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NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Docket Nos. 50-445 and 50-446

MEMORANDUM FOR: James C. McKnight
Document Management Branch
Division of Technical Information and
Document Control

FROM: Jose A. Calvo, Manager
Systems/Operational Group
Comanche Peak Project

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION,
PLACEMENT OF DOCUMENTS IN PDR

The attached documents are to be placed in the Comanche Peak File in the Public Document Room. The subject of these documents is the "Comanche Peak Response Team Program Plan and Issue Specific Action Plans."

The attached documents are (1) draft copy of Appendix A, (2) draft copy of Section X of Appendix C, and (3) draft copy of Section XI of Appendix C to the above Comanche Peak Program Plan.

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APPENDIX A

DESIGN ADEQUACY PROGRAM PLAN

I. INTRODUCTION - OBJECTIVES

Concerns regarding the construction and construction process at CPSES have been raised by a number of sources external to Texas Utilities. These sources are: the NRC Staff Technical Review Team reports ("TRT"), the NRC ASLB proceedings on the CPSES operating license ("ASLB"), the NRC Staff's Supplemental Safety Evaluation Reports ("SSERs") and its Construction Assessment Team ("CAT") and Special Investigation Team ("SIT") reports, certain Inspection Reports issued by NRC's Region IV staff ("R-IV"), and the Cygna Independent Assessment Program ("IAP"). Most of these issues have addressed concerns regarding the adequacy of the construction of installed hardware and the adequacy of the construction QA/QC program, but certain of the issues concern the adequacy of the CPSES design and/or the adequacy of the CPSES design process. In addition, some of the hardware issues raised by these external sources have been determined to have potential implications for the adequacy of the design or design process.

The CPRT has been charged with responding to and resolving the TRT and ASLB issues and remaining open SSER, CAT, SIT, R-IV and IAP issues (collectively, these are sometimes referred to herein as the "External Source issues"), and with advising Texas Utilities management whether there is reasonable assurance that CPSES can be operated without undue risk to the public. This Program Plan has been formulated by CPRT to accomplish that objective as it relates to the adequacy of the CPSES design and the adequacy of the CPSES design process. The Program Plan has three components:

> First, the CPRT will evaluate each of the specific design and programmatic design process issues raised by the External Sources. It will determine the nature of any safety significant design or design process deficiencies and the corrective actions necessary to resolve them. This aspect of the Program Plan will lead to the conclusion that there is reasonable assurance that there are no undetected and uncorrected safety significant design deficiencies associated with any of the External Sources issues.
>
> Second, the CPRT will investigate the root cause of each found safety significant deficiency (or trend of non-safety significant design deviations) and analyze the generic implications in order to determine the extent of any additional design efforts that might be deficient for similar reasons. This aspect of the Program Plan will lead to the conclusion that there is reasonable assurance that there are no undetected and uncorrected safety significant design deficiencies attributable to any of the root causes of safety-

significant design deficiencies associated with any of the External Source issues.

These two components of the Plan are complimentary and each has the potential for expanding the other. The evaluation of root cause and generic implications may lead to additional areas of the design or design process requiring evaluation, and the evaluation of found safety-significant design deficiencies (or trends of non-safety-significant deviations) may lead to the establishment of additional root causes and potential generic implications. Similarly evaluation of specific design issues may lead to the expansion of programmatic issues and the evaluation of programmatic root causes may lead to expansion of the review of specific designs.

The sum of the first two components of the Plan of this Design Adequacy Program Plan will fully resolve each of the External Source issues and it will fully bound the safety significant implications of any identified or found deficiency in either the CPSES design or the CPSES design process. It will also permit CPRT to make a statement about both the adequacy of the design of CPSES, the process by which that design was accomplished and the effectiveness of implementation of the design QA program.

For additional confidence, however, the CPRT will also conduct a Self-initiated Evaluation of selected additional design areas. These areas have been selected such that, when aggregated with the design investigations conducted in response to the External Sources issues, the investigation will have covered all of the significant design disciplines, activities and processes employed during the design of the project. Attachment 1 graphically demonstrates complete coverage of both the design and construction processes at CPSES by showing the inter-relationship between these CPSES processes and the CPRT Program Plan activities including the Design Adequacy, Quality of Construction and QA/QC Adequacy Programs. The addition of the Self-initiated Evaluation component will lead to the conclusion that there is reasonable assurance that there are no undetected and uncorrected safety significant design deficiencies at CPSES, regardless of the extent to which the design or design process may have been questioned by any of the External Sources.

Implementation of the Program Plan is by execution of Discipline Specific Action Plans ("DSAP's"), the methodology of which is described herein, and by the preparation of the results reports and a final Design Adequacy Program report described in "End Products."

II. ELEMENTS OF THE PLAN

A. The Design Adequacy DSAPs

The design adequacy DSAPs contain tasks falling into three categories:

- o The Category 1 DSAP tasks address specific CPSES design issues (other than Piping and Pipe Supports), either regarding the adequacy of the design or of the design process, that have been identified by the External Sources or that have been identified by the CPRT in the course of evaluating External Source issues for other (i.e., hardware) concerns.

- o The Category 2 DSAP tasks implement the CPRT's Self-initiated design evaluations (for areas other than Piping and Pipe Supports).

Typically, single DSAPs contain initiatives that are designed both to respond to specific concerns in a given design area and to implement a portion of the Self-initiated Evaluation in the same area.

- o The Category 3 DSAP includes a special Piping and Pipe Support program that will result in a significant level of reanalysis of these systems. This reanalysis will be performed for the CPSES project by an outside organization with no responsiblity for the original piping design, and the analytical process, the design criteria and root cause/generic implications will be reviewed by CPRT third-party personnel. This program is in part responsive to certain of the External Source issues and is in part a self-initiated action on the part of TUGCO.

The DSAP's are organized by the design disciplines they cover:

Civil/Structural
Piping/Supports
Mechanical Systems and Components
Electrical/Instrumentation & Control Systems and Components

The DSAPs themselves are included in Appendix C of the CPRT Program Plan.

1. <u>Initiatives Related to Specific External Source Concerns</u>

A six-step methodology is employed to respond to External Source issues. The logic governing execution of this methodology is provided as Attachment 2.

<u>Identification of Issues</u> is accomplished by a systematic review of the documents containing the External Source issues for concerns implicating either the CPSES design or design process. In addition to the primary source documents (e.g., TRT reports, SSERs and ASLB Memoranda), the documents reviewed include motions, affidavits and responses thereto filed by the parties to the ASLB proceeding, transcripts of technical meetings and documents referenced in the primary source documents. Where a review of the document by a member of the Design Adequacy

Review Team reveals a potential design concern, the concern is entered in the Issues Tracking Log, together with information regarding the source of the concern and the type of concern, and together with a cross-reference to the DSAP and associated tasks by which the concern will be addressed. This system is controlled by procedures and ensures thoroughness in the issues screening process, control over the issue resolution process, and the sorting of related issues for efficient resolution.

The Design Adequacy Review Team will review External Source documents for potential design issues. Where an identified issue has previously been resolved to the satisfaction of the source, the Review Team will review the resolution and, if determined to be consistent with existing knowedge including consideration of generic implications, the issue will be considered resolved with no further initiatives; however relevant information will be retained for use in generic implications evaluations.

As potential issues are identified, the Review Team will review documentation pertinent to the issue, including 10 CFR 50.55(e) reports, Design Deviation Reports, and Design Change Approval and Component Modification Card documentation. The Review Team may also make a preliminary evaluation of available documentation, including engineering walk-downs to qualify potential issues, identifying those issues requiring further review.

Definition of Issues requires that determinations be made about the adequacy of available documentation, identification of the potentially affected hardware, and the nature of the programmatic issues (i.e., design processes, design organizations, organizational interfaces) involved. The objective of this effort is to define the issue sufficiently to allow a determination of whether additional evaluations are required or whether direct corrective action is warranted based on the available information. The data obtained in this effort are also used as input into the root cause and Generic Implications evaluation.

Development of the Action Plan occurs once the issue has been sufficiently defined. Where an issue appears to be isolated, an issue-specific action plan (ISAP), or additional tasks within a DSAP may be devoted to that issue alone. Where the issue appears to have a potentially cumulative effect with other issues, tasks will be developed that permit an integrated solution to the set of potentially cumulative issues. Where identified, apparent or suspected root causes may be employed in determining the scope of an integrated ISAP or DSAP tasks.

This process has already identified two areas in which a sub-program, each consisting of multiple tasks, is appropriate: one sub-program deals with all issues relating to piping and pipe supports and the other covers cable trays, conduits and their supports.

In developing action plans it may be determined that it is more efficient to proceed directly to a corrective action program (such as for the modification or replacement of hardware) than to proceed with further engineering evaluation that might qualify the existing hardware.

Implementation of Action Plans will employ one or more of the evaluative initiatives described below to evaluate the adequacy of the CPSES designs and design processes. All implementation will be performed by third-party personnel meeting the CPRT criteria for objectivity or will be performed by the project and verified by third-party personnel. (All analyses that will become a design basis evaluation of record fall into the latter category). This step will include an investigation of root cause and generic implications to define the need for corrective action fully.

Corrective Actions will be determined in the case of all design deviations and safety-significant hardware deficiencies. All safety significant hardware deficiencies will be modified or replaced. All non-safety significant deviations from design commitments will result either in modification of the hardware to conform to the design commitments or justification for a modification of the design commitment.

Results Reports will be prepared as described below in "End Products."

This methodology for resolving External Source Issues has been partially implemented to date, leading to the identification of need for and development of action plan tasks within the DSAPs. The identified design-related External Source Issues requiring evaluation are listed by DSAP in Attachment 3.

Implementation of the Category 1 DSAPs will provide reasonable assurance that there are no undetectd and uncorrected safety-significant design deficiencies related to the External Source issues (or attributable to the same causes as any such deficiencies). Implementation of the Category 1 DSAP's will also provide input into the collective evaluations of design of CPSES and the design process employed at CPSES.

2. The Self-Initiated DSAP's

Determination of Scope

The self-initiated design evaluations are intended to extend beyond the scope of the External Source Issues and amplify the conclusions reached regarding the existence of undetected and uncorrected safety significant design deficiencies. The approach selected includes review and evaluation of a detailed "vertical slice" of the CPSES design effort, represented by a carefully selected sample of design areas within the entire class 1E, onsite electric power system and the auxiliary feedwater system (AFW) including hydraulic and instrumentation and control (I&C) design considerations. Additionally, a "vertical slice" of the civil/structural design has been selected. This "initial scope" will be expanded as appropriate to ensure consideration of all design activities, organizations and processes. The initial scope has been represented on matrices which present the design areas to be evaluated and the general depth of evaluation in terms of the ANSI N45.2.11 design review process (to be described later). Attachment 4 contains the initial scope matrices for each discipline.

The scope of the design reviews to be accomplished is determined by a four-step source-development process. The first step involves a systematic review of the scope of Independent Design Verification Programs ("IDVPs") and Integrated Design Inspections ("IDIs") conducted at other nuclear power plants for licensing purposes and a comparison of both the scope (breadth and depth) and findings of previous design assessments conducted at CPSES (which are themselves a source of the Category I ISAP's) and the initial scope contemplated under this Program. This activity provides confirmation that when aggregated, the initial design assessments to be conducted under this program cover all of the significant design areas and disciplines at CPSES.

The second step involves an evaluation of the selected systems to confirm that these are representative of other safety-related systems and that conclusions drawn may be later extrapolated. A profile of general characteristics for safety-related systems (e.g. design criteria, hardware types, organizations, interfaces, etc.) is developed for nine safety-related systems and a comparison made.

These first two steps have been accomplished. (For further detail, see Attachment 5). It has been determined that the initial scope is comparable to the scope of any IDVP or IDI performed for licensing purposes to date on a commercial nuclear power plant in the United States and that the selected systems are representative of the plant's safety-related systems.

The third step of this procedure will involve an analysis of the actual design processes, organizations and activities in the selected scope versus the processes, organizations and activities in the aggregate A-E design scope performed at CPSES. This step should lead to confirmation of the breadth of the initial scope (or suggest necessary expansions) and establish the minimum depth necessary for extrapolation of the results to the entirety of the design process related to safety-related systems, components and structures. The depth will be documented through the development of detailed checklists described below.

The fourth step involves an evaluation of the findings of this Design Adequacy program, including the bases for sample selection and expansion, the execution of root cause and generic implications evaluations and investigations and the determination of collective significance. Any further expansion of scope necessary to achieve the requisite extrapolatability will then be determined.

In this aggregate, this scope determination process will ensure that all design processes, organizations and activities employed with respect to safety-related designs at CPSES have been reviewed, that any required expansions of the self-initiated review scope have been identified, and that the final scope will have been sufficient to permit the accomplishment of the Program Plan objectives.

Self-Initiated Methodology

The self-initiated design review process parallels the design process upon which ANSI N45.2.11 is based. For each area of self-initiated design evaluation, the applicable design criteria (e.g., regulations, FSAR commitments, codes, standards and other bases) are identified, recorded on checklists and reviewed for consistency and completeness. In addition to ensuring completeness of the review process and the traceability of items reviewed, the checklists document design criteria to be verified, the verification scope, references to documentation and deviation reports. These criteria are then used to review the design analyses, calculations, engineering evaluations and implementing documents (e.g., flow diagrams, control and instrument diagrams, logic diagrams) to assess whether the design criteria have been correctly applied, whether the engineering analyses and evaluations have been adequate, and whether the design inputs have been correctly translated into design

outputs (drawings and specifications). Conformance with these design output requirements is verified in part by the Design Adequacy Review Team and in part by the Construction Quality Review Team as indicated on Attachment 1. Fabricator and supplier documentation is verified by the Design Review Team and site construction documentation and physical installation is verified by the Construction Quality Review Team.

The specific procedures to be employed in each of the self-initiated design evaluations are contained in the DSAPs that govern each evaluation.

Implementation of the Category 2 DSAP's provides a direct and efficient means of extending the scope and enhancing the confidence of conclusions regarding the adequacy of the CPSES design and design process. It is expected to provide information that will be necessary or useful in the root cause assessments to be performed in the execution of Category 1 DSAP's and it may provide an early focus on additional design evaluations to which the CPRT would be driven as a result of the execution of the Category 1 DSAPs. When implemented, the self-initiated reviews will provide reasonable assurance that there are no undetected and uncorrected safety-significant design deficiencies at CPSES (whether or not related to External Source issues).

3. Action Plan Initiatives

Each of the Design Adequacy DSAPs will employ one or more of the following initiatives:

Verification of Project Evaluations

Where an issue to be addressed in a Design Adequacy DSAP has already been reviewed and evaluated by the CPSES project, the Review Team may recommend that such previous work be verified by the CPRT in lieu of the undertaking of an original evaluation by the Review Team. Where validation is employed, it will be accomplished pursuant to appropriate and pre-defined criteria.

Engineering Evaluations

An engineering evaluation is a study that is typically more qualitative than either the special studies or reanalyses described above and is employed typically to determine conformance with industry practice or analytical techniques (as opposed to a particular analysis). All engineering evaluations will result in documented bases for the conclusions reached.

Engineering Walk-Downs

An engineering walk-down differs from an inspection in that it is conducted by engineering personnel rather than quality control personnel. Engineering walk-downs are used where engineering decisions, based on pre-defined criteria, must be made in the course of the walk-down. Where employed by an Action Plan, the Action Plan will define the objectives for the walk-down and ensure that the walk-down is conducted in accordance with appropriate procedures.

Hardware Inspections

Design adequacy DSAPs may require the performance of inspections by quality control personnel. Such inspections will either be performed or overviewed by the CPRT QA/QC Review Team in accordance with CPRT re-inspection procedures.

Special Studies

Special studies are analyses that differ in one or more respects from the standard analysis of record for the design. Special studies may be used to determine the existence of a design deviation or deficiency or as an alternative to the production analysis to demonstrate the adequacy of an existing design.

Testing

Testing, combined with analysis, may be used to determine the adequacy of existing designs or to provide additional data as input to a design reanalysis.

Direct Hardware Modification

CPRT may determine in some cases that hardware modifications designed to obviate an asserted or identified deficiency should be implemented directly, without attempting to qualify the existing design. This initiative will be employed on the basis of the relative efficiencies of analysis versus modification, the significance of identified deficiencies, and the total engineering and construction effort involved.

Reanalysis on a Sampling Basis

Reanalysis on a sampling basis may be employed to determine the existence of design deviations. Such sampling will be conducted in accordance with the CPRT Sampling Guidelines (see Appendix D to the CPRT Program Plan) and may be supplemented by a sample based on engineering judgment. Where statistically based sampling is employed, sufficient

controls will be employed as to ensure the appropriateness of populations and sample selection, in order that statistically based inferences may be drawn.

Complete Reanalysis of Affected Design

The CPRT may determine that, either because of identified deficiencies or to promote expedition, a complete reanalysis of the affected design should be conducted. It has already been determined that this initiative will be employed in the area of Piping and Pipe Supports as described below. In such cases sampling is not employed and the reanalysis may be employed by the Project as the design or analysis of record.

4. The Piping and Pipe Support Reanalysis

The area of Piping and Pipe Supports is an area in which it has already been determined that a significant level of reanalysis, as defined below, will be performed. To perform the analysis, TUGCO has retained Stone & Webster Engineering Corporation, an organization with no prior involvement in or responsibility for piping and pipe supports at CPSES. This reanalysis will be performed using Stone & Webster established methodologies and will become the analysis of record in this area for large bore ASME Class 2 and 3 piping, a sample reanalysis of small bore ASME Class 2 and 3 piping and evaluation of non-Westinghouse supports on ASME Class 1 systems.

As a project effort, the reanalysis performed by Stone and Webster will be subject to the CPSES QA/QC program. It will be design reviewed by Gibbs & Hill, the designers of record for the project. In addition, the reanalysis will be reviewed by the Design Adequacy Review Team for concurrence with the resolution of identified issues, criteria employed and implementation of criteria. The Review Team will also investigate the root cause and generic implications of these issues.

5. Root Cause and Generic Implications

Regardless of the evaluative initiatives employed, all deviations from design commitments will be recorded. Deviations will be assessed by the Review Team for safety significance, i.e., the potential for the deviation to lead to hardware that would be impaired in performing its safety function. Safety significance will be evaluated with respect to both impairment of component and system functionability. A detailed discussion of the CPRT safety significance evaluation process is provided in Appendix E of the CPRT Program Plan. In the case of all safety significant deficiencies (or potentially adverse trends of non-safety significant design deviations), the Review Team will

investigate the root cause or causes of the deficiency, and for each root cause identified the Review Team will determine the potential generic implications of the root cause (i.e., its potential for causing other, previously undetected safety significant design or hardware deficiencies). Additional evaluations may be required to determine the bounds of the root cause or existence or bounds of the generic implications in terms of potentially affected designs. The Review Team will note opportunities for improvement of quality, management or engineering programs and make recommendations for corrective action, as appropriate. Details of the Design Adequacy Program Generic Implications Evaluation process are provided as Attachment 6 to this Program Plan.

B. Design Adequacy Collective Evaluations

The results of the DSAP implementation will be the subject of a Collective Evaluation of the overall adequacy of the CPSES design and the adequacy of the CPSES design process. The collective evaluation will include a critical assessment within disciplines and across disciplines, potentially suggesting previously unidentified potential root causes or generic implications and/or requiring the performance of additional design evaluations. The results of the collective evaluation will be reorted separately in the Design Adequacy Program final report.

C. Inter-Relationship of Program Elements

The discipline structure of the Design Adequacy Program through implementation of DSAPs provides the focus for drawing conclusions relative to the adequacy of designs produced by the respective disciplines. DSAPs include tasks addressing both External Source Issues and Self-initiated Evaluations and use this information as input for assessing both design adequacy and root causes. The root cause assessment is initially conducted at the discipline level by CPRT third-party personnel to maintain the necessary technical perspective. These potential root causes are identified to the Programmatic/Generic Implications Coordinator for evaluation of generic (i.e. broader and collective significance) implications. Root causes potentially attributable to programmatic elements of the design process are identified to the QA/QC Review Team Leader. The QA/QC Review Team Leader factors this information, potentially supplemented by further evaluation, into an overall assessment of the Project's compliance with Criterion 3 of Appendix B to 10 CFR 50 (Design Control). He will identify any quality program weaknesses requiring improvement and make recommendations for both ongoing and future programs. The Design Adequacy Review Team will supplement these recommendations by addressing engineering work processes, management of these processes and the effectiveness of implementation of the design QA program.

