results of that review.

Technical Disposition

The Corrective Action Program (CAP) responsible engineer identifies the data to be considered during the subsequent technical disposition process. Examples of such items used in this disposition may include, but are not limited to:

- Historical documents (e.g., specifications, procedures, inspection results)
- Comanche Peak Response Team (CPRT) and external issues
- Construction practices
- Quality records
- Test results
- Audit reports
- Authorized Nuclear Inspection (ANI) records
- Surveillance reports
- NCRs, DRs, SDARs and CARs
- Inspections conducted to date
- Results of Third Party reviews
- Purchasing documents
- Construction packages
- Hardware receipt inspections

After compiling the data identified as pertinent to the attribute, the technical disposition will be performed. The actual steps and sequence of actions required for each technical disposition may differ; however, the tangible results from each technical disposition will be consistent. These results will include as a minimum:

- A written description of the attribute;

- A written justification by the Corrective Action Program (CAP) responsible engineer for acceptance of the attribute;

- A written explanation for the logic utilized to conclude that the attribute need not be field validated;

- A chronology demonstrating that the attribute has not been significantly altered by redesign;

- All documents reviewed to support the disposition;

- Concurrence of the acceptance of the attribute's validity by Comanche Peak Engineering (CPE).

If the Corrective Action Program (CAP) responsible engineer concluded that the data evaluated represented evidence of the attribute's acceptability, the conclusion will be documented. The documentation will be reviewed and approved by Comanche Peak Engineering (CPE) and filed in the Design Validation Package (DVP). If the Corrective Action Program (CAP) responsible engineer determines that the data reviewed does not provide evidence of the attribute's acceptability, the documentation will explain why the attribute cannot be accepted and recommend an alternative course of action. This alternative course of action may take various forms such as making the attribute accessible and inspecting it, or testing to support the attribute's acceptability. This alternative plan, after approval by Comanche Peak Engineering (CPE), will be implemented to validate the attribute.

In summary, the Post Construction Hardware Validation Program (PCHVP) is a comprehensive process by which each attribute in the PCHVP attribute matrix is validated to the validated design. The TU Electric Technical Audit Program (TAP) audits the Post Construction Hardware Validation Program (PCHVP). This audit program is complemented by the Engineering Functional Evaluation (EFE) being performed by an independent team comprised of Stone & Webster, Impell and Ebasco engineering personnel working under the Stone & Webster Quality Assurance (QA) Program and subject to direction by the Comanche Peak Response Team's (CPRT) Senior Review Team (SRT). The Post Construction Hardware Validation Program (PCHVP) provides additional assurance that the validated design has been implemented for safety-related hardware.

Ebasco prepared Post Construction Hardware Validation Program (PCHVP) implementation procedures for the systems interaction portion of the Corrective Action Program (CAP). The hardware validation process includes modifications, whenever necessary, to bring the systems, structures and components into compliance with the validated design. The tabulation of systems interaction final acceptance attributes is presented in Table 5-1.

The Post Construction Hardware Validation Program (PCHVP) is being implemented in accordance with appropriate Field Verification Method (FVM) procedures to validate all attributes in the attribute matrix as described below.

Interactions between essential systems, structures and components and high energy line break (HELB) pipe whip and jet impingement zones of influence are being validated by engineering walkdown. Interactions with non-essential components are also considered to assure that secondary interactions do not effect essential systems, structures or components. Where there are interactions, the targets are evaluated to assure that they continue to perform their essential functions of safely shutting down the reactor and of mitigating the consequences of the postulated pipe break. These engineering walkdowns and evaluations are based on the design criteria in the Design Basis Document (DBD) (Reference 6) and are performed in accordance with Systems Interaction Program (SIP) procedures (References 9, 10, 13, 15, 16, 17, 18 and 19).

Interactions between essential electrical equipment and fluid spray are validated by engineering walkdowns. Where there are interactions, the targets are evaluated to assure that the electric equipment can continue to perform its essential functions of safely shutting down the reactor and of mitigating the consequences of the postulated pipe break. These engineering walkdowns and evaluations are based on the design criteria in the Design Basis Document (DBD) (Reference 6) and are performed in accordance with Systems Interaction Program (SIP) procedures (References 9, 10,11, 13, 16, 18 and 20).

Engineering walkdowns are performed to obtain as-built data used in validating flooding calculations. Where there are flooding interactions, the targets are evaluated to assure that they can continue to perform their essential functions of safely shutting down the reactor and of mitigating the consequences of the postulated event. Engineering walkdowns are based on the design criteria in the Design Basis Document (DBD) (Reference 6) and are performed in accordance with Systems Interaction Program (SIP) procedures (References 8, 13, 20 and 23).

Engineering walkdowns and evaluations are performed to identify potential non-seismic sources which could cause interactions with Seismic Category I and Seismic Category II systems, structures or components. These potential non-seismic sources are evaluated using historical seismic data obtained subsequent to actual earthquake to determine if these sources will maintain their structural integrity following a Safe Shutdown Earthquake (SSE). These engineering walkdowns and evaluations are based on the design criteria in the Design Basis Document (DBD) (Reference 5) and are performed in accordance with the Systems Interaction Program (SIP) procedures (References 13, 25, and 26)

Engineering walkdowns and evaluations are performed to identify interactions between missiles and targets. Targets are evaluated to assure that they can continue to perform their essential functions of safely shutting down the reactor and of mitigating the consequences of a postulated missile generation event. Engineering walkdowns and evaluations are based on the design criteria in the Design Basis Document (DBD) (Reference 7) and are performed in accordance with Systems Interaction Program (SIP) procedures (References 12, 13, 16, 17 and 27).

5.2 RESULTS

5.2.1 Design Validation Results

The validation of the CPSES Unit 1 and Common systems interaction design has been completed as described in this Project Status Report (PSR). This effort included:

- Development of 206 safe shutdown logics (SSLs)
- Validation of 62 pipe movement calculations
- Validation of 41 environmental calculations
- Validation of 5 flooding calculations
- Validation of 2 missile calculations
- Validation of 2 procurement specifications
- Resolution of 148 Tenera, L.P. (TERA) Discrepancy Issue Reports (DIRs)
- Development of zone of influence sketches

The results of this design validation effort determined that some hardware modifications were required. These included modifications to pipe whip restraint systems and modifications to non-seismic components to meet Seismic Category II requirements.

This design validation effort has demonstrated that CPSES Unit 1 and Common systems interaction design and associated documentation are in conformance with CPSES licensing commitments and that the systems, structures and components are designed to perform their safety functions.

5.2.2 Post Construction Hardware Validation Program (PCHVP) Results

The Post Construction Hardware Validation Program (PCHVP) is being implemented through the validation of final acceptance attributes for systems, structures and components for CPSES Unit 1 and Common as discussed in Section 5.1.3.

5.3 QUALITY ASSURANCE (QA) PROGRAM

The Systems Interaction Program (SIP) is being conducted at two locations: Ebasco's New York office, and the CPSES site. Systems interaction activities in New York are performed in accordance with the Ebasco Quality Assurance (QA) Program and activities at the CPSES site are performed in accordance with the TU Electric Quality Assurance (QA) Program.

5.3.1 TU Electric Quality Assurance (QA) Program

TU Electric implements the Quality Assurance (QA) Program described in Chapter 17 of the CPSES FSAR which is in compliance with 10CFR50, Appendix B and has been reviewed and accepted by the NRC. Section 17.1 of the FSAR addresses the Quality Assurance (QA) requirements for all phases of design and construction of CPSES.

