WATTS BAR NUCLEAR

PERFORMANCE PLAN

TENNESSEE VALLEY AUTHORITY

MAY 1989

TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401

6N 38A Lookout Place

May 22, 1989

Chairman Lando W. Zech, Jr.
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority) 50-391

WATTS BAR NUCLEAR PLANT (WBN) - NUCLEAR PERFORMANCE PLAN, VOLUME 4

On March 10, 1986, TVA submitted to NRC the Corporate Nuclear Performance Plan - Revised. At the time we also indicated that we would submit at a later date plans which address NRC's plant-specific requests for information.

This submittal provides the Watts Bar Nuclear Performance Plan (WBNPP), the last of four volumes addressing TVA's total nuclear recovery program. This plan completes our response to enclosure 2 of W. J. Dircks's September 17, 1985, letter by providing information regarding TVA's WBN specific actions to correct problems in the management of nuclear activities.

The WBNPP describes the actions taken or planned by TVA to identify, document, investigate, and correct problems at WBN. The WBNPP specifically provides further assurance that upon completion of these actions, WBN design and construction will be in accordance with applicable regulatory requirements and TVA commitments. TVA notes, however, that the WBNPP does not address all licensing matters that will be required for fuel load and operation of WBN. Those remaining licensing matters have been addressed in previous safety evaluations or will be addressed in accordance with routine NRC licensing practices.

We look forward to supporting your staff in their detailed review of this plan. TVA will continue to monitor the progress of implementation of the WBNPP and provide additional information as needed.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Oliver D. Kingsley, Jr.
Senior Vice President
Nuclear Power

Enclosure
cc: See page 2

A045
1/

cc (Enclosure):
Commissioner Carr
Commissioner Curtiss
Commissioner Roberts
Commissioner Rogers
U.S. Nuclear Regulatory Commissioner
Washington, D.C. 20555

U.S. Nuclear Regulatory Commission (Enclosure--40 copies)
ATTN: Document Control Desk
Washington, D.C. 20555

Ms. S. C. Black, Assistant Director
for Projects
TVA Projects Division
U.S. Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852

Mr. B. A. Wilson, Assistant Director
for Inspection Programs
TVA Projects Division
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Watts Bar Resident Inspector
Watts Bar Nuclear Plant
P.O. Box 700
Spring City, Tennessee 37381

EXECUTIVE SUMMARY

In 1985, in response to various problems identified in the Tennessee Valley Authority (TVA) nuclear program and numerous employee concerns raised with respect to the Watts Bar Nuclear Plant (WBN), TVA shut down all of its operating nuclear units and delayed its pursuit of an operating license for WBN unit 1. Subsequently, the Nuclear Regulatory Commission (NRC) requested in a September 17, 1985 letter issued pursuant to 10 CFR 50.54(f) from the Executive Director for Operations, that TVA furnish plans for addressing issues raised with respect to its overall management and with respect to each of its nuclear plants. Based on these developments, TVA embarked on a long-term effort to review comprehensively its nuclear program and to respond to the NRC. This effort, as it specifically relates to WBN, is described in this document, the Watts Bar Nuclear Performance Plan (WBNPP) (Volume 4).

TVA's efforts began in 1986, with a comprehensive review of its management of the overall nuclear program. This review was aided by a team of senior industry advisors and led to the extensive organization and management changes described in the previously released Corporate Nuclear Performance Plan (CNPP) (Volume 1).

The WBNPP describes the actions taken or planned by TVA to identify, document, investigate, and correct problems at WBN. The WBNPP specifically provides further assurance that upon completion of these actions, WBN will be designed and constructed in accordance with applicable regulatory requirements and TVA commitments. In conjunction with the CNPP, the WBNPP responds to NRC's specific request for information under 10 CFR 50.54(f) as it relates to WBN. TVA notes, however, that the WBNPP does not address all licensing matters that will be required for fuel load and operation of WBN. Those remaining licensing matters have been addressed in previous safety evaluations or will be addressed in accordance with routine NRC licensing practices.

As described in the WBNPP, TVA's efforts at WBN began with the WBN Task Force, comprised of experienced nuclear industry personnel. The WBN Task Force reviewed and evaluated several previously completed discovery programs, including numerous self-examinations conducted by both internal and independent external review groups. Through this evaluation process, problems were categorized and grouped by characteristic and type in order to facilitate the development of effective corrective actions, which became known as Special Programs.

These previous discovery programs, along with the efforts of the WBN Task Force, show that TVA had organizations, programs, and defined processes in place to control the design and construction of its nuclear power plants. However, weaknesses in some programs were also identified that were not in all cases adequately addressed. These weaknesses related to definition of problem scope, root cause analyses, implementation of corrective actions, and recurrence control. A number of these weaknesses were addressed in the CNPP.

Out of concern for the impact of these weaknesses at WBN, TVA decided to take additional action beyond the corrective actions defined by the WBN Task Force to assure that WBN would comply with associated regulatory requirements and TVA commitments. Accordingly, the Watts Bar Program Team (WBPT) was appointed by the Senior Vice President, Nuclear Power. Members were selected on the basis of their experience and independence from WBN design and construction. The objective of the WBPT was to look beyond the previously identified problems and perform an overall evaluation of plant design and construction in order to identify corrective actions necessary to provide reasonable assurance that WBN meets licensing requirements and TVA commitments.

