UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

June 23, 1988

Docket Nos: 50-390/391

APPLICANT: Tennessee Valley Authority (TVA)

FACILITY: Watts Bar Nuclear Plant, Units 1 and 2

See Rept.

SUBJECT: MEETING SUMMARY FOR THE JUNE 7, 1988, MEETING REGARDING WATTS BAR PROGRAM PLAN

On June 7, 1988, a meeting was held in Rockville, Maryland, at the request of TVA between the NRC staff and representativves of TVA. The purpose of the meeting was to present to NRC management, the TVA's overall plan for the completion of Watts Bar Nuclear (WBN) Units. Attachment 1 is the list of attendees and Attachment 2 is a copy of the handouts provided by TVA at the meeting.

TVA opened the meeting by stating that the objective of the Watts Bar Program Plan (WBPP) is to perform a systematic evaluation of WBN design and construction, to develop corrective actions as required, and to prepare the WBN Nuclear Performance Plan (NPP), Volume 4. TVA further stated that the implementation of the plan will be the responsibility of the existing line organizations.

The program indicates that at present, there are 27 special programs at Watts Bar. These programs were or are being developed to resolve the nonconforming issues identified through the employee concerns, internal TVA and external audits and reviews, and the routine process for identifying conditions adverse to quality. Five of these programs (Hanger and Analysis Update, Concrete Quality, Equipment Qualification (EQ), Control Room Design Review, and Welding) are well defined, and the Corrective Action Programs (CAPs) identified. In some of these areas substantial work has already been completed. The scope and breadth of some of the remaining 22 programs are not yet fully defined. Additional CAPs will be developed to address issues in these programs.

TVA explained that the objective of the vertical slice review (VSR) is exploratory as well as confirmatory. The review will include one mechanical and one electrical system. VSR program will exclude the five well defined programs. The results of the VSR may expand the scope of current special programs or initiate new programs.

The NRC staff stated that there are several areas in the program plan which are not clearly explained. Specific comments and concerns were relayed to TVA regarding inclusion and exclusion of certain programs in the VSR, implementation of the program plan, final confirmatory review of design and construction, role of Engineering Assurance (EA) in the program, and the NRC interface.

The schedule provided at the meeting for submitting various reports and documents for NRC staff review and approval is not clear. According to the schedule, TVA intends to submit a final VSR report by September 15, 1988 and all CAP reports by August 1988. It is the staff's understanding that additional CAPs resulting from the VSR program will be submitted to NRC after September 1988. The staff has not as yet received the details of the VSR program. The NRC staff concluded the meeting by stating that the staff will respond to TVA's letter of May 27, 1988 as soon as the review is completed.

Original signed by

Rajender Auluck, Project Manager
TVA Projects Division
Office of Special Projects

Attachments:
As Stated

cc w/ attachments
See next page

OSP:TVA/LA
MSimms MES
6/23/88

TVA:OSP/PM
RAuluck:dw
6/23/88

TVA:AD/P
SBlack
6/23/88

DISTRIBUTION FOR MEETING SUMMARY DATED: June 23, 1988

Facility: Watts Bar Nuclear Plant, Units 1 and 2

Docket File
NRC PDR
Local PDR
Projects Reading
S. Ebneter
J. Partlow
J. Axelrad
S. Richardson
S. Black
B. D. Liaw
R. Auluck
M. Simms
F. McCoy
J. Rutberg
B. Zalcman
S. Elrod
G. A. Walton
R. Pierson
R. Hermann
E. Marinos
ACRS (10)
GPA/PA
GPA/CA (M. Callahan) (5)
F. Miraglia
E. Jordan
P. Gwynn
J. Scarborough
G. Marcus
C. Miller
T. Elsasser
C. Ader
TVA-Rockville
Watts Bar Rdg

LIST OF ATTENDEES
FOR June 7, 1988
MEETING ON WATTS BAR PROGRAM PLAN

Name	Affiliation*
R. Auluck	NRC/OSP
S. Black	NRC/OSP
J. Axelrad	NRC/OSP
J. G. Partlow	NRC/OSP
S. Ebneter	NRC/OSP
S. Richardson	NRC/OSP
R. Gridley	TVA/Licensing
Y. Ippolito	TVA
W. Horn	TVA/WBPP
R. E.Ewis	TVA/WBPT
R. C. Heider	Sargent & Lundy
H. S. Taylor	Sargent & Lundy
B. A. Erler	Sargent & Lundy
C. D. Lundin	TVA Weld Program
Mike Callahan	NRC/GPA/CA
B. Zalcman	NRC/OSP
S. Elrod	NRC/OSP
G. A. Walton	NRC/OSP
B. D. Liaw	NRC/OSP
R. C. Pierson	NRC/OSP
R. A. Hermann	NRC/OSP
E. C. Marinos	NRC/OSP

*TVA = Tennessee Valley Authority
*NRC = Nuclear Regulatory Commission

DOCKET NO. 50-390 Watts Bar Nuclear TVA

Meeting Summary For The June 7, 1988, Meeting Regarding Watts Bar Program Plan

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WATTS BAR PROGRAM PLAN
- PROGRAM OBJECTIVE -

- **Provide Reasonable Assurance That:**
  - **Design and Construction Deficiencies Have Been Detected**
  - **Appropriate Corrective Actions Have Been Defined**
- **Develop WBN NPP**
- **Successful Implementation of WBN NPP Will Confirm that WBN is Ready for Licensing**

WATTS BAR PROGRAM PLAN
- APPROACH -

- Establish Program Team with Oversight Advisors
- Develop Program Plan
- Conduct Systematic Evaluation of WBN
- Develop WBN NPP, Volume 4
- Implementation of NPP Will Confirm that WBN is Ready for Licensing

WATTS BAR PROGRAM PLAN
- PROGRAM TEAM -

- **Responsibilities**
- **Independence**
- **Qualifications**
- **NRC Interface**

WATTS BAR PROGRAM TEAM
- RESPONSIBILITIES -

- Recommend a Program
- Oversee Systematic Evaluation
- Assure Adequacy of Corrective Actions
- Develop Nuclear Performance Plan

WATTS BAR PROGRAM TEAM
- INDEPENDENCE -

- Reports to Senior Vice President, Nuclear Power Group
- Program Team Members:
  - No Watts Bar Line Responsibility
  - No Cost/Schedule Responsibility
- Independent Reviewer Protocol
- Objectivity Questionnaire

WATTS BAR PROGRAM TEAM
- QUALIFICATIONS -

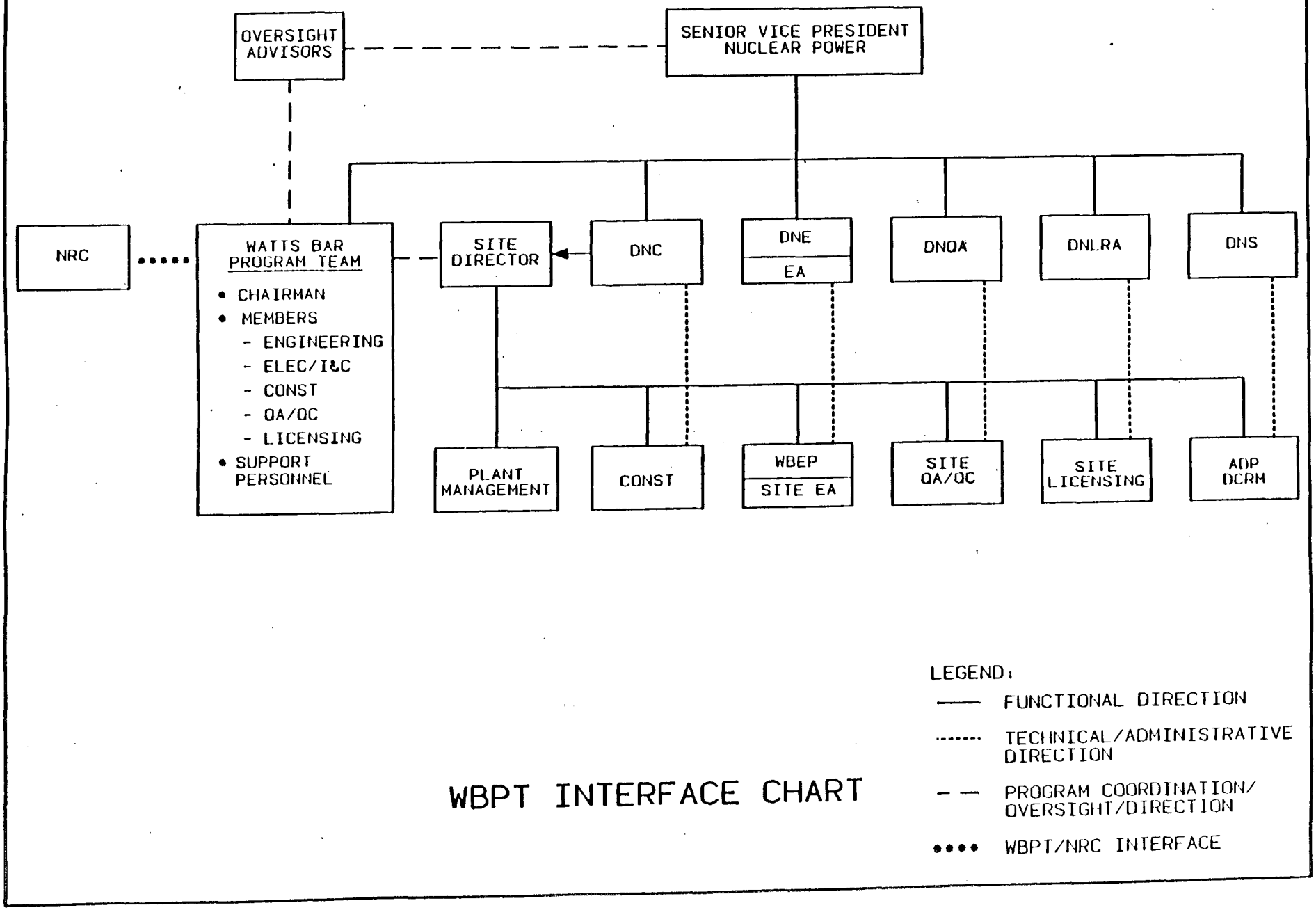
- **Experienced in:**
  - **Engineering**
  - **Construction**
  - **Quality Assurance**
  - **Licensing**
  - **Electrical/I&C**
- **Demonstrated Management Ability to Make Sound Decisions**

WATTS BAR PROGRAM TEAM
- NRC INTERFACE -

- Openness and Close Coordination
- All Actions Open to NRC
- Periodic General Review Meetings
- Notification of Changes to WBPT Membership
- Normal WBN/DNLRA Interaction
- Concurrence Sought for:
  - Watts Bar Program Plan
  - VSR Plan
  - Corrective Action Plans
  - Nuclear Performance Plan

WATTS BAR PROGRAM TEAM
- OVERSIGHT ADVISORS -

- **Function:**
  - **Review Program Activities Periodically**
  - **Review Methodology for Problem Identification, Root Cause Analysis and Problem Correction**
  - **Evaluate Completeness of Coverage by Systematic Evaluation**
- **Background:**
  - **Nationally Recognized for Their Experience in Nuclear Power Programs**
- **Independence:**
  - **From Outside TVA**
  - **Will Report Directly to Senior Vice President, Nuclear Power**