TU Electric has developed and implemented procedures which meet the requirements of ANSI N45.2.11 (Reference 41) and NRC Regulatory Guide 1.64 (Reference 29) to control the Systems Interaction Program (SIP) conducted by Ebasco at the CPSES site. The TU Electric Quality Assurance (QA) Program requires that detailed procedures covering the performance of the Systems Interaction Program (SIP) be developed and issued. These procedures are contained in the CPSES Engineering and Construction-Engineering (ECE) Procedures Manual. The ECE Procedure Manual includes procedures applicable to the validation efforts performed under TU Electric's Quality Assurance (QA) Program. These procedures also direct the organization and format of documents used to validate the design and the hardware. These procedures were distributed to System Interaction Program (SIP) supervisory personnel and are readily available for SIP personnel use. The issuance of these procedures was followed by detailed training programs for the applicable personnel.

TU Electric Quality Assurance (QA) has developed and implemented procedures to perform audits which meet the requirements of ANSI-N45.2.12 (Reference 34) and NRC Regulatory Guide 1.144 (Reference 31). These procedures have been implemented by the Internal Audit, Technical Audit Program (TAP)[5] and Engineering Surveillance Groups to assure that the System Interaction Program (SIP) is accomplished within the requirements of the TU Electric Quality Assurance (QA) Program.

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5 The TU Electric Technical Audit Program (TAP) has been in effect since January 1987. Prior to January 1987, the TU Electric Quality Assurance (QA) Department performed audits of selected engineering service contractors using technical specialists as part of its vendor audit program.

Audits to verify the implementation of design procedures and to assess the technical adequacy of the Systems Interaction Program (SIP) were performed under the TU Electric Technical Audit Program (TAP). Audits to verify compliance with programmatic aspects of the Systems Interaction Program (SIP) were periodically performed by the TU Electric Internal Audit Group.

Surveillances were conducted to verify the implementation of procedures and to assess the technical adequacy of the Systems Interaction Program (SIP) by the TU Electric Quality Assurance (QA) Engineering Surveillance Group.

5.3.2 Ebasco Quality Assurance (QA) Program

Ebasco implements their Corporate Nuclear Quality Assurance (QA) Program described in Ebasco's Topical Report ETR-1001 (Reference 32), which is in conformance with 10CFR50, Appendix B, and has been approved by the NRC. ETR-1001 addresses all phases of completion of a nuclear power plant including design, procurement and construction. ETR-1001 has been modified to make it CPSES project specific, providing additional levels of detail to make calculation preparation, criteria selection and design interfaces consistent with the TU Electric Corrective Action Program (CAP). Ebasco's Corporate Nuclear Quality Assurance (QA) Program, as modified for CPSES, has been reviewed and approved by TU Electric's QA organization.

Ebasco developed and issued a Manual of Procedures (Reference 33) specifically related to CPSES work. This Manual of Procedures, includes specific procedures to supplement the Ebasco standard Engineering, Nuclear, Project and Procurement Procedures Manuals. The Manual of Procedures includes procedures applicable to the design validation efforts performed under Ebasco's Quality Assurance (QA) Program. These procedures are issued to direct the organization and format of documents used to validate the design. These procedures are issued so that calculation documentation will be prepared in a uniform and complete manner. These procedures were distributed to Systems Interaction Program (SIP) supervisory personnel and are readily available for SIP personnel use. The issuance of these procedures was followed by detailed training programs for the applicable personnel.

Audits were periodically conducted by Ebasco's Quality Assurance (QA) Engineering-Auditing Group, covering work done in New York for systems interaction. These audits were performed in accordance with procedures approved by Ebasco's Quality Assurance (QA) Department and satisfy the requirements in ANSI N45.2.12 and NRC Regulatory Guide 1.144 concerning QA auditing. These audits cover compliance with applicable procedural requirements in the Manual of Procedures. Management audits are periodically conducted to review the Quality Assurance (QA) Department's compliance with its procedures.

Subcontractors were evaluated and qualified to provide services or products. In addition, a survey was conducted at the subcontractors' facility to evaluate how they implement their Quality Assurance (QA) Program.

5.3.3 Systems Interaction Audits, Surveillances and Inspections

The adequacy and implementation of these Quality Assurance (QA) Programs and the technical adequacy of the work performed under these QA Programs were extensively audited and surveilled by the TU Electric Technical Audit Program (TAP), TU Electric Quality Assurance (QA) Engineering Surveillance Group, the TU Electric Quality Assurance (QA), and the Ebasco Quality Assurance Engineering (QA) Audit Group.

A total of 9 audits and surveillances of the Systems Interaction Program (SIP) were performed by these organizations to date for CPSES Unit 1 and Common as shown on Table 5-2. To date, more than 2000 work hours have been expended by TU Electric Quality Assurance (QA) and Ebasco Quality Assurance (QA) in activities directly attributable to the systems interaction portion of the Corrective Action Program (CAP) (i.e., training, procedure development, auditing and support from the QA Director's staff).

The TU Electric Technical Audit Program (TAP) and the TU Electric Quality Assurance (QA) Engineering Surveillance Group evaluated the technical adequacy of the engineering product (e.g., Design Basis Documents (DBDs), calculations, specifications, engineering walkdowns and evaluations).

The following list of audit and surveillance subjects describes the depth of review that has been performed:

- Adequacy of project technical and design control procedures
- Technical adequacy and documentation of calculations
- Non-Conformance Reports (NCRs)
- Specification validation
- Calculation validation
- Records maintenance
- Generic Issue Report (GIR)
- Discrepancy Issue Reports (DIRs)
- Design Basis Documents (DBDs)
- Indoctrination and training

- Licensing activities

- Corrective Action Requests (CARs)

- Personnel qualification and experience verification

- Design modifications

These audits and surveillances collectively assessed the adequacy and implementation of the applicable Quality Assurance (QA) Program. These audits and surveillances have resulted in enhancements to the procedures and methods and thus contributed to the overall quality of the CPSES design.

In addition to the audits and surveillance described above, TU Electric has initiated the Engineering Functional Evaluation (EFE) (Reference 35). The EFE began auditing the systems interaction portion of the Corrective Action Program (CAP) in May 1987. The Engineering Functional Evaluation (EFE) is an overview program which is performing an independent, in-depth technical evaluation of the Corrective Action Program (CAP) to provide additional assurance that the CAP is effectively implemented. The Engineering Functional Evaluation (EFE) is conducted under the SWEC Quality Assurance (QA) Program and is directed by a Program Manager who reports to the SWEC Chief Engineer, Engineering Assurance. The Engineering Functional Evaluation (EFE) is performed by highly qualified and experienced engineers from SWEC, Impell and Ebasco who have not been involved with previous engineering and design work at CPSES. The Engineering Functional Evaluation (EFE) is performed in a formal, preplanned and fully documented manner to provide objective evidence of completion of the planned scope of the evaluation and to provide documentation of its results and conclusions. The Engineering Functional Evaluation (EFE) is comparable in scope, level of effort and personnel qualifications to integrated, independent design inspections and verifications conducted at other nuclear plants.

The audits and surveillances collectively represent a very detailed and complete assessment of the following:

- Adequacy of the Quality Assurance (QA) Programs.
- Implementation of the Quality Assurance (QA) Programs.
- Technical adequacy of the design criteria and procedures.
- Implementation of the design criteria and procedures.

In some cases, these audits and surveillances identified the need for procedure modifications and specific calculation revisions to incorporate an omission or required clarification. Additional training in implementation of procedures in these cases was provided as required.

Each item identified in the audit report was carefully reviewed and response to all items was provided. Any corrective/preventive actions determined necessary as a result of the audit findings were identified and implemented. Proper implementation of commitments made in response to the audit items are verified during subsequent audits.

The NRC Office of Special Projects (OSP) conducted inspections of the Systems Interaction Program (SIP) beginning in October 1987. The inspections involved technical evaluations of the design validation process and focused primarily on the review of calculations, procedures and Design Basis Documents (DBDs), and their compliance with licensing commitments.