The WBPT recognized the need to review the entire plant in an integrated, systematic manner. Accordingly, the WBPT developed the Systematic Evaluation to examine individual safety-related structures and components (elements) and those characteristics related to their capability to perform their intended function (attributes). Using this element/attribute approach, the WBPT was able to evaluate previously developed Special Programs, conditions adverse to quality (CAQs), employee concerns, and the Vertical Slice Review (VSR), all of which are described briefly herein and in detail in the WBNPP.

The review of Special Programs conducted by the WBPT resulted in identification of corrective actions of a programmatic nature or of broad scope and required early NRC review and concurrence. These Corrective Action Programs (CAPs) required approval of TVA upper management. All CAPs have now been submitted to NRC for review. The Special Programs, as well as the individual CAPs, have been thoroughly reviewed and accepted by the WBPT and form the basis for the majority of actions to be taken to provide additional assurance that WBN complies with licensing requirements and TVA commitments.

A key part of the Systematic Evaluation was the performance of the VSR by an independent contractor. This extensive program was initiated to detect any problems that had not yet been identified through previous discovery programs, while at the same time confirming that the corrective actions planned were adequate to resolve the identified problems. The VSR covered design, construction, and records attributes for two systems, as well as a horizontal cross-section of plant features that were not a part of the systems reviewed. This program, which spanned approximately nine months, was completed in February 1989. The VSR has provided valuable information to the WBN line organizations to enable them to enhance and strengthen the corrective actions described in the CAPs and Special Programs to further assure that they completely and adequately address the problems at WBN.

Another key element of the Systematic Evaluation is the TVA CAQ process. This process, which is an important element of the TVA Nuclear QA Program, had been revised in the CNPP to require the direct involvement of Nuclear Power management in assuring that timely and effective actions are taken to correct problems and prevent their recurrence. Many specific issues at WBN have been and currently are being addressed through this process.

The Systematic Evaluation and the resulting corrective actions will provide additional assurance that WBN is designed and constructed in conformance with licensing requirements and TVA commitments. However, TVA views implementation of the various corrective actions as an important step before operating the plant. Accordingly, the WBNPP identifies the overall methods established to assure that the implementation process is carried out in an effective manner.

Specifically, for each of the CAPs and Special Programs, a Project Manager has been assigned as the single point of responsibility for its effective implementation. To further ensure the effective implementation of corrective actions, a site integrated schedule has been prepared to identify activities scheduled to be complete before fuel load. This schedule includes the CAPs and Special Programs.

An integral part of the implementation methodology is the quality verification process. This verification process is carried out by the Site Quality Manager to provide an adequate level of confidence that work has been performed in accordance with requirements. As routine quality assurance functions are implemented, any additional problems or deficiencies that are identified as conditions adverse to quality will be tracked and corrective actions implemented in accordance with the established TVA Nuclear Quality Assurance (NQA) Program. As a final confirmation of the adequacy and implementation of the design, construction, and inspection processes and the adequacy and implementation of corrective action programs, experienced quality assurance personnel will perform an in-depth audit similar to the NRC Integrated Design Inspection (IDI) performed at the Sequoyah Nuclear Plant (SQN).

TVA has also addressed management and organizational issues at WBN. In order to further strengthen management involvement and project control, the Senior Vice President, Nuclear Power announced the establishment of the position of Vice President, New Projects. The WBN Site Director will report to this newly created position in June 1989. TVA has established at WBN an organizational structure and management process consistent with the Nuclear Power organization and processes established by the CNPP. For example, the overall WBN organization has been strengthened by reorganization into functional departments that generally parallel the functional departments in TVA's corporate organization. Where applicable, each site support organization, such as site licensing, quality assurance, and engineering, receives technical direction from its respective corporate organization. In addition, specific organizations are being strengthened onsite to assure control of operations, maintenance, design and modification activities, and quality assurance. Knowledge of the plant has also been strengthened through additional Senior Reactor Operator and plant systems training for plant engineering supervisors who will be involved with the eventual operation and maintenance of WBN.

Because of past problems attributed to a lack of management involvement in the control of work practices, several actions have also been taken in the areas of goal setting, communication with employees, training, procedures involvement, corrective action programs, and resolution of employee concerns. These measures are described in the WBNPP. Employee concerns expressed at WBN before February 1, 1986, were evaluated and resolved by TVA's Employee Concerns Task Group (ECTG). The evaluation and resolution of these concerns were described in a series of reports which have been submitted to NRC. The conclusions of the ECTG are provided in the WBNPP.

In addition, in order to foster employee trust in TVA's nuclear management and to instill an atmosphere conducive to high-quality work, TVA has established a system in which employees are encouraged to express concerns to nuclear management without fear of reprisal, and with assurance that their concerns will be fully addressed. This enhanced Employee Concern Program (ECP) is described in the WBNPP and will be continued after the plant begins operation.

As the corrective action work at WBN proceeds toward completion, the organizations and management required to operate and maintain the plant will be preparing for operation. Assurance that readiness for operation is achieved will be provided through a planned series of reviews and evaluations by both onsite line organizations and independent offsite organizations. Plans for assuring operational readiness are described in this WBNPP.