D. Relationship to Other CPRT Activities

To ensure the effective pursuit of potential root causes, issues that may relate to Design Adequacy that are identified during execution of the Quality of Construction and QA/QC Adequacy Plan or TRT-issues ISAPs will be referred to the Design Adequacy Review Team Leader, and issues that may relate to Construction Adequacy or QA/QC that are identified during execution of the Design Adequacy Program will be referred to the QA/QC Review Team Leader. Hardware inspections, as-built verification programs and walk-downs conducted under the auspices of either Program are coordinated for the purposes of ensuring thoroughness and consistency, as well as schedule and other economies.

The Design Adequacy Review Team will perform safety significance evaluations of hardware deviations identified by the QA/QC Review Team where the deviations are in areas that are already the subject of investigation by the Design Adequacy Review Team. In other areas, the safety significance evaluations will be performed by the Safety Significance Evaluation Group (SSEG) described in the QA/QC Program Plan and the results of such evaluations will be transmitted to the Design Adequacy Review Team for review and comment to ensure consistency, data input and collective design evaluation as described previously. Any safety significant design-related deficiencies identified by SSEG shall require evaluation by the Design Adequacy Review Team. Inspection criteria for hardware reinspections conducted by the QA/QC Review Team will be transmitted to the Design Adequacy Review Team (or to another Review Team involved in the specific area) for review and comment. Other information transfer interfaces are described in detail within Attachment 7.

E. Design Adequacy Review Team

The Design Adequacy Review Team is the organization established by the CPRT to implement this Program Plan. The Review Team is headed by the Review Team Leader, Mr. Howard A. Levin, who has the responsibility for implementing this Program Plan, subject only to the direction of the SRT.

The Review Team organization is divided into the following four disciplinary areas and the Programmatic/Generic Implications Evaluation:

Civil/Structural
Piping/Supports
Mechanical Systems and Components
Electrical/Instrumentation & Control Systems and Components

Attachment 8 depicts the organizational structure of these five areas, identifies the third-party individual responsible for each, and indicates the interfaces between the discipline and the CPSES project and among the Design Adequacy Review Team personnel. Each Design Adequacy DSAP identifies additional personnel charged with specific responsibilities for implementing the action plan tasks and for maintaining the required interface with other third-party and project personnel.

Coodination and management of the five areas is the responsibility of Mr. Frank A. Dougherty.

Coordination of the interface with the site based SSEG has been delegated to Dr. John Honekamp. Mr. Edward B. Blackwood has been delegated responsibility for coordination of programmatic considerations with the QA/QC Review Team. He also is responsible for coordination and management of the Programmatic/Generic Implications Evaluation element of this Program Plan.

The piping and pipe supports reanalysis will be performed by personnel from Stone & Webster Engineering Corporation, with review by the Design Adequacy Review Team. Stone & Webster has had neither involvement in nor responsibility for the existing designs in this area.

Hardware re-inspections performed by the QA/QC Review Team, shall utilize inspectors organized into the three principle disciplines (mechanical, electrical/instrumentation and civil/structural), each of which is led by a Level III inspector. All inspectors are qualified in accordance with ANSI N45.2.6 and Reg. Guide 1.58.

All Review Team staff and all Stone & Webster staff performing the piping and pipe support reanalysis are third-party personnel who have satisfied the CPRT criteria for objectivity.

III. END PRODUCTS

The implementation of this Design Adequacy Plan will result in the following end products:

- Individual DSAP Results Reports for all Category 1 and Category 2 DSAPs. Results Reports will provide documentation of identified safety significant deficiencies and trends of non-safety significant deviations, conclusions regarding root cause(s) and generic implications, and required corrective action. Where corrective action includes redesign or reanalysis efforts by the CPSES project using procedures and/or criteria concurred with by the third-party, the Review Team Leader may determine that issuance of the Results Report will await the overview of the application of such procedures and/or criteria by the project to the point where the CPRT is

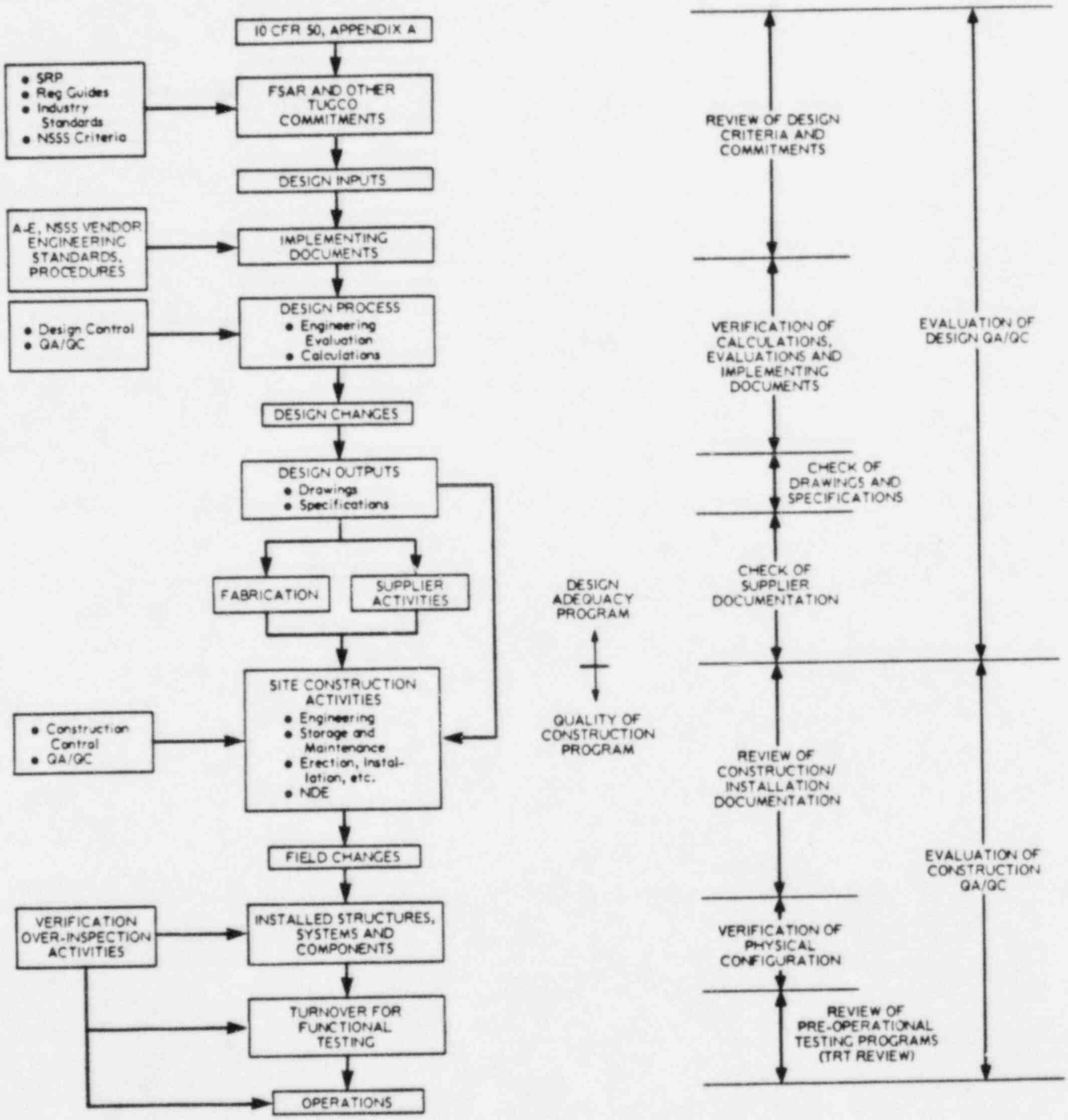
satisfied that the procedures and criteria have been adequately communicated and understood and are being applied properly.

- A third-party CPRT Results Report concurring in the criteria, process used, and implementation for the piping and pipe supports reanalysis. This report will also address the root cause and generic implications of the identified piping and pipe support issues.

- A final Design Adequacy Program Report documenting a Collective Evaluation related to; the adequacy of the CPSES design program, including the identification of any necessary improvements related to future CPSES design activities and to CPSES plant operations, and the adequacy of the CPSES design, including the identification of corrective actions necessary to resolve any identified safety-significant design discrepancies.

ATTACHMENT I

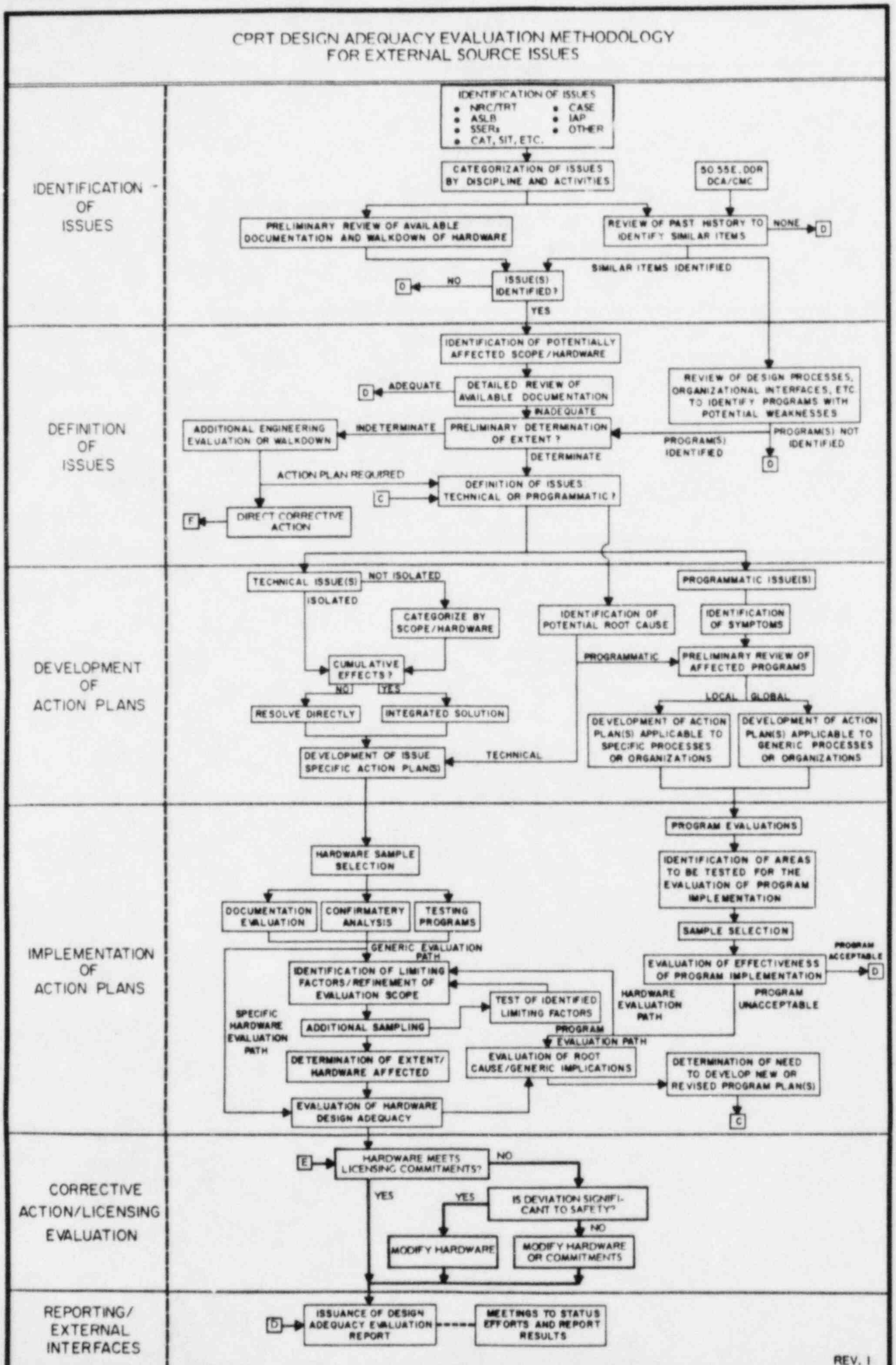
INTER-RELATIONSHIP BETWEEN THE CPSES DESIGN AND CONSTRUCTION PROCESS AND THE CPRT DESIGN ADEQUACY, QUALITY OF CONSTRUCTION AND QA/QC ADEQUACY PROGRAMS



DESIGN AND CONSTRUCTION PROCESS (ABBREVIATED)

CPRT PROGRAM PLAN ACTIVITIES

ATTACHMENT 2



ATTACHMENT 3

IDENTIFIED EXTERNAL SOURCE DESIGN-RELATED ISSUES

Discipline	TRT Design-Related Issues	Other Sources (e.g. IAP, ASLB, etc.)
Civil/Structural	Steam Generator Restraints (Item V.B)	Cable Tray Supports
	Design of Seismic Category II Items (Item II.D)	Conduit Supports
Piping/Supports	Piping Isolation [2] (Item V.C)	Large Bore Piping/Supports [2]
		Small Bore [2] Piping/Supports
Mechanical Systems and Components		Class 5 Piping [3]
		CCW System Maximum Temperature [3]
		Single Failure [3]
		Radiation Monitor Function Changes
Electrical, I&C Systems and Components	Component Functional Requirements (Items I.A.3, I.B.1, and I.B.2)	Instrument Pressure/ Temperature Ratings [2]

1. Identified to date

2. Addressed within Stone & Webster Piping/Supports Program

3. Addressed within Self-initiated Evaluation Review Scope

ATTACHMENT 4
SELF-INITIATED EVALUATION
INITIAL SCOPE MATRICES

1. Civil/Structural Initial Review Matrix

2. Mechanical Systems and Components: Auxiliary Feedwater System Initial Review Matrix

3. Electrical, Instrumentation and Control Systems and Components:

    a. Electric Power System - Power Supplies, Instrumentation and Control Initial Review Matrix

    b. Auxiliary Feedwater System - Power Supplies, Instrumentation and Control Initial Review Matrix

CIVIL/STRUCTURAL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
CONCRETE DESIGN			
o Loads and Load Combinations	X	X	
o Analysis Techniques	X	X	
o Design Procedures/Acceptance	X	X	X
STEEL DESIGN			
o Loads and Load Combinations	X	X	
o Analysis Techniques	X	X	
o Design Procedures/Acceptance	X	X	X
HVAC SUPPORTS			
o Loads and Load Combinations	X	X	
o Analysis Techniques	X	X	
o Design Procedures/Acceptance	X	X	X
MULTI-DISCIPLINE CONSIDERATIONS			
o High Energy Line Break	X	X	
o Seismic Qualification	X	X	

MECHANICAL SYSTEMS AND COMPONENTS
AUXILIARY FEEDWATER SYSTEM
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
SYSTEM OPERATING MODES			
o Startup/Shutdown	X	X	
o Transient/Accident Conditions	X	X	
o System Alignment/Switchover	X	X	
OPERATING LIMITS			
o NPSH	X	X	X
o Maximum Conditions	X	X	X
o Minimum Conditions	X	X	X
o Overpressure Protection	X	X	X
o Steam Flow Requirements	X	X	X
HEAT REMOVAL CAPABILITY			
o Heat Removal Bases	X	X	
o Flow Requirements	X	X	
WATER SUPPLIES			
o Sources	X	X	
o Stored Volume	X	X	
COMPONENT FUNCTIONAL REQUIREMENTS			
o Pumps and Drivers	X	X	X
o Valves and Operators	X	X	X
o Tanks	X	X	X
o Piping	X	X	X

MECHANICAL SYSTEMS AND COMPONENTS
AUXILIARY FEEDWATER SYSTEM
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

(Continued)

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
SINGLE FAILURE/FMEA	X	X	
ELECTRICAL ASPECTS	(See Self-Initiated Evaluation Electrical/I&C System and Components Matrix for the AFW System)		
INSTRUMENTATION AND CONTROL	(See Self-Initiated Evaluation Electrical/I&C System and Components Matrix for the AFW System)		
SUPPORT SYSTEMS			
o HVAC	X	X	
o Cooling Water	X	X	
CLASS 5 PIPING	X	X	
MULTI-DISCIPLINE CONSIDERATIONS			
o High Energy Line Breaks	X	X	
o Internal Flooding	X	X	
o Fire Protection	X	X	X
o Missile Protection	X	X	
o Environmental Qualification	X	X	X
o Seismic Qualification	X	X	X

ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
ELECTRIC POWER SYSTEM
-POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
SYSTEM OPERATING LIMITS			
o Voltage	X	X	
o Time	X	X	
o Current	X	X	
o Frequency	X	X	
SYSTEM OPERATING MODES			
o Normal/Start-up Shutdown	X	X	
o LOCA/Loss of Offsite Power	X	X	
o Station Blackout	X	X	
ELECTRICAL CHARACTERISTICS			
o Voltage Profiles	X	X	
o Short Circuit Currents	X	X	
o Terminal Voltages	X	X	X
o Cable Sizing	X	X	X
ELECTRICAL LOAD CAPACITY			
o Standby Power Supplies (DGs)	X	X	X
o Inverters	X	X	X
o Batteries/Chargers	X	X	X
o Transformers	X	X	
LOAD SEQUENCING, SHEDDING AND TRANSFERS	X	X	X
PROTECTIVE RELAYING	X	X	X

ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
ELECTRIC POWER SYSTEM
POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

(Continued)

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
CONTROL			
o System Interlocks	X	X	X
o Automatic Initiation/Operation	X	X	X
o Manual Operation	X	X	X
INSTRUMENTATION			
o Status Indication			
o Operational Surveillance	X	X	X
o Alarm	X	X	X
o Protective Devices/Settings	X	X	X
COMPONENT FUNCTIONAL REQUIREMENTS	X	X	X
SINGLE FAILURE/FMEA			
o Redundancy	X	X	
o Independence	X	X	
o FMEA	X	X	X
o Separation/Cable Routing	X	X	X
SUPPORT SYSTEMS			
o DG Fuel Oil Transfer	X	X	
o DG Cooling Water Requirements	X	X	
o HVAC	X	X	X

ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
ELECTRIC POWER SYSTEM
POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

(Continued)

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
MULTI-DISCIPLINE CONSIDERATIONS			
o High & Moderate Energy Line Break		X	
o Environmental Qualification	X	X	X
o Fire Protection	X	X	X
o Missile Protection	X		
o Seismic Qualification	X	X	X

ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
AUXILIARY FEEDWATER SYSTEM
POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
SYSTEM OPERATING LIMITS			
o Voltage	X	X	
o Time	X	X	
o Current	X	X	
o Frequency	X	X	
SYSTEM OPERATING MODES			
o Normal/Start-up Shutdown	X	X	
o LOCA/Loss of Offsite Power	X	X	
o Station Blackout	X	X	
ELECTRICAL CHARACTERISTICS			
o Terminal Voltages	X	X	X
CONTROL			
o System Interlocks	X	X	X
o Automatic Initiation/Operation	X	X	X
o Manual Operation	X	X	X
o Process Control	X	X	
INSTRUMENTATION			
o Status Indication			
o Operational Surveillance	X	X	X
o Alarm	X	X	X
o Protective Devices/Settings	X	X	X

ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
AUXILIARY FEEDWATER SYSTEM
POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

(Continued)

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
COMPONENT FUNCTIONAL REQUIREMENTS	X	X	X
SINGLE FAILURE/FMEA			
o Redundancy	X	X	
o Independence	X	X	
o FMEA	X	X	X
o Separation/Cable Routing	X	X	X
SUPPORT SYSTEMS	(See Power Supplies, Instrumentation and Control Systems and Components Initial Review Matrix)		
MULTI-DISCIPLINE CONSIDERATIONS			
o Environmental Qualification	X	X	X
o Seismic Qualification	X	X	X

ATTACHMENT 5
SCOPE DEVELOPMENT PROCESS

1.0 PURPOSE

It is the goal of the Design Adequacy Program (DAP) to provide reasonable assurance that safety significant design deficiencies have been detected and resolved. This goal is supported by a number of specific objectives. In particular, the design adequacy program is to be a comprehensive program that provides reasonable assurance of detecting significant issues that are presently unidentified. The self-initiated design evaluations were developed to implement this objective. In order for the self-initiated design evaluations to achieve this objective, it is necessary that the specific areas tested within the Discipline Specific Action Plans (DSAPs) be representative of the systems, structures, and components at Comanche Peak as well as the engineering design process that produced these systems, structures, and components. This attachment to the Design Adequacy Plan addresses how the initial scopes of the DSAPs were developed and provides the bases for evaluating the breadth and depth of the final Design Adequacy Program, including consideration of the results of DSAP implementation. A four phase process has been established.