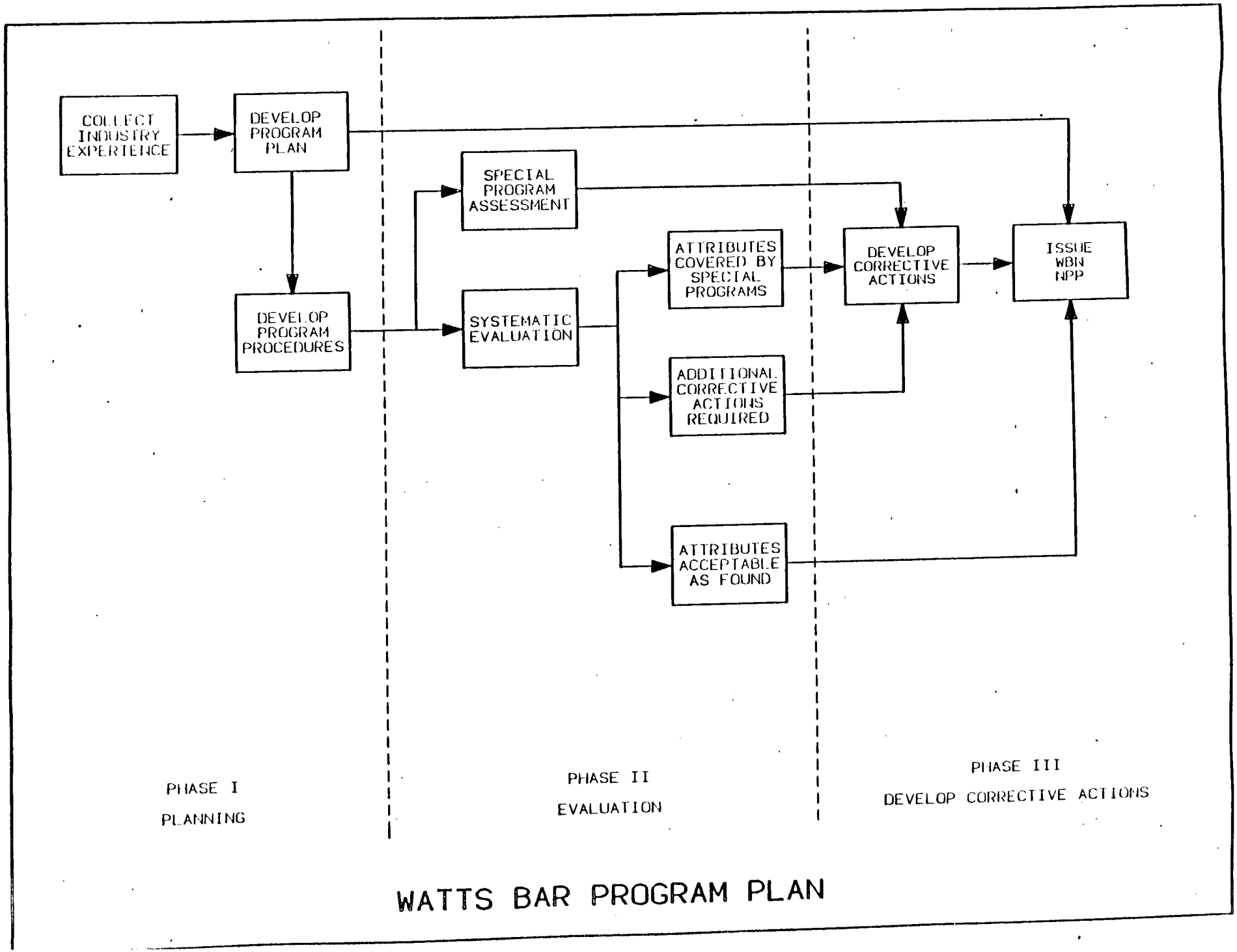
WBPT INTERFACE CHART

WATTS BAR PROGRAM PLAN
- PRINCIPLES -

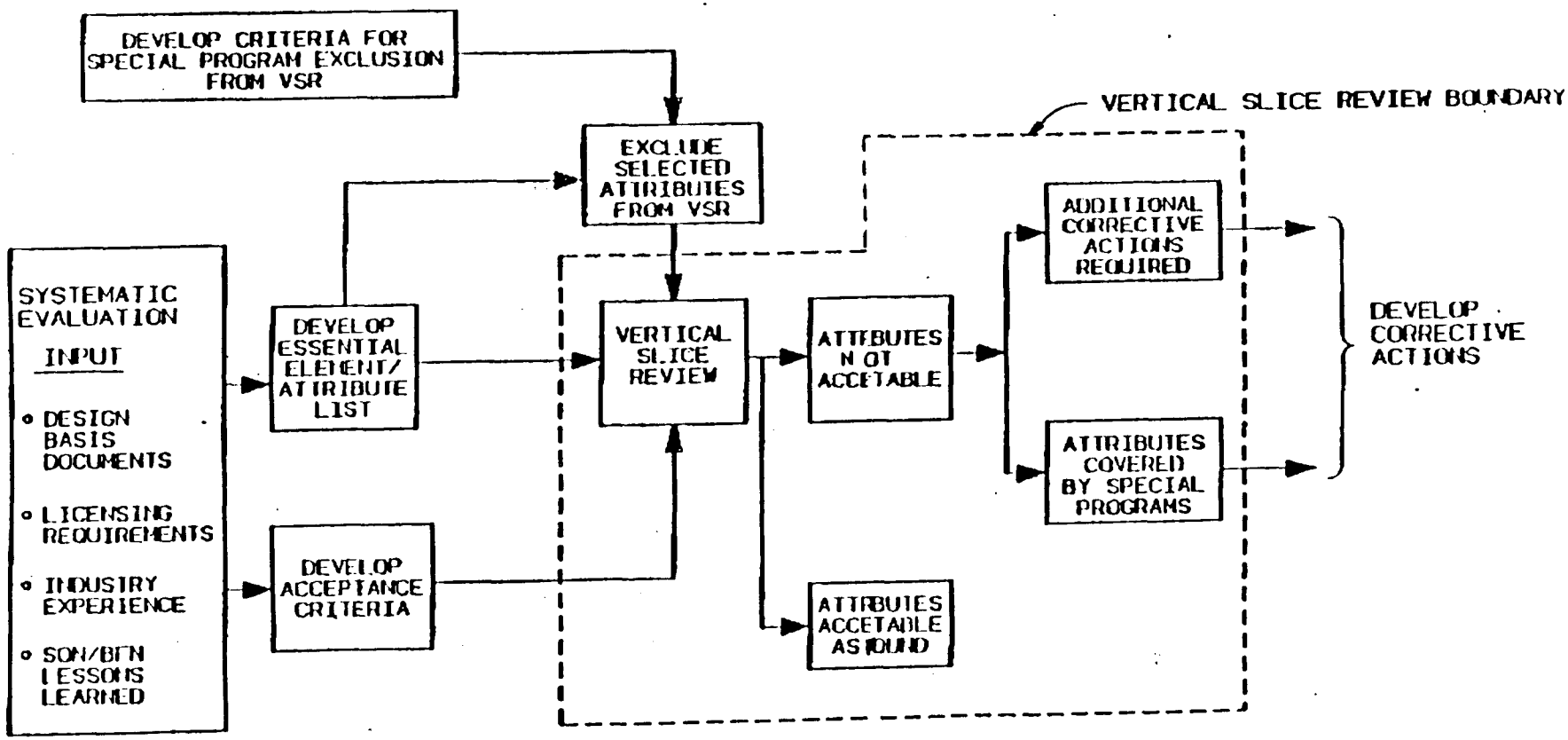
- Objectivity and Credibility
- Industry Experience
- Systematic Evaluation
- Corrective Actions
- Procedures
- Documentation and Records
- Program Oversight
- Close Coordination with NRC

WATTS BAR PROGRAM PLAN
- THREE PHASED APPROACH -

- **Planning:**
  - **Consider Industry Experience**
    - **Other NTOL Plants**
    - **Advice of Industry Experts**
    - **Other TVA Plant Experience**
  - **Develop Program Plan**
- **Evaluation (Systematic Approach)**
- **Development of Corrective Actions, and Preparation of NPP**



WATTS BAR PROGRAM PLAN



SYSTEMATIC EVALUATION PROCESS

SYSTEMATIC EVALUATION

- **Essential Elements and Attributes:**
  - **Design**
  - **Construction**
  - **QA/QC Records**

- **Identify Those Which:**
  - **Are Acceptable as Found**
  - **Do Not Conform:**
    - **Existing Special Program**
    - **Develop Corrective Action**
- **Vertical Slice Review Approach**

SYSTEMATIC EVALUATION
- ELEMENT/ATTRIBUTE LIST -

- **Element: A Structure, System or Component of the Plant**
- **Attribute: A Quality Characteristic Essential to Function of an Element**
  - **Design -- Pump: Pressure**
  - **Construction -- Pump/Driver Alignment**
  - **QA/QC -- Alignment Records**

SYSTEMATIC EVALUATION
- ACCEPTANCE CRITERIA -

- **Design:**
  - **Codes and Standards**
  - **Design Criteria**
  - **System Descriptions**
  - **FSAR and Licensing Commitments**
- **Construction:**
  - **Drawings**
  - **Specifications**
- **QA/QC Records**
  - **Codes and Standards**
  - **Specifications**
  - **Procedures**

SYSTEMATIC EVALUATION
- VERTICAL SLICE REVIEW (VSR) -

- **Objective:**
  - **Exploratory**
  - **Confirmatory**
- **Contractor Selection Criteria**
- **System Selection Criteria**
- **Methodology, Procedures, and Protocol**
- **Exclusions from VSR**
- **Findings and Resolutions**

SYSTEMATIC EVALUATION
- VSR CONTRACTOR SELECTION CRITERIA -

- **Full Scope A/E Firm**
- **Independent from Original WBN Design and Construction**
- **Independent from Ongoing Production Work**
- **Previous IDR/IDVP Experience**
- **Strong Management Team**

SYSTEMATIC EVALUATION
- VSR SYSTEM SELECTION CRITERIA -

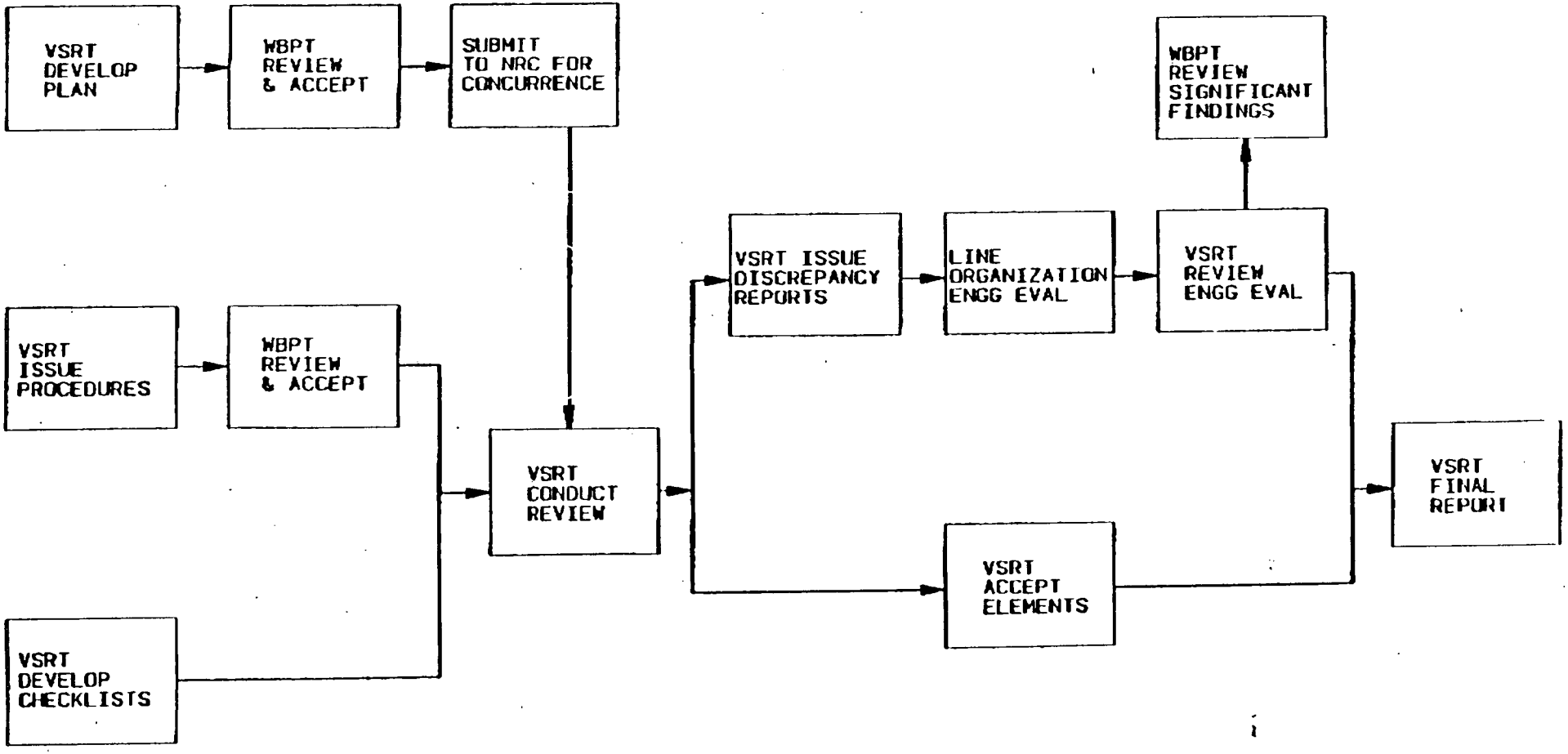
- Safety-Related
- Generally Representative of Plant Safety Features
- Concept and Design by TVA
- Cross Section of Disciplines
- Internal (TVA) and External Interface
- Reasonably Complex
- Clearly Defined Design Basis
- Major Portions Already Installed
- Has Had Design Changes

SYSTEMATIC EVALUATION

- SYSTEMS/AREAS SELECTED FOR VSR -

- Mechanical System:
  - Component Cooling System
  - Hot Piping System: Portions of Steam Generator Blowdown System
- Electrical System:
  - AC Shutdown Power System
  - Portions of Steam Generator Blowdown System
- HVAC System:
  - Control Building--Electrical Board Room Air Conditioning System
- Horizontal Review for Spatial Features, e.g., Fire Protection, Flooding