The Senior Vice President of Nuclear Power has determined that the WBPT will remain on site to provide advice and assistance to assure that the various corrective action programs are initiated in a satisfactory manner and to facilitate the transition from the planning phase to the implementation phase. In fulfilling this role, the WBPT will review and approve changes to CAPs and Special Programs and will provide any necessary recommendations for changes to this WBNPP to the Senior Vice President of Nuclear Power. As the corrective action plans are implemented using the methods outlined in this WBNPP, the need for continued WBPT involvement will be evaluated by the Senior Vice President of Nuclear Power.

In summary, TVA has conducted a full and comprehensive discovery program, and through the Systematic Evaluation, has identified corrective actions that, once implemented, will provide substantial additional assurance that WBN is designed and constructed in accordance with regulatory requirements and TVA commitments. TVA has also established the organizational structure and management processes, consistent with the CNPP, to effectively carry out the completion of corrective work and to prepare for power operation.

WATTS BAR UNIT 1 NUCLEAR PERFORMANCE PLAN

VOLUME 4

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF TABLES AND FIGURES

ACRONYM LIST

ITEM	DESCRIPTION
ABCSM	Adhesive-Backed Cable Support Mounts
ACR	Attribute Coverage Report
AFW	Auxiliary Feedwater
AI	Administrative Instruction
ALARA	As Low as Reasonably Achievable
ANSI	American Nuclear Standards Institute
AOI	Abnormal Operating Instruction
AP	Administrative Procedure
ASER	Accreditation Self Evaluation Report
ASME	American Society of Mechanical Engineers
ASOS	Assistant Shift Operations Supervisor
ASTM	American Society of Testing Materials
AUO	Assistant Unit Operator
BIF	Background Information File
BFN	Browns Ferry Nuclear Plant
BFNPP	Browns Ferry Nuclear Performance Plan
BLN	Bellefonte Nuclear Plant
CAP	Corrective Action Program
CAQ	Condition Adverse to Quality
CAQR	Condition Adverse to Quality Report
CAR	Corrective Action Report
CATD	Corrective Action Tracking Document
CCB	Change Control Board
CCRS	Computerized Cable Routing System
CCTS	Corporate Commitment Tracking System
CCW	Condenser Circulating Water
CEB	Civil Engineering Branch
CFR	Code of Federal Regulations
CMTR	Certified Materials Test Report
CNPP	Corporate Nuclear Performance Plan
CSOC	Closed System Outside Containment
CR	Completion Report
DBD	Design Basis Document
DBVP	Design Baseline and Verification Program
DC	Design Criteria
DCIP	Design Change Improvement Program
DCN	Design Change Notice
DCR	Design Change Request
DCRDR	Detailed Control Room Design Review
DOE	Department of Energy
DR	Discrepancy Report
EA	Engineering Assurance
E/A	Elements/Attributes
ECN	Engineering Change Notice
ECP	Employee Concern Program
ECP-SR	Employee Concern Program - Site Representative
ECSP	Employee Concern Special Program
ECTG	Employee Concern Task Group
EEB	Electrical Engineering Branch

ITEM	DESCRIPTION
EI	Emergency Instruction
EPA	Electrical Penetration Assembly
EQ	Environmental Qualification
ER Spec	Engineering Requirements Specification
ERCW	Essential Raw Cooling Water
ESQ	Equipment Seismic Qualification
E&TT	Engineering and Technical Training
FSAR	Final Safety Analysis Report
GDC	General Design Criteria
GET	General Employee Training
GOI	General Operating Instruction
HAAUP	Hanger and Analysis Update Program
HVAC	Heating, Ventilating, and Air Conditioning
I&C	Instrumentation and Controls
IE	Inspection and Enforcement
IDI	Integrated Design Inspection
IEEE	Institute of Electrical and Electronics Engineers
IG	Inspector General
INPO	Institute of Nuclear Power Operation
IRC	Internal Review Committee
ISEG	Independent Safety Engineering Group
IVP	Integrated Verification Plan
JTG	Joint Test Group
LCC	Lower Compartment Cooler
LDCM	Licensing Document Commitment Matrix
LER	Licensee Event Report
LOCA	Loss of Coolant Accident
M&TE	Measuring and Test Equipment
MAC	Management Analysis Company
MAI	Modification and Addition Instructions
MELB	Moderate Energy Line Break
MEQ	Mechanical Equipment Qualification
MFL	Master Fuse List
MI	Maintenance Instruction
MIC	Microbiologically Induced Corrosion
MSLB	Main Steamline Break
MWe	Megawatt (electrical)
MWt	Megawatt (thermal)
NC	Nuclear Construction (WBN)
NCR	Nonconforming Condition Report
NDE	Nondestructive Examination
NE	Nuclear Engineering
NEC	National Electric Code
NEP	Nuclear Engineering Procedures
NERP	Nuclear Experience Review Program
NMRG	Nuclear Managers Review Group
NPP	Nuclear Performance Plan
NQA	Nuclear Quality Assurance
NQAM	Nuclear Quality Assurance Manual
NRC	Nuclear Regulatory Commission