In summary, an appropriate level of attention has been given to the quality of all Systems Interaction Program (SIP) activities; the TU Electric and Ebasco Quality Assurance (QA) Programs are appropriate for the scope of work; project performance has been demonstrated to be in compliance with the QA Programs; and appropriate corrective and preventive actions have been taken whenever they were required.

5.4 CORRECTIVE AND PREVENTIVE ACTIONS

Ebasco has developed Design Basis Documents (DBDs) and procedures to implement the systems interaction portion of the Corrective Action Program (CAP). The Design Basis Documents (DBDs) contain the design criteria for validating the systems interaction design of CPSES Unit 1 and Common. The procedures assure compliance with the design criteria and the resolution of the Commanche Peak Response Team (CPRT) issues. As a result of the systems interaction portion of the Corrective Action Program (CAP), the CPSES Unit 1 and Common systems, structures and components are validated as being capable of performing their safety-related functions when subjected to systems interaction.

This validation is documented in the calculations, evaluations and specifications which are contained in the Design Validation Packages (DVPs). This validated design documentation will be provided to TU Electric at the completion of the Corrective Action Program (CAP). The Design Basis Documents (DBDs) and procedures used for validation will also be provided to Comanche Peak Engineering (CPE). The validated design documentation and Design Basis Documents (DBDs) and procedures can provide the basis for configuration control of CPSES systems, structures and components and can be utilized by TU Electric to facilitate operation, maintenance and future modifications in accordance with licensing commitments following issuance of an operating license.

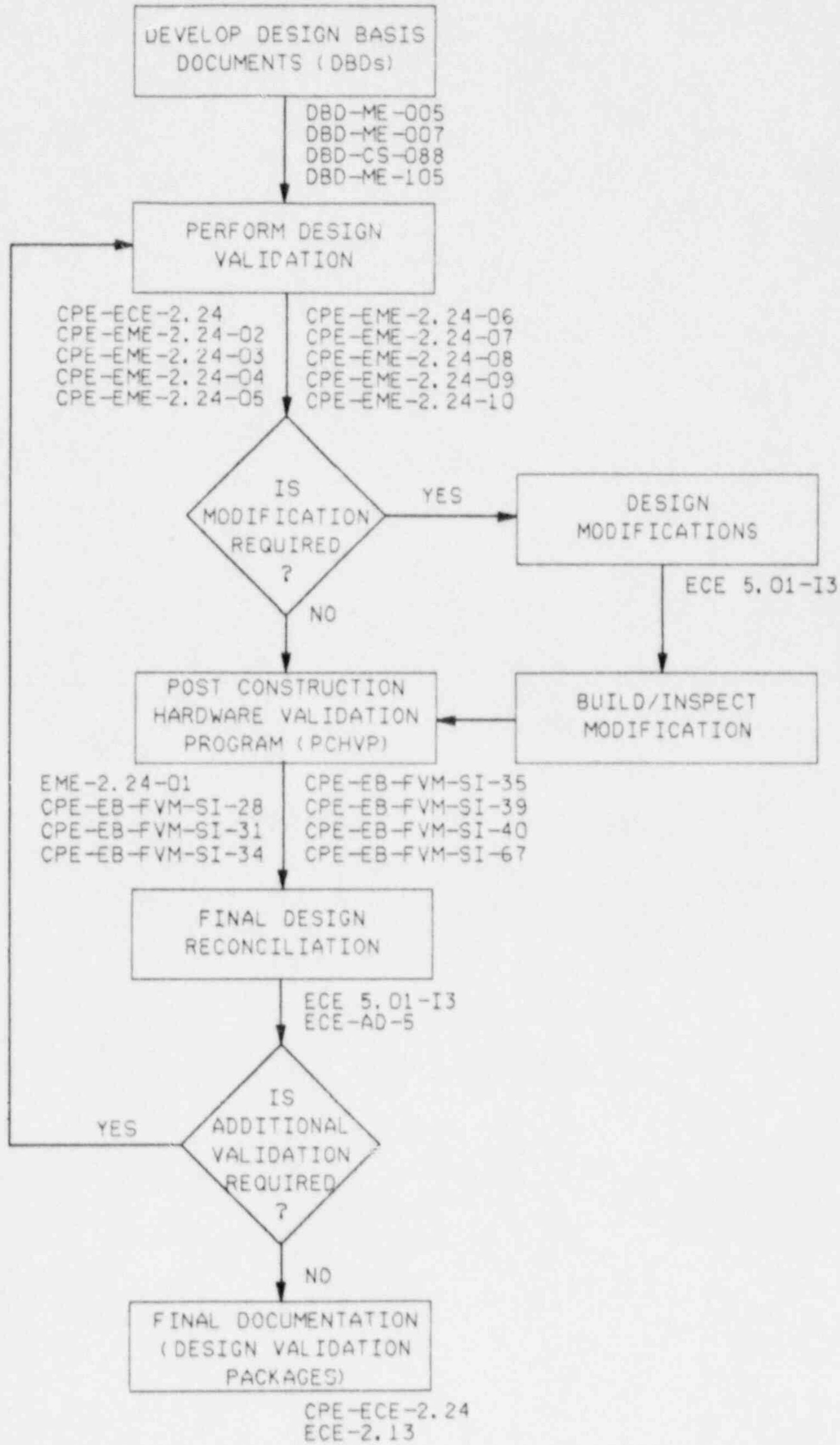
Interfaces between organizations have been identified and addressed in detail within the procedures. Those systems interaction interfaces are discussed in Section 5.1.2.6.

Practical experience has been provided to Comanche Peak Engineering (CPE) engineers who have worked alongside Ebasco engineers during the ongoing validation process. Experience gained by Comanche Peak Engineering (CPE) engineers included changes in design documents, and familiarization with procedures and regulatory requirements.

TU Electric Comanche Peak Engineering (CPE) is developing a program to assure a complete and orderly transfer of the engineering and design function from Ebasco to CPE. The program provides for the identification of those tasks presently being performed by Ebasco which are to be transferred to Comanche Peak Engineering (CPE) and the identification of all procedures, programs, training and staffing requirements. The program is based upon three prerequisites: (a) the Corrective Action Program (CAP) effort to support plant completion is finished for the particular task; (b) the systems interaction Design Validation Packages (DVPs) are complete; and (c) any required preventive action taken, as discussed in Appendices A and B, is complete.

FIGURE 5-1

CORRECTIVE ACTION PROGRAM (CAP)
SYSTEMS INTERACTION
FLOW CHART AND GOVERNING PROCEDURES



0S4:[050,012]SICAP.DGN;1

QS4:[050.012]CNDCAP.DGN:1

FIGURE 5-2
CORRECTIVE ACTION PROGRAM (CAP) INTERFACES SYSTEMS INTERACTION PROGRAM (SIP)