VERTICAL SLICE REVIEW PROCESS



SYSTEMATIC EVALUATION
- PROTOCOL -

- **Principles:**
  - **Independence Not Compromised**
  - **Document That Independence**
- **Formal Communications:**
  - **Discussion of Findings or Recommendations**
  - **Discussion of Resolutions**
  - **Prior Notification of Meetings and Telecons Required**
  - **Documentation Required**
- **Informal Communications**
  - **Requests for Data or Additional Information**
  - **Requests for Clarifications**
  - **No Prior Notification of Meetings and Telecons Required**
- **Commercial Matters Outside Protocol**

SYSTEMATIC EVALUATION
- EXCLUSIONS FROM VSR SCOPE -

- Welding Evaluation
- Concrete Quality Evaluation
- Environmental Qualification of Equipment
- Hanger and Analysis Update Program
  - All Safety-Related Large Bore Piping
  - Class 1 Small Bore Piping
- Detailed Control Room Design Review

SYSTEMATIC EVALUATION

- CONTROLLED SPECIAL PROGRAMS FOR VSR -

- Electrical Calculations
- Q-List
- Piece Parts Program
- Containment Isolation
- Unit 1/Unit 2 Interface

SYSTEMATIC EVALUATION
- CLASSIFICATION OF FINDINGS -

- **Observation: Perceived nonconformance with design and licensing documents**
- **Discrepancy: Observation confirmed by review**
- **Design-Significant Discrepancy: Nonconformance confirmed through engineering evaluation**
- **Safety-Significant Discrepancy: If undetected, could result in loss of safety function**

SYSTEMATIC EVALUATION
- EVALUATION OF DISCREPANCIES -

- **All Discrepancies Evaluated by Line Organizations for Design Significance**
- **Design Significant Discrepancies Evaluated for Safety Significance**
- **All Discrepancies Trended**

SYSTEMATIC EVALUATION
- RESOLUTION OF DISCREPANCIES -

- **Disposition Required for All Discrepancies**
- **Corrective Actions Required for:**
  - **Design and Safety Significant Discrepancies**
  - **Adverse Trends**
- **Corrective Actions May Involve:**
  - **A Change in the Hardware**
  - **Additional Evaluations**
  - **An Approved Change in the Requirements**
  - **Generic Implications Evaluation**
  - **Actions to Prevent Recurrence**

WATTS BAR PROGRAM PLAN
- NUCLEAR PERFORMANCE PLAN, VOLUME 4 -

- **Watts Bar NPP to Include:**
  - **Description of Results**
  - **Corrective Actions to Resolve Issues**
  - **Operational Readiness Review**

- **Submit to NRC after NPG Approval**

WATTS BAR PROGRAM PLAN
- CONCLUSIONS -

- **Comprehensive, In-depth Review**
- **Assure Design and Construction Meet Licensing Requirements**
- **WBN Obtains Operating License After Implementation of NPP**

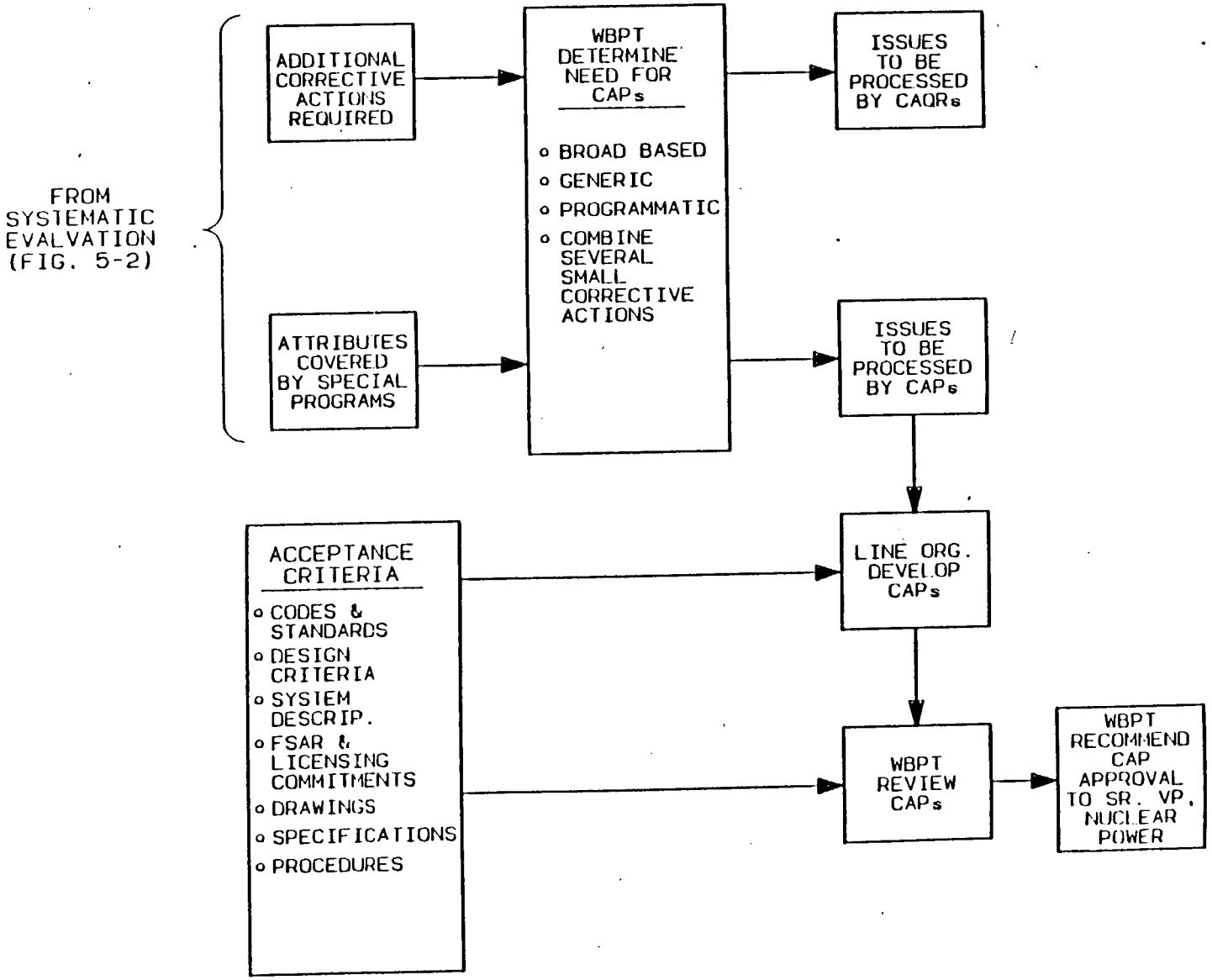
WATTS BAR PROGRAM PLAN
- SCHEDULE -

Submittal of WBPP	May 27, 1988
Presentation of VSR Plan	June 7, 1988
Begin Vertical Slice Review	June 15, 1988
VSR Final Report	September 15, 1988
Presentation of CAPS	June-August, 1988
WBN NPP	December 1988

WATTS BAR PROGRAM PLAN
- CORRECTIVE ACTIONS -

- **Sources of Corrective Actions:**
  - **Existing Special Programs**
  - **Systematic Evaluation**

- **Corrective Action Programs (CAP):**
  - **Broad Scope**
  - **Generic**
  - **Programmatic**
  - **May Combine Several Small Actions**
  - **Also Identified as CAQR**
- **Other Corrective Actions Handled by CAQR Process**



EVALUATION OF SPECIAL PROGRAMS AND DEVELOPMENT OF CAPS

WATTS BAR PROGRAM PLAN
- CAP DEVELOPMENT AND REVIEW -

- **CAP Reviewed for:**
  - **Issue Thoroughly Defined**
  - **Issue Thoroughly Resolved**
  - **Root Cause and Trend Analysis Performed**
  - **Generic Implications Analysis Performed**
  - **Actions to Prevent Recurrence Defined**
  - **Licensing Requirements Satisfied**
  - **SQN and BFN Experiences Incorporated**

WATTS BAR PROGRAM PLAN
- CAP DEVELOPMENT AND REVIEW -

- Resolution Options
  - Hardware Modifications
  - Additional Evaluations
  - Approved Change in Requirements
- CAP Change Control

HANGER AND ANALYSIS UPDATE PROGRAM

Background:

- **Program Responding to Cumulative Issues**
  - **NRC Notices, Bulletins, Commitments**
  - **Employee Concerns**
  - **Condition Adverse to Quality Reports**
  - **Internal/External Technical Reviews**

- **Scope of Piping and Hangers**
  - **All TVA Category I (ASME Class 1, 2, and 3)**
  - **All TVA Category I (L) Pressure Boundary Retention (ANSI B31.1 and B31.5)**
  - **All TVA Category I (L) Position Retention**

HANGER AND ANALYSIS UPDATE PROGRAM

- Corrective Action Program Sequence of Activities
  - Identify Sources of Issues
  - Categorize Issues
  - Update Design and Licensing Criteria
  - Update Design Inputs
  - Prepare Procedures and Documentation Requirements
  - Train Staff in Criteria/Procedures
  - Walkdown Piping and Hangers
  - Perform Piping and Hanger Review and Update
  - Reconcile HAAUP Output with Other Groups
  - Finalize Documentation

HANGER AND ANALYSIS UPDATE PROGRAM
- WATTS BAR PROGRAM TEAM REVIEW

- Scope
  - Review Sources of Issues
    - Industry Practices Incorporated (Complete)
    - Internal/External Review Comments Incorporated (Complete)
  - Review Process of Categorizing Issues
  - Confirm Scope Correlation to Above

- Results of Review
  - Written Plans to Address Qualification Methodologies
  - Matrix of Technical/Procedural Item to Piping/Hanger

HANGER AND ANALYSIS UPDATE PROGRAM
WATTS BAR PROGRAM TEAM REVIEW

- Methodology
  - Review Major Elements in Methodology
    - Upper-tier Criteria Documents
    - Technical Approach to Each Item
    - Procedural Controls and Interfaces
    - Documentation Requirements
- Results of Review
  - Criteria Documents Updated; Extensive Use of Industry Reviewers (Conplete)
  - Screening Method to Identify High Rework Potential
  - Procedural Controls In Place

HANGER AND ANALYSIS UPDATE PROGRAM
WATTS BAR PROGRAM TEAM REVIEW

- Acceptance Criteria
  - Review Codes, Standards, and Code Cases (Complete)
  - Review Design Criteria Revisions (Complete)
  - Review Status of Updated Design Inputs
  - Review FSAR Commitments
  - Reviewing Other Licensing Commitments versus CAP to Ensure Compliance
  - Review Design Change Notice Program
- Results of Review
  - Written Basis for Utilizing:
    - Later Codes
    - Code Cases
  - SQN and BFN Issues Correlated
  - Licensing Compliance Being Reviewed

INSTRUMENT PROJECT

Background:

- **NCRs, CAQRs, Employee Concerns**
- **Issues Raised**
  - **Instrument Sense Line Slope**
  - **Hangers, Clamps, and Bolts**
  - **Pipe and Tube Bending**
  - **Compression Fittings**
  - **Instrument Line Thermal Analysis**

Causes:

- **Engineering Criteria**
- **Site Implementing Procedures**

INSTRUMENT PROJECT

Scope/Status:

- **Engineering Requirements Document (ER-WBN-EEB-001)**
  - **New Work**
  - **Installed Work Not Yet Inspected**
  - **Primary Safety-Related Instruments**
- **Evaluation and Qualificaton of:**
  - **Unapproved Hangers**
  - **Tube Bending (Complete)**
  - **Compression Fittings (Complete)**
- **Redesign of:**
  - **Radiation Monitoring System**
  - **Sample System Lines**

Vertical Slice Review
Watts Bar Nuclear Plant

Tennesse Valley Authority

June 7, 1988

SARGENT & LUNDY

C1660 006 6-3-88

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VERTICAL SLICE REVIEW

OUTLINE OF PRESENTATION

- SCOPE
- ORGANIZATION
- METHODOLOGY
- SCHEDULE

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OVERVIEW OF VERTICAL SLICE REVIEW

- TWO SYSTEMS PLUS HORIZONTAL INVESTIGATION

- EXPLORATORY AND CONFIRMATORY

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THREE SEPARATE AREAS

- DESIGN
- CONSTRUCTION
- QA/QC RECORDS

ENGINEERING VERIFICATION

- DESIGN IS IN CONFORMANCE WITH LICENSING REQUIREMENTS

- FUNCTIONAL REVIEW

- PARTIAL PHYSICAL REVIEW
  - SYSTEM COMPONENTS
  - SYSTEM INTERFACE WITH PLANT

- REVIEW DESIGN PROCESS FOR ADEQUACY

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CONSTRUCTION VERIFICATION

- CONSTRUCTED PLANT IS IN ACCORDANCE WITH DESIGN OUTPUT DOCUMENTS

- CERTIFIED INSPECTORS

- SOME ELEMENTS WILL BE COMMON IN ENGINEERING VERIFICATION, CONSTRUCTION VERIFICATION AND RECORDS VERIFICATION PROGRAMS

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QA/QC RECORDS VERIFICATION

- PERMANENT LIFE TIME RECORD
- RECORDS AGREE WITH THE CONSTRUCTED PLANT
- PORTIONS OF THE CONSTRUCTION VERIFICATION ELEMENTS
- DESIGN RECORDS REVIEW IN ENGINEERING VERIFICATION REVIEW