2.0 INITIAL SCOPE IDENTIFICATION - PHASE 1

The initial scope identification was conducted through a review of Independent Design Verification Programs (IDVPs) and Integrated Design Inspections (IDIs) conducted at other nuclear power plants for licensing purposes. The IDVPs reviewed were those performed on the Midland and Diablo Canyon nuclear power plants. (This selection was based upon the breadth and depth of these programs). The IDIs reviewed were for the Perry, Callaway, Byron, Seabrook, and Shearon Harris nuclear plants. A collective list (attached) was made of the design areas addressed in each of these IDVPs and IDIs. This list was then compared against previous Comanche Peak reviews. Those reviews include all four phases of the IAP conducted by Cygna; the SIT, SRT, CAT and TRT reviews conducted by the NRC and the INPO evaluation conducted by Sargent & Lundy for TUGCO. The profile thus developed addressed the breadth of the reviews already conducted on Comanche Peak, the depth of those reviews, and the associated findings. A comparison of the intended DAP scope with the evaluation of previous Comanche Peak reviews demonstrated that:

- o the scope of the initial scope of review is comparable to that of other IDVPs and IDIs
- o adequate depth was applied in the initial scope of review

3.0 SCOPE DEVELOPMENT

3.1 <u>System Validation - Phase 2</u>

After determining that the initial scope was comparable to IDI and IDVP scopes for other projects, a documented basis for confirming

that the selected systems are representative of the systems at Comanche Peak was developed. This determination was made by developing a list (attached) of safety significant system design characteristics and comparing characteristics applicable to the AFW and electric power systems against other safety systems in an effort to determine that selection of the AFW and electric power systems provides a representative sample of CPSES safety systems. The selected characteristics included the general design criteria, internal and external interfaces involved in the design of the systems, types of components, system requirements and types of design activities. The systems selected for comparison with AFW and electric power included service water, CCW, containment spray, RHR, and ECCS. This review demonstrated that the AFW system and the electric power systems provide a good profile of the safety related systems at Comanche Peak and are generally representative. It is recognized that further reviews are necessary in order to ensure the ability to extrapolate the results from the selected test scope to all safety related areas in the plant. It should be noted that the civil/structural area was not included in the scope of this evaluation because coupled with the comprehensive cable tray and conduit supports program it was determined that a representative initial Self-initiated Evaluation selection had been made through selection of concrete, steel and HVAC and other support design in various areas of the plant.

3.2 Engineering Process Validation - Phase 3

As noted above, a determination was made that the selected systems were representative of the safety related systems, structures and components at the plant. In order to reach a conclusion regarding the ability to extrapolate results, it was also necessary to know whether the design processes and activities in the design of those systems, structures and components were sufficiently comparable to allow such extrapolations to be made. It is also necessary to develop a final scope of work that addresses the depth to which the reviews will be made.

The methods of validating the initial scope and expanding that scope where necessary are:

- o Defining the organizational structure and design processes used in the design of the AFW, electric power, and other safety-related systems, structures and components.
- o Tabulating the classes of hardware and structures included in the CPSES design.
- o Correlation of the organization and processes with the classification of hardware and structure types to produce a list of specific design activities (e.g. performance of NPSH calculations, development of mechanical flow diagrams, electrical power cable sizing, calculation of instrument set points, etc.).

Each design activity represents a reasonably homogeneous type of engineering process. The scope will be considered valid if the DAP plan includes verification of design activities as determined above or provides a basis for not including a specific activity (i.e. by demonstrating that the activity has been considered by others or is bounded by the results of tests or other means). Additions will be made to the initial scope to ensure that this condition is met.

Proceeding in parallel with the validation of the scope is the development of checklists that correlate design criteria with specific documents (and associated design scope) to be reviewed. The product of the successful completion of this phase of scope determination, is confirmation of the minimum depth and breadth of the DAP and a confirmation of the ability to extrapolate results of the DAP to other safety related systems, structures, and components.

4.0 SCOPE EXPANSION

In the conduct of the DAP, it may be necessary to add additional scope. Such scope expansions, after the completion of the validation of the intial scope, would be to accomplish one or more of the following:

- investigation of trends of deviations
- investigation of root causes
- identification of the random or programmatic nature of deficiencies
- assurance that areas reviewed bound the problem in such a manner that reasonable assurance exists that all deficiencies within those limits have been identified

Certain conditions exist wherein scope expansion is a requirement. These include the existence of:

- deficiencies
- one or more deviations that would be deficiencies if occurring elsewhere
- identified root causes that can affect design activities outside or inside the scope of review

If any of these conditions are present, the scope of the design review will be increased to the extent necessary to achieve reasonable assurance that all deficiencies have been identified. The exact nature of the expanded scope will depend upon the nature of the potential root cause. As a minimum, the scope would be extended to similar designs or design processes.

5.0 FINAL SCOPE DETERMINATION - PHASE 4

The final scope determination for the design adequacy program is the summation of the initial scope as validated per paragraph 3.2 (above) and any scope additions resulting from deficiencies or trends of deviations identified in the course of action plan implementation. Thus the ultimate scope of the DAP depends on the deviations and deficiencies found during its conduct. The scope of the DAP will be considered final when there is reasonable assurance that safety significant deficiencies could not remain undetected because of the breadth and depth of the design adequacy program.

CPRT
DESIGN ADEQUACY PROGRAM
INITIAL SCOPE IDENTIFICATION
SELF-INITIATED EVALUATION
(PHASE I)

Areas of Design Assessments by Industry and NRC

Civil/Structural

Design Bases, Commitments, Criteria

System/Component Supports

- Electrical
  - Cable Trays
  - Conduits
  - Electrical/I&C Equipment
- Mechanical
  - Component Supports
- HVAC Supports

Concrete

Structural Steel

Seismic Design

- Instructure Response Spectra
- Building Analysis

As-Built Surveys

Tanks

Buried Piping/Ducts

Foundations/Soils

Wind/Torando Design

Missile Protection

Design Control

Organization

Design Process/Analysis

Qualification and Training

Design Interfaces

Procedures

Documentation

Corrective Action

Document Control

Design Changes

Design Input References

Inspections, Audits, Surveillances

Design Reviews

CPRT
DESIGN ADEQUACY PROGRAM
INITIAL SCOPE IDENTIFICATION
SELF-INITIATED EVALUATION
(PHASE I)

(Continued)

Areas of Design Assessments by Industry and NRC

Mechanical Systems & Components

Design Bases, Commitments, Criteria

System Operating Modes

- Startup/Shutdown
- Accident Conditions
- System Alignment/Switchover

System Operating Limits

- NPSH
- Maximum/Minimum Conditions
- Overpressure Protection
- Fluid Flow Requirements

Heat Removal Capability

- Bases
- Flow Requirements

Fluid Supplies

- Sources (Steam, Water)
- Stored Volume

Component Functional Requirements

- Pumps and Drivers
- Valves and Operators
- I&C Components

Piping and Pipe Supports

- Pipe Stress
- Pipe Supports

Single Failure/Failure Modes and Effects Analysis (FMEA)

Support Systems

- HVAC
- Cooling Water

Multi-Discipline Considerations

- High and Moderate Energy Line Breaks
- Piping Classification
- Internal Flooding
- Fire Protection
- Missile Protection
- Environmental Qualification
- Seismic Qualification

As-Built Verification

CPRT
DESIGN ADEQUACY PROGRAM
INITIAL SCOPE IDENTIFICATION
SELF-INITIATED EVALUATION
(PHASE I)

(Continued)

Areas of Design Assessments by Industry and NRC

Electrical/I&C Systems and Components

Design Bases, Commitments, Criteria

System Operating Modes

- Normal Startup/Shutdown
- LOCA/Loss of Offsite Power
- Station Blackout

System Operating Limits

- Voltage
- Current
- Time
- Frequency

Electrical Characteristics

- Voltage Profiles
- Terminal Voltages
- Short Circuit Currents
- Cable Sizing/Rating

Electrical Load Capacity

- Offsite Power
- Standby Power Supplies
- Transformers
- Inverters
- Batteries/Chargers

Load Sequencing, Shedding and Transfers

Protective Relaying

Control

- Process Control
- Systems Interlocks
- Automatic Initiation/Operation
- Manual Operation

Instrumentation

- Monitoring
- Alarm/Annunciation
- Protective Devices/Settings

Component Functional Requirements

Single Failure/FMEA

- Single Failure
- Redundancy
- Independence
- FMEA
- Separation/Cable Routing

Support Systems

- HVAC
- Heating/Cooling Requirements
- Fuel Oil Transfer

Multi-Discipline Considerations

- High and Moderate Energy Line Breaks
- Internal Flooding
- Fire Protection/Safe Shutdown
- Missile Protection
- Environmental Qualification
- Seismic Qualification of Components

CPRT
DESIGN ADEQUACY PROGRAM
SYSTEM VALIDATION
SELF-INITIATED EVALUATION
(PHASE 2)

Safety-Related System Characteristics

Design Organization
Primary Design Discipline
Design Interfaces
    External (Vendor)
    - Mechanical
    - Electrical
    - I&C
    - Civil/Structural (Seismic)
    - Piping/Pipe Supports
    - With Westinghouse
    Internal
Function
    Electric Power
    Control Power
    Instrument Power
    Water
    Steam
    Cooling/Heat Removal
    Instrument or Control Air
    Indication (Process of Status)
    Alarm
    Protection
    - Mechanical
    - Electrical
Operational Modes Applicable
    Normal Operation
    Emergency Conditions
    Initiation, Alignment, Switchover Actuation Logic
Type of Hardware Involved
    Pump
    Valve
    - Manual
    - Motor Operated
    - Air Operated
    - Relief Valve
    - Control Valve
    - Check Valve
    Piping (ASME Code Class) (Non-ASME)
    Control System
    - Electrical (Sequencer)
    - Combination (Electro-Pneumatic)
    Motor
    Electrical Switchgear
    Electrical Cable
    Instrumentation
    - Mechanical
    - Electrical
    - Electronic
    - Combination
    Containment Penetration
    - Electrical
    - Mechanical
    Interlocks and Permissives
    Electronics (e.g., Signal, Bistable, Isolation)
    Relays
Types of Calculations Performed
    NPSH and Runout Flow
    Pressure Drop
    Heat Load
    Flow Balance
    Max/Min Conditions (System Parameters)
    Fan Sizing
    Motor Sizing (by Vendors)
    Cable Sizing/Rating
    Voltage Profiles
    Terminal Voltages at Bus, at Load
    Motor Characteristics (by Vendors)
    Short Circuit Current
    Under/Over Voltage (Degraded Conditions)
    Switchgear and Relay Coordination
    Load Sequencing, Shedding, Transfers
    Single Failure
    Support Systems
    Line Breaks
    Max/Min Valve Stroke Time
    Power Supply Capacities

ATTACHMENT 6

PROGRAMMATIC AND GENERIC IMPLICATIONS EVALUATION PROCESS

1.0 PURPOSE

The purpose of this element of the Design Adequacy Program Plan is to establish a systematic process for identifying and evaluating generic implications related to the adequacy of programs, processes and controls in the design of Comanche Peak. This systematic process implements TUGCO's commitment to investigate the generic implications of deficiencies in the area of design. The process is intended to:

- o Determine whether identified deficiencies in design have generic implications and effects, and if so the extent of these effects;
- o Ensure that adverse impacts on hardware that result from generic effects are evaluated and resolved; and
- o Identify corrective action necessary to preclude recurrence of each deficiency.

2.0 SCOPE

The scope of this program encompasses all valid deficiencies identified to determine those potentially generic issues or concerns related to design adequacy that have been identified within the Design Adequacy Program or by sources external to this program. These potentially generic issues or concerns may have been identified either externally or internally in the past, or they may have yet to be identified in the course of ongoing or future activities within the Design Adequacy Program. One or more of the disciplines that are being evaluated in the Design Adequacy program could be affected by a generic issue.

The basic inputs to this evaluation of generic implications are identified deficiencies and trends in deviations as determined by CPRT issue-specific

action plans or by self-initiated design evaluations conducted within the Design Adequacy Program. The issue-specific action plans may be either in response to External Sources issues or part of the Design Adequacy Program. Root causes of deficiencies that have been identified as having generic implications in prior independent reviews of the Comanche Peak design are also considered. In addition to the root causes of design deficiencies, deficiencies and trends in deviations in design programs, processes or controls are also inputs to the evaluation.

3.0 BACKGROUND

Issues or concerns that relate to the adequacy of design have been identified by several groups external to the CPRT.

Within the scope of the past reviews conducted by NRC or independent third parties, design-related issues have been identified as generic or potentially generic issues or concerns. These reviews were found to have gone to varying degrees of depth in reaching conclusions that an issue had generic implications. In addition, some of the reports of these reviews suggest further investigation of the issues to determine any generic effects on the adequacy of design, i.e., to confirm or disprove that generic implications had any safety-significant, adverse effects on design.

In addition, the CPRT's work on some of the issue-specific action plans could be expected to reveal potentially generic issues or concerns. These issues or concerns are being evaluated within the scope of the Design Adequacy Program, the outcome of which will include root causes of deficiencies or deviations that are found, where possible.

It is possible that root causes could indicate deficiencies or deviations of a programmatic nature. It is also possible that the root causes or identified deficiencies or deviations could have produced similar problems in areas of design other than those in which the issue had been initially identified or subsequently evaluated. It is further possible that the root cause itself of

hardware deficiencies at CPSES could be a programmatic deficiency. For these reasons, it is appropriate to consider whether or not root causes and programmatic deficiencies could have propagated hardware deficiencies not yet identified in other areas of design.

4.0 METHODOLOGY AND IMPLEMENTATION

The methodology for evaluation of generic implications is described in the following subsections entitled Identification, Definition, Evaluation, and Resolution and Closure of Issues. The way in which this methodology will be implemented and its interrelationship with other activities in the Design Adequacy Program are also described. An overview of the generic implications process is depicted in Figure 1. Figure 2 shows the interrelationship between the generic implications program and other parts of the Design Adequacy Program.

Briefly, the methodology consists of receiving deficiencies from the disciplines within the Design Adequacy Program or external sources. The details of these deficiencies are entered in an attributes matrix. Commonalities in the attributes among the deficiencies are identified, and potentially generic issues are confirmed to be generic issues. These generic issues are evaluated within the Design Adequacy Program to establish their bounds of applicability, impacts on hardware designs and necessary changes in design programs, processes or controls to prevent recurrence. Generic issues are considered resolved and will be closed when the boundaries of the issues are determined and corrective action is developed, clearly defined and evaluated acceptable by the third party. Corrective action can apply to both hardware and programmatic aspects of the issues as appropriate.

4.1 Identification of Issues

There are two types of input to the generic implications program. The first type of input is deficiencies and deviations identified by sources external to the Design Adequacy Program. These sources are reports of independent reviews and other documentation that involve design adequacy at Comanche Peak.

Examples of these reports are those resulting from NRC reviews, Licensing Board proceedings, CASE issues that resulted in findings of valid programmatic deficiencies in design, the self-initiated review of design and construction done pursuant to the criteria of the Institute of Nuclear Power Operations (INPO), and the Independent Assessment Program.

The second type is identified design deficiencies that have been identified by issue-specific action plans and self-initiated design evaluations. These inputs are expected to originate primarily within the Design Adequacy Program. Input resulting from action plans within the CPRT's overall scope will be considered to the extent that they may relate to design adequacy. These other action plans include the CPRT's TRT action plans and those within the Quality of Construction and QA/QC Adequacy Program.

Specific documents that have been identified initially as external sources are listed in Table I attached. Any additional documents from external sources that are reviewed in the course of the generic implications program will be documented in the results report as having been considered for inputs to this program.

The inputs to the generic implications program will be contained in the open issues data base for purposes of tracking and assuring closure.

4.2 Definition of Issues

The objective of this part of the process is to identify common attributes among identified deficiencies and deviations trends, such that the generic applicability of the issue may be established, if appropriate. In accomplishing this objective, one outcome will be to determine whether similar deficiencies have surfaced elsewhere in the design process, and if so, in what areas of design. Issues defined in this manner will contribute, based on known information, to determining where else similar deficiencies stemming from the same root cause could exist.

The extent to which generic issues can be defined using similarities among identified deficiencies is dependent on the comprehensiveness of past evaluations

of design and design control. In some design areas, such as piping and pipe supports, for instance, a measure of confidence that all significant deficiencies have been identified could be justified on the basis of the depth to which this area has been probed in the past.

However, some other areas of design have not been probed to such an exhaustive depth. It is in these other areas that self-initiated design evaluations have been developed to establish confidence in the design or to detect deviations or deficiencies that may not yet have been identified. The completeness of coverage in these other areas is based on the four phases being used to determine the scope of self-initiated evaluations. See Attachment I of this Appendix.

The self-initiated evaluations will enable conclusions to be drawn as to generic implications of a single deficiency that had been previously identified but had not exhibited reasonable correlation with others. One of two outcomes could result: first, that investigation confirms that the deficiency is in fact isolated and without generic effects, or second, that the known deficiency was the first indication of a generic problem. In this manner, the generic implications program relies on and is closely coupled with self-initiated evaluations performed by all CPRT disciplines.

Each deficiency will have been described by its originator as having certain attributes. Within the generic implications program, these attributes will be reviewed to characterize potentially generic implications or known generic effects if adverse impacts on hardware design have been identified. Attributes that will be considered in defining issues in design include:

- Sources
- Affected organizations, disciplines, processes or programs
- Potential safety significance, and
- Root cause

The details of these attributes, that will be used initially in the generic implications program, are described in Table 2. A simplified example of the concept and inter-relationships among these attributes are depicted in Figure 3.

Characteristics such as these will provide collectively a basis for evaluating the generic implications of design-related issues. For some issues, it is likely that generic implications will be identified without having detailed information on each of the attributes. In these cases, additional information on enough attributes to conclude whether generic effects have adverse impacts on hardware design will be developed as part of the evaluation process.

There are two different dimensions that are considered in defining generic issues, given a known deficiency or deviation trend: (1) commonalities, and (2) the possibility that a single deficiency could be manifest in other areas of design.

Within the first dimension, common attributes for deficiencies resulting from evaluations of different, apparently unrelated issues, in action plans will serve to confirm the generic nature of a deficiency in design; e.g., the deficiencies in the design of different hardware were traced to a common root cause. A finding of this type should become apparent as a result of the definition process; deficiencies are grouped according to their attributes, and commonalities among them are revealed.

The second dimension flows from but is differentiated from, the first because commonality among inputs may not have been revealed in the definition process. That is, it is not yet known whether a deficiency does actually have a generic impact (adverse effect) in other design areas. Although there is no indication from the inputs that the single deficiency is generic in nature, the possibility that hardware deficiencies could exist but have not yet surfaced cannot be discounted. The hypothesis that would be investigated in situations such as this is that there are no generic effects in other design areas that have stemmed from a previously identified root cause or programmatic deficiency. The way in which reasonable assurance will be established that hypothesis is true is described in the next section.

For the sake of completeness in this logic, there could be one additional case: a design deficiency in hardware and a generic cause for the deficiency both

exist, but neither has yet been detected by any review of design adequacy to date. Although the existence of this case is believed to be somewhat remote, it has been recognized as a possibility and has been accommodated within the Design Adequacy Program, through the implementation of the self-initiated design evaluation process.

Since it is clearly impossible to conduct any evaluation of generic implications on what is not known, the above case is not discussed further in the generic implications program. Instead, the self-initiated design evaluations will be sufficiently comprehensive to establish reasonable assurance that any unknown case such as this will be detected. If any such deficiency (with safety significance by definition) were to be detected, the deficiency and its attributes would be fed into the generic implications program. In addition, the determination of the scope of self-initiated design evaluations has been structured to establish reasonable validity for extrapolating the adequacy of designs from the systems, structures and components evaluated to other safety-related systems, structures and components not subjected to the same level of scrutiny.

The issue definition process also includes capturing and trending deviations from criteria or commitments. Even though these deviations may be found not to have caused safety significant deficiencies, deviations will be trended to develop added confidence that any similar undetected deviations could not have caused safety significant deficiencies in design. Trends of deviations will be evaluated using information in the Design Adequacy Program Tracking System. Any adverse trends will be evaluated by the appropriate discipline. This graded approach to the rigor with which trends in deviations are evaluated is consistent with the definitions of a deviation and a discrepancy. Clearly, deficiencies as defined warrant greater scrutiny than deviations which prove not to have caused safety significant deficiencies.

The definition process includes evaluating generic implications by grouping deficiencies by their attributes and identifying commonalities among these attributes.