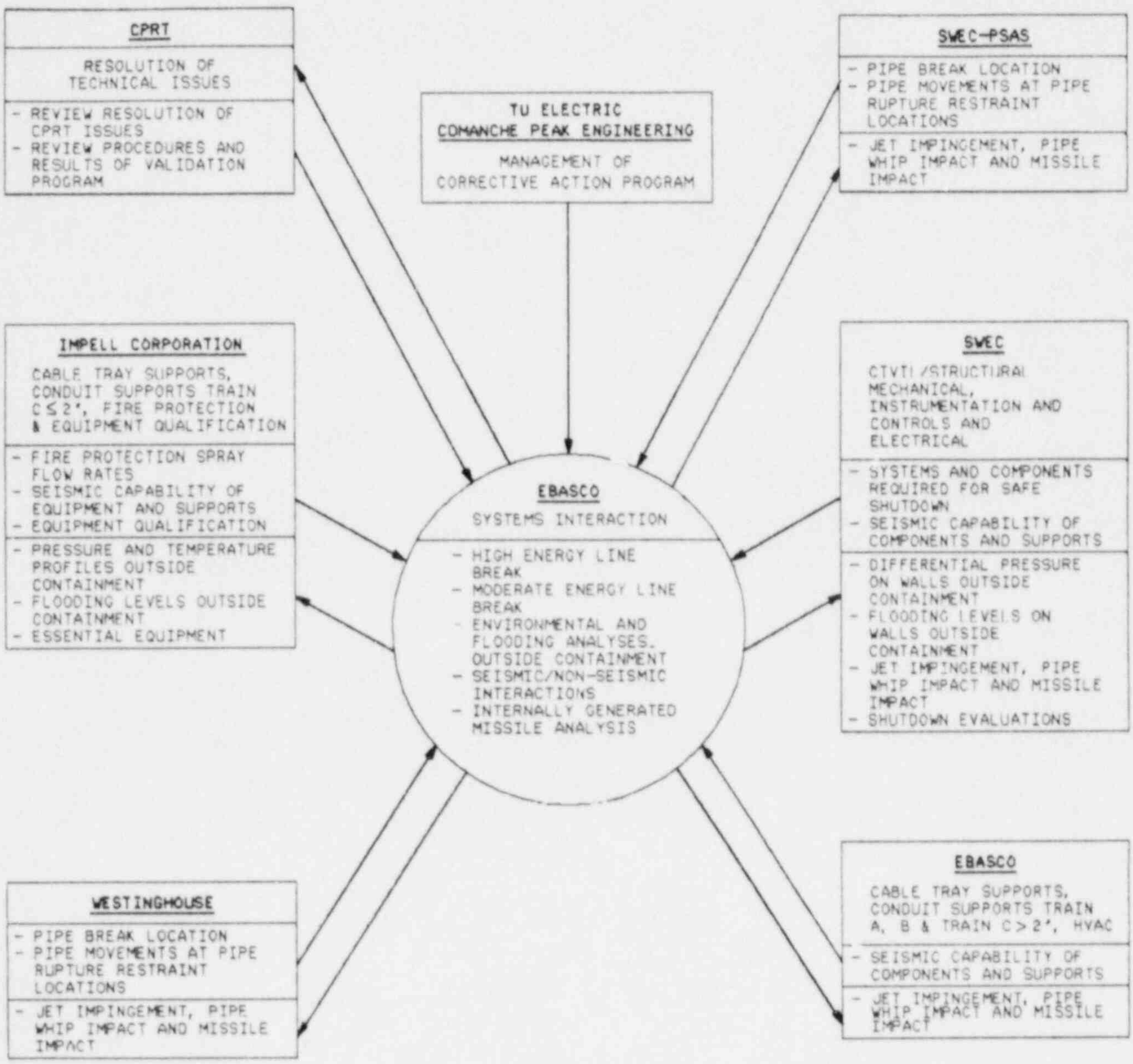


FIGURE 5-3

POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP)

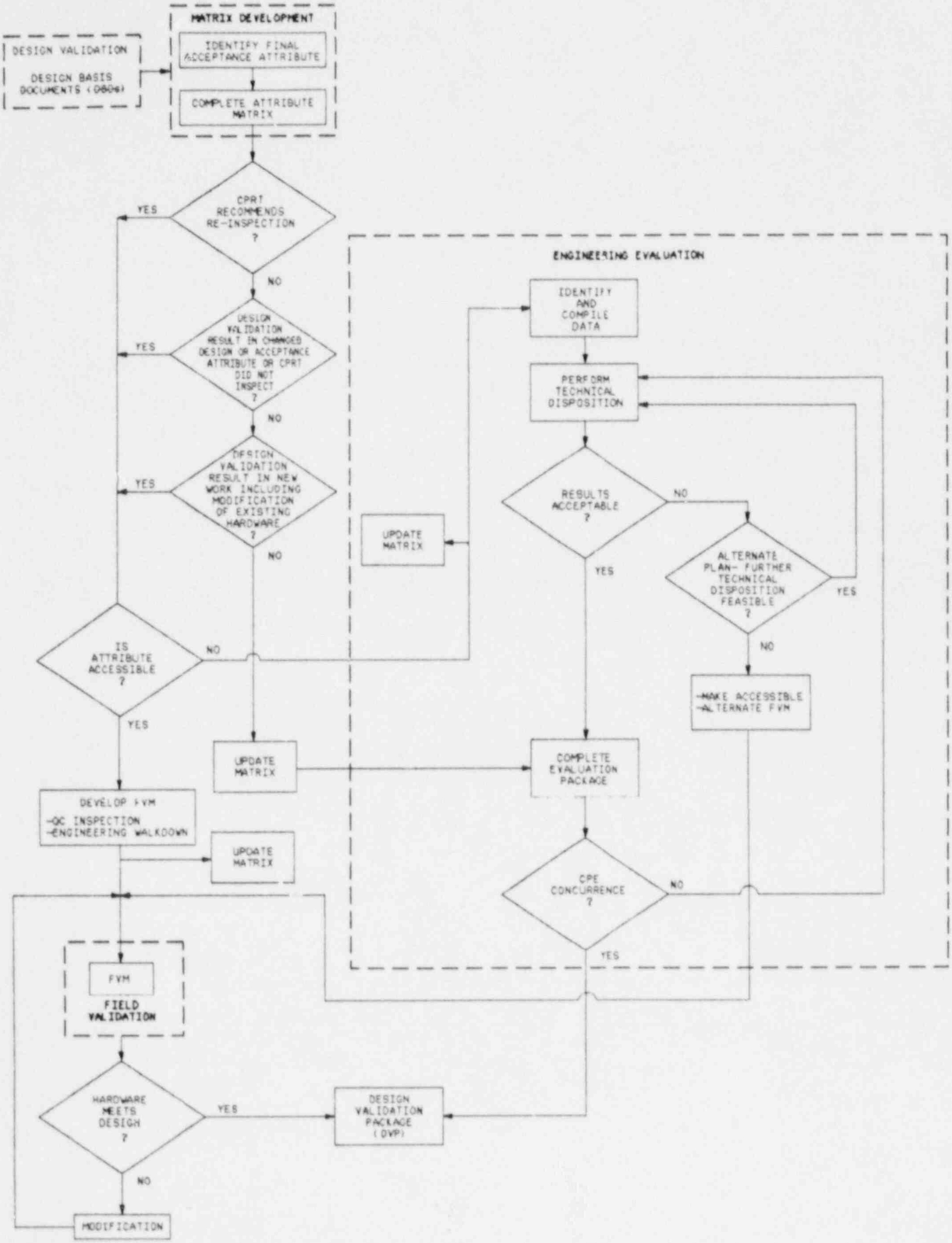


TABLE 5-1

POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP)
SYSTEMS INTERACTION

Construction Work Category	Final Acceptance Attribute	PCHVP Attribute Validation Method
Piping	Identify break location	CPE-EB-FVM-SI-28, 34 (References 12 and 19)
	Identify structures that can effect the zone of influence	CPE-EB-FVM-SI-31 (Reference 15)
Essential Electrical Equipment	Identify location	CPE-EB-FVM-SI-28, 67 (References 12 and 27)
Rotating Equipment	Identify location	CPE-EB-FVM-SI-28, 67 (Reference 12 and 27)
	Identify essential components and Seismic Category I structures within the zone of influence	CPE-EB-FVM-SI-67
Valves	Identify location	CPE-EB-FVM-SI-28, 67
	Identify essential components and Seismic Category I structures within the zone of influence	CPE-EB-FVM-SI-28
Non-Seismic Structure/Components	Identify location	CPE-EB-FVM-SI-40 (Reference 26)
	Identify Seismic Category I components within the zone of influence	CPE-EB-FVM-SI-40
Walls, Floors, Ceilings	Identify rooms and free volumes	CPE-EB-FVM-SI-35, 39 (References 20 and 23)
	Identify vent areas between rooms	CPE-EB-FVM-SI-35, 39