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SEQUENCE OF DESIGN REVIEW ACTIVITIES

ENGINEERING VERIFICATION

REQUIREMENTS	DESIGN ADEQUACY
DESIGN REQUIREMENTS DEVELOP CHECKLISTS	REVIEW CALCULATIONS DRAWINGS, SPECIFICATIONS, STRESS REPORTS, ETC., AGAINST CHECKLIST REQUIREMENTS

CONSTRUCTION VERIFICATION

REQUIREMENTS	CONSTRUCTION ADEQUACY
DESIGN OUTPUT DOCUMENTS DEVELOP CHECKLISTS	INSPECT ELEMENTS AGAINST DESIGN OUTPUT DOCUMENTS

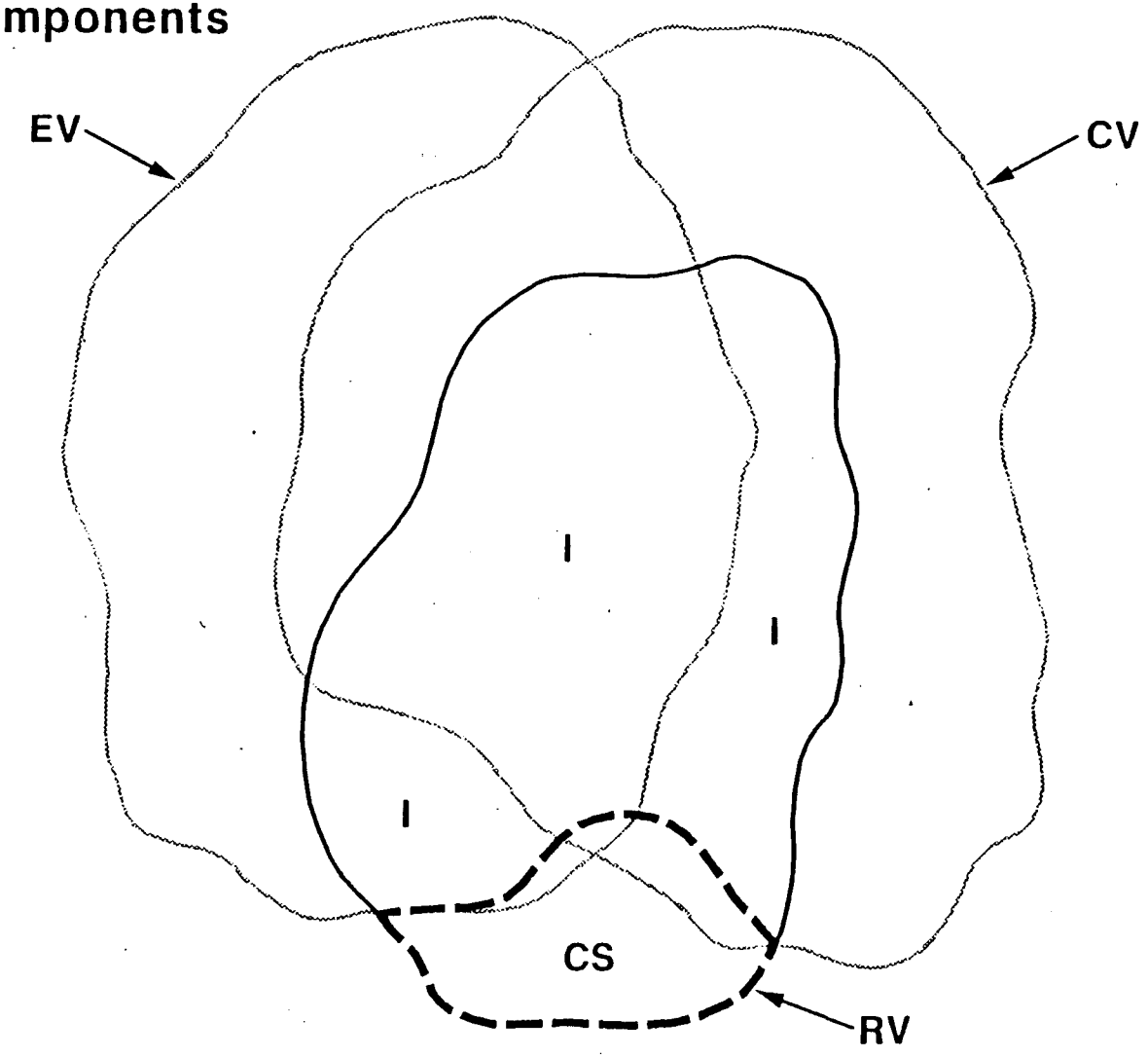
RECORDS VERIFICATION

REQUIREMENTS	RECORDS ADEQUACY
PERMANENT RECORD REQUIREMENTS DEVELOP CHECKLISTS	REVIEW RECORDS

GENERAL ASSESSMENTS
DISCREPANCIES TRENDS/ROOT CAUSES FINAL REPORT

Watts Bar VSR

System(s) components



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SPECIAL PROGRAMS EXCLUDED FROM VSR

- LARGE BORE AND CLASS 1 SMALL BORE PIPE STRESS ANALYSIS AND SUPPORT DESIGN, THEIR CONSTRUCTION, AND ASSOCIATED QA/QC RECORDS

- INSTALLATION OF PLANT WELDS AND ASSOCIATED QA/QC RECORDS

- CONCRETE QUALITY

- ENVIRONMENT QUALIFICATIONS PER 10CFR50.49 (ELECTRICAL AND INSTRUMENTS ONLY)

- CONTROL ROOM HUMAN FACTORS DESIGN, CONSTRUCTION, AND ASSOCIATED QA/QC RECORDS

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CONTROLLED SPECIAL PROGRAMS INCLUDED IN VSR

- CONTAINMENT ISOLATION
- ELECTRICAL CALCULATIONS
- UNIT 1/UNIT 2 INTERFACE
- PIECE PARTS PROGRAM
- Q-LIST

PROJECT DESIGN AND CONSTRUCTION REQUIREMENTS

- FSAR
- SER
- Other Licensing Commitments From:
  - Construction Descrepancy Reports 50.55(e)
  - NRC Bulletins
  - Notice of Violation
  - Generic Letters

Systematic Evaluation Process

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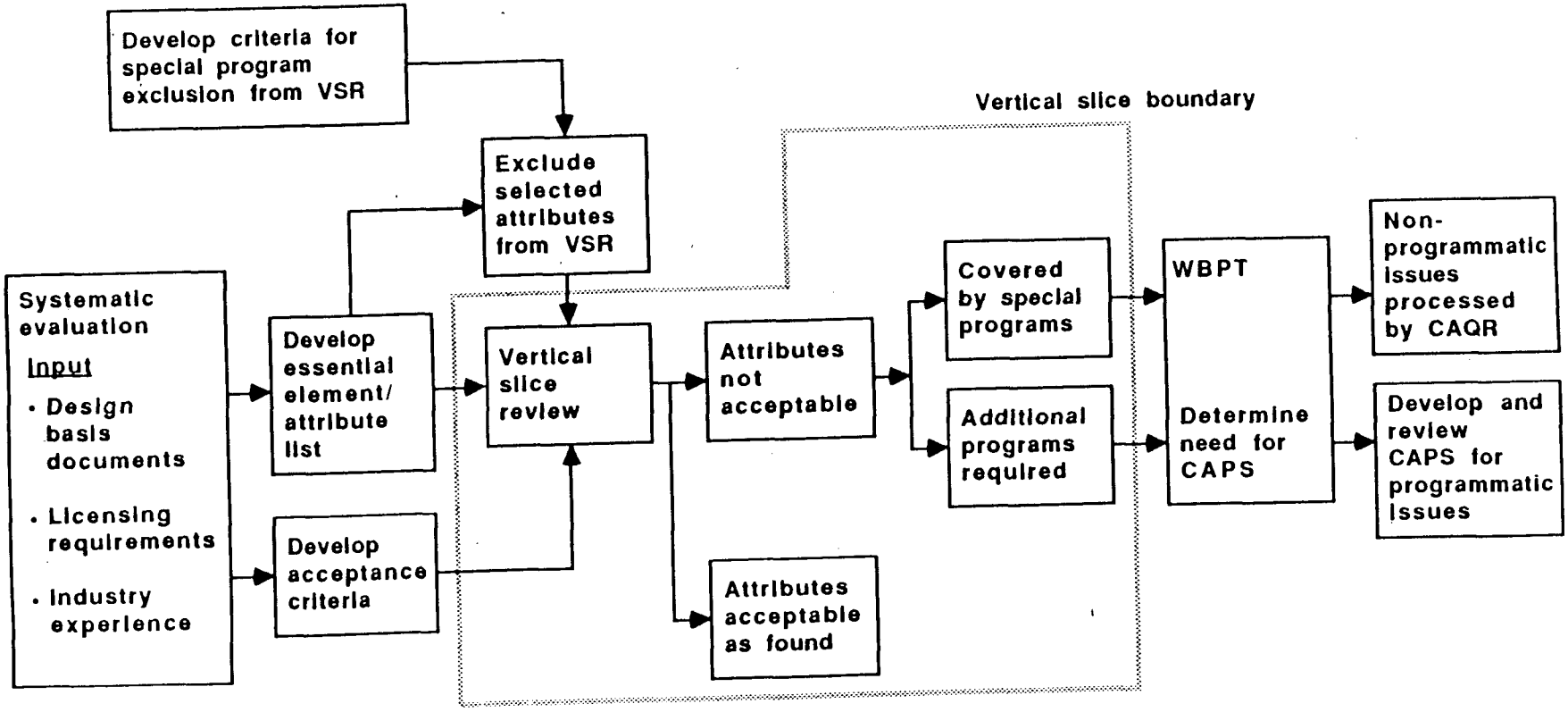

Program Team Evaluation

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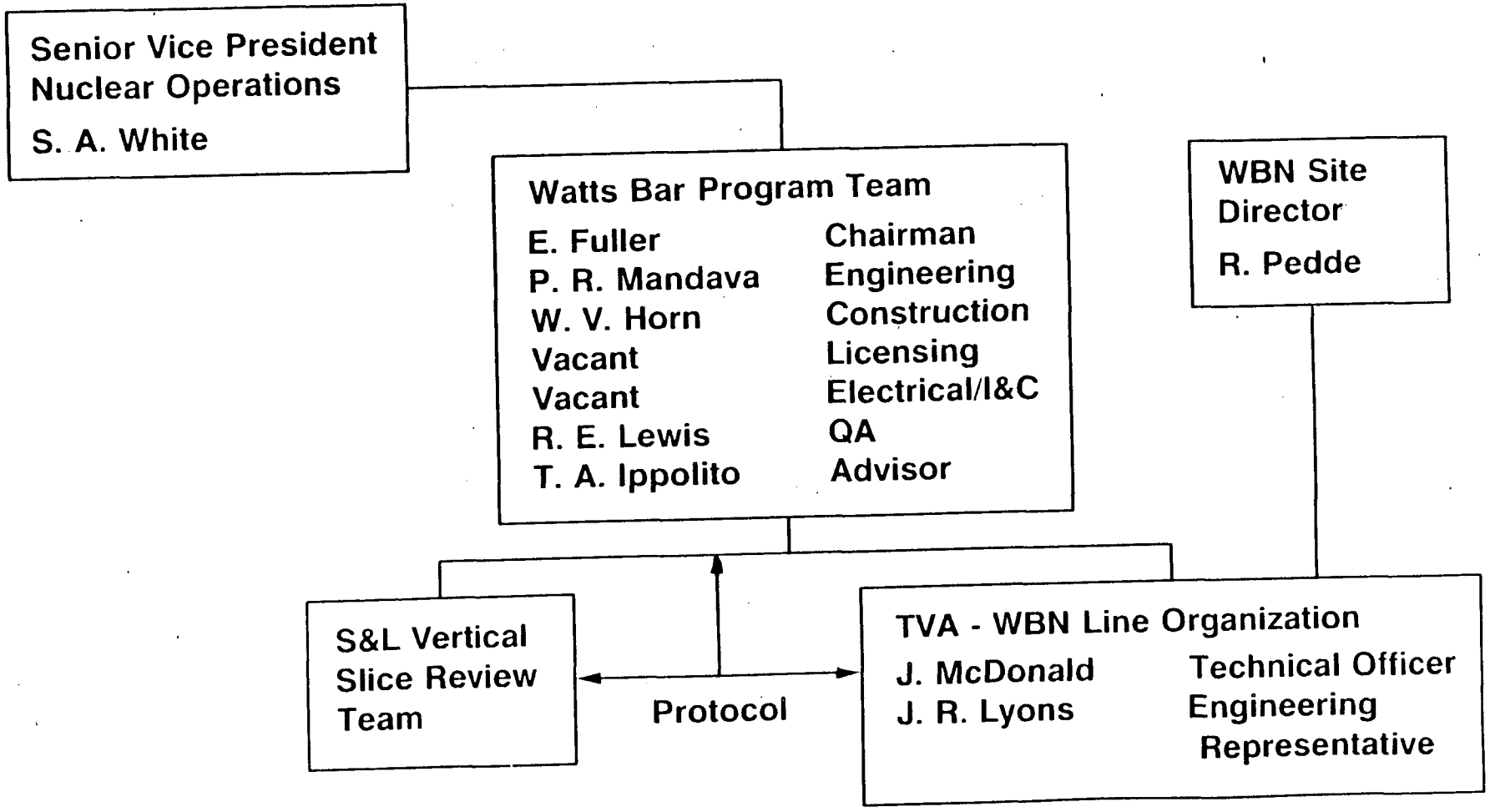