Where sufficient common attributes are found in deficiencies, the generic implications evaluation process will confirm whether design-related generic issues exist. Where commonalities are not found, additional reviews are made to ensure that potential generic implications are adequately considered. This process will consider the extent to which the scope (breadth and depth) of other completed reviews of design adequacy could reasonably have led to similar findings. If sufficient opportunities to detect the potentially generic issue existed within these past evaluations, but the issue was not detected, this information will contribute to confirming that the deficiency is isolated (i.e., not generic).

If past reviews of design adequacy could not have reasonably detected a similar attributes, such as root cause, then the potentially generic deficiency will be investigated as part of existing action plans or within the CPRT's self-initiated design evaluations. In this manner, design-related issues will be confirmed to be isolated or generic; and if generic, their scope of applicability will be determined during the evaluation process described in the next section.

Safety significant issues that are confirmed to be isolated will be resolved through corrective action that is developed as part of the Action Plan in which the deficiency was identified. Isolated issues will be those for which no generic implications or effects were identified. Those safety significant issues that are confirmed to be generic will be evaluated by the appropriate design adequacy disciplines for their impact on hardware design. Any resultant corrective action will address, as appropriate, correction of specific deficiencies in hardware design and correction of programs, processes or controls to prevent recurrence.

4.3 Evaluation of Issues

The objective of this part of the generic implications program is to determine the designs or aspects thereof that are affected by generic issues. This evaluation process describes the methods that will be used to manage technical evaluations that will generate Action Plan outputs. These outputs are not only the designs affected by each generic issue (extent or boundaries of applicability), but also the resultant impacts on the design of hardware and the associated programs, processes or controls that were operative in the hardware design.

Evaluations of generic issues will be managed in one of two ways: incorporation into a self-initiated evaluation or existing issue specific action plan; or development of a new action plan.

The preferred method is to revise or expand the scope of an existing self-initiated evaluation or an existing issue specific action plan. Efficiency within the overall Design Adequacy Program is gained by folding generic issues into ongoing, established action plans. Either method of evaluating a generic issue will ensure that the issue will be evaluated, resolved and documented by the proper discipline. The benefits of this preferred approach accrue from integrating a generic issue into existing structured and documented efforts of the discipline and the ability of applying current corporate knowledge of the discipline to resolution of a newly identified generic issue.

There may be situations in which a generic issue might not conveniently fit into an existing action plan. For instance, if an issue appears to affect more than one discipline, it would be appropriate to develop a separate action plan. In so doing, the efforts of affected disciplines will be coordinated in evaluating the issue so that it can be resolved in an efficient, timely manner.

The techniques used to evaluate generic issues are similar to those employed elsewhere in the Design Adequacy Program. In order to determine the extent of applicability of a deficiency, sampling will be conducted in design activities where the deficiency could logically exist. The objective of sampling in such cases is to confirm whether a deficiency does exist in related activities or whether a known or hypothesized root cause could have generic effects in related activities.

Integral parts of each issue-specific action plan or self-initiated evaluation are to seek common attributes (e.g., root causes) of deficiencies and to conduct further evaluations of problems that are found in an attempt to determine the extent of each problem. This is a first step in identifying generic implications, but doing so within the scope of an existing action plan or evaluation.

In a parallel fashion, confirmation of generic implications involves the same technique. If an action plan or self-initiated evaluation contains a process through which generic issues can be evaluated, then the evaluation would entail expanded sampling. If existing action plans or evaluations do not contain such a process, then the breadth or depth of the action plan or evaluation would be expanded to encompass investigation of generic implications. An example of such a scope expansion in a given discipline would be to investigate whether generic issues found in other disciplines also exist in this one.

In addition to determining the boundaries of a generic issue, it is also necessary to determine whether the issue has an effect on hardware designs and, if so, whether the effects are safety significant. This aspect of generic issues is resolved by the appropriate discipline. The programmatic aspects of generic deficiencies will also be evaluated to develop recommended improvements in design programs, processes or controls.

5.0 RESPONSIBILITIES

The Programmatic and Generic Implications Evaluation Process provides services to the technical disciplines within the Design Adequacy Program. Programmatic and Generic Implications is responsible for receiving deviations and deficiencies from the disciplines or external sources, for evaluating whether these inputs have generic implications and for ensuring that identified generic issues are evaluated within the Design Adequacy Program. The Programmatic and Generic Implications Evaluation Process is also responsible for trending deviations that are identified within the Design Adequacy Program or that have been reported by external sources.

The technical disciplines within the Design Adequacy Program are responsible for identifying deficiencies and deviations to the generic implications process. They are also responsible for evaluating confirmed generic issues to establish the bounds of these issues, the effects of generic issues on hardware, and recommendations for corrections of deficiencies in programs, processes or controls that apply to specific disciplines.

The interfaces that exist between the Programmatic and Generic Implications Evaluation Process and other parts of the CPRT are depicted in Figure 2.

PROGRAMMATIC AND GENERIC IMPLICATIONS PROGRAM

TABLE I
EXTERNAL SOURCES OF DESIGN ISSUES

- Independent Assessment Program (IAP) conducted by CYGNA.
  - o Phases 1 and 2 Final Report, No. TR-83090-01, Rev. 0 October 12, 1984.
  - o Phase 3 Final Report, No. TR-84042-01, Rev. 1 November 20, 1984.
  - o Phase 4 Checklists and Review Criteria for Mechanical and Electrical Disciplines, transmitted to NRC by Cygna letter 84056.065, April 29, 1985.

- NRC Special Inspection Team (SIT) report of inspection during the period October 13-December 2, 1982 and January 18, 1983. NRC Region IV Inspection Report Nos. 50-445/82-26 and 50-446/82-14 transmitted by NRC letter February 15, 1983.

- NRC Special Review Team (SRT) Report of a special review during the period April 3-13, 1984, transmitted by NRC letter, July 13, 1984.

- NRC Construction Appraisal Team (CAT) Report of inspection during the period January 24 - February 4, 1983 and February 14 - March 3, 1983. NRC Inspection Report Nos. 50-445/83-18 and 50-446/83-12 transmitted by NRC letter April 11, 1983.

- NRC Technical Review Team (TRT) briefing materials (September 18, 1984) and reports transmitted by NRC letters November 29, 1984 and January 8, 1985. Also NRC Supplemental Safety Evaluation Reports No. 7, 8, 9, 10 and 11 related to TRT issues.

- Design and Construction Sef-Initiated Evaluation Report of evaluation by Sargent & Lundy during the period October 18 - 29, 1982 using performance objectives and criteria developed by the institute of Nuclear Power Operations (INPO). Report dated October 1982.

PROGRAMMATIC AND GENERIC IMPLICATIONS PROGRAM

TABLE 2

COMMON ATTRIBUTES

Level I

- Design Activity
- Design Disciplines
- Design Organization
- Source of Issue
- Reported Potential Safety Significance
- Reported Root Cause

Level II

1. Design Activity
   - Design program requirements
   - Design input requirements
   - Design process
   - Interface control
   - Design verification
   - Document control
   - Design change control
   - Corrective action
   - Audits

2. Design Disciplines
   - Civil/Structural
   - Mechanical Systems and Components
   - Electrical, Instrumentation and Control Systems and Components
   - Piping and Pipe Supports

3. Design Organization

   Tugco (TUSI)

   Gibbs & Hill

   Westinghouse (outside NSSS Scope of Supply)

   Ebasco

   Stone & Webster

   ITT Grinnell

   NPSI

   Other major vendors of equipment or services

4. Source of Issue

   NRC

   IAP

   ASLB

   CASE

   Sargent & Lundy (INPO self-initiated evaluation)

   Allegation from other source

5. Reported Potential Safety Significance

   Type of failure in performance of intended safety function (list)

6. Reported Root Cause

   Potential or postulated root cause of the deficiency or deviation (list)

Level III - Design Activity

1. Design Activity - Design Program Requirements (procedures only)

   Organizational structure
   Responsibilities of organizations
   Technical information exchanges
   Document control
   Design document maintenance and retention
   Management review
   Training
   Design inputs
   Document preparation
   Quality levels, acceptance standards, records
   Design verification
   Audits
   Corrective action
   Experience reports
   Design changes

2. Design Activity - Design Input Requirements
   (ANSI N 45.2.11, Section 3.2 appropriate grouping)

3. Design Activity - Design Process
   Translation of inputs
   Procedures
   Design Analyses

Calculations

Design Outputs (drawings, specifications, other)

4. Design Activity - Interface Control

External (identification, responsibility, communication, documentation)

Internal (identification, responsibility, communication, documentation)

5. Design Activity - Design Verification

Reviews (ANSI N45.2.11, Section 6.3.1 appropriate grouping)

Alternate calculations

Qualification testing

6. Design Activity - Document Control

Preparation

Approval

Issuance

Revision

7. Design Activity - Design Change Control

Reasons for changes

Review of changes

8. Design Activity - Corrective Action

Detection (ANSI N45.2.11, Section 9.1 appropriate grouping)

Review and modification of procedures

9. Design Activity - Audits

Personnel

Internal

External

Control

Schedule

Results

Follow-up

Level III - Design Discipline

1. Design Discipline - Civil/Structural (work areas within discipline)

    Cable trays/supports

    Conduits and supports

    Structural Steel

    Concrete

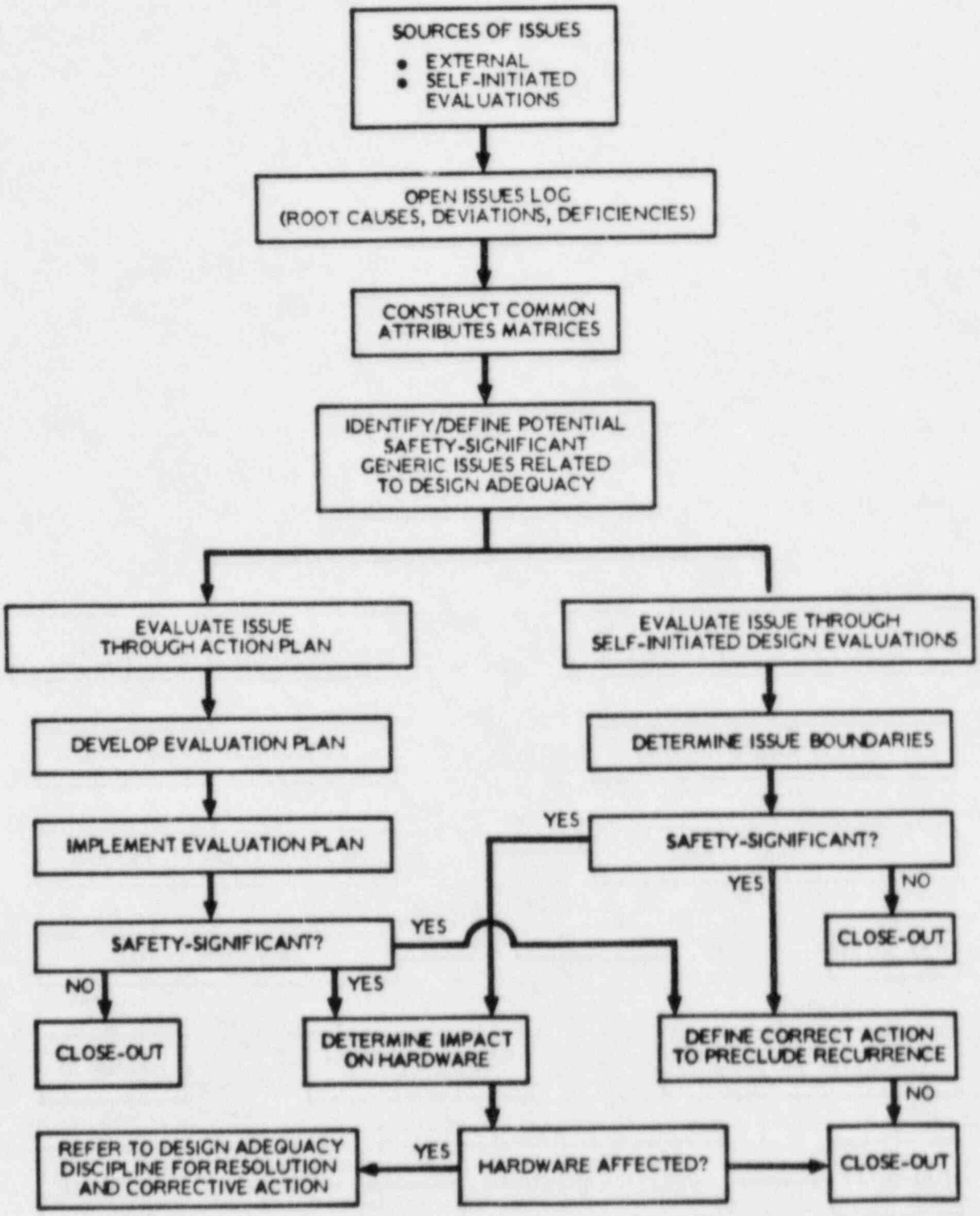
2. Design Discipline - Mechanical Systems and Components (work areas within discipline)

3. Design Discipline - Electrical, Instrumentation and Control (work areas within discipline)

4. Design Discipline - Piping and Pipe Supports (work areas within discipline)

FIGURE I

PROGRAMMATIC AND GENERIC IMPLICATIONS PROGRAM
PROCESS OVERVIEW



ATTACHMENT 7
INTERFACE BETWEEN THE QUALITY OF CONSTRUCTION, QA/QC ADEQUACY PROGRAM AND THE DESIGN ADEQUACY PROGRAM

The program developed by the CPRT to address the issues identified in the areas of Design Adequacy, Quality of Construction and Adequacy of the QA/QC program has been structured to focus the proper expertise in each discipline area and assure objective third-party evaluations of these issues. The multi-discipline nature of the basic processes used in the design, construction and QA/QC areas, as well as the nature of some of the identified issues, dictate the need for multi-discipline evaluations by the CPRT. These evaluations will address both the adequacy of the products in the design and construction areas and the adequacy of the QA/QC program. There are two contexts in which QA/QC program adequacy is considered in these evaluations:

a) Adequacy of QA/QC program elements related to future work including corrective action identified by the CPRT, and

b) Specific or generic problems identified in the historical QA/QC program that need to be considered in evaluating the adequacy of the products of the design and construction activities.

To achieve the proper multi-discipline input to the CPRT evaluation process, the interface responsibilities between the Quality of Construction, QA/QC Adequacy Program and the Design Adequacy Program have been defined as shown in the following information interface matrices.

INFORMATION FROM QUALITY OF CONSTRUCTION
AND QA/QC ADEQUACY PROGRAMS TO
DESIGN ADEQUACY PROGRAM

ITEM	Info Only	Review & Comment By DAP As Req.	Action By DAP	Coordination of Results of Action with QOC & QA/QC
ISAP Results Report	X			
Information on design related problems discovered during inspections and document reviews			X	X
Selection of design-related attributes		X		
Information on root cause analyses (no design concerns)	X			
Information on root cause analysis (design related concerns identified)			X	X
Information on generic implications evaluation (no design related concerns)	X			
Information on generic implications evaluation (design related concerns identified)			X	X

INFORMATION FROM QUALITY OF CONSTRUCTION AND QA/QC ADEQUACY PROGRAMS TO DESIGN ADEQUACY PROGRAM

(Continued)

ITEM	Info Only	Review & Comment By DAP As Req.	Action By DAP	Coordination of Results of Action with QOC & QA/QC
Reinspection/Document Review Program Information Without Applicability to Design				
Sample Selection	X			
Population Descriptions	X			
Population Checklists	X			
Safety Significant Construction or QA/QC Deficiencies		X		
Results	X			
Collective Evaluation Report	X			
Periodic Trend Reports	X			
Safety Significance Evaluations		X		
Safety Significant Design-Related Deficiencies			X	X

INFORMATION FROM DESIGN ADEQUACY PROGRAM
TO QUALITY OF CONSTRUCTION AND
QA/QC ADEQUACY PROGRAMS

ITEM	Info Only	Review & Comment By QOC & QA/QC	Action By QOC & QA/QC	Coordination of Results of Action with DAP
ISAP Results Reports	X			
Requests for QC Inspections of Hardware			X	X
Requests for QA Evaluations of identified design process problems			X	X
Construction-Related Requirements		X		
Information on root cause analysis (no quality of construction or QA/QC concerns identified)	X			
Information on root cause analysis (QA/QC program or quality of construction concern identified)			X	X
Information on generic implications evaluation (no quality of construction or QA/QC concerns identified)	X			

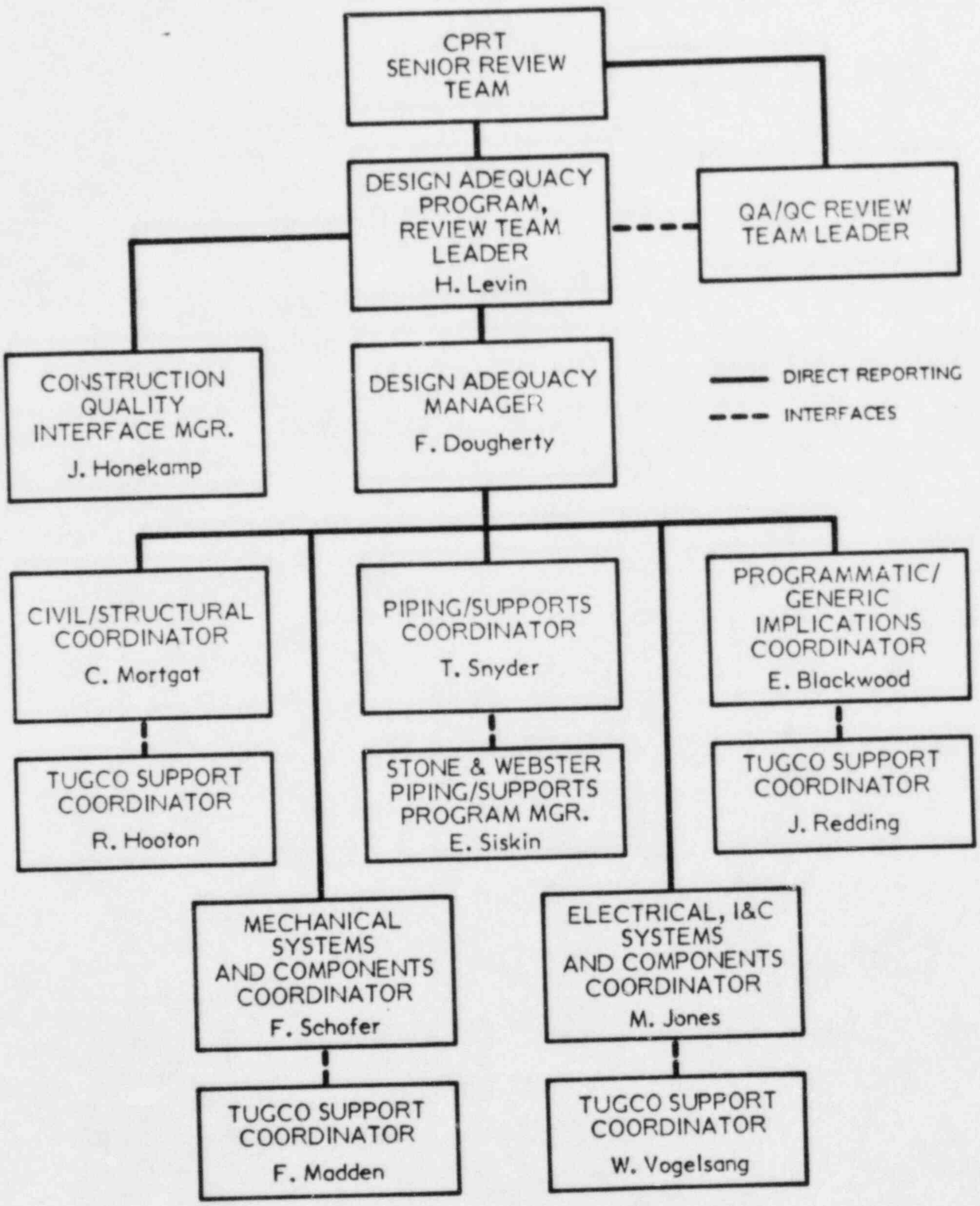
INFORMATION FROM DESIGN ADEQUACY PROGRAM
TO QUALITY OF CONSTRUCTION AND
QA/QC ADEQUACY PROGRAMS

(Continued)

ITEM	Info Only	Review & Comment By QOC & QA/QC	Action By QOC & QA/QC	Coordination of Results of Action with DAP
Information on generic implications evaluation (QA/QC program or quality of construction concerns identified)			X	X
Collective evaluation Report	X			
Periodic Trend Reports	X			
Safety Significant Construction or QA/QC Deficiencies			X	X

ATTACHMENT 8

CPRT DESIGN ADEQUACY PROGRAM ORGANIZATION



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X. MECHANICAL SYSTEMS AND COMPONENTS

1.0 PURPOSE

The purpose of the mechanical discipline specific action plan (DSAP) is to investigate, evaluate, and resolve known and presently unknown design issues concerning mechanical systems and components by:

- o Evaluating and responding to design-related issues in the mechanical systems discipline that were identified by the Independent Assessment Program as having the potential for occurrence in other systems.
- o Executing a self-initiated system review that has a reasonable assurance of detecting any significant issues that are presently unidentified.
- o Identifying necessary corrective actions and determining whether adequate plans exists for correction of safety-significant deviations from design-related commitments.
- o Investigating the root cause and generic implications of identified deficiencies.