TABLE 5-2

SUMMARY OF AUDITS AND SURVEILLANCES

AUDITS

AUDIT NUMBER	AUDITING ORGANIZATION	LOCATION	DATES OF AUDIT	AUDIT REPORT TRANSMITTAL	AUDIT RESPONSE TRANSMITTAL
2859	Ebasco QA	New York	Mar 24-26, 1987	Apr 1, 1987	Apr 17, 1987
2884	Ebasco QA	New York	Dec 22-29, 1987	In Progress	
ATP-87-45	TU Electric TAP	CPSES	Aug 17-Sep 8, 1987	Oct 13,1987	Nov. 9, 1987
ATP-87-62	TU Electric TAP	CPSES	Nov 17-23, 1987	December 29, 1987	In Progress

SURVEILLANCES - TU ELECTRIC QUALITY ASSURANCE
ENGINEERING SURVEILLANCE

SURVEILLANCE NUMBER	LOCATION	SURVEILLANCE DATES	REPORT TRANSMITTAL
ES-87-008	CPSES	Apr 7-23, 1987	May 6, 1987
ES-87-019	CPSES	May 11-20, 1987	June 16, 1987
ES-87-020	CPSES	May 22-June 3, 1987	June 18, 1987
ES-87-023	CPSES	June 15-22, 1987	June 30, 1987
ES-87-047	CPSES	Sep 4-23, 1987	Oct 16, 1987

6.0 REFERENCES

1. TU Electric Letter No. TXX-6631, W.G. Counsil to U.S. Nuclear Regulatory Commission, Comanche Peak Programs, August 20, 1987

2. TU Electric Letter No. TXX-6500, W.G. Counsil to U.S. Nuclear Regulatory Commission, Comanche Peak Programs, June 25, 1987

3. TERA - DAP-E-M-501, "Evaluation of High Energy Line Breaks", Letter No. DAP-L-161, October 2, 1986

4. TERA - DAP-E-M-507, "Missiles Hazards", Letter No. DAP-L-157, October 1, 1986

5. CPSES Design Basis Document DBD-ME-005 "Seismic/Non-Seismic Systems Interaction Program", Revision 1, December 30, 1987

6. CPSES Design Basis Document DBD-ME-007 "Pipe Break Postulation and Effects", Revision 1, January 8, 1988

7. CPSES Design Basis Document DBD-ME-105 "Missile Postulation and Effects", Revision 1, December 31, 1987

8. Procedure EME-2.24-03 "Systems Interaction Program Essential Component Lists", Revision 1, October 19, 1987

9. Procedure EME-2.24-06 "Systems Interaction Program Sketches", Revision 0, August 18, 1987

10. Procedure EME-2.24-07 "Systems Interaction Program Database Management", Revision 1, September 16, 1987

11. Procedure EME-2.24-08 "Systems Interaction Program Shutdown Analysis", Revision 0, August 18, 1987

12. Field Verification Method CPE-EB-FVM-DS-28 "Location Verification of Components", Revision 1, July 16, 1987

13. Procedure ECE 2.24, "Systems Interaction Program", Revision 0, August 18, 1987

14. Procedure EME-2.24-05 "Pipe Rupture Books", Revision 0, August 18, 1987

15. Field Verification Method CPE-EB-FVM-SI-31 "Field Review of Pipe Rupture Zone of Influence Sketches", Revision 1, July 16, 1987

16. Procedure EME-2.24-09 "Engineering Analysis of Systems Interaction Program Secondary Effects", Revision 0, August 18, 1987

17. Procedure EME-2.24-10 "Systems Interaction Program Interaction Evaluations", Revision 0, August 18, 1987

18. Field Verification Method CPE-EB-FVM-SI-51 "Target Evaluation Data", Revision 0, July 16, 1987

19. Field Verification Method CPE-EB-FVM-SI-34 "HELB Target Identification", Revision 1, July 16, 1987

20. Field Verification Method CPE-EB-FVM-SI-35 "MELB Interaction Identification", Revision 0, July 16, 1987

21. Procedure EME-2.24-02 "Flooding Analyses", Revision 1, October 6, 1987

22. Procedure EME-2.24-04 "Environmental Analyses", Revision 1, October 6, 1987

23. Field Verification Method CPE-EB-FVM-SI-39 "Environmental Analysis As-Built Walkdown Data", Revision 0, July 16, 1987

24. Regulatory Guide 1.29, "Seismic Design Classification", Revision 2, February 1976

25. Procedure EME-2.24-01 "Evaluation of Seismic/Nonseismic Interactions", Revision 1, October 5, 1987

26. Field Verification Method CPE-EB-FVM-SI-40 "Seismic/Non-Seismic Walkdown", Revision 1, October 1, 1987

27. Field Verification Method CPE-EB-FVM-SI-67 "Missile Target Identification", Revision 0, July 16, 1987

28. Comanche Peak Response Team Program Plan and Issue-Specific Action Plans, Appendix D, CPRT Sampling Policy, Applications and Guidelines, Revision 1, January 31, 1986, and Appendix E, Resolution of Discrepancies Identified by the CPRT, Revision 3, June 18, 1987

29. NRC Regulatory Guide 1.64, "Quality Assurance Requirements for the Design of Nuclear Power Plants", Revision 2, June 1976

30. ANSI/ANS 58.2 1980, Standard Design Basis for Protection of Light Water Nuclear Power Plants Against Effects of Postulated Pipe Rupture

31. NRC Regulatory Guide 1.144, "Auditing of Quality Assurance Programs for Nuclear Power Plants", Revision 1, September 1980

32. Ebasco's Topical Report ETR-1001, Ebasco Nuclear Quality Assurance Program Adapted for TU Electric CPSES, Revision 5

33. Ebasco Manual of Procedures for CPSES, October 26, 1987

34. American National Standards Institute (ANSI) N45.2.12, "Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants", Revision 0

35. TU Electric Letter No. TXX-6676, W.G. Counsil to U.S. Nuclear Regulatory Commission Technical Audit Program and Engineering Functional Evaluation, September 8, 1987

36. CPSES Design Basis Document DBD-CS-088 "Pipe Whip Restraints Design and Analysis", Revision 0, September 1, 1987

37. TU Electric CPSES Unit 1 & 2 "Design Basis Consolidation Program Plan", Ebasco Services, Inc., Revision 1, April 11, 1987.

38. Comanche Peak Specification CPE-S-1021 "Commodity Clearance Specification", Revision 0, dated June 5, 1987.

39. Field Verification Method CPE-SWEC-FVM-CS-068, "Commodity Clearance", Revision 0, dated July 31, 1987.

40. Issue Specific Action Plan, Control Room Ceiling ISAP II.d., Revision 1, October 21, 1987

41. American National Standards Institute (ANSI) N45.2.11, Quality Assurance Requirements for the Design of Nuclear Power Plants, Revision 2, May 1973

42. Mechanical Project Status Report (PSR), Revision 0

43. Engineering Construction Procedure ECE-9.04, "Control of the Post Construction Hardware Validation Program Manual", dated September 1987

44. TERA-DAP-E-EIC-505, "Fire Protection", Letter No. DAP-L-40

45. Standard Review Plan 3.6.1 (NUREG-0800), Branch Technical Position ASB3-1, Revision 1, July 1981

46. Conduit Supports Train C 2 Inch Diameter and Less Project Status Report (PSR), Revision 0.

APPENDIX A

COMANCHE PEAK RESPONSE TEAM (CPRT) ISSUES

This appendix contains a comprehensive summary of the Ebasco evaluation, resolution and corrective and preventive action for all Comanche Peak Response Team (CPRT) issues which are related to the Systems Interaction Program (SIP). Specific references to the design criteria or procedures which have resolved the issues are provided.