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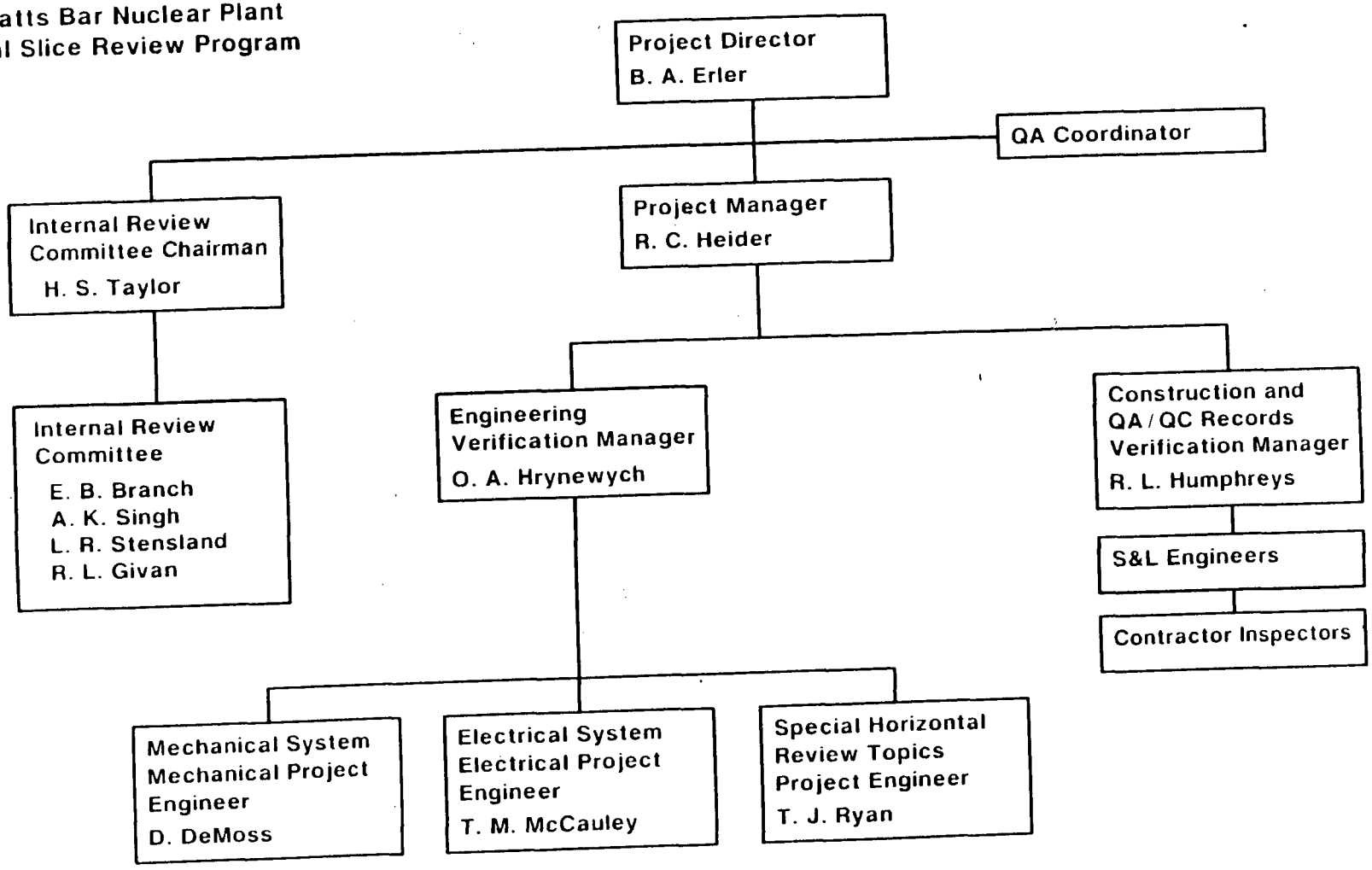
TVA Watts Bar Nuclear Plant
Vertical Slice Review Program



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VSR PROJECT TEAM EXPERIENCE LEVEL

	S&L Position	Responsibility	Nuclear Plant Design Experience (Years)
B. A. Erler	Partner, Project Director	Project Director	18
R. C. Heider	Associate, Project Manager	Project Manager	20
O. A. Hrynewych	Associate, Project Manager	Engineering Verification Manager	20
R. L. Humphries	Senior Construction Project Engineer	Construction and QA/QC Records Verification Manager	16
D. DeMoss	Mechanical Project Engineer	Mechanical Project Engineer	11
T. M. McCauley	Associate, Senior Electrical Project Engineer	Electrical Project Engineer	15
T. J. Ryan	Associate, Senior Structural Project Engineer	Special Horizontal Review Topics Project Engineer	15

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INTERNAL REVIEW COMMITTEE

	S&L Position	Nuclear Plant Design Experience (Years)
H. S. Taylor	Associate, Head Quality Assurance Division	16
E. B. Branch	Associate, Mechanical Design Director	18
A. K. Singh	Associate, Structural Design Director	15
L. R. Stensland	Associate, Electrical Design Director	23
R. L. Givan	Control & Instrumentation Consultant	13

Experience Complying with Audits and Design Reviews

Client	Station/Unit	Description of Audit or Design Review
Public Service Electric and Gas Company	Hope Creek 1	S&L performed an independent design verification program to provide additional independent assurance that the design of Hope Creek Generating Station met licensing requirements and Nuclear Regulatory Commission (NRC) regulations through a review of the technical adequacy of the design of representative station systems and structures, and the design process used on Hope Creek. This verification included both vertical- and horizontal-type reviews.
Commonwealth Edison Company	Braidwood 1,2	Braidwood Construction Assessment Program (BCAP) Commonwealth Edison Company conducted a sample inspection of construction work and QC records to verify the quality of construction. S&L participated in checklist preparation and performed all construction discrepancy evaluations. S&L also trended the discrepancies and drew conclusions regarding the construction quality and participated in the preparation of the final BCAP report. The Institute of Nuclear Power Operations (INPO) conducted an evaluation of our control of the design, including examinations of our organization and administration, design control, project support, training, quality control, and test control. The evaluation involved a detailed vertical path examination through the design combined with a horizontal examination at several points.
	Byron 1,2	Bechtel Power Corporation reviewed our design of the essential service water system, component cooling water system, and 125 volt dc distribution system for adherence to design requirements, technical adequacy, and adequacy of the design process.

Client	Station/Unit	Description of Audit or Design Review
		Commonwealth Edison Company conducted a QC Inspector Reinspection Program to verify the qualifications of inspectors. Assessments regarding the quality of construction by the various contractors were also made. S&L evaluated the discrepancies found and recommended appropriate sample expansions and additional reinspections in order to establish confidence in the quality of construction. S&L described their engineering assessments in the final report which was instrumental in favorably reversing the ASLB license decision for Byron 1.
		An NRC integrated design inspection team performed a detailed review of our design of the auxiliary feedwater and containment spray systems. The team evaluated the project organization; technical aspects of mechanical, electrical, instrumentation, and structural design; and adequacy of compliance with design requirements. The design process, including the adequacy of our design interface with the NSSS vendor, was also reviewed in detail.
		INPO conducted an evaluation of our control of the design, including examinations of our organization and administration, design control, project support, training, quality control, and test control. The evaluation involved a detailed vertical path examination through the design combined with a horizontal examination at several points.
		Teledyne Engineering Services conducted an independent design review of our design for the residual heat removal system in the low-pressure coolant injection mode for loop C.

Client	Station/Unit	Description of Audit or Design Review
The Detroit Edison Company	Enrico Fermi 2	Cygna performed an Independent Design Verification Program of S&L's design. Included a horizontal review to confirm that an adequate design control process was established and implemented; and an in-depth, multi-disciplined technical review to confirm that the as-built configuration agreed with design specifications, criteria, and licensing commitments. This vertical review confirmed the accuracy and completeness of the design changes. Systems investigated included the RHR primary shutdown path components, RHRSW fluid path components, and the RHR cooling tower.
Illinois Power Company	Clinton 1	Bechtel Power Corporation reviewed our design of the shutdown service water system, high-pressure core spray system, Class 1E AC electrical system and common requirements (HELB/MELB, fire protection, seismic II/I interaction) for adherence to design requirements, technical adequacy, and adequacy of the design process. Baldwin Associates performed a 100% field verification of completed construction and Illinois Power Company conducted a sample overinspection of this work. S&L prepared checklists and acceptance criteria for the inspection work and dispositioned all NCRs that resulted from the inspections. We also determined the safety significance of discrepancies and did a trend analysis of the discrepancies found in the overinspection effort. S&L participated in the preparation of final reports which established the quality of the construction work. INPO reviewed our control of design and construction processes associated with the residual heat removal system, the shutdown service water system, and the auxiliary power and dc systems.

Client	Station/Unit	Description of Audit or Design Review
Public Service Indiana	Marble Hill 1	Nova, an outside engineering consulting firm, performed an engineering review to examine the engineering techniques S&L used in developing the Marble Hill design. The scope of Nova's review was directed to the instrumentation and controls area, it included documentation reviews, field examination and interviews with S&L engineering personnel.
TU Electric	Comanche Peak 1,2	S&L conducted an INPO-type, self-initiated evaluation of the construction project including an evaluation of the design control, construction control, scheduling, planning, quality assurance, and administration. The evaluation included examination of TU Electric organization and administration, the design process, training, quality control, quality assurance, testing, planning, and scheduling and involved a detailed vertical path examination through the organization's design and construction functions, as well as horizontal examination at several points of the design process.
The Cincinnati Gas & Electric Company	Zimmer 1	Bechtel Power Corporation, as the construction manager and constructor, performed a detailed review of our design and the status of engineering.

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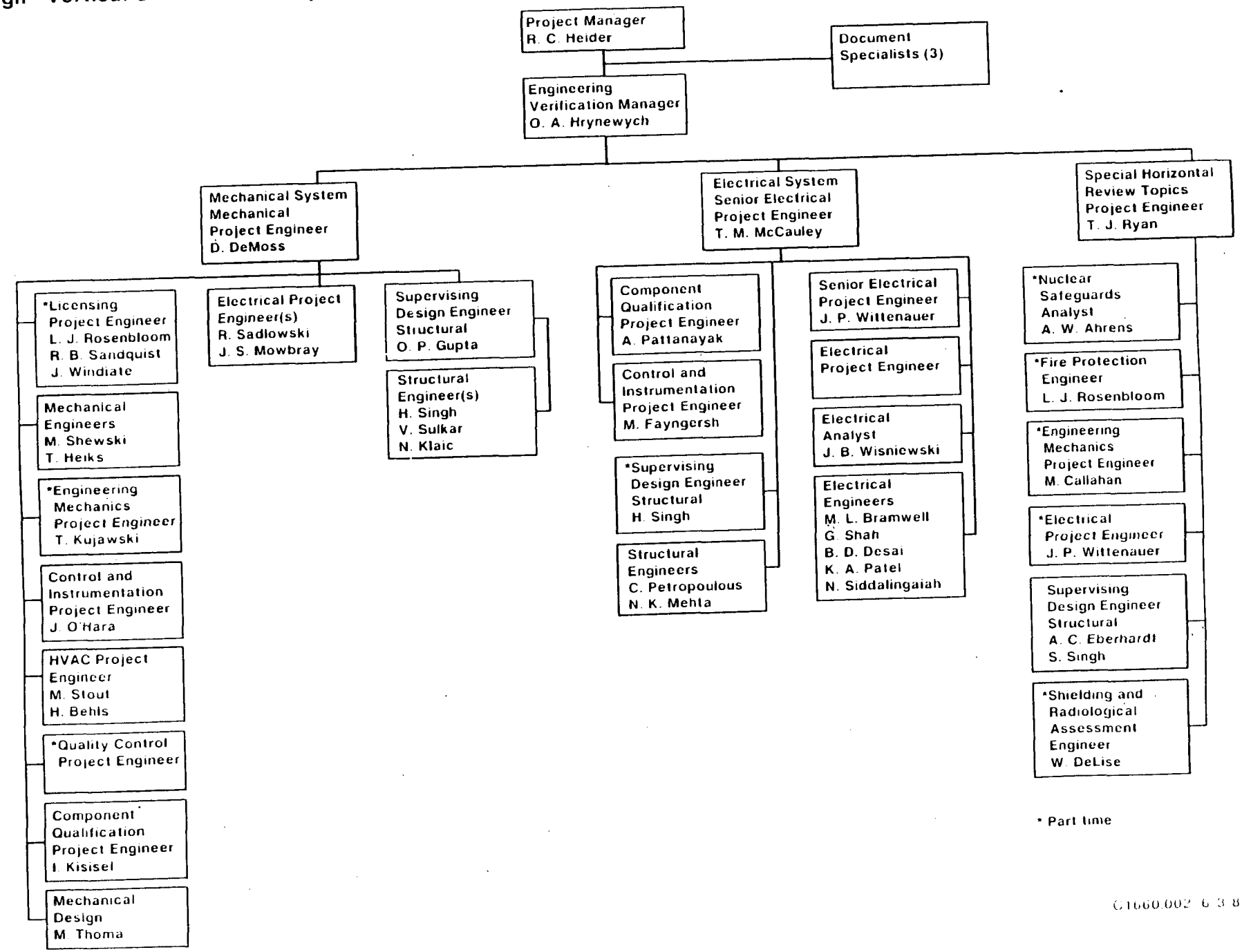
Design – Vertical Slice Review Project Team Organization