2.0 SCOPE

This scope of the mechanical DSAP encompasses two tasks. One is a self-initiated review of the mechanical systems and components aspects of the Auxiliary Feedwater (AFW) system. The other is an action-specific review of all radiation monitors that serve either a control function or as effluent monitors.

The scope of the AFW system task includes safety-related portions of the system, interfaces with non-safety related aspects to the extent necessary to verify the adequacy of the safety-related installations, and supporting mechanical systems. The scope of the safety-related portions of the AFW system are shown on Figure X-1. Table X-1 is a list of the system interface boundaries. This task includes review of design inputs (criteria), evaluation of design analyses (implementing documents), and review of design output (drawings and specifications). Figure X-2 is a preliminary matrix of the review areas included in the AFW system review, and an indication of the depth of the review conducted for each of the review areas. This matrix indicates the minimum scope of the AFW mechanical systems and components reviews. Details of the scope of this review are presented in Section 4.1 of this report. The electrical, instrumentation, and control aspects of the AFW system are covered in a separate DSAP.

The radiation monitor task scope includes a review of all plant radiation monitor design requirements and commitments (criteria), regarding

monitor function, location, and type, as well as an evaluation of design documentation to determine if the design requirements and commitments have been met. Area radiation monitors, portable radiation instrumentation, and other radiation instruments without control functions are excluded from the scope of this task.

3.0 BACKGROUND

The mechanical DSAP has been developed to address the concerns identified by the Independent Assessment Program review in the mechanical systems area (ref. Cygna letter no 84056.064 dated April 23, 1985). No ASLB, SSER, or TRT related concerns have been identified in this area.

As stated previously, the mechanical DSAP consists of two tasks, one self-initiated and one action specific. The action-specific task was developed to address the generic implications of the Cygna identified concern with radiation monitors control function changes. The self-initiated AFW system and component review task was developed to address the generic implications of multiple IAP concerns and to determine that all design process and activities employed with respect to safety significant systems has been reviewed.

The AFW System was selected for review on the following basis:

- Importance to safety,
- Interdisciplinary interfaces,
- Westinghouse interfaces,
- System diversity (water and steam fluid system, multiple pumps and drivers),
- Seismic Category I/non-Seismic Category I interfaces,
- Components inside and outside containment,
- System complexity (normal, transient, and accident operating modes).

The relationship between the IAP concerns and the responding DSAP tasks follow.

Five concerns were identified by the IAP review:

- CCW System Maximum Temperature - The IAP concern is that system components should be re-verified for proper qualification whenever new operating conditions are identified. Although the CCW components were proven to be properly qualified for the identified operating conditions, the potential generic implication is that

pressure-temperature ratings for components were incorrectly specified throughout the plant. This concern will be tested in the AFW system and components task.

- Class 5 Piping - The IAP concern is that class 5 designated piping should have been designed to remain functional during and after an SSE. Although it was determined that the class 5 piping reviewed by the IAP was in fact seismically designed, the potential generic implication is that this seismic interface was improperly considered in safety systems. This generic concern will be tested in the AFW system and components task review.

- Single Failure - Reactor Coolant Pump Thermal Barrier - The IAP concern is the possible failure-to-close of the single temperature controlled isolation valve on the outlet of the reactor coolant pump thermal barrier. If this valve failed to close subsequent to a reactor coolant pump thermal barrier rupture, reactor coolant would be released outside containment. The potential generic implication is that the single failure criteria was misapplied in safety system design. This generic concern will be tested in the AFW system task review.

- CCW Surge Tank Isolation on High Radiation Signal - The IAP concern is that with the removal of the surge tank isolation control function from the system radiation monitors, radiation releases may exceed 10 CFR Part 100 limits. Although a TUGCO calculation demonstrated the release to be within 10 CFR 100 limits in this case, no generic review was performed for other plant radiation monitor control changes. Therefore, the radiation monitoring changes task was developed to comprehensively address this concern.

- Fire Doors - The IAP concern is with the discovery of the installation of a non-qualified fire door. This concern is addressed in the QA/QC Construction Adequacy Plan.

4.0 CPRT ACTION PLAN IMPLEMENTATION

The mechanical DSAP begins with the identification of TRT and ASLB issues and remaining open SSER, CAT, SIT RIV, and IAP issues applicable to this area of review. These issues are then incorporated into the mechanical system and component review tasks as described below to determine whether these same issues occur in another system or in the same system when the previous design assessments did not perform a generic review.

4.1 Auxiliary Feedwater Mechanical Design Verification Task

4.1.1 Development of Current Criteria

The mechanical system and component evaluation of the AFW system begins with the identification of criteria and

regulatory requirements applicable to the system. The sources of such requirements include the FSAR, documents referenced by the FSAR, Westinghouse-supplied interface criteria, regulations (10 CFR), safety evaluation reports and its supplements, and correspondence between the NRC and TUGCO. These and other sources of criteria will be reviewed and applicable criteria and requirements extracted and listed. The current criteria list thus developed forms the basis for subsequent stages of the review. The compliance of the design with these commitments will be deemed acceptable if no safety-significant deviation exists between the as-installed and tested design and the requirements identified on the current criteria list.

4.1.2 Review of Current Criteria

The criteria list is subjected to a third party review for consistency and completeness. The objective of this stage of the review process is to ensure that the criteria list contains no criteria that are inconsistent or incompatible with each other. Furthermore, the review considers whether the criteria list is sufficiently complete to allow an experienced systems designer to develop an auxiliary feedwater system design that satisfies its functional purposes. As part of the review of the current criteria for consistency and completeness, an identification is made of the operating modes and limiting conditions for the AFW system. Any apparent inconsistencies or lack of completeness in the AFW criteria are evaluated to determine whether the inconsistency or lack of completeness has any potential safety significance. Any inconsistencies or lack of completeness that could have safety significance will be evaluated for their effect on the system, after determining the correct or additional criteria. Any such lack of completeness or consistency will be further reviewed for generic implications. The final consolidated current critiera that is evaluated to be consistent and complete, including the system operating modes and limiting conditions, is used as the basis for evaluating the design as reflected in design analyses and design output documents.

4.1.3 Review of Implementing Documents

Implementing documents include design analyses, evaluations, and other documents used by the architect/engineer to demonstrate compliance of the system with criteria or to communicate criteria among designers. Implementing documents are an intermediate step between design inputs

(e.g., criteria) and design outputs (e.g., drawings and specifications). Examples of implementing documents include calculations, evaluations, analyses, and similar documentation. The review of implementing documents begins with an identification of the implementing documents applicable to the AFW system. Table X-2 is a preliminary list of implementing documents applicable to the Comanche Peak AFW system. The process used in evaluating implementing documents involves the identification of the most significant criteria applicable to each implementing document. Consideration is given to whether criteria are reflected in multiple documents. For each implementing document included in the scope of the review, a checklist is developed. The checklist contains the criteria with which the document must be consistent. Furthermore, the checklist requires that any assumptions or limiting conditions introduced into the design by the implementing document must be reviewed against the consolidated criteria list for consistency (for example, if a calculation introduces an assumption that affects the AFW system design criteria, that assumption must be evaluated against the current consolidated criteria list). Where assumptions can be validated by tests, test program results are reviewed to determine whether in fact the design as tested is consistent with those assumptions. Where assumptions cannot be validated by test, a basis is determined for the validity of the assumption. Calculations and evaluations are reviewed for adequacy of the applied methodology as well as accuracy of the implementation of the methodology. Calculation verification will be accomplished by either detailed check of the calculation or by performance of an alternate calculation.

4.1.4 Review of Drawings and Specifications

The review of design outputs (drawings and specifications) considers both architect/engineer-originated drawings and specifications and vendor documents. The A/E drawings and specifications include flow diagrams, piping drawings; procurement specifications for AFW pumps, valves, etc.; and A/E-prepared installation specifications. Vendor documents include component drawings, installation instructions, vendor manuals, vendor analyses, and similar documentation. Table X-3 is a preliminary list of A/E and vendor documents which may be used in this evaluation. For each document selected, applicable implementing documents and criteria from the consolidated criteria list will be determined and a checklist will be prepared. A review will be made using the checklist to determine whether the drawings and specifications are

consistent with the applicable implementing documents and criteria. Inconsistencies determined in this process will be reviewed against test program results and evaluated for safety significance. Safety-significant deviations will be considered further for generic implications.

4.1.5 Review Scope

The following sections describe the initial scope of review for each of the review topics.

4.1.5.1 System Operating Modes

The AFW system will be reviewed to assess its capability to perform its functional performance requirements as specified in design criteria and commitments.

4.1.5.2 Startup/Shutdown

The AFW system will be reviewed to determine whether design criteria was appropriately specified and implemented to perform the system's normal functional performance requirements during plant startup or shutdown. These performance requirements will be based upon NSSS considerations. The review will consist of a design criteria and commitments review, a review of implementing documents, and a calculation and evaluation verification.

4.1.5.3 Accident and Transient Conditions

The FSAR accident analyses and transient evaluations will be reviewed to identify those accidents and system operating transients in which the AFW system may be involved. An evaluation will be made to determine whether the system was properly considered in these analyses and to verify that the system operation mode appropriately reflect the accident and transient analyses considerations.

4.1.5.4 System Alignment/Switchover

System alignment criteria and commitments under all modes of operation will be reviewed against the implementing documents. Switchovers and potential alignments will be reviewed to determine whether the system can meet design objectives. Any

switchovers designed to occur automatically will be reviewed against single failure criteria as described in Section 4.1.5.6. Manual switchovers will be reviewed to verify that sufficient time is available to accomplish the switchover before the system function is required.

4.1.5.2 Operating Limits

✓4.1.5.2.1 NPSH

Calculations and evaluations performed to determine the available NPSH for each system operating mode and suction water supply will be verified. The scope includes a comparison to the vendor's requirements.

✓4.1.5.2.2 Maximum and Minimum Conditions

A review of criteria and commitments and implementing documents will be made for the system temperature, pressure, and hydraulic design. A review will be made of implementing documents which communicate these parameters. This activity will incorporate results obtained from the system operating modes evaluation and will verify that these parameters were considered as design criteria for the interfacing systems. AFW component specifications will be reviewed to verify that the design parameters are properly implemented.

✓4.1.5.2.3 Overpressure Protection

Implementing documents will be reviewed to verify the inclusion of applicable design criteria and commitments for overpressure protection devices. AFW component specifications will be reviewed to verify that the overpressure protection criteria have been properly implemented.

✓4.1.5.2.4 Steam Flow Requirements

The steam flow required to supply the AFW pump turbine, as determined by

design criteria, commitments, and as required to accomplish the system operating modes will be reviewed against the requirements provided by the equipment vendor.

(1) 4.1.5.3 Heat Removal Capability

Calculations and evaluations performed to demonstrate the adequacy of the system's heat removal capability and flow requirements will be verified. The scope includes a comparison of the systems functional requirements identified in Section 4.1.5.1 to the results of the operating limits evaluation contained in Section 4.1.5.2.

✓ 4.1.5.4 Water Sources

The criteria and commitments established for water sources, from both safety and nonsafety sources, will be identified. Included in the scope of this review is the verification of stored water volumes and water quality requirements. A review will also be made of implementing documents for proper use of the established criteria.

4.1.5.5 Component Functional Requirements

Selected AFW mechanical components (listed in Table X-4) will be reviewed to their functional requirements. The development of the functional requirements such as flow rate, NPSH, and similar characteristics will be determined from the previously described evaluations. These design criteria and commitments established for the AFW system will be checked to assure the inclusion of all required design inputs. In addition, the review of component functional requirements will verify that adequate attention has been given to the specification of applicable ASME and industry codes and service loading conditions to provide assurance as to the structural integrity and operability of AFW components. Calculations and evaluations that specifies the component functional specifications from the general AFW system design criteria will be verified. These verified component functional requirements will then be compared to the component design specification and vendor documents to ensure that the component functional requirements have been met.

4.1.5.6 Single Failure/FMEA

The Comanche Peak failure modes and effects evaluations contained in FSAR Sections 10.4.9 and in the Response to Three Mile Island Action Plan were performed to assess the capability of the AFW system to accomplish its intended safety functions. These FMEAs as supplemented by any implementing eva'uations that support these FMEAs will serve as the basis for this evaluation. This evaluation will include the review of electrical and control failures to determine their effect on the capability of the AFW system to accomplish its intended safety functions.

4.1.5.7 Support Systems

Equipment cooling requirements for AFW mechanical components will be checked and a determination made that these heat loads have been considered as design criteria for the interfacing systems. The applicable design criteria for AFW electric power supplies will be considered separately in the electrical, instrumentation, and control DSAP.

4.1.5.8 Class 5 Piping

This activity will include the review of all AFW safety and nonsafety piping located within Seismic Category I structures. These interfaces will be reviewed to verify that failure of the nonsafety portion would not result in unacceptable safety consequences or result in doses that exceed the values stated in Regulatory Guides 1.26 and 1.29. Included in this review will be the protective measures provided to assure acceptable consequences due to credible failures of the pressure integrity of nonsafety portions of the AFW system.

4.1.5.9 Multi-Discipline Considerations

4.1.5.9.1 High Energy Line Breaks (HELB)

HELB criteria and associated commitments related to the AFW system and other safe shutdown systems will be reviewed and the bases for the associated design process will be confirmed. Included will be the review

of the protective measures taken to assure acceptable consequences due to postulated jets or pipe whipping in the vicinity of AFW and other safe shutdown system components.

4.1.5.9.2 Internal Flooding

This activity will include the review of criteria and commitments related to establishing the basis for flood protection from sources internal to the plant. The criteria associated with this design process and the methods used to provide the necessary flood protection to AFW and other safe shutdown system components will be reviewed.

4.1.5.9.3 Fire Protection

The applicable fire protection criteria and commitments were reviewed by TUGCO and audited by the NRC. This audit sampled the project's fire protection evaluations to meet the necessary requirements for all essential safe shutdown systems. Included in this review were the designation and location of minimum safe shutdown components, fire protection separation analysis, alternate shutdown, fire detection and suppression, and emergency lighting pertaining to safe shutdown system components as reported in Inspection Report No. 84-44. To ensure that the design assessment conducted under this program cover all significant evaluations at the CPSES, this program will include the review of the AFW flow diagram to verify that all AFW components and instrumentation required to achieve and maintain safe shutdown are included in the fire protection safe shutdown analysis. This review will also consider spurious component operation of AFW components caused by a fire. From this list of required AFW components, the electrical, instrumentation, and control DSAP will randomly select several components to evaluate whether its cables were properly incorporated into

the fire protection safe shutdown analysis. Included in the scope of the electrical, instrumentation, and control DSAP is the verification that AFW equipment and component power supplies are coordinated with the emergency power distribution system.

4.1.5.9.4 Missile Protection

A review of criteria and commitments will be made of the potential missiles which could affect the AFW and other safe shutdown systems. Included will be the review of the protective measures taken to assure acceptable consequences due to postulated internal and external missiles.

4.1.5.9.5 Mechanical Equipment Environmental Qualification

Mechanical equipment environmental qualification requirements will be reviewed to verify whether the correct environmental envelopes were specified and given those envelopes, whether the qualification methods specified were adequate to demonstrate that the component would meet its functional requirements. The review will include nonmetallic seals, gaskets, belts, and lubrication used in various types of AFW system equipment of representative complexity in mild and harsh environments. Electrical equipment environment qualification is addressed in the electrical, instrumentation, and control DSAP.

mechanical component discipline

4.1.5.9.6 Seismic Qualification

The seismic qualification requirements including response spectra, load combinations, and equipment functional criteria will be reviewed to verify whether the appropriate seismic design inputs were incorporated into the component design. A review of various types of AFW and other safety system equipment will be performed.

Calculations and evaluations performed by project that demonstrate that these AFW components can perform its functional requirements after the design basis earthquake will be verified.

4.2 Radiation Monitoring Changes Mechanical Design Verification Task

The IAP identified a concern (see IAP Mechanical Systems Review Item List, Revision 1, Item 2, Cygna letter number 84056.064 dated 4/23/85) with a revision to a radiation monitoring functional design requirement identified by Westinghouse. The project had deleted a radiation control function based on concern that spurious actuations would occur. The IAP was provided with an analysis that demonstrated that the instrument was not required. In its letter of 4/23/85, the IAP noted that no generic review was conducted of other radiation monitor locations that had been deleted or changed to ensure that all such changes were valid. This task is intended to achieve that requirement.

A review will be made of Westinghouse-supplied documentation concerning the numbers, types, and locations of radiation monitors. Additionally, the FSAR will be reviewed with respect to its commitments regarding radiation monitoring for effluents and a review will also be made of regulatory requirements for such monitors. The review will be conducted by the project with third party overview to determine that all radiation instrumentation requirements identified by Westinghouse, the FSAR, and regulations have been met. Deviations from criteria will be reviewed to determine whether an adequate basis exists for an exception to those criteria and whether deviations from these criteria have safety significance. Where the project has taken exceptions to any of these criteria, third party personnel will review the bases and documentation supporting the change. If deficiencies are found in either the bases or the documentation, appropriate changes will be made to ensure that regulatory requirements are met.

4.3 Reporting

A mechanical discipline specific action plan results report will be prepared to document the results of the AFW and radiation monitoring task reviews. This report will contain a detailed list of the implementing documents and design output documents that were selected for review, and will also contain the consolidated criteria list. The results report will contain the final review matrix and a list of the documents reviewed in each category. Any deviation determined to be safety-significant will be described in detail in the report. Any analyses or evaluations conducted by the CPRT to validate aspects of the design will also be documented. The checklists prepared in the course of performing these activities will be maintained in accordance with the CPRT Program Plan requirements for documentation.

5.0 ORGANIZATION AND RESPONSIBILITY

The mechanical DSAP organization was established to implement the mechanical systems and components design verification tasks. This organization is shown in Figure X-3. The primary responsibility of the mechancial system coordinator is to assist the review team leader in implementing the mechanical DSAP. The mechanical system coordinator is responsible for:

a. Developing and revising the Discipline-Specific Action Plan within the mechanical area.

b. Providing day-to-day technical guidance to assure that the mechanical DSAP is being implemented correctly.

c. Ensuring that root causes and generic implications of identified deficiencies or trended deviations are coordinated with the generic implication coordinator.

d. Preparing the mechanical discipline specific action plan results reports.

e. Maintaining a Project Working File for each mechanical system and component design verification task.

f. Assisting in the criteria and design verification efforts as described below.

g. Serving as the principal interface with the generic implication coordinator, the QA/QC review team, and the TUGCo mechanical systems and support coordinator.

Two specialist groups exists to assist in the mechanical DSAP implementation for specific technical areas. These two areas are criteria and design verification.

The criteria verification engineers, under the direction of the mechanical systems coordinator, are responsible for developing the system and component criteria lists. The criteria verification engineers are responsible for:

a. Determining whether the criteria are consistent and compatable.

b. Determining whether the criteria are sufficiently complete to design a system or to specify a component that satisfies its functional purpose.

c. Evaluating the safety significance of incompatible criteria and incomplete criteria after the appropriate criteria is determined.

d. Assessing the occurence of incompatible or incomplete criteria for generic implications or root causes.

e. Informing the mechanical systems coordinator on the status and implementation of the evaluation.

f. Assisting in the preparation of the mechanical DSAP Results Report.

The design verification engineers, under the direction of the mechanical systems coordinator, are responsible for ensuring that project implementing documents and design outputs conform to the verified system and component criteria list. The design verification engineers responsibilities include:

a. Developing the document criteria checklists.

b. Reviewing the design documents and design outputs using the document criteria checklists to verify all applicable design criteria are implemented.

c. Evaluating the safety significance of incomplete criteria checklists and unsatisfactory criteria implementation .

d. Assessing the occurrence of incomplete criteria or unsatisfactory criteria implementation for root causes or generic implications.

e. Identifying and defining corrective actions for any identified deficiencies or trended deviations.

f. Identifying and defining necessary actions to preclude occurance of similar problems.

g. Performing engineering evlauations or calculations to support their findings.

h. Assisting in the preparation of the mechanical DSAP Results Report.