To report the resolution of the Comanche Peak Response Team (CPRT) issues, an individual subappendix was developed for each issue. Each subappendix includes: a definition of the issue; issue resolution; and corrective and preventive action.

Issue A1 came from Issue Resolution Report (IRR), DAP-E-M-501 (Reference 3) related to High Energy Line Breaks (HELBs). Issue A2 came from Issue Resolution Report (IRR), DAP-E-M-507 (Reference 4) related to internally generated missile evaluations. Issue A3 came from the Issue Specific Action Plan (ISAP) related to Control Room Ceiling, ISAP II.d (Reference 40). Issue A4 came from Issue Resolution Report (IRR), DAP-E-EIC-505 (Reference 44) related to Fire Protection.

The preventive action is embodied in the procedures and the Design Basis Documents (DBDs) developed and used in the systems interaction portion of the Corrective Action Program (CAP). These procedures and the Design Basis Documents (DBDs) resolve all Comanche Peak Response Team (CPRT) issues. Implementation of these preventive actions can assure that the design and hardware for CPSES Unit 1 and Common will continue to comply with the licensing commitments throughout the life of the plant as described in Section 5.4.

Comanche Peak Response Team (CPRT) issues contained in Appendix A are listed below:

Issue No.	Issue Title
A1	High Energy Line Break Protection
A2	Missile Hazards
A3	Seismic Design of Control Room Ceiling Elements
A4	Fire Protection Systems Interaction

SUBAPPENDIX A1

HIGH ENERGY LINE BREAK PROTECTION (IRR DAP-E-M-501)

1.0 Definition of Issue

1.1 Jet Impingement Loads and Area Projections

The issue was that the use of inappropriate methods of calculating jet impingement loads and area projections in the original calculations may have produced inaccurate loads.

1.2 Pipe Whip Zones of Influence

The issue was that insufficient documentation existed to justify the original pipe whip zones of influence.

1.3 Identification of Safety-Related Targets

The issue was that the original design may have had incomplete identification of essential targets within the postulated pipe break jet impingement and pipe whip zones of influence. This may have been due to:

- Incorrect determination of jet impingement zones of influence;
- Incorrect determination of pipe whip zones of influence;
- Inaccurate surveys.

1.4 Environmental Parameters

The issue was that the original environmental parameters may not have been accurate because the original high energy line break (HELB) calculations were not up to date concerning changes in CPSES Unit 1 and Common architectural features and break locations. This issue was also raised in IRR DAP-E-EIC-503 (Reference 4.13).

1.5 Safe Shutdown Capability

The issue was that insufficient documentation existed to justify the high energy line break (HELB) safe shutdown capability.

2.0 Issue Resolution

2.1 Jet Impingement Loads and Area Projections

Ebasco resolved this issue by performing new calculations to validate the pipe break jet impingement loads and area projections. These calculations were performed in accordance with Systems Interaction Program (SIP) procedures (References 4.1, 4.3 and 4.4) and were based on the design criteria in the Design Basis Document (DBD) (Reference 4.2).

2.2 Pipe Whip Zones of Influence

Ebasco resolved this issue by developing a Design Basis Document (DBD) (Reference 4.2), Systems Interaction Program (SIP) procedures (References 4.1, 4.3, 4.7 and 4.8) and by performing new calculations to develop validated zones of influence calculations. These procedures require that the zone of influence calculations be documented.

2.3 Identification of Safety-Related Targets

Ebasco resolved the issue by developing validated pipe whip and jet impingement zones of influence calculations based on the design criteria specified in the Design Basis Document (DBD) (Reference 4.2) and Systems Interaction Program (SIP) procedures (References 4.7, 4.8, and 4.9). References 4.7 and 4.8 provide guidance on the proper determination of jet impingement and pipe whip zones of influence. Reference 4.9 provides guidance for conducting target identification surveys.

2.4 Environmental Parameters

Ebasco resolved this issue by validating the environmental parameters by performing new high energy line break (HELB) calculations. These calculations were based on CPSES Unit 1 and Common design documents and engineering walkdowns (Reference 4.6). The Systems Interaction Program (SIP) procedure (Reference 4.1) provides controls for maintaining the calculations current with plant design.

2.5 Safe Shutdown Capability

Ebasco resolved this issue by performing a calculation validating and documenting the safe shutdown capability of CPSES Unit 1 and Common as a result of high energy line breaks (HELBs). This calculation was performed in accordance with Systems Interaction Program (SIP) procedures (References 4.1, 4.10 and 4.11) and was based on the criteria in the Design Basis Document (DBD) (Reference 4.2).

3.0 Corrective and Preventive Action

- No additional issues were identified during review and resolution of these issues.

- These issues were determined to be reportable under the provisions of 10CFR 50.55(e). It was reported as Significant Deficiencies Analysis Report (SDAR) CP-87-133 in letter number (TXX-88118), dated January 18, 1988 from TU Electric to the NRC.

3.1 Corrective Action

New calculations have been performed in accordance with Systems Interaction Program (SIP) procedures (References 4.1, 4.3, 4.4, 4.7, 4.10 and 4.11) and based on the Design Basis Document (DBD) (Reference 4.2) that validated the high energy line break (HELB) design. Engineering walkdowns are being performed during the Post Construction (PCHVP) in accordance with Systems Interaction Program (SIP) procedures (References 4.5, 4.6, 4.8, 4.9 and 4.12) to validate the hardware.

3.2 Preventive Action

Systems Interaction Program (SIP) procedures (References 4.1, 4.3 and 4.4) and Design Basis Document (DBD) (Reference 4.2) were developed and used to validate the high energy line break (HELB) calculations. In addition the Systems Interaction Program (SIP) developed and implemented a design control procedure (Reference 4.1) which requires that all calculations and evaluations be checked and independently reviewed and that the calculations and evaluation documentation be properly controlled.

4.0 References

4.1 Procedure ECE 2.24, "Systems Interaction Program", Rev 0.

4.2 Design Basis Document, DBD-ME-007, "Pipe Break Postulation and Effects", Rev 1.

4.3 Procedure EME 2.24-05, "Pipe Rupture Books", Rev 0.

4.4 Procedure EME 2.24-10, "Systems Interaction Program Interaction Evaluations", Rev 0.

4.5 Field Verification Method, CPE-EB-FVM-SI-51, Target Evaluation Data, Rev 0.

4.6 Field Verification Method, CPE-EB-FVM-SI-39, "Environmental Analysis As-Built Walkdown Data", Rev 0.

4.7 Procedure EME 2.24-06, "Systems Interaction Program Sketches", Rev 0.

4.0 References Cont'd

4.8 Field Verification Method, CPE-EB-FVM-SI-31, "Field Review of Type Rupture Zone of Influence Sketches", Rev 1.

4.9 Field Verification Method, CPE-EB-FVM-SI-34, "High Energy Line Break Target Identification", Rev 1.

4.10 Procedure EME 2.24-08, "Systems Interaction Program Shutdown Analysis", Rev 0.

4.11 Procedure EME 2.24-03, "Systems Interaction Program Essential Component Lists", Rev 1.

4.12 Field Verification Method, CPE-EB-FVM-SI-28, "Location Verification of Components", Rev 1.

4.13 TERRA IRR DAP-E-EIC-503, Environmental Qualification of Electrical and Mechanical Equipment, Letter DAP-L-161, Rev 0, October 2, 1986.

SUBAPPENDIX A2

MISSILE HAZARDS (IRR DAP-E-M-507)

1.0 Definition of the Issue

The issue was that insufficient documentation existed for the original internally generated missile analysis and therefore the protection of the essential systems, structures and components could not be demonstrated.