* Part time

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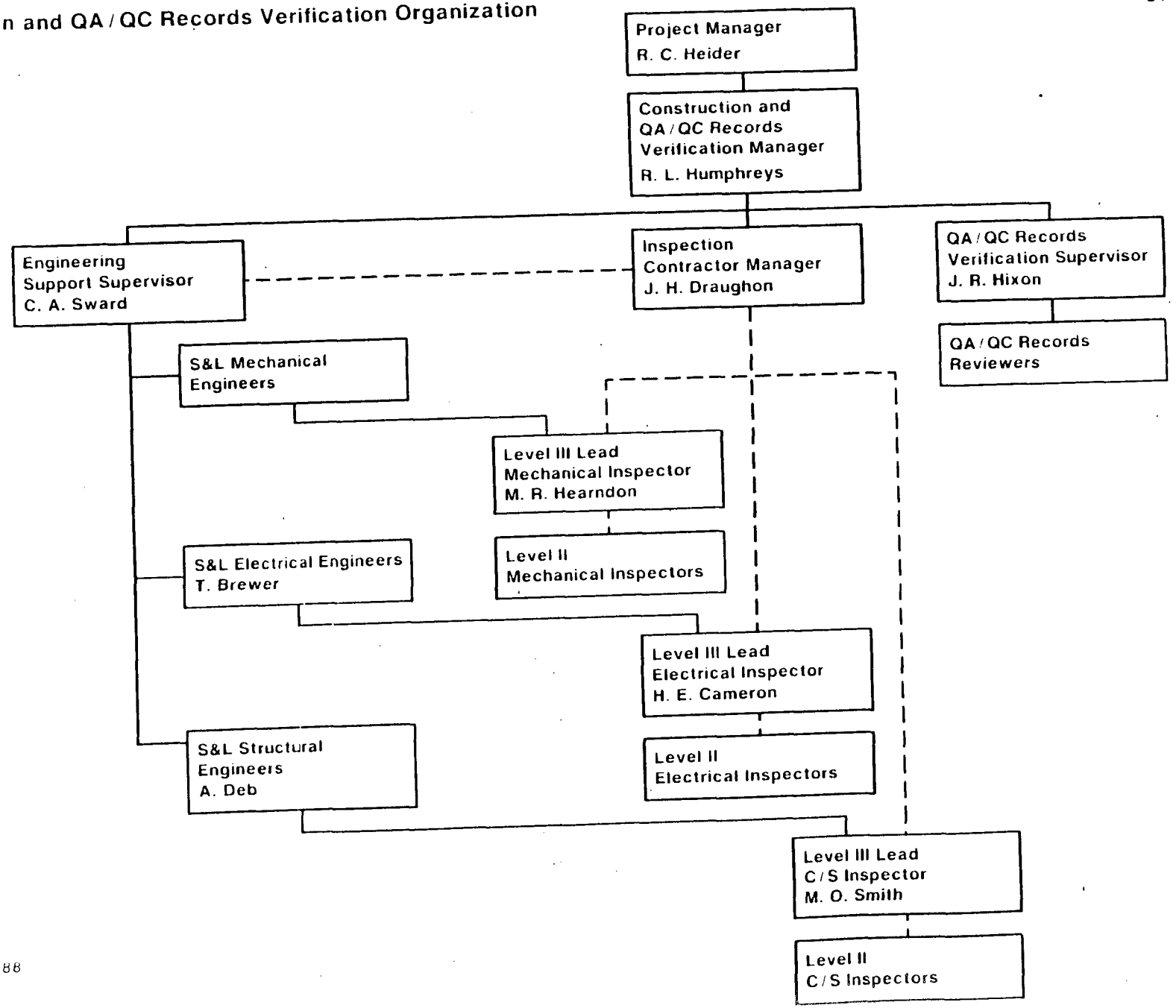
Construction and QA/QC Records Verification Organization



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SUBCONTRACTOR RESPONSIBILITIES

- ASSEMBLE DRAWINGS FOR INSPECTION PACKAGES
- PERFORM COMPONENT VISUAL INSPECTION - LEVEL II
- REVIEW INSPECTION REPORTS - LEVEL III
- AUDIT INSPECTIONS - LEVEL III
- SCHEDULE DETAILED INSPECTIONS
- REPORT INSPECTION PROGRESS
- INTERFACE WITH TVA SUPPORT FOR SCAFFOLDING, INSULATION REMOVAL, DEENERGIZATION

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WATTS BAR VERTICAL SLICE REVIEW

CRITERIA FOR SYSTEM SELECTION

- THE SYSTEM MUST BE SAFETY-RELATED, ESSENTIAL TO PLANT SAFETY
- THE SYSTEM SHOULD INVOLVE A CROSS-SECTION OF ENGINEERING AND DESIGN DISCIPLINES WITHIN THE TVA DESIGN ORGANIZATION
- THE CONCEPT AND IMPLEMENTATION OF THE SYSTEM DESIGN SHOULD BE BY TVA
- THE SYSTEM SHOULD BE GENERALLY REPRESENTATIVE OF SAFETY-RELATED FEATURES OF OTHER SYSTEMS
- THE SYSTEM SHOULD BE REASONABLY COMPLEX, REQUIRING SEVERAL MODES OF OPERATION INVOLVING REDUNDANCY AND SINGLE FAILURE CONSIDERATIONS
- THE SYSTEM DESIGN SHOULD INVOLVE INTERNAL INTERFACES BETWEEN FUNCTIONAL AREAS SUCH AS:
  - MECHANICAL
  - CIVIL/STRUCTURAL
  - ELECTRIC POWER
  - INSTRUMENTATION AND CONTROL

  AND THE EXTERNAL INTERFACES WITH WESTINGHOUSE, COMPONENT VENDORS, AND TVA ENGINEERING
- MAJOR PORTIONS OF THE SYSTEM SHOULD ALREADY BE INSTALLED
- THE SYSTEM SHOULD HAVE A CLEARLY DEFINED DESIGN BASIS
- THE SYSTEM SHOULD HAVE REQUIRED DESIGN CHANGES OVER THE PLANT DESIGN PERIOD

6/7/88

WATTS BAR VERTICAL SLICE REVIEW CRITERIA

FOR SYSTEM SELECTION -- ADDITIONAL CONSIDERATIONS

- THE SYSTEM SHOULD INCLUDE NEW OR UNIQUE DESIGN FEATURES

- IF A PRA HAS BEEN PERFORMED ON THE WBN, CONSIDERATION OF THE RESULTS OF THE PRA WILL BE INCLUDED IN THE SYSTEM SELECTION

- RESULTS OF OTHER INSPECTIONS SUCH AS IDVPS, IDRS, IDIS AND CAPS WILL BE CONSIDERED IN SYSTEM SELECTION

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ELEMENT/ATTRIBUTE LIST

- COMPRISED OF 21 ELEMENT CATEGORIES
  - 71 ELEMENT
  - 12 DESIGN FEATURES
- ATTRIBUTES LISTED FOR DESIGN, CONSTRUCTION AND QA/QC RECORD DOCUMENTATION
- E/A LIST USED AS INPUT DOCUMENT TO VSR
- CRITICAL ELEMENT CATEGORIES INCLUDED IN VSR
- REMAINING ELEMENT CATEGORIES ADDRESSED BY WBPT
- CRITICAL ELEMENT CATEGORIES USED IN SPECFIC ELEMENT (COMPONENT) SELECTIONS
- ATTRIBUTES/SUBATTRIBUTES CONSIDERED IN CHECKLIST PREPARATION.

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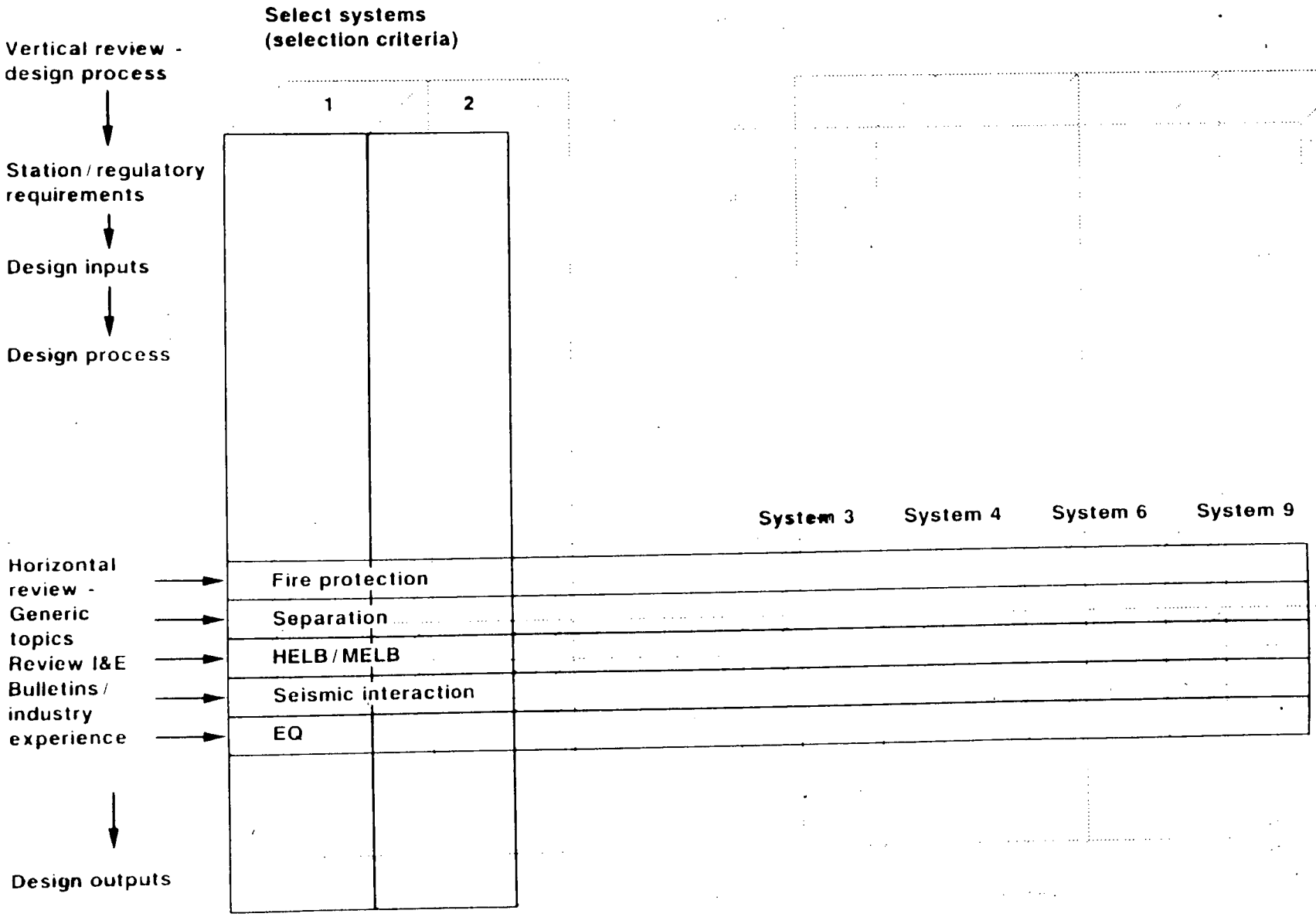
INPUT TO THE VERTICAL SLICE REVIEW

- RESULTS OF NRC'S INTEGRATED DESIGN INSPECTION OF SEQUOYAH UNIT 2

- CURRENT INDUSTRY ISSUES

Vertical Review of Design – General Concept



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SYSTEM SELECTION

190 SYSTEMS TESTED

MECHANICAL

AUXILIARY FEEDWATER
ESSENTIAL RAW COOLING WATER
COMPONENT COOLING
CONTAINMENT SPRAY
STANDBY DIESEL-GENERATOR
PRIMARY CONTAINMENT COOLING
STEAM GENERATOR BLOWDOWN*
CONTROL ROOM HVAC
AUXILIARY FEEDWATER PUMP ROOM HVAC
STANDBY DIESEL-GENERATOR ROOM HVAC
ELECTRICAL EQUIPMENT ROOMS HVAC*