The generic implication coordinator is responsible for coordinating the review and the expansion of DSAP scope, and the assessment of safety significance and corrective actions resulting from generic implications or root causes identified in the DSAPs. In performing these activities he is responsible for:

o Coordinating the development of new tasks or the expansion of existing tasks within the mechanical DSAP.

o Ensuring that the scope of review is broad enough to bound the potential generic implications of design-related deviations, deficiencies and their potential root causes.

o Determining the extent of applicability of design-related deficiencies and potential root causes.

- Ensuring that any resulting adverse effects on hardware are evaluated and resolved.
- Identifying necessary corrective actions to preclude recurrence.
- Providing reasonable assurance that generic effects of root causes and design deficiencies have been identified and resolved.

The TUGCo mechanical systems and support coordinator is responsible for managing the interface of the Comanche Peak project with the CPRT and providing documents and information as requested by the mechanical systems coordinator.

The QA/QC review team, under the direction of the QA/QC review team leader, is responsible for performing quality assurance activities and executing the quality assurance program commitments for the CPRT program.

TABLE X-1

AFW SYSTEM INTERFACE BOUNDARIES

Interfacing System	Interface Point (Component Included in AFW)
Main Steam	Valves 1MS-142 and 1MS-143
NSSS	Steam Generator Nozzles
Service Water A	Valve 1HV4395
Service Water B	Valve 1HV4396
Condensate System	Valves 1HV2484, 1CO195 and 1CO196
Demineralized and Reactor Makeup System	Valve 1LV2478
Vents and Drains	First Valve or atmosphere
HVAC	AFW pump room fan coolers
Instrument Air	Valve interfacing AFW component with air source
Nitrogen Supply	Valve 1AF225

NOTES:

1. Power supplies feeding AFW electrical components are addressed separately in the electrical, instrumentation, and control DSAP.

2. The auxiliary feedwater system review includes a portion of the feedwater system up to the steam generator nozzles

TABLE X-2

PRELIMINARY LIST OF AFW SYSTEM IMPLEMENTING DOCUMENTS

CALCULATIONS

Calculation No.	Rev.	Date	Calculation Title
TNE-SY-CA-3702-150	0	3-7-85	Aux. FW Flow Rate vs. S.G. Pressure
TNE-SY-CA-3703-151	0	3-11-85	Aux. FW Turbine Driven Pump Performance Evaluation
206-5	1	10-30-78	Condensate Storage Volume
206-6M	1	6-12-79	Sizing Aux. FW Flow Limiting Orifice (Motor Dr. Pump)
206-6T	2	10-6-81	Sizing Aux. FW Flow Limit Orifice (Turbine Driven Pump)
206-7	3	1-29-82	Aux. FW System Pressure Drop Calc
206-8	1	10-3-79	Aux. FW Pump NPSH Calc.
206-11	0	5-7-80	Aux. FW System Set Points
206-12	0	7-22-82	Air Accumulator Set Points
206-13	0	1-25-82	Eval. of FW Line Break with Uncontrolled Blowdown (This calc. may be withdrawn since blowdown isolation valves are active)
202-23	1	4-26-82	Main Steam Supply to Turbine
202-25	0	3-20-80	Steam Supply Line Drain Pot Set Point Calc.
IC-005	1	6-28-78	Accumulator Sizing for Aux. FW Control Valve
544	0	5-19-82	Flooding Analysis with Flood Level
548	0	11-15-82	Flooding Analysis with Fire Suppression

TABLE X-2

PRELIMINARY LIST OF
AFW SYSTEM IMPLEMENTING DOCUMENTS
(continued)

EVALUATIONS

Evaluation No.	Rev.	Date	Evaluation Title
GTN-69951	NA	3-29-85	Water Hammer Analysis
AB-10B	2	12-03-84	Aux. FW System Steam Backleakage
AB-10C	1	12-07-83	
AB-10D	1	12-02-83	
AB-10E	2	12-03-84	
AB-5	1	1-04-84	
AB-6	1	12-30-83	
AB-7	1	12-29-83	
AB-8	1	12-28-83	
FSAR PART II.E1.1	NA	1-20-81	Aux. Feedwater System Reliability Study
2323-TD-0206	1	7-76	Aux. Feedwater System Technical Description

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Auxiliary Feedwater System Reliability Study Evaluation - Sandia National Laboratory
NUREG-CR-2248, SAND 81 - 1625 Published September 1981

TABLE X-3

PRELIMINARY LIST OF AFW SYSTEM DESIGN DRAWINGS, SPECIFICATIONS, AND VENDOR DOCUMENTS

SPECIFICATIONS

Specification No.	Rev.	Date	Specification Title
MS-7	1	5-2-75	Auxiliary FW Pumps and Driver Mini Flow Breakdown Orifice
ES-1B	2	6-16-75	Aux. FW Pump Motors
MS-62	0	6-9-78	Breakdown Orifice for Test Line
MS-67	1	3-18-77	Condensate Storage Tank
MS-43A	5	7-3-84	Piping Nuclear
MS-20A.1	2	12-1-76	Valves 2 inches and smaller
MS-20B.1	2	8-12-76	Valves 2.5 inches and larger
MS-20C	2	8-9-76	Motor Operated Butterfly Valves
MS-600	3	9-1-76	Power Operated Control Valves
MS-624	1	11-8-76	Flow Elements
MS-621	1	10-20-76	Temperature Elements
MS-615	1	3-28-77	Pressure Indicators
MS-620	1	10-20-75	Level Transmitters
MS-74	0	6-8-76	Moment Restraints
MS-16A	1	5-10-76	Condensate Transfer Pump
MS-21D.1	1	11-10-75	Non-Nuclear Steel Valves Greater than 2½ inches
MS-44A	4	9-30-81	Non-Nuclear Piping
MS-21B	3	1-25-77	Non-Nuclear Steel Valves Less than 2 inches

TABLE X-3

PRELIMINARY LIST OF AFW SYSTEM DESIGN DRAWINGS, SPECIFICATIONS, AND VENDOR DOCUMENTS (continued)

FLOW DIAGRAMS

Diagram No.	Rev.	Date	Diagram Title
2323-MI-0206	CP-5	07/25/84	Auxiliary Feedwater System Flow Diagram

COMPOSITE DRAWINGS

Drawing No.	Rev.	Date	Drawing Title
2323-M1-0601	7	6-25-82	Composite Piping Safeguards Building Plan Below El.873'-6"
2323-M1-0601-01	8	6-25-82	Composite Piping Safeguards Building Sections
2323-M1-0602	11	9-25-78	Composite Piping Safeguards Building Plan Below El.852'-6"
2323-M1-0603	13	3-7-83	Composite Piping Safeguards Building Plan Below El.831'-6"
2323-M1-0604	15	3-7-83	Composite Piping Safeguards Building Plan Below El.810'-6"
2323-M1-0605	14	9-25-78	Composite Piping Safeguards Building Plan Below El.798'-6"
2323-M1-0617	18	9-25-78	Composite Piping Safeguards Building Plan Below El.831'-6"
2323-M1-0618	19	9-25-78	Composite Piping Safeguards Building Sections
2323-M1-0619	11	9-25-78	Composite Piping Safeguards Building Sections

TABLE X-3

PRELIMINARY LIST OF AFW SYSTEM DESIGN DRAWINGS, SPECIFICATIONS, AND VENDOR DOCUMENTS (continued)

ISOMETRIC DRAWINGS

BRP No.	Rev.	Date	Drawing Title
AF-1-AB-001	4	9-26-80	Auxiliary Feedwater
AF-1-EC-001	5	7-23-80	Auxiliary Feedwater
AF-1-SB-001	18	12-13-83	Auxiliary Feedwater
AF-1-SB-002	9	11-15-83	Auxiliary Feedwater
AF-1-SB-003	15	4-9-84	Auxiliary Feedwater
AF-1-SB-004	12	11-15-83	Auxiliary Feedwater
AF-1-SB-005	11	3-26-84	Auxiliary Feedwater
AF-1-SB-006	17	4-9-84	Auxiliary Feedwater
AF-1-SB-007	18	10-18-84	Auxiliary Feedwater
AF-1-SB-008	23	4-27-84	Auxiliary Feedwater
AF-1-SB-008A	9	4-18-84	Auxiliary Feedwater
AF-1-SB-009	8	11-15-84	Auxiliary Feedwater
AF-1-SB-010	13	4-27-84	Auxiliary Feedwater
AF-1-SB-010A	8	12-13-83	Auxiliary Feedwater
AF-1-SB-011	6	12-7-83	Auxiliary Feedwater
AF-1-SB-012	16	12-13-83	Auxiliary Feedwater
AF-1-SB-013	15	11-28-83	Auxiliary Feedwater
AF-1-SB-014	16	6-6-84	Auxiliary Feedwater
AF-1-SB-015	11	10-25-84	Auxiliary Feedwater
AF-1-SB-016	12	11-28-83	Auxiliary Feedwater
AF-1-SB-017	18	3-9-84	Auxiliary Feedwater
AF-1-SB-018	10	11-28-83	Auxiliary Feedwater
AF-1-SB-019	8	11-22-83	Auxiliary Feedwater
AF-1-SB-020	8	11-22-83	Auxiliary Feedwater
AF-1-SB-021	11	11-22-83	Auxiliary Feedwater
AF-1-SB-022	10	11-15-83	Auxiliary Feedwater
AF-1-SB-023	14	11-8-83	Auxiliary Feedwater
AF-1-SB-024A	9	10-15-83	Auxiliary Feedwater
AF-1-SB-024B	11	12-28-83	Auxiliary Feedwater
AF-1-SB-025	16	12-13-83	Auxiliary Feedwater
AF-1-SB-026A	10	10-12-83	Auxiliary Feedwater
AF-1-SB-026B	13	5-14-84	Auxiliary Feedwater
AF-1-SB-027A	9	10-12-83	Auxiliary Feedwater
AF-1-SB-027B	16	11-3-83	Auxiliary Feedwater
AF-1-SB-028	14	5-23-84	Auxiliary Feedwater
AF-1-SB-029A	8	10-18-83	Auxiliary Feedwater
AF-1-SB-029B	10	11-28-83	Auxiliary Feedwater
AF-1-SB-029C	12	11-3-83	Auxiliary Feedwater

TABLE X-3

PRELIMINARY LIST OF AFW SYSTEM DESIGN DRAWINGS, SPECIFICATIONS, AND VENDOR DOCUMENTS (continued)

ISOMETRIC DRAWINGS

BRP No.	Rev.	Date	Drawing Title
AF-1-SB-030A	10	10-18-83	Auxiliary Feedwater
AF-1-SB-030B	12	5-10-84	Auxiliary Feedwater
AF-1-SB-031	8	11-22-83	Auxiliary Feedwater
AF-1-SB-031A	10	11-15-83	Auxiliary Feedwater
AF-1-SB-032	9	11-15-83	Auxiliary Feedwater
AF-1-SB-033	11	11-28-83	Auxiliary Feedwater
AF-1-SB-034	10	11-15-83	Auxiliary Feedwater
AF-1-SB-035	9	11-28-83	Auxiliary Feedwater
AF-1-SB-036	10	5-14-84	Auxiliary Feedwater
AF-1-SB-037	3	8-5-80	Auxiliary Feedwater
AF-1-TB-001	7	9-26-80	Auxiliary Feedwater
AF-1-YD-001	11	12-01-83	Auxiliary Feedwater
AF-1-YD-002	12	12-01-83	Auxiliary Feedwater
AF-1-YD-003	11	12-01-83	Auxiliary Feedwater
AF-1-YD-004	13	12-10-83	Auxiliary Feedwater
AF-1-YD-005	22	4-24-84	Auxiliary Feedwater
AF-1-YD-006	2	7-8-80	Auxiliary Feedwater
AF-1-YD-007	15	4-9-84	Auxiliary Feedwater
AF-1-YD-008	7	12-28-83	Auxiliary Feedwater

TABLE X-3

PRELIMINARY LIST OF AFW SYSTEM DESIGN DRAWINGS,
SPECIFICATIONS, AND VENDOR DOCUMENTS
(continued)

VENDOR DOCUMENTS

Document No.	Rev.	Date	Document Title
CP-07-102202E	J	9/2/81	Auxiliary Feedwater Pump Turbine Outline
CP-07-102462D	L	1/14/85	Schematic-Oil Piping - Turbine Driven Pump
CP-07-2323-MS-7	O	11/5/84	Equipment Qualification Package
CP-07-25-81	NA	NA	Technical Bulletin-Horizontal Multi-Stage Pumps
CP-07-300D438AJX6	O	2/27/84	Dwgs. for Orifice Assemblies
CP-07-86651D	O	06/27/75	Terry Turbine Aux. Feedwater Pumps
CP-07-8972D73	1	5/20/76	AFW Pump Motor Outline
CP-07-C-300D438AJX2B	3	8/10/78	Orifice Assembly
CP-07-C-49HMTA500X10B	1	10/5/77	HMTA-Motor Driven AFW Pump
CP-07-C-49HMTA86X17B	4	8/10/78	Motor Driven Pumps General Arrangement
CP-07-C-56HMTA500X10B	1	10/5/77	HMTA-Turbine Driven AFW Pump
CP-07-C-56HMTA87X41A	1	5/7/79	Pump/Turbine Bedplate Outline
CP-07-C-5HMTA321X100A	1	7/12/78	Manifold Piping
CP-0007-001	NA	NA	Centrifugal Pump Aux. Feedwater, 4 HMTA-9 Stage - Instruction Manual
CP-0007-002	NA	NA	Centrifugal Pump Aux. Feedwater, 5 HMTA-6 Stage - Instruction Manual
CP-0007-003	NA	NA	Steam Turbine, Aux. Feedwater Pumps - Instruction Manual.

TABLE X-3

PRELIMINARY LIST OF AFW SYSTEM DESIGN DRAWINGS, SPECIFICATIONS, AND VENDOR DOCUMENTS (continued)

VENDOR DOCUMENTS

Document No.	Rev.	Date	Document Title
CP-07-Curve N-1022	NA	8/10/78	Performance Test Curve
CP-07-Curve N-1072	NA	10/23/78	Performance and NPSH Curves
CP-07-Curve N-652	2	11/4/76	Turbine Drive Aux. Feedwater Pump
CP-07-Curve N-653	2	11/4/76	Motor Auxiliary Feedwater Pump
CP-07-E/L 20.316	NA	12/11/78	Seismic Test Spec - Terry Corp.
CP-07-Letter 3/21/84	NA	3/21/84	Letter Concerning 0102 Inch Thick Gasket Material
CP-07-LN-49HMTA86X17	4	8/10/78	Auxiliary Feedwater Pump
CP-07-PL-49HMTA500X10A	2	10/5/77	Motor Driven Auxiliary Feedwater Pump
CP-20A.1-CNS-25602	A	3/12/84	Valve Seismic Calculations
CP-20B.1-CDP-75780-1	NA	9/3/79	S/N 35650 Doc. Package for 12GB1602TBPG0
CP-43A-MP-2005	8	3/22/79	Piping Manufacturing Procedure
CP-43A-PQR-T-17374	1	10/1/79	Procedure Qualification Record
CP-43A-PQR-T-19644-A	NA	1/5/77	Procedure Qualification Record
CP-43A-PQR-T-19742	NA	4/2/79	Procedure Qualification Record
CP-43A-PQR-T-21778-A	12	5/31/78	Procedure Qualification Record
CP-62-556-32473	8	9/19/83	Orifice Plate Outline and Assembly
CP-62-556-33110	1	5/19/82	Outline Dwg. Concentric Orifice Pls.

TABLE X-3

PRELIMINARY LIST OF AFW SYSTEM DESIGN DRAWINGS, SPECIFICATIONS, AND VENDOR DOCUMENTS (continued)

VENDOR DOCUMENTS

Document No.	Rev.	Date	Document Title
CP-62-FC-19615-1	1	10/27/82	Flow Calculation Data
CP-600-10A8873	C	11/12/76	Steel Valve Body Plain Bonnet
CP-600-14A4585	A	NA	Steel Valve Body Plain Bonnet
CP-600-14A4976	A	NA	Steel Valve Body Plain Bonnet
CP-600-35A3605	B	3/14/80	Body Diaphragm Actuated Control Valve
CP-600-35A3608	B	6/11/80	Body Diaphragm Actuated Control Valve
CP-600-35A3609	B	6/11/80	Body Diaphragm Actuated Control Valve
CP-600-AV3816	A	NA	Diaphragm Acuator
CP-600-CTS 1.9	2	5/9/78	Valve Performance Testing Procedure
CP-600-G26251	D	11/17/80	10" Type 9520 Valve With Limitorque

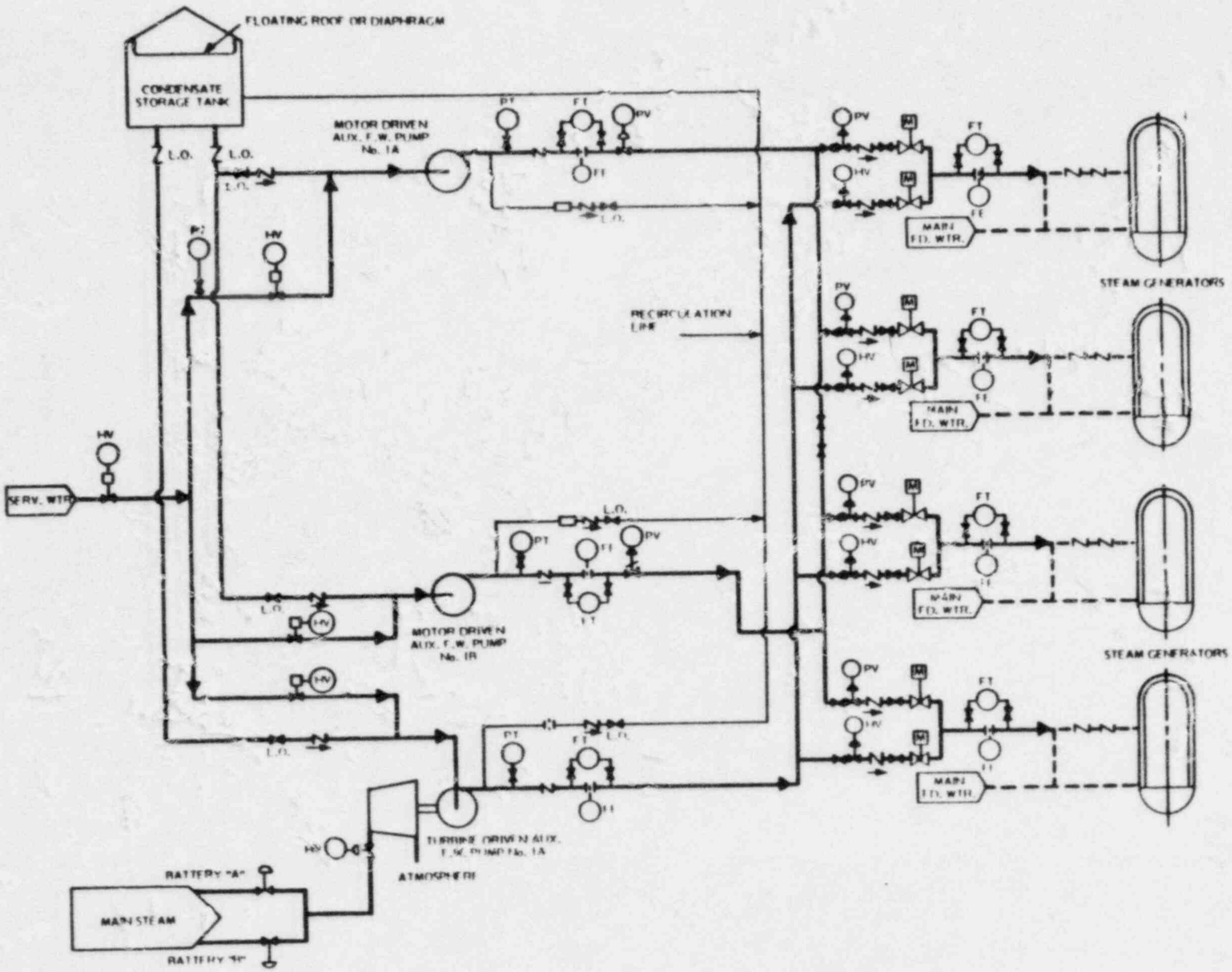
TABLE X-4

PRELIMINARY LIST OF SELECTED AFW MECHANICAL COMPONENTS TO BE REVIEWED FOR FUNCTIONAL REQUIREMENTS

Component Description	Component Identifier
Motor driven pumps	CP1-AFAPMD-01, -02,
Turbine driven pump	CP1-AFAPTD-01
Air accumulators	CP1-CIATAF-01 through -08
Branch line flow control valves	1PV-2453A, B 1PV-2454A, B 1HV 2459, -2460, -2461, -2462
Flow limiting orifice	CP1-AFORFR-04 through -011
Steam supply line valve to turbine driven pump	1HV 2452-1 and 1HV 2452-2
Steam generator isolation valves	1AF094, 1AF099, 1AF084, 1AF087, 1AF076, 1AF079, 1AF102, 1AF107
Service water isolation valves	1AF022, 1AF019, 1AF030, 1HV4395, 1HV4396
Condensate storage tank	CP1-AFATCS-01
Piping classes	152, 1303, 2002, 2003