2.0 Issue Resolution

Ebasco resolved this issue by developing a Field Verification Method (FVM) (Reference 4.3) based on the Systems Interaction Program (SIP) procedure (Reference 4.1) and on the criteria in the Design Basis Document (DBD) (Reference 4.2). This Field Verification Method (FVM) (Reference 4.3) is being used for the performance of engineering walkdowns and evaluations during the Post Construction Hardware Validation Program (PCHVP). These engineering walkdowns and evaluations validate and document that essential systems, structures and components will continue to perform their safety-related function to safely shutdown the reactor and mitigate the consequences of a postulated missile generation event.

3.0 Corrective and Preventive Action

- No additional issues were identified during the review and resolution of this issue.
- This issue was determined not to be reportable under the provisions of 10CFR50.55(e).

3.1 Corrective Action

Engineering walkdowns (Reference 4.3) and evaluations are performed and documented in accordance with the Systems Interaction Program (SIP) procedures (Reference 4.1) and based on the Design Basis Document (DBD) (Reference 4.2).

3.2 Preventive Action

A Systems Interaction Program (SIP) procedure (Reference 4.1) and a Design Basis Document (DBD) (Reference 4.2) were developed and used during the design validation process. In addition this design control procedure (Reference 4.1) requires that all calculations and evaluations be checked and independently reviewed and that the calculations and evaluation documentation be properly controlled.

4.0 References

4.1 Procedure ECE 2.24, "Systems Interaction Program", Rev 0.

4.2 Design Basis Document, DBD-ME-105, "Missile Postulation and Effects", Rev 1.

4.3 Field Verification Method, CPE-EB-FVM-SI-67 "Missile Target Identification," Rev 0.

SUBAPPENDIX A3

SEISMIC DESIGN OF CONTROL ROOM CEILING ELEMENTS (ISAP II.d, systems interaction portion)

1.0 Definition of Issue

1.1 Line Mounted Items on Small Bore Piping

The issue was that potential interactions resulting from commodities that were line mounted on small bore piping were not identified.

1.2 Pipe/Conduit Over Cable Trays

Ebasco resolved this issue by developing a Field Verification Method (FVM) (Reference 4.2) to evaluate the interactions between pipes/conduits and cable trays that were originally resolved based on inadequate criterion. This Field Verification Method (FVM) (Reference 4.2) is being used for the performance of engineering walkdowns and evaluations during the Post Construction Hardware Validation Program (PCHVP). These engineering walkdowns and evaluations are performed in accordance with Systems Interaction Program (SIP) procedures (References 4.1, 4.2, and 4.3) and are based on the design criteria in the Design Basis Document (DBD) (Reference 4.4).

1.3 Evaluation of Architectural Features

The issue was that architectural features (e.g., doors, ladders, platforms, gratings, handrails, and sheetrock walls) were not specifically addressed in the systems interaction seismic/non-seismic program.

2.0 Issue Resolution

2.1 Line Mounted Items on Small Bore Piping

Ebasco resolved this issue by developing a Field Verification Method (FVM) (Reference 4.2) to identify and evaluate interactions resulting from commodities that are line mounted on small bore piping. This Field Verification Method (FVM) (Reference 4.2) is being used for the performance of engineering walkdowns and evaluations during the Post Construction Hardware Validation Program (PCHVP). These engineering walkdowns and evaluations are performed in accordance with Systems Interaction Program (SIP) procedures (References 4.1, 4.2, and 4.3) and are based on the design criteria specified in the Design Basis Document (DBD) (Reference 4.4).

2.2 Pipe/Conduit Over Cable Trays

Ebasco resolved this issue by developing a Field Verification Method (FVM) (Reference 4.2) to evaluate the interactions between pipes/conduits and cable trays that were originally resolved based on inadequate criterion. This Field Verification Method (FVM) (Reference 4.2) is being used for the performance of engineering walkdowns and evaluations during the Post Construction Hardware Validation Program (PCHVP). These engineering walkdowns and evaluations are performed in accordance with Systems Interaction Program (SIP) procedures (References 4.1, 4.2, and 4.3) and are based on the design criteria specified in the Design Basis Document (DBD) (Reference 4.4).

2.3 Evaluation of Architectural Features

Ebasco resolved this issue by developing a Field Verification Method (FVM) (Reference 4.2) to evaluate the effects of interactions between architectural features in the control room and safety related components. This Field Verification Method (FVM) (Reference 4.2) is being used for the performance of engineering walkdowns and evaluations during the Post Construction Hardware Validation Program (PCHVP). These engineering walkdowns and evaluations are performed in accordance with Systems Interactions Program (SIP) procedures (References 4.1, 4.2, and 4.3) and are based on the design criteria specified in the Design Basis Document (DBD) (Reference 4.4). The architectural features requiring modification to comply with the design criteria are being identified to SWEC civil/structural. The validation that these architectural features will retain their structural integrity is described in the Civil/structural Project Status Report (PSR) (Reference 4.5).

3.0 <u>Corrective and Preventive Action</u>

- No additional issues were identified during review and resolution of the issues.
- These issues were determined to be reportable under the provisions of 10CFR 50.55(e). It was reported as Significant Deficiency Analysis Report (SDAR) CP-86-54 in letter number TXX-6007 dated October 31, 1986 from TU Electric to the NRC.

3.1 Corrective Action

Engineering walkdowns and evaluations were performed in accordance with System Interaction Program (SIP) procedures (References 4.1, 4.2 and 4.3) and based on the Design Basis Document (DBD) (Reference 4.4). These engineering walkdowns and evaluations validated that interactions involving small bore line mounted items, pipe/conduit over cable trays and architectural features comply with the design criteria.

3.2 Preventive Action

The System Interaction Program (SIP) procedures (References 4.1, 4.2 and 4.3) and Design Basis Documents (DBD) (Reference 4.4) were developed and used during the performance of Systems Interaction Program (SIP).

4.0 <u>References</u>

4.1 Procedure ECE 2.24, "Systems Interaction Program", Rev 0.

4.2 Field Verification Method, CPE-EB-FVM-SI-40, "Seismic/ Nonseismic Walkdowns", Rev 1.

4.3 Procedure EME 2.24-01, "Evaluation of Seismic/Nonseismic Interactions", Rev 1.

4.4 Design Basis Document, DBD-ME-005, "Seismic/Nonseismic Systems Interaction Program", Rev 1.

4.5 Civil/Structural Project Status Report (PSR), Rev 0.

SUBAPPENDIX A4

FIRE PROTECTION SYSTEMS INTERACTION (IRR DAP-E-EIC-505)

1.0 Definition of the Issue

The issues were as follows:

1.1 Seismic Qualification of Deluge Valves

1.1.A The issue was that diesel generator operability could be affected by inadvertent operation of the diesel generator fuel oil day tank room fire protection system due to a seismically induced failure of the deluge valve.

1.1.B This issue was that diesel generator operability could be affected by inadvertent operation of the diesel generator room fire protection system due to a seismically induced failure of the fusible link type sprinkler heads.

1.2 Diesel Generator Room Spray Shields

The issue was that diesel generator operability could be affected by inadvertent operation of the fire suppression system resulting in damage to equipment from the effects of water sprays.

1.3 Seismic Supporting of Fire water Piping in Diesel Generator Rooms

The issue was that diesel generator operability could be affected by damage due to seismically induced failure of fire suppression system piping in diesel generator rooms.

2.0 Issue Resolution

2.1 Seismic Qualification of Deluge Valves

2.1.A Ebasco resolved this issue by performing new flooding calculations to validate flood levels resulting from seismic induced inadvertent operation of the diesel generator fuel oil day tank rooms fire suppression deluge valves. The calculations were performed in accordance with Systems Interaction Program (SIP) procedures (Reference 4.1, 4.2, 4.3) and were based on the design criteria in the Design Basis Document (DBD) (Reference 4.4). These calculations demonstrate that the flood levels are such that the diesel generator operability is not affected.