ITEM	DESCRIPTION
NSRB	Nuclear Safety Review Board
NSRS	Nuclear Safety Review Staff
NT	Nuclear Training
NTOL	Near Term Operating License
NUMARC	Nuclear Management and Resources Committee
OBE	Operating Basis Earthquake
OE	Office of Engineering
OEDC	Office of Engineering Design and Construction
OI	Operating Instruction
OIE	Office of Inspection and Enforcement
OIG	Office of Inspector General
ONP	Office of Nuclear Power
OQA	Office of Quality Assurance
OR	Observation Report
ORR	Operational Readiness Review
PAM	Postaccident Monitor
PC&BS	Project Controls and Budget Services
PDA	Preliminary Design Assessment
PE	Project Engineer
PIR	Problem Identification Report
PMP	Plant Modification Package
PORC	Plant Operations Review Committee
PORS	Plant Operations Review Staff
POTC	Power Operations Training Center
PPL	Preliminary Projects List
PSAR	Preliminary Safety Analysis Report
PTI	Preoperational Test Instruction
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Procedure
QTC	Quality Technology Corporation
RCS	Reactor Coolant System
RIMS	Records and Information Management System
RIP	Replacement Items Program
RMS	Radiation Monitoring System
RO	Reactor Operator
RR	Resolution Report
SALP	Systematic Assessment of Licensee Performance
SCR	Significant Condition Report
SD	System Description
SER	Safety Evaluation Report
SI	Surveillance Instruction
SIP	Specification Improvement Program
SIS	Site Integrated Schedule
SOI	System Operating Instruction
SOS	Shift Operations Supervisor
SQN	Sequoyah Nuclear Plant
SR	Surveillance Requirement
SRO	Senior Reactor Operator
SRP	Senior Review Panel
SSE	Safe Shutdown Earthquake

ITEM	DESCRIPTION
STA	Shift Technical Advisor
SWBP	Sidewall Bearing Pressure
TACF	Temporary Alteration Control Form
TB&A	Theodore Barry and Associates
TI	Technical Instruction
TMI	Three Mile Island
TROI	Tracking and Reporting of Open Items
TS&M	Technical Staff and Managers
TVA	Tennessee Valley Authority
UE&C	United Engineers and Constructors
VSR	Vertical Slice Review
VSRT	Vertical Slice Review Team
WBEP	Watts Bar Engineering Project
WBN	Watts Bar Nuclear Plant
WBNPP	Watts Bar Nuclear Performance Plan
WBPP	Watts Bar Program Plan
WBPT	Watts Bar Program Team
WBTC	Watts Bar Training Center
WBTD	Watts Bar Training Department
WEP	Weld Evaluation Project
WOG	Westinghouse Owners Group
WP	Welding Project

I. INTRODUCTION

1.0 PURPOSE

In response to problems that had developed in its nuclear program, the Tennessee Valley Authority (TVA) voluntarily shut down all of its operating units in 1985. Because of these problems and numerous employee concerns raising safety issues at Watts Bar Nuclear Plant (WBN), TVA delayed its pursuit of an operating license for WBN unit 1.

On September 17, 1985, in a letter from William J. Dircks, Executive Director for Operations, Nuclear Regulatory Commission (NRC), to Charles Dean, Chairman, Board of Directors, TVA, NRC provided its Systematic Assessment of Licensee Performance (SALP) and requested specific information pursuant to 10 CFR 50.54(f) (Ref. 1). This letter requested TVA to furnish its plans for addressing issues raised with respect to its overall management and with respect to each of its nuclear plants.

Since receipt of the NRC request for information, TVA has significantly restructured its nuclear organization and management, established improvement programs, and defined systematic approaches for identifying and correcting problems, including those at WBN.

The Corporate Nuclear Performance Plan (CNPP) (Ref. 2), which has been approved by the NRC, describes the measures that have been taken by TVA to improve its nuclear program at the corporate level. This Watts Bar Nuclear Performance Plan (WBNPP), in combination with the CNPP, describes the plan for providing additional management controls and performing specific actions to identify, document, investigate, and correct problems at WBN. This plan responds to NRC's specific request for information under 10 CFR 50.54(f), and presents an integrated plan for further assuring the adequacy of design and construction of the plant. An important aspect of the WBNPP is the performance of a systematic evaluation of plant design and construction in order to identify the corrective actions to provide reasonable assurance that WBN meets licensing requirements and TVA commitments.

Although many of the programs associated with unit 1 are applicable to unit 2, this volume is specifically directed toward unit 1 and common facilities. It will be necessary to conduct an evaluation of results and conclusions drawn from the programs described in this volume at a later time to determine their applicability to unit 2.

The CNPP and the WBNPP provide an account of the actions TVA is taking to improve its nuclear program for WBN. The WBNPP describes the actions taken and corrective actions planned to demonstrate that the plant has been designed and constructed in accordance with applicable regulatory requirements and TVA commitments. TVA notes, however, that the WBNPP does not address all licensing matters that will be required for fuel load and operation of WBN. Those remaining licensing matters have been addressed in previous safety evaluations or will be addressed in accordance with routine NRC licensing practices. Activities normally required to obtain an operating license will be conducted using

established plans and procedures. Upon reaching the fuel load milestone, the WBNPP will have accomplished its purpose and will therefore no longer be necessary.