FIGURE X-1

SIMPLIFIED AUXILIARY FEEDWATER SYSTEM



(TO BE REVISED TO REFLECT THE LATEST PROJECT DESIGN)

FIGURE X-2

MECHANICAL SYSTEMS AND COMPONENTS
AUXILIARY FEEDWATER SYSTEM
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
SYSTEM OPERATING MODES			
o Startup/Shutdown	X	X	
o Transient/Accident Conditions	X	X	
o System Alignment/Switchover	X	X	
OPERATING LIMITS			
o NPSH	X	X	X
o Maximum Conditions	X	X	X
o Minimum Conditions	X	X	X
o Overpressure Protection	X	X	X
o Steam Flow Requirements	X	X	X
HEAT REMOVAL CAPABILITY			
o Heat Removal Bases	X	X	
o Flow Requirements	X	X	
WATER SUPPLIES			
o Sources	X	X	
c Stored Volume	X	X	
COMPONENT FUNCTIONAL REQUIREMENTS			
o Pumps and Drivers	X	X	X
o Valves and Operators	X	X	X
o Tanks	X	X	X
o Piping	X	X	X

FIGURE X-2

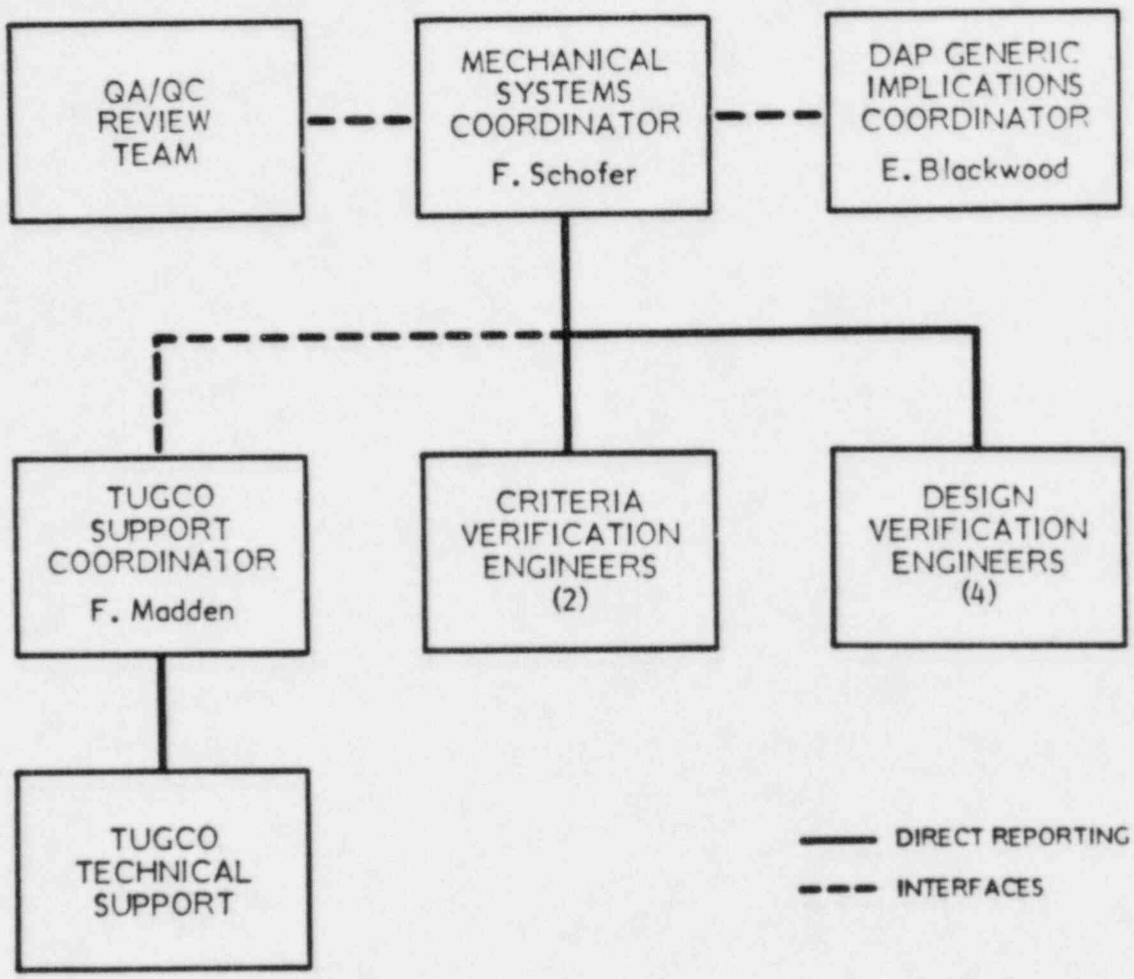
MECHANICAL SYSTEMS AND COMPONENTS
AUXILIARY FEEDWATER SYSTEM
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

(Continued)

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
SINGLE FAILURE/FMEA	X	X	
ELECTRICAL ASPECTS	(See Self-Initiated Evaluation Electrical/I&C System and Components Matrix for the AFW System)		
INSTRUMENTATION AND CONTROL	(See Self-Initiated Evaluation Electrical/I&C System and Components Matrix for the AFW System)		
SUPPORT SYSTEMS			
o HVAC	X	X	
o Cooling Water	X	X	
CLASS 5 PIPING	X	X	
MULTI-DISCIPLINE CONSIDERATIONS			
o High Energy Line Breaks	X	X	
o Internal Flooding	X	X	
o Fire Protection	X	X	X
o Missile Protection	X	X	
o Environmental Qualification	X	X	X
o Seismic Qualification	X	X	X

FIGURE X-3

MECHANICAL SYSTEMS AND COMPONENTS
DESIGN ADEQUACY PROGRAM ORGANIZATION



6/25/85

XI ELECTRICAL, INSTRUMENTATION AND CONTROLS SYSTEMS AND COMPONENTS

DRAFT

1.0 PURPOSE

The purpose of the electrical, I&C program is to confirm the adequacy of the CPSES electrical and instrumentation systems through a detailed examination of externally generated design issues and through the implementation of a self-initiated action plan that will test the design through the detailed examination of representative plant systems and components. External sources have identified two issues: one a TRT related issue involving the qualification of field-initiated electrical components, and the other an IAP identified issue regarding the pressure and temperature ratings of process instrumentation.

The self-initiated action plan will provide an evaluation of the CPSES electrical/instrumentation and control (E/I&C) systems design for compliance with licensing commitments, design requirements and functional performance requirements. By carefully reviewing the E/I&C aspects of the auxiliary feedwater system and the electrical power supply systems (including the standby power system, the balance-of-plant uninterruptible AC and the 125 volt DC systems), and by expanding the review scope where needed for a comprehensive program, the CPRT will be able to reach an informal judgement regarding the adequacy of the CPSES design and the ability of the plant to be operated safely.

2.0 SCOPE AND BACKGROUND

2.1 Issues Generated by External Sources

The scope of this plan with regard to externally-generated issues will encompass two items: the TRT issue regarding the qualification of electrical components where the requirement for them was site-initiated, and the IAP issue regarding the pressure and temperature ratings of process instruments.

The scope of the TRT issue will include a review of the engineering approval of the qualifications of certain electrical components where the requirement for their use was begun at the site. In two instances, the Amp butt-splices and the Servicair metallic conduit, the TRT discovered a lack of adequate engineering qualification of the item for its intended service. The action plan will identify all other site-initiated electrical components, review the qualification documentation and, if necessary, perform an evaluation of each identified item. Sampling techniques may be specified if warranted. Detailed review activities are given below.

The IAP-generated issue involves the discovery of two instances in which changing system pressure/temperature parameters resulted in the design ratings of process instruments being exceeded. Although

the instruments in question were later shown to be qualified for the higher condition or to be protected by interlocks, the possibility exists that design and operating parameters for other systems may have been revised without a matching review of the affected instrumentation. The action plan will require a review of all other safety-related fluid systems where changes to the pressure/temperature ratings may have been made, and the identification of the population of affected instruments. Where statistically warranted, a sampling program may be established to verify the adequacy of the instrument design ratings. Otherwise, and particularly if the number is small, all affected instruments will be reviewed for design adequacy and under the revised system operating conditions.

2.2 Self-Initiated Action Plan

The scope of this section of the ISAP initially encompasses the E/I&C design of the auxiliary feedwater system, the safety-related standby electrical power system, the Class 1E balance-of-plant (bop) uninterruptible 118 volt AC system and the Class 1E 125 volt DC system for the work performed by the architect/engineer (A/E) and by TUGCO. Several component types important to safety that do not appear within the boundaries of the initial system selection have also been included. Provision for expansion of the initial scope is provided in the program so that representative systems, component types and design activities of all types will be included in the review. Figures XI-1 and XI-2 are matrices of the initial review areas included in the E/I&C systems review, and gives an indication of the depth of the review to be conducted for each of the review areas. The detailed review activities pertinent to each area are given in Section 3.0, "Implementation". The scope includes a review of the design inputs (criteria), evaluations of design analyses (calculations, evaluations, etc.) and reviews of design outputs such as drawings and specifications.

The E/I&C design review boundaries for the AFW system include all safety-related design activities or components up to and including the vendor interface and the A/E activities. That is to say that the vendor design process will be sampled at its interface with the A/E and utility design activities. This boundary, for instance, includes an evaluation of the use of the design information which crossed the boundary concerning the Engineered Safety Features Actuation System (ESFAS) supplied by Westinghouse and the impact of this information on the A/E design activities. The review boundaries include non-safety related instrumentation for the AFW system. The Standby Power System, 118 Vac, and 125 Vdc support systems for the AFW system will be reviewed as plant power supplies as described in this plan. The mechanical aspects of the AFW system are covered in a separate Action Plan.

The review of the E/I&C areas for power supplies includes the Class 1E Standby Power system or diesel generators (D/Gs) together with

FIGURE XI-1
ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
ELECTRIC POWER SYSTEM
POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
SYSTEM OPERATING LIMITS			
o Voltage	X	X	
o Time	X	X	
o Current	X	X	
o Frequency	X	X	
SYSTEM OPERATING MODES			
o Normal/Start-up Shutdown	X	X	
o LOCA/Loss of Offsite Power	X	X	
o Station Blackout	X	X	
ELECTRICAL CHARACTERISTICS			
o Voltage Profiles	X	X	
o Short Circuit Currents	X	X	
o Terminal Voltages	X	X	X
o Cable Sizing	X	X	X
ELECTRICAL LOAD CAPACITY			
o Standby Power Supplies (DGs)	X	X	X
o Inverters	X	X	X
o Batteries/Chargers	X	X	X
o Transformers	X	X	
LOAD SEQUENCING, SHEDDING AND TRANSFERS	X	X	X
PROTECTIVE RELAYING	X	X	X

FIGURE XI-1
(CONTINUED)
ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
ELECTRIC POWER SYSTEM
- POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
CONTROL			
o System Interlocks	X	X	X
o Automatic Initiation/Operation	X	X	X
o Manual Operation	X	X	X
INSTRUMENTATION			
o Status Indication	X	X	X
o Operational Surveillance	X	X	X
o Alarm	X	X	X
o Protective Devices/Settings	X	X	X
COMPONENT FUNCTIONAL REQUIREMENTS	X	X	X
SINGLE FAILURE/FMEA			
o Redundancy	X	X	
o Independence	X	X	
o FMEA	X	X	X
o Separation/Cable Routing	X	X	X
SUPPORT SYSTEMS			
o DG Fuel Oil Transfer	X	X	
o DG Cooling Water Requirements	X	X	
o HVAC	X	X	X

FIGURE XI-1
(CONTINUED)
ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
ELECTRIC POWER SYSTEM
- POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
MULTI-DISCIPLINE CONSIDERATIONS			
o High & Moderate Energy Line Break	X	X	
o Environmental Qualification	X	X	X
o Fire Protection	X	X	X
o Missile Protection	X		
o Seismic Qualification	X	X	X

FIGURE XI-2
ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
AUXILIARY FEEDWATER SYSTEM
POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

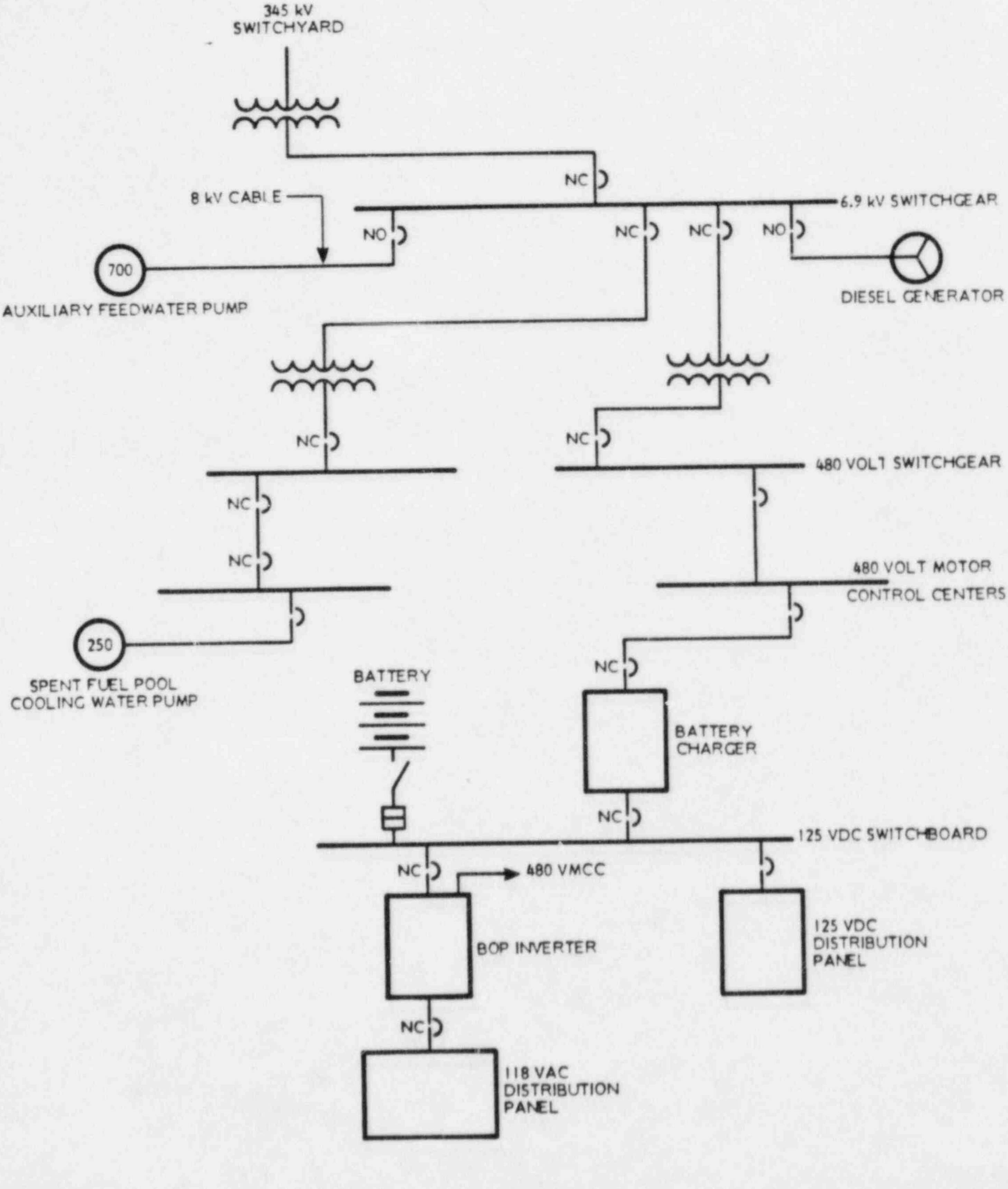
Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
SYSTEM OPERATING LIMITS			
o Voltage	X	X	
o Time	X	X	
o Current	X	X	
o Frequency	X	X	
SYSTEM OPERATING MODES			
o Normal/Start-up Shutdown	X	X	
o LOCA/Loss of Offsite Power	X	X	
o Station Blackout	X	X	
ELECTRICAL CHARACTERISTICS			
o Terminal Voltages	X	X	X
CONTROL			
o System Interlocks	X	X	X
o Automatic Initiation/Operation	X	X	X
o Manual Operation	X	X	X
o Process Control	X	X	
INSTRUMENTATION			
o Status Indication			
o Operational Surveillance	X	X	X
o Alarm	X	X	X
o Protective Devices/Settings	X	X	X

FIGURE XI-2
(CONTINUED)
ELECTRICAL, INSTRUMENTATION AND CONTROL
SYSTEMS AND COMPONENTS
AUXILIARY FEEDWATER SYSTEM
POWER SUPPLIES, INSTRUMENTATION AND CONTROL
INITIAL REVIEW MATRIX
SELF-INITIATED EVALUATION

Review Area	Criteria Identification and Review	Implementing Document Review	Design Output Review
COMPONENT FUNCTIONAL REQUIREMENTS	X	X	X
SINGLE FAILURE/FMEA			
o Redundancy	X	X	
o Independence	X	X	
o FMEA	X	X	X
o Separation/Cable Routing	X	X	X
SUPPORT SYSTEMS	(See Power Supplies, Instrumentation and Control Systems and Components Initial Review Matrix)		
MULTI-DISCIPLINE CONSIDERATIONS			
o Environmental Qualification	X	X	X
o Seismic Qualification	X	X	X

FIGURE XI-3

SIMPLIFIED PLANT ONE-LINE
FOR ILLUSTRATION ONLY - TRAIN "A" REVIEW SCOPE



their associated Class 1E power distribution systems from the 6.9 kV level to 480 volt switchgear and 480 volt motor control centers (MCCs). This review boundary is drawn at and includes the isolation devices at the safety/non-safety interface and the distribution breakers at the 6.9 kV switchgear and 480 volt switchgear and MCCs. The exception to this general rule is that the review boundary includes any distribution system connections between 6.9 kV switchgear, 480 volt switchgear, and 480 volt MCCs, and any connections between these and AFW system loads, or the 118 Vac, or 125 Vdc systems. The review boundary includes the interconnections between the D/G, 118 Vac, 125 Vdc and AFW systems. The D/G support system review includes the E/I&C aspect of the D/G room HVAC system and the D/G fuel oil transfer and storage system. Thus, the combined standby power system and AFW review considers the Electrical/I&C aspects from D/G outputs down to 480V loads.

The Class 1E balance-of-plant uninterruptible 118V ac power supply review includes the power supply to the inverters, the inverters, and the distribution system out to the distribution panels. The system out to any AFW loads is included within this boundary. The 125 Vdc system review boundary includes the batteries and their distribution system out to the distribution panels and any AFW, D/G, and 118 Vac interfaces.

Figure XI.3 is a simplified one-line diagram illustrating the scope of the initial systems selection.

3.0 CPRT ACTION PLAN IMPLEMENTATION

The development of action plans to address the CPRT Electrical/Instrumentation and Control issues is divided into two sections: 1) those issues which have been identified by external sources (TRT and IAP) and 2) the self-initiated evaluation of the design program.

3.1 External Issues

3.1.1 TRT identified issue - Electrical Component Functional Requirements

As discussed in Section 3.2 two related issues were identified by the NRC TRT letter of 9/18/84 and subsequently by NUREG--0797 Supplement No. 7, January 1985. These were:

- o Qualification of AMP butt splices for the expected service conditions.
- o Qualification of Servicair flexible metallic conduit as an acceptable barrier for the purposes of electrical separation.