↓

COMPONENT COOLING SYSTEM

ELECTRICAL

6900 V SHUTDOWN POWER
480 V SHUTDOWN POWER
125 V DC VITAL POWER

↓

6900 V AND 480 V
SHUTDOWN POWER SYSTEM

*PORTIONS OF SYSTEMS CONSIDERED UNDER HORIZONTAL REVIEW

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HORIZONTAL REVIEW ITEMS

- HIGH ENERGY LINE BREAK EFFECTS
- FIRE PROTECTION
- CONTROL ROOM HABITABILITY
- HOT PIPING SYSTEM
- CONCRETE STRUCTURE
- BURIED PIPE DESIGN
- HVAC

DEFINITIONS

- OBSERVATIONS
  - A DESIGN, CONSTRUCTION, OR RECORDS RELATED CONDITION WHICH IS PERCEIVED BY A REVIEWER OR INSPECTOR TO BE IN NONCONFORMANCE WITH THE LICENSING OR OTHER DOCUMENTS IMPOSING SAFETY-RELATED REQUIREMENTS
- NON-DISCREPANT OBSERVATIONS
  - AN OBSERVATION WHICH IS CONFIRMED, AFTER A REVIEW, TO BE IN CONFORMANCE WITH THE LICENSING OR OTHER DOCUMENTS IMPOSING SAFETY-RELATED REQUIREMENTS
- DISCREPANCY
  - AN OBSERVATION WHICH IS CONFIRMED, AFTER REVIEW, TO BE IN NON-CONFORMANCE WITH THE LICENSING OR OTHER DOCUMENTS IMPOSING SAFETY-RELATED REQUIREMENTS

DEFINITIONS (Continued)

- DESIGN-SIGNIFICANT DISCREPANCY

  - A DESIGN, CONSTRUCTION, OR RECORDS RELATED DISCREPANCY WHICH, AFTER ENGINEERING EVALUATION, IS FOUND TO BE IN NONCONFORMANCE WITH THE APPROPRIATE CODE, STANDARD, OR LICENSING REQUIREMENTS

- SAFETY-SIGNIFICANT DISCREPANCY

  - A DESIGN SIGNIFICANT DISCREPANCY WHICH, IF IT REMAINED UNDETECTED, COULD RESULT IN THE LOSS OF CAPABILITY OF THE AFFECTED SYSTEM OR STRUCTURE TO PERFORM ITS INTENDED SAFETY FUNCTION: FOR THIS EVALUATION, CREDIT IS NOT ALLOWED FOR REDUNDANCY AT SYSTEM OR TRAIN LEVEL

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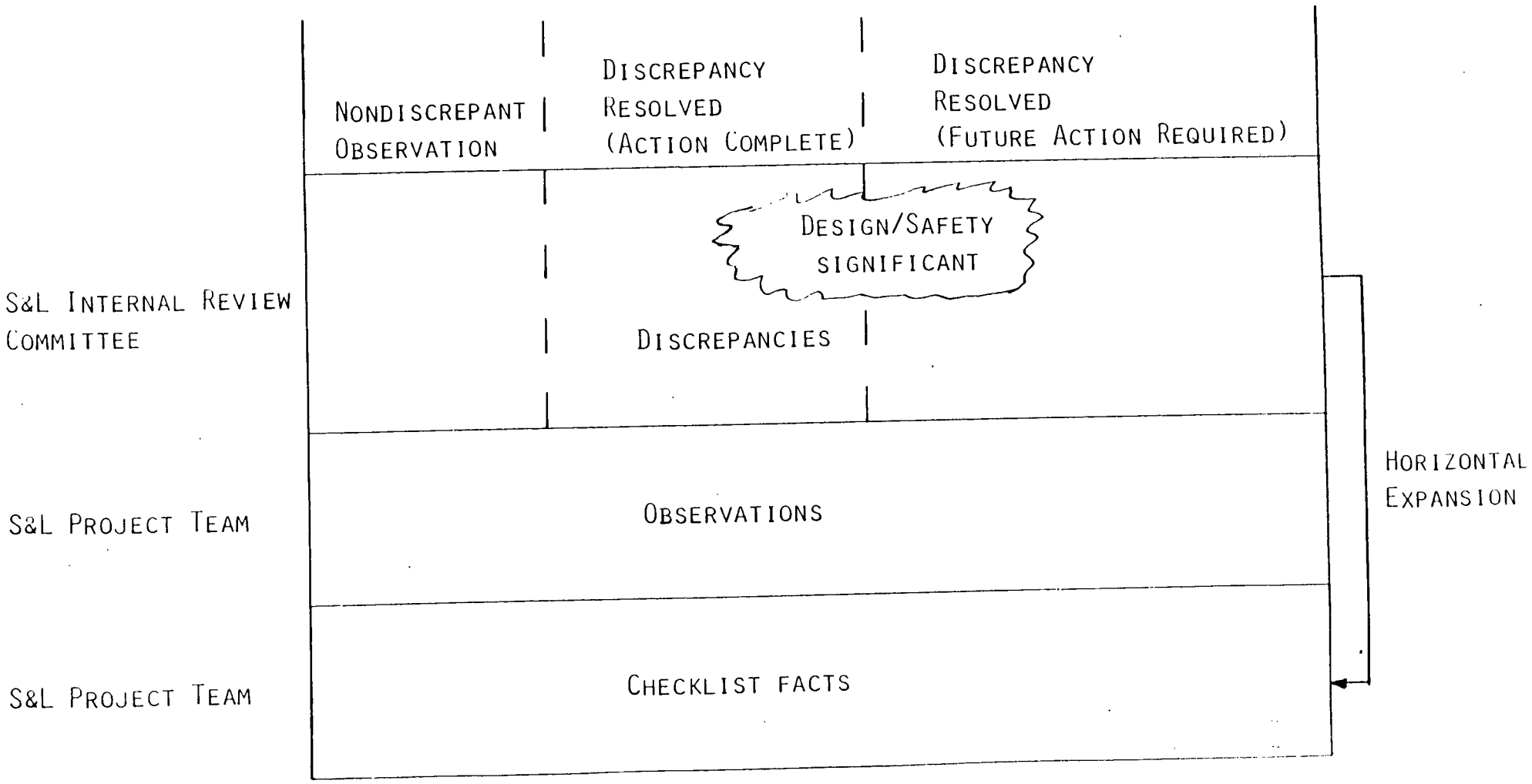
THRESHOLD OF FINDINGS



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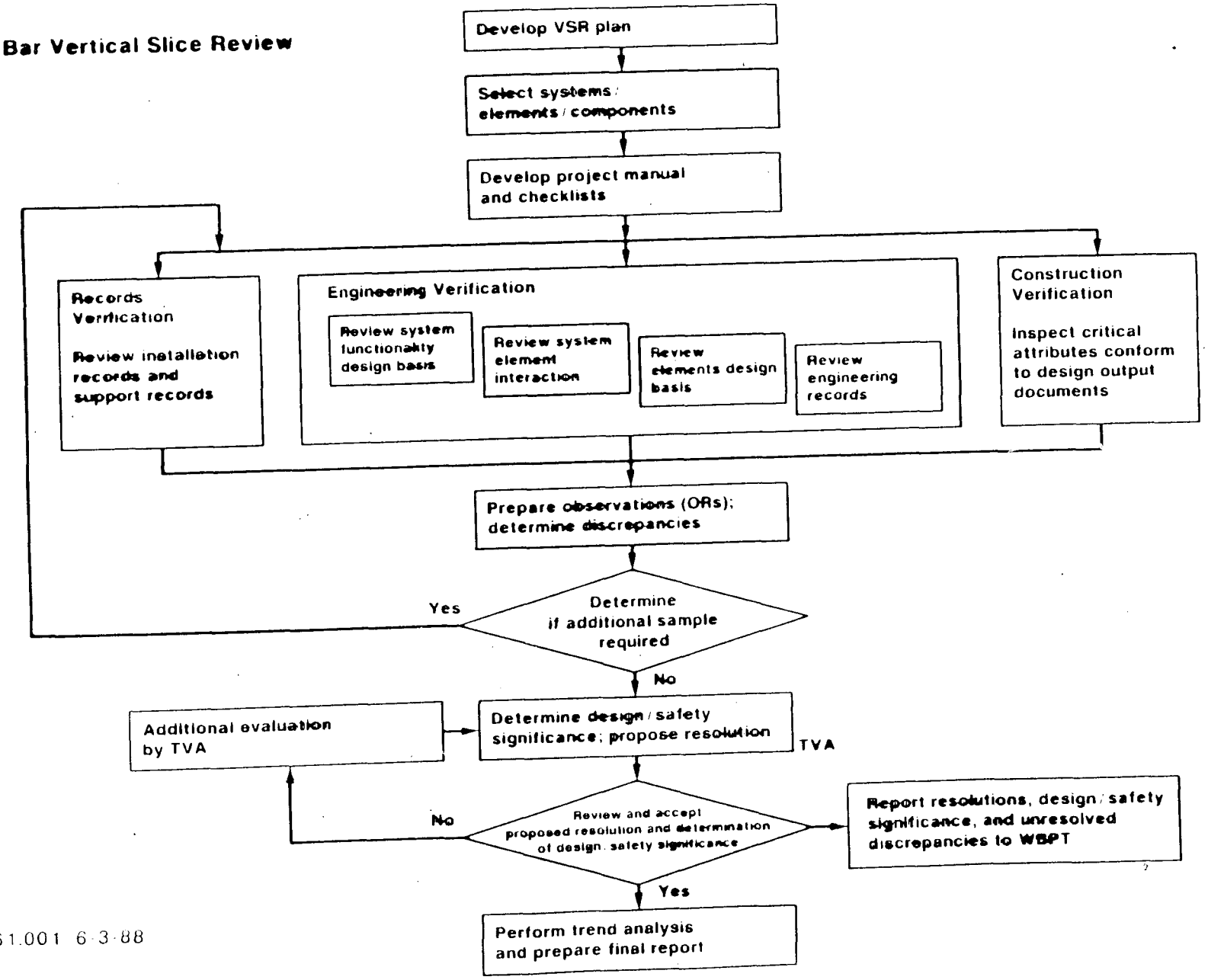
HORIZONTAL EXPANSION

ADDITIONAL ELEMENTS MAY NEED TO BE REVIEWED AS A RESULT OF A DISCREPANCY. THE TYPES OF CONDITIONS WHICH MAY INITIATE SUCH AN EXPANSION ARE:

- APPLICABILITY OF DISCREPANCY TO A UNIQUE SET OF ELEMENTS CANNOT BE BOUNDED BY DESIGN, CONSTRUCTION OR RECORDS PROCEDURES
- DISCREPANCY HAS FAR REACHING IMPACT ON OTHER ELEMENTS OR ATTRIBUTES
- ATTIRBUTE CANNOT BE VERIFIED ON SAMPLED ELEMENT

SUCH EXPANSIONS WILL BE DIRECTED BY THE INTERNAL REVIEW COMMITTEE.

Watts Bar Vertical Slice Review



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TREND ANALYSIS

DISCREPANCY REPORTS WILL BE EVALUATED TO ASSESS THEIR:

- NATURE
- SIGNIFICANCE
- FREQUENCY OF OCCURENCE

APPARENT (ROOT) CAUSES OF EACH DISCREPANCY WILL BE DETERMINED.

DISCREPANCY REPORTS WILL BE SUMMARIZED AND REPORTED BY CAUSE, DESIGN AREA, AND AFFECTED DOCUMENT.