2.0 BACKGROUND

WBN is a two-unit nuclear power plant located approximately 50 miles northeast of Chattanooga, Tennessee. The nuclear steam supply system for each unit is a four-loop pressurized water reactor rated at 3411-MWt furnished by Westinghouse Electric Corporation. Each unit is rated at 1160-MWe. The plant was designed, is being built, and will be operated by TVA. Construction of unit 1 and common facilities is essentially complete except for the corrective actions plans described in this WBNPP. Unit 2 construction is approximately 85 percent complete, and is currently in layup pending the determination of TVA's future power needs.

In early 1985 WBN was in the final stages of review before obtaining an operating license. The NRC had already issued a Safety Evaluation Report (SER) (Ref. 3) and four supplemental SERs (Refs. 4 through 7).

In April 1985, TVA and NRC became aware of numerous TVA employee concerns that related to WBN's readiness to receive an operating license. Several of these concerns were addressed directly to NRC. After consultation with the NRC, TVA took a number of major actions including shutting down all operating units. In addition, TVA established a special program for collecting and resolving employee concerns, particularly those from employees associated with WBN.

On September 17, 1985, NRC requested under 10 CFR 50.54(f) that TVA submit its plan to correct programmatic and management deficiencies throughout the TVA Nuclear Program, as well as deficiencies specific to WBN, before licensing of WBN unit 1 (Ref. 1).

In January 1986, the Board of Directors appointed a new Manager of Nuclear Power to oversee all aspects of TVA's nuclear power program. As discussed in the CNPP, a comprehensive review of the nuclear program was initiated to identify problems, causes of problems, and actions required to correct them. The root causes of the problems in TVA's program were determined by a team of senior experienced industry advisors. Their work was supported by a study performed by a contractor, entitled "Systematic Analysis of Identified Issues/Concerns at TVA" (Ref. 8). This study accumulated issues and concerns from sources external to TVA, encoded these concerns into a data base, analyzed the resultant information, and supported the preparation of the CNPP.

A special WBN Task Force, consisting of senior personnel experienced in nuclear design and construction, was established on March 19, 1986, to identify specific plant problems and develop resolutions before fuel load of WBN. This Task Force examined the WBN-related issues to confirm that the actions taken at WBN suitably addressed the problems identified.

The WBN Task Force developed a list of corrective actions (except for those of a routine nature) to be completed before fuel load. These corrective actions addressed similar or related problems and became known

as Special Programs. These corrective actions were compiled from issues previously identified by NRC, the Institute of Nuclear Power Operation (INPO), outside contractor recommendations, and various corporate and site quality assurance related processes. The WBN Task Force established criteria for evaluating the issues and worked closely with WBN line managers in developing resolutions to the known problems. It provided an overview of site activities and information to the Site Director and the Manager of Nuclear Power regarding these and other potential problems.

The WBN Task Force initiative was the first action taken to consolidate issues and develop corrective actions to address similar issues collectively through an integrated plan. The following section describes TVA's actions to perform an overall evaluation of plant design and construction to provide reasonable assurance that corrective actions are established to meet licensing requirements and TVA commitments.

3.0 OUTLINE OF TVA'S APPROACH TO CORRECTING WBN'S PROBLEMS

Previous evaluations by TVA, as well as by outside contractors and regulatory and audit agencies such as NRC and INPO, show that before January 1986, TVA had organizations, programs, processes, and procedures in place to control the design and construction of its nuclear power plants. A collective evaluation of these programs also shows that there were weaknesses identified in some of TVA's programs that were not in all cases adequately addressed. In some cases TVA did not adequately scope weaknesses, did not adequately identify root causes, did not adequately implement the identified corrective actions, or did not provide adequate recurrence control.

The root cause identification and corrective actions taken to address these weaknesses at the corporate level since 1986 are described in the CNPP. In summary, the actions include: hiring experienced nuclear managers; developing and training TVA managers; restructuring the nuclear organization to clarify lines of authority and responsibility and to provide centralized direction and control of nuclear activities; taking steps to restore employee trust in nuclear management; increasing upper management awareness of and involvement in nuclear activities; and improving the management systems and controls, the corrective action program, and other programmatic areas of operation, maintenance, design change, plant modification, and quality assurance.

The study of root causes and corrective actions was also carried from the corporate level to the WBN project. Corrective action initiatives taken at the corporate level are being implemented at WBN through the WBN Site Director as well as through offsite organizations responsible for direct support to WBN. These improvements include organizational changes compatible with corporate-level restructuring, improved management control and involvement, revised conduct of operations and maintenance activities, improved quality awareness, centralized design control, a long-term program for upgrading procedures, and programs to restore employee confidence. The efforts to standardize organizations, programs, and procedures at the corporate and all site offices are designed to improve communication between sites and apply improvements made at one

site to all sites in a timely manner. These efforts also have the additional benefit of improving the exchange of information between NRC and TVA.

In addition to these improvements, many external reviews have been performed to evaluate the adequacy of the TVA Quality Assurance (QA) program and TVA has made a number of program improvements as a result of these reviews. TVA's expanded program for resolving employee concerns also provides added assurance that significant plant deficiencies have been identified and appropriate corrective actions undertaken.