2.1.B The resolution of this issue is addressed in the Fire Protection Project Status Report (PSR) (Supplement B of the Mechanical PSR).

2.2 Diesel Generator Room Spray Shields

The resolution of this issue is addressed in the Fire Protection Project Status Report (PSR) (Supplement B of the Mechanical PSR).

2.3 Seismic Supporting of Fire Water Piping in Diesel Generator Rooms

Ebasco resolved this issue by reviewing the design specification (Reference 4.5) and performing new flooding calculations. This review validated that the fire suppression system piping in the diesel generator rooms is seismically supported (i.e., the piping can leak, but it will not fall). This review was performed in accordance with Systems Interaction Program Procedure (Reference 4.1) and was based on the criteria in the Design Basis Document (DBD) (Reference 4.5). The flooding calculations validate the flooding levels resulting from seismically induced failure of fire suppression system piping in the diesel generator rooms. The calculations were performed in accordance with Systems Interaction Program procedures 9Reference 4.1, 4.2, and 4.3) and were based on the design criteria in the DBD (Reference 4.4). These calculations demonstrate that the flood levels are such that the diesel generator operability is not affected.

3.0 Corrective and Preventive Action

- No additional issues were identified during the review and resolution of this issue.

- This issue was determined not to be reportable under the provisions of 10CFR50.55(e).

3.1 Corrective Action

New flooding calculations have been performed in accordance with Systems Interaction Program (SIP) procedures (References 4.1, 4.2, and 4.3) and based on the design Basis Document (DBD) (Reference 4.4) that validated that the diesel generator operability is not affected in the event of seismically induced failure of the deluge valves and/or fire suppression system piping.

3.2 Preventive Action

Systems Interaction Program (SIP) procedures (Reference 4.1, 4.2, and 4.3) were developed to evaluate system interactions due to flooding in accordance with the design criteria specified in the Design Basis Document (DBD) (Reference 4.4) and used to validate the diesel generator systems interaction design.

4.0 References

4.1 Procedure ECE 2.24, "Systems Interaction Program", Rev 0.

4.2 Procedure EME 2.24-02, "Flooding Analysis", Rev 1.

4.3 Field Verification Method, CPE-EB-FVM-SI-35, "MELB Interaction Identification, Rev 0.

4.4 Design Basis Document, DBD-ME-007, "Pipe Break Postulation and Effects", Rev 1.

4.5 Design Specification 2323-MS-46B, "Piping Hangers (Non-nuclear)", Rev 3.

4.6 Design Basis Document - DBD-ME-005, "Seismic/Non-Seismic Systems Interaction Program", Rev 1.

APPENDIX B

ISSUES IDENTIFIED DURING THE PERFORMANCE OF THE CORRECTIVE ACTION PROGRAM (CAP)

This appendix describes the details of the resolutions of issues that have been determined to be reportable under the provision of 10CFR50.55(e) and were identified during the performance of the systems interaction portion of the Corrective Action Program (CAP). Included in this appendix are systems interaction related Significant Deficiency Analysis Report (SDARs) initiated by TU Electric. Specific references to the criteria and procedures which have resolved the issues are provided.

To report the resolution of issues identified during performance of the Corrective Action Program (CAP), an individual subappendix was developed for each issue. Each subappendix includes: a definition of the issue; issue resolution; and corrective and preventive action.

The preventive action is embodied in the procedures and Design Basis Documents (DBDs) developed and used in the systems interaction portion of the Corrective Action Program (CAP). These procedures and Design Basis Documents (DBDs) resolve the systems interaction portion of the Corrective Action Program (CAP) issues. Implementation of these preventive actions can assure that the design and hardware for CPSES Unit 1 and Common will continue to comply with the licensing commitments throughout the life of the plant as described in Section 5.4.

Ebasco has reviewed the Safety Evaluation Report (SER) and its supplements (SSERs) and determined that the systems interaction design criteria, design procedures and validated hardware are consistent with the NRC staff positions stated in the SER and its supplements (SSERs). Specific references to the criteria, procedures, engineering studies, and tests which have resolved the issue are provided.

Corrective Action Program (CAP) issues contained in Appendix B are listed below:

Issue No.	Issue Title
B1	SDAR CP-87-57, Computer Modeling Error: COMPARE MOD 1A
B2	SDAR CP-87-58, Computer Modeling Error: RELAP-3

SUBAPPENDIX B1

SDAR CP-87-57, COMPUTER MODELING ERROR: COMPARE MOD 1A

1.0 Definition of the Issue

The issue was that an incorrect computer model orginally used for damper operation may have resulted in miscalculation of environmental conditions due to postulated high energy line breaks (HELBs) outside containment.

2.0 Issue Resolution

Ebasco resolved this issue by revising the computer model of the dampers to be consistent with the operation described in vendor documentation. New outside containment high energy line break (HELB) environmental calculations were performed using the validated computer model.

3.0 Corrective and Preventive Action

- No additional issues were identified during the review and resolution of this issue.

- This issue was determined to be reportable under the provisions of 10CFR50.55(e). It was reported as Significant Deficiency Analysis Report (SDAR) CP-87-57 by letter TXX-6929, dated 11/16/87 from TU Electric to the NRC.

3.1 Corrective Aciton

Calculations have been performed by Ebasco in accordance with Systems Interaction Program (SIP) procedures (References 4.1 and 4.2) based upon the design criteria specified in the Design Basis Document (DBD) (Reference 4.3) to validate the outside containment high energy line break (HELB) environmental conditions. These validated calculations used the revised computer model and replaced the original calculations.

3.2 Preventive Aciton

The design procedure (Reference 4.1) requires the review of input data for calculations and computer models.

4.0 References

4.1 Procedure ECE 2.24, "Systems Interaction Program", Rev 0.

4.2 Procedure EME 2.24-04 "Systems Interaction Program Environmental Analysis", Rev 1.

4.3 Design Basis Document (DBD), DBD-ME-007 "Pipe Break Postulation and Effects", Rev 1.

SUBAPPENDIX B2

SDAR CP-87-58, COMPUTER MODELING ERROR: RELAP 3

1.0 Definition of the Issue

The issue was that errors in the RELAP-3 computer code and errors in the original systems interaction model used with the RELAP-3 code resulted in miscalculation of loads applied to pipe whip restraints.

2.0 Issue Resolution

Ebasco resolved this issue by using the RELAP-5 computer code and by revising the systems interaction models during the design validation process. Computer code RELAP-5 is the latest version of the RELAP series of computer codes and incorporates the resolution of deficiencies noted in RELAP-3. New pipe whip restraint load calculations were performed using RELAP-5 and the validated computer models.

3.0 Corrective and Preventive Action

- No additional issues were identified during the review and resolution of this issue.

- This issue was determined to be reportable under the provisions of 10CFR50.55(e). It was reported as Significant Deficiency Analysis Report (SDAR) CP-87-58 by letter TXX-6951, dated 11/16/87 from TU Electric to the NRC.

3.1 Corrective Action

Calculations have been performed by Ebasco in accordance with Systems Interaction Program (SIP) procedures (References 4.1 and 4.2) based upon the design criteria specified in the Design Basis Document (DBD) (Reference 4.3) to validate the loads applied to pipe whip restraints. These calculations used RELAP-5 and the validated computer models to replace the original calculations.

3.2 Preventive Action

Design procedures (References 4.1 and 4.2) require the review of input data for calculations and computer codes and provide requirements for developing system interaction models.

4.0 References

4.1 Procedure ECE 2.24, "Systems Interaction Program", Rev 0.

4.2 Procedure EME 2.24-05, "Pipe Rupture Books", Rev 0.

4.3 Design Basis Document (DBD) DBD-ME-007, "Pipe Break Postulation and Effects", Rev 1.