DISCREPANCY REPORTS WILL BE EVALUATED INDIVIDUALLY AND COLLECTIVELY TO DETERMINE ANY GENERIC IMPLICATIONS APPLICABLE:

- DESIGN AND CONSTRUCTION OF THE OVERALL SYSTEM OR STRUCTURE
- TO THE WATTS BAR OVERALL DESIGN AND CONSTRUCTION PROCESS
- TO THE DESIGN AND CONSTRUCTION OF OTHER WATTS BAR SYSTEMS AND STRUCTURES

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COMMUNICATIONS PROTOCOL

- PURPOSES OF PROTOCOL
  - ENSURE CONTRACTOR'S INDEPENDENCE IS NOT COMPROMISED
  - ENSURE CREATION AND RETENTION OF DOCUMENT TRAIL TO VERIFY INDEPENDENCE
  - ENSURE THAT OBSERVATIONS AND POTENTIAL DISCREPANCIES ARE BASED ON COMPLETE AND CORRECT USE OF DATA

- AREAS COVERED BY PROTOCOL
  - SEPARATION OF COMMERCIAL AND TECHNICAL MATTERS
  - CORRESPONDENCE FOR DATA REQUESTS
  - MEETINGS AND MINUTES
  - TELEPHONE CONVERSATIONS
  - ORAL CONVERSATIONS
  - GENERATION OF OBSERVATIONS AND DISCREPANCIES BY CONTRACTOR
  - RESPONSES BY AFFECTED ORGANIZATIONS
  - INTERNAL REVIEW COMMITTEE
  - MAINTENANCE OF RECORDS AND DATA

- WBPT TO MONITOR PROTOCOL COMPLIANCE

Vertical Slice Review Schedule

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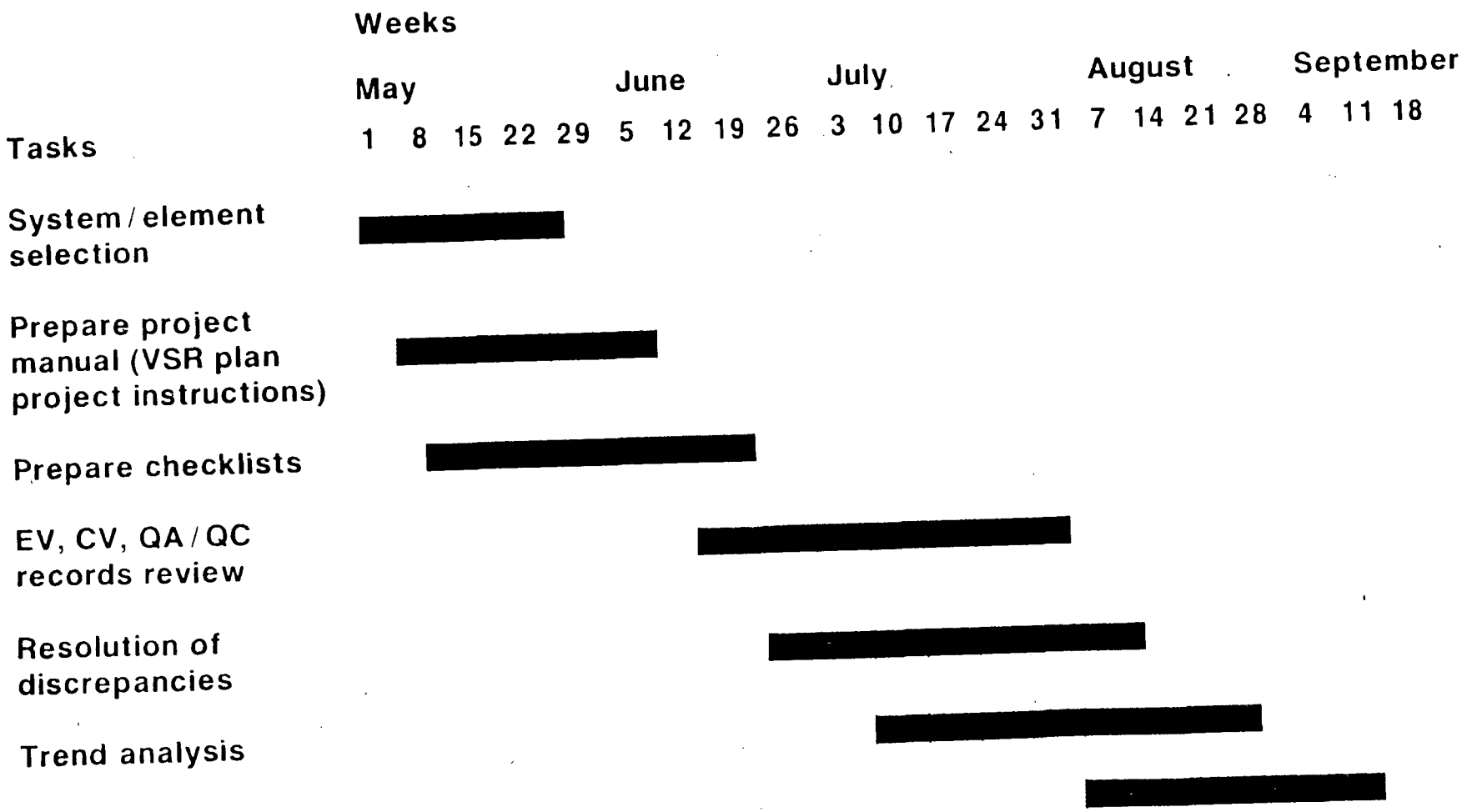

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PRELIMINARY FINAL REPORT OUTLINE

EXECUTIVE SUMMARY

I. INTRODUCTION
   - A. OBJECTIVE
   - B. SCOPE
   - C. APPROACH
     1. GENERAL
     2. SYSTEM AND COMPONENT SELECTION
     3. CHECKLIST PREPARATION
     4. VERTICAL SLICE REVIEW PROCESS

II. ASSESSMENTS AND CONCLUSIONS
   - A. GENERAL
   - B. REVIEW AREAS
     1. DESIGN VERIFICATION
     2. CONSTRUCTION VERIFICATION
   - C. TREND ANALYSIS
   - D. CONCLUSIONS
     1. DESIGN OF REVIEWED SYSTEMS AND AREAS
     2. CONSTRUCTION AND QA/QC RECORDS
     3. OVERALL PLANT ASSESSMENT

III. DESIGN ENGINEERING VERIFICATION
   - A. MECHANICAL REVIEW
   - B. CIVIL/STRUCTURAL REVIEW
   - C. ELECTRICAL REVIEW
   - D. LICENSING REQUIREMENTS AND DESIGN PROCESS REVIEWS
     1. LICENSING REQUIREMENTS
     2. DESIGN PROCESS REVIEW

IV. CONSTRUCTION VERIFICATION
   - A. MECHANICAL INSPECTION
   - B. CIVIL/STRUCTURAL INSPECTION
   - C. ELECTRICAL INSPECTION

V. QA/QC RECORDS VERIFICATION
   - A. PROCESS REVIEW
   - B. INSTALLATION PACKAGE REVIEW

PRELIMINARY FINAL REPORT OUTLINE (CONTINUED)

APPENDICES

A. PROJECT TEAM
B. INTERNAL REVIEW COMMITTEE
C. DEFINITIONS
D. LIST OF DOCUMENTS REVIEWED
E. LIST OF CHECKLISTS
F. REVIEW RECORDS
G. DISCREPANCY REPORTS
H. INDEPENDENCE STATEMENT
I. VSR PROJECT MANUAL

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DOCUMENTS REQUIRED FOR DESIGN CONTROL AND INTERFACE ADEQUACY REVIEW

- TVA QUALITY ASSURANCE MANUALS
- WATTS BAR PROJECT MANUAL
- TVA DESIGN GUIDES AND STANDARDS
- TVA GENERIC ENGINEERING PROCEDURES
- TVA FLOW CHARTS THAT REPRESENT DESIGN PROCESS
- INTERFACE DESIGN SPECIFICATIONS (TVA AND WESTINGHOUSE)

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REQUIRED DOCUMENTS

DOCUMENTS OR INFORMATION ANTICIPATED TO BE PERTINENT TO THE SYSTEMS, STRUCTURES OR COMPONENTS BEING REVIEWED INCLUDE:

- SYSTEM PIPING AND INSTRUMENTATION DIAGRAMS
- GENERAL ARRANGEMENT DRAWINGS
- APPLICABLE ENGINEERING STANDARDS
- SYSTEM AND COMPONENT DESIGN CRITERIA
- TECHNICAL SPECIFICATIONS
- DESIGN INSTALLATION AND TEST SPECIFICATIONS
- INSTALLATION/CONSTRUCTION DRAWINGS
- NON-CONFORMANCE REPORTS (NCR)
- CONDITION ADVERSE TO QUALITY REPORTS (CAQR)
- FIELD CHANGE REQUEST (FCR)
- ENGINEERING CHANGE NOTICES (ECN)
- DESIGN DRAWING HIERARCHY
- LOGIC DIAGRAMS (WITH LEGEND SHEETS)
- LOOP DIAGRAMS
- INSTRUMENT INDEX
- INSTRUMENT DATA SHEETS
- INSTRUMENT LOCATION DRAWINGS
- COMPUTER I/O LIST
- ANNUNCIATOR DRAWINGS
- INSTRUMENT PROCUREMENT SPECIFICATIONS
- CONTROL BOARD ARRANGEMENT DRAWINGS
- CONTROL BOARD PHYSICAL DRAWINGS
- CONTROL BOARD WIRING DRAWINGS

REQUIRED DOCUMENTS (CONTINUED)

- INTERMEDIATE INSTRUMENTATION CABINET PHYSICAL DRAWINGS
- INTERMEDIATE INSTRUMENTATION CABINET WIRING DRAWINGS
- INSTRUMENT IMPULSE LINE ROUTING DRAWINGS
- ELECTRICAL CALCULATIONS
- ELECTRICAL SINGLE-LINE DRAWINGS
- ELECTRICAL SCHEMATIC DIAGRAMS
- ELECTRICAL RACEWAY AND ROUTING DRAWINGS
- ELECTRICAL WIRING DRAWINGS
- CABLE TABS
- TERMINATION CARDS
- MASTER CONTROL DIAGRAMS OR EQUIVALENT
- DESIGN BASIS CRITERIA CALCULATIONS AND/OR ANALYSIS FOR:
  - A-C ON-SITE POWER SYSTEMS
  - D-C POWER SYSTEMS
  - A-C INSTRUMENTATION POWER SYSTEMS
  - POWER CABLE AMPACITY AND DERATING
  - POWER AND CONTROL CIRCUIT VOLTAGE DROP
- EQUIPMENT SPECIFICATIONS AND EQUIPMENT DATA PACKAGES
- EQUIPMENT LIST
- VALVE LIST
- SPECIFICATION INDEX
- ASME DESIGN SPECIFICATIONS
- SYSTEM PIPING DRAWINGS
- PIPING ISOMETRIC DRAWINGS
- SEISMIC II OVER I ASSESSMENT REPORT

REQUIRED DOCUMENTS (CONTINUED)

- FLOODING REPORT
- PIPE WHIP RESTRAINT DRAWINGS
- WESTINGHOUSE SYSTEM DESIGN SPECIFICATIONS AND DATA SHEETS
- WESTINGHOUSE INSTRUMENT DATA SHEETS
- APPROVED DESIGN CHANGE DOCUMENTS
- HANGER SKETCHES
- HANGER INSTALLATION DRAWINGS
- THE FOLLOWING DESIGN BASIS DOCUMENTATION:
  - PIPE SUPPORT RESTRAINT CALCULATIONS
  - PIPE SUPPORT AUXILIARY STEEL CALCULATIONS
  - DATA PREPARED FOR INPUT TO THE PIPE PROGRAM USED IN ANALYSIS
  - SPECIAL CALCULATIONS USED FOR FLANGE QUALIFICATION
  - STRESS INDICES CALCULATIONS USED FOR NON-STANDARD FITTING INCLUDING INTEGRAL ATTACHMENTS
  - STRUCTURAL ANCHOR CALCULATIONS, IF ANY
  - CALCULATIONS FOR FLUID TRANSIENT LOADS, IF ANY
  - PIPE SIZING FOR PRESSURE AND FLOW INCLUDING CORROSION ALLOWANCES USED IN CALCULATING PIPE WALL THICKNESS
- STRESS REPORTS INCLUDING THE FOLLOWING ASPECTS:
  - FUNCTIONAL CAPABILITY ASSURANCE
  - PIPE BREAK LOCATION IDENTIFICATIONS, BASED ON STRESS CRITERIA OR LACK THEREOF
  - ANY ISI REQUIREMENTS
  - THERMAL TRANSIENT STRESS EVALUATION

REQUIRED DOCUMENTS (CONTINUED)

- STRESS REPORTS INCLUDING THE FOLLOWING ASPECTS: (CONTINUED)
  - FATIGUE EVALUATION OF GAMMA PLUGS
  - CLASS I FITTING DETAILS AND CONTOURS FROM FIELD MEASUREMENTS
  - STRESS INDICES FOR SMALL TAPS
- EXISTING INPUT DATA INCLUDING:
  - SITE SEISMIC G-LEVEL AND RELATED GEOLOGICAL DATA
  - BUILDING SEISMIC RESPONSE SPECTRA
  - INSTRUMENTATION AND CONTROLS STANDARD SPECIFICATIONS
  - STANDARD EQUIPMENT PRODUCT LITERATURE AND TEST REPORTS SUPPLIED BY VENDORS TO TVA
  - GENERIC ENGINEERING OR TEST DATA SUPPLIED BY WESTINGHOUSE
  - STRUCTURAL CALCULATIONS
  - *INSTALLATION - CONSTRUCTION RECORDS - GENERAL
  - *INSTALLATION - CONSTRUCTION RECORDS - EACH DISCIPLINE
  - *INSTALLATION - CONSTRUCTION RECORDS - RECEIVING AND STORAGE
  - *MANUFACTURING RECORDS
  - *PROCUREMENT RECORDS
  - *CONSTRUCTION PROGRESS STATUS FOR SELECTED SYSTEMS
  - *DISCIPLINE CONSTRUCTION SPECIFICATIONS FOR ALL DISCIPLINES

*TO BE PROVIDED AT SITE ONLY

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