In addition to the significant improvements made in the TVA and WBN organizations and management through the implementation of the CNPP, many Special Programs were developed, which in some cases, have already been implemented to resolve known nonconforming issues. However, because previously completed discovery programs found instances of inadequate root cause determinations and recurrence control for identified weaknesses, questions arose about the degree to which the design and construction of WBN met regulatory requirements. In addition, questions arose about the adequacy of the records documenting the acceptability of nonconforming design, construction and installation for WBN. As a result, the Senior Vice President of Nuclear Power established an independent Watts Bar Program Team (WBPT) to perform an integrated systematic evaluation (Systematic Evaluation) of WBN. This required a more comprehensive evaluation of WBN than had been performed previously. The objective of the WBPT was to look beyond the known problems and perform an overall evaluation of plant design and construction in order to identify the necessary corrective actions to provide reasonable assurance that WBN meets licensing requirements and TVA commitments.

As its first activity, the WBPT developed the Watts Bar Program Plan (WBPP) (Ref. 9) which outlined its overall strategy for evaluating WBN and described the Systematic Evaluation as the means for meeting its objective. The WBPP was endorsed by NRC in its June 27, 1988 letter to TVA (Ref. 10).

A key part of the Systematic Evaluation was the performance of a Vertical Slice Review (VSR) by an independent contractor. This review served both a discovery and a confirmatory role in TVA's evaluation strategy. Its purpose was to detect problems that had not yet been identified through previous discovery programs, while at the same time confirming that the corrective actions planned were adequate to resolve the identified problems. By selecting two representative systems and extensively verifying the adequacy of design and construction of these systems, overall conclusions can and have been made by the independent review as to the overall adequacy of WBN design and construction.

The WBPT was responsible for developing this WBNPP and recommending the Corrective Action Program (CAP) plans (Refs. 11 through 29) and Special Programs to TVA upper management for approval. The analytical approach used by the WBPT is described in Chapter II. The associated CAPs and Special Programs are addressed in Chapter III.

As a final confirmation of the adequacy and implementation of the design, construction, and inspection processes and the adequacy and implementation of corrective action programs, Nuclear Quality Assurance (NQA) will perform an in-depth technical audit at WBN. The audit will be managed by an organization separate from the WBN line organization and will be performed by a team composed of experienced technical personnel. The audit will be similar to the NRC Integrated Design Inspection (IDI) performed at the Sequoyah Nuclear Plant (SQN), but expanded to include additional construction, installation, inspection, operations, and maintenance areas. The audit will be conducted approximately six months before fuel load and at or near completion of CAPs and Special Programs. The audit scope will include a safety system, support systems, and portions of other systems and structures as necessary to obtain adequate coverage. An audit plan will be prepared well in advance of the audit to define, in detail, the audit scope, its approach and the criteria for selection of systems and structures. The audit plan and report will be provided to the NRC.

In following the course of action outlined in the CNPP and this WBNPP, the WBN project will benefit from prior TVA experiences in implementing programs and corrective action plans that have been proven effective and led to the successful restart of SQN units 1 and 2.

4.0 PLAN ARRANGEMENT

The WBNPP describes programs that identify and correct problems and defines the organizational and management methods for implementing them to ensure operational readiness. It provides information needed by NRC to plan and conduct its audits of the programs. While detailed descriptions of processes are included, technical details are omitted unless they are necessary to describe programs. Documents (procedures, program plans, etc.) are referenced within the sections of the text where applicable.

This WBNPP is comprised of seven major chapters:

- Chapter I reviews the purpose of the WBNPP, provides background information, discusses the approach taken to identify, evaluate, and resolve issues at WBN, and describes its arrangement. Chapter I provides the background for many of the actions taken to correct past problems described in this WBNPP.

- Chapter II describes the past and current processes used to assess WBN design and construction adequacy. This chapter discusses issue discovery, including the WBN Task Force, the Employee Concerns Program (ECP), independent reviews, the Conditions Adverse to Quality (CAQ) Program, NRC audits, and generic industry issues. This chapter also discusses issues previously identified and consolidated to form the basis of the CAPs and Special Programs.

Chapter II also addresses (1) WBPT's purpose, objectives, and methodology; (2) the Systematic Evaluation process and methodology; (3) the results of the VSR; and (4) conclusions from the overall WBN assessment of design and construction.

- Chapter III summarizes the corrective actions designed to resolve specific issues prior to licensing. The summary of each CAP plan and Special Program includes a description of the issue involved, its root causes, and the action taken to rectify the problem and prevent recurrence.

- Chapter IV discusses the implementation of corrective actions and closure of issues as related to the CAPs, Special Programs, the VSR results, and other corrective actions.

- Chapter V describes the program for improving the overall conduct of operations to achieve and maintain a high performance standard at WBN. The WBN organization is being restructured to be consistent with the overall Nuclear Power organization to provide for effective management of its activities. This chapter describes the restructuring of WBN organizations and programs necessary to support an operating plant.

  The discussion of organizational improvements includes steps that have been taken to strengthen functional support, specific organizational and management improvements that have been made, areas of responsibility, accountability, and authority that have been redefined or clarified, and the increased understanding of systems operations by WBN line management.

  The discussion of programmatic improvements includes enhanced management control and involvement through clearer definition of goals and objectives, improved communication with employees, improved training, closer adherence to correct procedures, effective corrective action, improved quality assurance, continued implementation of the ECPs, and an improved design change control process.

  Chapter V also discusses lessons learned from SQN and Browns Ferry Nuclear Plant (BFN) and improvements made as a result, including the assignment of experienced SQN and BFN personnel to WBN.