The use of both these items was initiated by site project electrical engineering and approved for use prior to confirmation of their functional qualification. No formal review of the butt-splice qualifications was performed to the TUGCO procedures, and there was not an adequate review of the adequacy of the flexible conduit as a barrier within control panels.

Although preliminary results from the CPRT action plans on these issues indicate that both items are capable of being qualified for their intended service, a remaining issue involves the potential use, without a complete engineering review, of components that were initiated by site engineering. There is, therefore, a concern that potentially unqualified components may be used in safety-related applications elsewhere in the plant.

3.1.1.1 Identification of Site-Initiated Electrical/I&C Components

All safety-related electrical or instrumentation and control items whose use was initiated by site project engineering will be identified. This will be done through a formal review of design change documentation and the related specifications and purchase orders. Cognizant site engineering personnel will be interviewed to identify other means by which unqualified items may have been selected for use.

3.1.1.2 Review of Qualification Documentation

Once all site-initiated electrical/I&C items have been identified, a determination will be made of the status of the qualification of each. Those identified as clearly having been formally qualified in accordance with the TUGCO procedures will be accepted, while the remainder will be subjected to further review. If the number of these is small (fewer than five) then all items will be reviewed by the CPRT for compliance to their functional requirements. If five or greater are identified, a sampling plan will be selected to determine the specific items to be reviewed (see CPRT Program Plan Appendix D - Sampling). Components not selected for CPRT review will be referred to the Project for further qualification action.

In selecting samples for a complete review, consideration will be given to (1) the safety significance of the item or component, (2) the harshness of its operating environment and (3) the relative number of such items used in the plant. Not less than five

such items will be reviewed presupposing that at least that number are identified.

3.1.1.3 Identify Criteria Applicable to Components

The design criteria applicable to each component will be identified through a review of the following:

- NRC Requirements
- FSAR
- Vendor Input
- Westinghouse Interface Criteria
- Industry Codes and Standards
- Safety Evaluation Reports
- Analysis, Evaluations or Tests
- Drawings and Specifications
- Design Change Documentation

The resulting criteria for each component will be reviewed for consistency and completeness. It is noted that component functional requirements may also result from analysis (for example plant environmental analysis) and drawings or specifications. A review of design changes will ensure that only the latest information is included.

3.1.1.4 Evaluation of Component

This evaluation will consist of a point to point comparison of the information available for the component to the identified requirements. The evaluation will proceed from the criteria to the vendor data, test results or evaluations to the component specification and drawings such that the requirements are traced from criteria to implementing documents to design output. This evaluation will be documented in the Results Report.

3.1.1.5 Development of Corrective Action for Identified Deficiencies

Should deficiencies in component adequacy be identified, the CPRT will recommend an appropriate plan to resolve the deficiency, in accordance with the requirements of the Program Plan. Such a plan may include any or all of the following:

- Obtain additional information
- Perform analysis or test
- Shelter (change component service condition)
- Replace component
- Make a related system design change

The adequacy of any or all of these measures will depend on the nature of the component deficiency, the system design, the availability of additional information and the number of such components in the plant.

3.1.1.6 Handling of Review Results

If deficiencies are found in the review of component functional adequacy that cannot be resolved solely by obtaining additional information, the size of the review sample will be increased to a level appropriate to the total number of identified component types (i.e. the safety-related components for which the decision to use was initiated by site engineering).

Similarly, if sufficient instances exist where components are found to be functionally inadequate, or if use of improperly qualified components seems pervasive, the scope of the program may be expanded to other disciplines (for example, mechanical or electrical). The root cause and generic implications of identified deficiencies will be processed in accordance with the requirements of the CPRT Program Plan.

3.1.2 IAP-Identified Design Issue - Temperature/Pressure Ratings of Instruments

During the IAP review, two instances were noted where the pressure/temperature ratings for instruments installed in the Component Cooling Water System (CCW) were lower than the maximum pressure or temperature of the system as indicated in the Gibbs and Hill analysis. Although the instruments in question were later shown to be either qualified for higher design conditions or protected by interlocks, there is a concern that similar situations may exist in other systems.

3.1.2.1 Identification of Other Systems/Components

Other plant fluid systems where design changes or re-evaluation of system operating conditions may have resulted in higher pressure or temperature ratings will be identified through a review of the plant flow diagrams system descriptions or other documents. A review of the systems history will be used to identify any systems where ratings may have been increased.

3.1.2.2 Selection of Instruments for Review

From the systems selected above, if any, the total population of process instruments which could be affected by changing temperature or pressure ratings will be identified. If the number of such instruments is large enough to warrant a statistical sampling, a program will be developed to meet the requirements of Appendix D. If not, all identified instruments will be reviewed.

3.1.2.3 Identify Pressure/Temperature Criteria Applicable to the Instruments

The pressure/temperature criteria applicable to each instrument will be established through review of the system operating parameters under the various operating conditions. Any code requirements will be considered as will appropriate interlocks or other active means of isolation will be considered.

3.1.2.4 Evaluation

Where it appears that an instrument does not meet the system requirements for pressure and temperature ratings, a further evaluation will be conducted. For example, additional vendor information may be obtained, additional analyses of the system may be conducted, the instrument may be sheltered (by protective interlock, etc.) or a system design or operating requirement change may be recommended.

The adequacy of any or all of these measures will depend upon the nature of the instrument deficiency, the system design, the availability of additional information or other considerations.

3.1.2.5 Review Results

Negative findings during the review may result in recommendations to the Project to make any or all of a number of changes such as are described above. A sufficient number of findings or indication of a trend may result in the expansion of the sample within the identified population, or if sufficiently poor, to the expansion into other similar areas of review (a survey of the qualification of instruments to meet other attributes such as radiation, etc.).

For any case, any deviations or deficiencies will be used to determine the root cause and any possible generic implications as described in the Design Adequacy Program.

3.2 Self-Initiated Action Plan - Electrical/I&C

As stated above, the purpose of the self-initiated action plan is to verify the adequacy of the electrical and instrument and control design by determining whether the AFW and the electrical power supplies (standby power, balance-of-plant uninterruptible 118 volt AC and 125 volt DC) comply with licensing commitments, design requirements and functional performance requirements. In addition, provision is made in the Program Plan to expand the scope of systems or components reviewed so as to ensure that a complete review is made of a cross-section of those items and design processes. Figure XI-3 is a simplified one-line diagram which shows in a very general manner the initial system/component selections.

3.2.1 Initial System and Component Selection

The bases for electrical power supply system selection included:

- o Importance to safety
- o Design interfaces
- o Diversity of systems and equipment

Similarly, the bases for the selection of the AFW system included:

- o Importance to safety
- o Representative multi-discipline system
- o Large number of interfaces
- o Consistency with the mechanical system review

Since the objective of the self-initiated action plan is to determine whether design deviations exist in the electrical/instrumentation and control areas the initial scope includes:

- o A review of the instrumentation and controls for:
  - the AFW system
  - electrical power supplies
- o A review of the 1E electrical power supply systems
  - from onsite power at the startup transformer to the 6.9kV bus and then down to the 480 volt motor control centers

- the balance-of-plant uninterruptible 118 volt AC power supplies from the inverters to the distribution panels

- the 125 volt DC power supplies from batteries to the distribution panels

- the various interconnections between the AFW, off-site, standby, 118 volt AC and 125 volt DC systems

Using the described bases a number of important components within these systems were selected for a comprehensive review (see Section 3.2.5.8 Component Functional Requirements) including motors, valves, switchgear, instruments and battery charging and inverter equipment. To ensure that there was an adequate cross-section of all design activities it was obvious that a number of component types not found within the initial system boundaries would also be included. The first selected were:

- o Main Steam Isolation Valves
- o Reactor Coolant Pump containment electrical penetrations
- o A large motor fed from 480V

As the design review progresses, additional areas of design activities and component types not yet identified will be added to the program scope (see Appendix A - Design Adequacy Program).

3.2.2 Review of Design Criteria and Commitments

The E/I&C evaluation of the AFW, standby power, 118 Vac, and 125 Vdc systems begins with the identification of criteria and regulatory requirements applicable to the system. Typical sources of E/I&C criteria or requirements include:

- o FSAR
- o Westinghouse Interface Criteria
- o NRC requirements
- o Industry codes and standards
- o Safety Evaluation Reports
- o Plant/site physical features
- o Correspondence

These and other sources of criteria will be reviewed and applicable criteria and requirements extracted and listed. The current criteria list thus developed forms the basis for subsequent stages of the review. The compliance of the design with these commitments will be deemed acceptable if no safety-significant deviation exists between the tested

design and the requirements identified on the current criteria list.

The criteria list is subjected to a review for consistency and completeness. The objective of this stage of the review process is to ensure that the criteria list contains no criteria that are inconsistent or incompatible with each other. Furthermore, the review considers whether the criteria list is sufficiently complete to allow an experienced systems designer to develop an AFW and power supplies system design that satisfies its functional purposes. As part of the review of the current criteria for consistency and completeness, an identification is made of the operation modes and limiting conditions for the systems being reviewed. Any apparent inconsistencies or lack of completeness in the criteria are evaluated to determine whether the inconsistency or lack of completeness has any potential safety significance. Any inconsistencies or lack of completness that could have safety significance will be evaluated for their effect on the systems, after determining the correct or additional criteria. Any such lack of completeness or consistency will be further reviewed for generic implications. The final consolidated current criteria that is judged to be consistent and complete is used as the basis for evaluating the design as reflected in design analysis and design output documents.

3 4.2.3 Review of Implementing Documents

Implementing documents translate the design inputs into working level documentation. This working level documentation is the intermediate step (or several steps as the case may be) in the design process to produce design outputs. Examples of the implementing documents for the CPSES design process which will be reviewed include:

- o Calculations/Evaluations/Studies - examples:
  - Load Capacity Voltage Profile
  - Short Circuit
  - Cable Sizing
  - Instrument Setpoints
  - Single Failure/Failure Modes and Effects
- o One Line Diagrams
- o Instrumentation and Control Drawings (Logic)
- o Flow Diagrams

The process used in evaluating implementing documents involves the identification of the criteria applicable to each implementing document. For each implementing document included in the scope of the review, a checklist is developed. The checklist contains the criteria with which the document must be consistent. Furthermore, the checklist requires that

any assumptions or limiting conditions introduced into the design by the implementing document must be reviewed against the consolidated criteria list for consistency.

For each document selected for review, a checklist will be prepared. A review will be made using the checklist to determine whether the drawings and specifications are consistent with the applicable implementing documents and criteria. Inconsistencies determined in this process will be reviewed against test program results and evaluated for safety significance. Safety-significant deviations will be considered further for generic implications.

3.2.5 Review Scope

The review activities Topics are listed below for the AFW and the Class IE Standby Power (D/G), uninterruptible 118 Vac and 125 Vdc power systems. The list shown below is not intended to be all inclusive of the activities or documents, drawings or specifications which will be reviewed for each Topic. Review specifics will vary as a function of the depth and breadth of other reviews and with the results of each step in the review process. Neither is the list specific as to the detailed design attributes to be verified, but is intended to indicate the general design areas to be reviewed. The results of the design criteria review largely determine the specific attributes to be verified in later review steps.

3.2.5.1 Systems Operating Modes (Topic A)

The review activities for this Topic include the identification of applicable criteria for the operating limits of voltage, frequency, time, and current for the D/G, 118 Vac and 125 Vdc power supplies. The consideration of these limits as input to power supply load calculations and/or sizing calculations will be checked in the review of Electrical Load Capacity. The consideration of the identified system limits on D/G, inverter, and battery specifications will be checked.

3.2.5.2 Systems Operating Modes (Topic B)

The specific review activities for this Topic include the identification of the AFW and D/G, 118 Vac and 125 Vdc design basis modes of operation (LOCA, loss of offsite power, station blackout, etc.). The resulting criteria will be used as input for the review of implementing and design output documents of other Topics such as in the review of calculations, drawings or specifications as

appropriate. In addition, the power supplies for the AFW components under its various operating modes will be verified to be adequate for the required system operating condition.

3.2.5.3 Electrical Characteristics (Topic C)

The specific review activities for this Topic are the identification of the design criteria including input from other Topics regarding voltage and current limits (including terminal voltages) and cable sizing. The applicable design criteria will be used to review the inputs, assumptions and methodology for the following calculations:

- o 6.9 kV and 480 Vac bus voltage profile
- o 6.9 kV and 480 Vac bus short circuit
- o Power cable sizing
- o Control circuit cable sizing

In addition, an independent calculation will be made of terminal voltage available to selected AFW components under the most restrictive power system conditions.

3.2.5.4 Electrical Load Capacity (Topic D)

The specfic review activities fur this Topic include the identification of design criteria and commitments for the D/G, 118 Vac, and 125 Vdc loads including consideration of Topics A, B, E and vendor data. The verified criteria will be used in a review of the inputs, assumptions and methodology for the following calculations:

- o D/G load
- o Battery sizing
- o 118 Vac inverter load

The D/G, inverter, and battery specifications will be reviewed for adequacy of these components to meet their design load requirements. The load sequencer specification will be used as input to the D/G load profile. The D/G load test results will be reviewed against the load calculation and D/G specification.

3.2.5.5 Load Shedding, Transfers and Sequencing (Topic E)

The specific review activities for this Topic include the identification of applicable design criteria and commitments regarding the timing of load

sequencing, shedding and transfers. These activities also include a review of the 6.9 kV circuit breaker schematics to check for incorporation of design requirements. The load sequencer specification will be reviewed for compliance with design requirements and as input to the D/G load profile check.

3.2.5.6 Control (Topic F)

The specific review activities for this Topic include the identification of applicable design criteria relevant to system controls including interlocks, permissives, automatic initiation, local and/or manual operation, and process control for the AFW and power supply (D/G, 118 Vac and 125 Vdc) systems. The verified criteria will be used to review the AFW system and D/G output breaker control schematics for compliance to design criteria. The AFW schematics will also be reviewed for process control design compliance to requirements. The AFW system and D/G schematic diagrams will be reviewed for appropriate incorporation of control logic. AFW startup test results will be used to verify component or sub-system operation in accordance with control requirements.

3.2.5.7 Instrumentation (Topic G)

The specific review activities for this Topic include the identification of criteria concerning process indications, system monitoring, alarms, bypass indication, and protective instruments for the AFW and D/G, 118 Vac and 125 Vdc systems. The CPSES design commitments will be reviewed against the verified criteria. The AFW flow diagram and ICDs will be reviewed for compliance to design requirements. The bases for AFW instrument setpoints and at least two setpoint calculations will be checked. In addition, the bases for 6.9 kV bus protective relay setpoints and setpoint calculations for bus undervoltage in degraded grid conditions will be reviewed. Other items to be reviewed include the bases for at least three A/E-supplied D/G alarm setpoints and the protective relay coordination for two loads on the 6.9 kV bus. AFW instrument data sheets will be checked for appropriate instrument type, range, accuracy, response and interface requirements. Lastly, the AFW and D/G indications on the main control boards and remote shutdown panel will be verified at the drawing level.

3.2.5.8 Component Functional Requirements (Topic H)

The review activities for this Topic include the identification of design criteria and input from other evaluations concerning specific component functional requirements for components in the AFW and power supply systems. Calculations and evaluations which specify the component functional requirements from the general system design criteria will be verified. These verified component functional requirements will then be compared to the component procurement and vendor documents to ensure that the component functional requirements have been met. The initial list of components to be reviewed is:

- o Within the initial systems
  - AFW Pump Motor
  - AFW Pump Motor Breaker
  - AFW Isolation Valve
  - 6.9 kV Switchgear
  - 8 kV Cable
  - 480 V Motor Control Center
  - AFW Flow Transmitter
  - Battery Charger
  - Battery
  - BOP Inverter
  - AFW Flow Control Valve

- o Outside the initial systems
  - Containment Electrical Penetrations
  - Main Steam Isolation Valve
  - Spent Fuel Pool Cooling Water Pump Motor (fed from 480V)

3.2.5.9 Single Failure/FMEA (Topic I)

The review activities for this Topic include the identification of criteria concerning redundancy, single failure, independence, separation (including safety to non-safety isolation) and failure modes and effects for the Standby Power, 118 Vac and 125 Vdc systems. A review of design commitments against criteria will be performed. The plant cable routing down to the raceway schedule level and the plant single line drawings will be checked for compliance to criteria. The FSAR FMEA studies will be reviewed against criteria and plant single lines.

3.2.5.10 Support Systems (Topic J)

The review activities for this Topic include the identification and review of design criteria relevant to the E/I&C aspects of D/G support systems including fuel oil, and HVAC. The fuel oil transfer and HVAC Flow Sheets and ICDs will be reviewed to verify appropriate consideration of these requirements.

3.2.5.11 Multi-Discipline Considerations (Topic K)

The review activities for this Topic include the identification of design requirements for electrical, instrumentation and control aspects of HELBA, internal flooding, missile protection, fire protection, environmental qualification. CPSES design commitments will be reviewed for consideration of the appropriate requirements. The mechanical self-initiated action plan includes field inspection activities to check for the implementation of the E/I&C criteria for the HELB and internal flooding subjects. The mechanical review will also include a check of protective measures for missiles. The fire protection activities include a review of the breaker coordination study for components associated with safe shutdown under conditions of a plant fire. A minimum of five electrical components will be selected for review of their environmental qualification and an independent evaluation of their qualification (based on available reports) will be made. The seismic qualification reports and/or analyses for several E/I&C components will also be evaluated for compliance to design criteria.

4.0 ORGANIZATION AND RESPONSIBILITIES

4.1 Organization

The organization chart for the Electrical/I&C systems Design Adequacy Program is shown in Figure XI-4. Under the Electrical I&C coordinator, the organization is divided into two sections, the Electrical Systems and the I&C Systems, each headed by a System Leader. Project Support and interfaces with the architect/engineer, contractors or other project organizations, including vendors, is furnished by the TUGCO Support Coordinator and the TUGCO Technical Support group.

In both the Electrical and I&C Systems group, reviewing engineers are divided into two functional areas: criteria verification and design verification. The number of reviewers to be initially assigned to each classification is as shown on the organization chart; however, individuals may be reassigned between "criteria" and "verification" activities to meet changes in the number of activities as the work progresses.

4.2 Responsibilities

The primary responsibility of the Electrical and I&C Systems Coordinator is to assist the review team leader in implementing the electrical and the I&C systems action plans. He is responsible for:

1. Developing and revising the Issue-Specific Action Plans within the electrical and instrumentation and control areas.
2. Ensuring that the root causes and generic implications of identified deficiencies or trended deviations are coordinated with the generic implication coordinator.
3. Preparing the E/I&C systems and components design adequacy program results reports.
4. Serving as the principal interface with the generic implication coordinator, the QA/QC review team, and the TUGCO E/I&C Support Coordinator.

The responsibilities of the Electrical and I&C Systems Leaders includes:

1. Providing day-to-day technical guidance to assure that the ISAP's are being correctly implemented.
2. Review and approval of internally generated documents such as check lists, criteria lists, and others.
3. Review tracking, and resolution of identified discrepancies, deviations and deficiencies.
4. Maintaining the project working files.
5. Directing and assisting the criteria and design verification efforts as described below.

The criteria verification engineers are responsible for reviewing the component criteria list for consistency, completeness and accuracy and form.

1. Determining whether the criteria are consistent and compatible.
2. Determining that the criteria are complete.
3. Evaluating the significance of incomplete or inappropriate criteria.
4. Assessing the occurrence of incomplete or inappropriate criteria for trends, generic implications or root causes.

5. Identification and evaluation of discrepancies, deviations and deficiencies.

6. Communicating the status of the program and its implementation to the Systems Leader.

7. Assisting in the preparation of the DAP Results Report.

The design verification engineers are responsible for ensuring that project implementing documents and design outputs conform to the verified system and component criteria list, and for:

1. Preparing or reviewing the document criteria checklists for completeness and accuracy.

2. Reviewing the design documents and design outputs using the criteria checklists to verify that the design criteria have been correctly implemented.

3. Performing engineering evaluations and/or calculations to verify adequacy of the design.

4. Evaluating the significance of incomplete or unsatisfactory criteria implementation.

5. Identifying trends, generic implications and/or root causes.

6. Identifying and communicating corrective actions for trended deviations or identified deficiencies.

7. Assisting in the preparation of the electrical/I&C DAP Results Report.

The TUGCO Support Coordinator and his Technical Support Group are responsible for managing the interface bteween the CPRT E/I&C team and the Project. They are responsible for providing documents and information as requested by the mechanical systems coordinator.

ELECTRICAL/I&C SYSTEMS AND COMPONENTS DESIGN ADEQUACY PROGRAM ORGANIZATION