- Chapter VI describes the Operational Readiness Program to be conducted at WBN before fuel load and startup. In addition to each of the programs described herein, a readiness review of plant activities, procedures, and programs will be performed to ensure that appropriate requirements and industry standard practices are being satisfied before fuel load and that operational prerequisites have been met. It is not the intent of this WBNPP to address all licensing matters that will be required for fuel load. However, a summary description of the Operational Readiness Program is provided because this effort will provide additional assurance that WBN is prepared to load fuel and that required commitments have been met.

- Chapter VII provides the integrated project milestones that identify the major corrective actions required and the interrelationships between them.

- Appendix A provides information in response to NRC's concerns stated in the 10 CFR 50.54(f) September 17, 1985 letter.

- Appendix B provides a summary description of results of independent reviews conducted before 1986 and associated corrective actions.

- Appendix C discusses the 11 Nuclear Safety Review Staff (NSRS) perceptions and identifies where each is addressed in this WBNPP.

- Appendix D gives the status of TVA licensing commitments from the CNPP that apply to WBN.

- Appendix E provides the licensing commitments from this WBNPP.

II. WATTS BAR ASSESSMENT

1.0 INTRODUCTION

Throughout the design and construction of WBN, TVA had organizations, programs, processes, and procedures in place to control its design and construction activities. During this period, TVA performed numerous self-examinations, conducted by both internal and independent external review groups. A collective evaluation of these reviews shows that there were weaknesses identified in some of TVA's programs that were not in all cases adequately addressed. In some cases TVA did not adequately scope weaknesses, did not adequately identify root causes, did not adequately implement the identified corrective actions, or did not provide adequate recurrence control.

To address these problems, TVA initiated a vigorous recovery program in 1986. The CNPP was developed to respond to these problems by capturing the programmatic and organizational issues, determining root causes, implementing corrective actions, and establishing recurrence control at the corporate level. At WBN, a Task Force was established to review the implementation of the CNPP, to review the identified issues, and work with the line organization to develop the required corrective actions to resolve those issues.

The WBN Task Force effort resulted in the development of a number of Special Programs involving significant corrective actions. However, toward the end of 1987, it was recognized that the issue discovery process at WBN may not have identified all nonconforming issues. This recognition was based on the fact that various reviews, audits, and employee concerns looked only at portions of the WBN design and construction. The issues identified were related to those parts that were reviewed, however, no comprehensive evaluation of overall WBN design and construction was performed to identify nonconforming issues. Therefore, the WBPT was established to perform an integrated, Systematic Evaluation of WBN and to make recommendations regarding the adequacy of WBN design and construction.

This chapter describes the past and current processes used for the assessment of WBN adequacy including the independent reviews, CAQs, NRC audits, ECP, generic industry issues, and the WBN Task Force activities. This issue discovery process is described in Section 2. Section 3 describes the process of issue integration and consolidation in the CAPs and Special Programs. The objectives of the WBPT and the approach used to meet those objectives are discussed in Section 4. Details of the WBPT Systematic Evaluation are presented in Section 5. The VSR, a principal program used in the Systematic Evaluation, is detailed in Section 6. Conclusions from the Systematic Evaluation are given in Section 7.

2.0 ISSUE DISCOVERY

Several methods, which are described in the following subsections, have been used at WBN to identify nonconforming issues. These methods include a number of independent reviews performed in the past, the CAQ process, the ECP, NRC audits, and consideration of generic industry issues identified through NRC generic letters, bulletins, information notices, and INPO reports. This section also describes the effort of the WBN Task Force, which was the initial attempt to integrate the known issues and develop programmatic corrective actions.

2.1 Independent Reviews

During the design and construction of WBN, the TVA program in general, and the WBN program in particular, were independently assessed by a number of organizations. During the 1970s when the TVA nuclear plants were in the design and construction phase, these reviews were primarily conducted by consultants hired by TVA to examine the adequacy of programs within the engineering and construction organizations. These included reviews by the management consultant firm, Theodore Barry and Associates (TB&A) and by the architect/engineering firm, United Engineers and Constructors (UE&C).

With the expanded industry emphasis on safety and quality after the accident at Three Mile Island (TMI), additional independent reviews were performed after 1980. This increased review activity included programmatic reviews by NSRS, the NRC Region II, and INPO. The reviews by NSRS and INPO included examination of the activities of the line organizations and the auditing activities performed by the QA organization. During the 1980s, the NSRS specifically examined the QA program and organizations on two occasions. TVA also retained Management Analysis Company (MAC) in 1984 to examine its QA program. In addition to broad programmatic reviews by such groups, WBN also benefited from specific reviews of selected program elements, as in the cases of Duke Power Company's review of the TVA piping and pipe support program in 1984, and the more extensive independent review of the design and construction of the WBN auxiliary feedwater system conducted by Black & Veatch from 1982 through 1984.

Four independent reviews were conducted within TVA during 1985, including one by INPO of the construction program at WBN unit 2, and two by NRC Region II pertaining to TVA's QA program activities, in particular, the changes brought about by the reorganization of line and QA organizations. A fourth by WESTEC Services involved review of environmental qualification (EQ) activities to determine the degree of compliance with 10 CFR 50.49.

In 1985 and 1986, a series of design control surveys of TVA operating plants was conducted by the Office of Engineering (OE), which used independent teams to assess the design control process; and in 1987, NRC performed an IDI of SQN.

The scope of the above reviews, their significant findings, and the corrective actions taken at the time of the reviews are described in Appendix B to this WBNPP.

As part of the Systematic Evaluation, the WBPT has reviewed the findings resulting from these independent reviews and concluded that the completed or currently planned corrective actions have adequately addressed the findings.

2.2 Conditions Adverse to Quality

CAQs have been identified by various names within TVA since the initiation of the WBN Project. Although the names have changed, they had the same purpose: to identify and correct problems and deficiencies in accordance with 10 CFR 50, Appendix B.

Before 1987, TVA used various reports to document and disposition CAQs. These reports included, but were not limited to Nonconforming Condition Reports (NCRs), Significant Condition Reports (SCRs), Problem Identification Reports (PIRs), Deficiency Reports (DRs), Corrective Action Reports (CARs), and Audit Deficiency Reports.

In 1987, the Condition Adverse to Quality Report (CAQR) was developed as part of a corporate process to document and disposition CAQs. This process was established as part of the corporate corrective action program developed as a result of the implementation of the CNPP. The CAQR process has undergone several modifications but has retained its central purpose of identifying and classifying problems and tracking their resolution to completion.

In 1987 a decision was made to use the Tracking and Reporting of Open Items (TROI) system as a single system to track CAQRs. This process has been enhanced and continues to function with the current CAQ process. This entire system continues to be upgraded as new developments are made to enhance the overall TVA nuclear QA program.

The issues identified in the CAQs were bounded along with similar issues identified by the Employee Concerns Special Program (ECSP), NRC audits, etc., to develop CAPs and Special Programs, as discussed in Chapter III.

2.3 NRC Audits

Many issues were identified by NRC reviews and audits at WBN. NRC findings, violations, inspection followup items, etc., documented in NRC inspection reports have been included as part of the issue discovery process at WBN. Open NRC findings are tracked on the TROI system and are resolved with NRC through the normal plant completion and licensing process.

2.4 Employee Concern Program

2.4.1 Background

In April 1985, while TVA was making preparations to obtain an operating license for WBN, the NRC notified TVA that some TVA employees had raised a number of safety concerns, particularly related to WBN, in correspondence to NRC and to congressional staffs. Among those concerns were the employees' fear of reprisal by TVA management for expressing their views about alleged safety problems within TVA. The NRC indicated to TVA that a communications problem existed between management and employees at WBN regarding safety concerns. Further, in NRC's view, the potential existed that nuclear safety problems could be repressed as a result of employees' fear of reprisal from TVA management.

After discussing these issues with NRC, TVA initiated major programmatic actions. One of these actions was to establish a special program for collecting and resolving employee concerns, particularly those from employees associated with WBN. To ensure that employees felt free to express their concerns without fear of reprisal, TVA selected an independent contractor to interview employees then assigned to WBN as well as some former employees.

By January 1986 the interview phase of the special program for resolving concerns at WBN had been completed and investigations had begun. Approximately one-third of the more than 5800 employees interviewed had expressed one or more concerns, resulting in approximately 5000 individual employee concerns to be evaluated. Each concern was a documented description of one or more conditions or circumstances that the employee thought was unsafe, unjust, inefficient, or incorrect. Although TVA had extended the program through the use of mailers and a toll-free telephone number to solicit views from employees at all Nuclear Power locations, the majority of concerns were the product of interviews with WBN employees.

Because of the large backlog of concerns accumulated from the interview process, TVA decided to implement a new process for resolving concerns, and established the ECSP with an implementing task group. The Employee Concerns Task Group (ECTG), was charged to evaluate and report on all concerns expressed before February 1, 1986. Also, a new ongoing ECP was established to process all concerns expressed by employees throughout Nuclear Power on or after February 1, 1986. The ECSP program for resolution of concerns and the new ongoing ECP effort have been described to members of the NRC staff at various meetings and in the TVA transmittal to NRC on May 2, 1986 (Ref. 30). Additional details of the program description were transmitted to NRC on

August 29, 1986 (Ref. 31). The NRC staff reported the results of their Safety Evaluation on the ECSP on October 6, 1987 (Ref. 32). In this report the NRC staff concluded that the ECSP program "is an acceptable program for evaluating and providing corrective actions to the employee concerns addressed by the program."

As the ECTG's comprehensive approach to problem resolution intensified, its scope was expanded to resolve additional concerns and items gathered from sources other than the employees interviewed at Watts Bar. Consequently, in April 1986, the ECTG scope of activity was expanded to include:

- Concerns generated by earlier employee concern programs.
- Additional concerns identified by NRC from the interview files of the independent contractor that had conducted the interviews.
- Additional items identified by ECTG evaluators.
- Concerns received by NRC before February 1, 1986 and referred to TVA.
- Concerns identified by TVA's former NSRS
- Open items identified from reviews of TVA incoming correspondence from sources such as NRC, INPO, and the U.S. Congress.

The expanded scope of the ECSP increased the total number of concerns to approximately 6000 and involved evaluations at all TVA sites because of the generic applicability of some concerns beyond the site of origin.

2.4.2 ECSP Results

Employee concerns that were evaluated by the ECSP were grouped into nine categories for evaluation, determination of generic applicability, and resolution. In order to facilitate the evaluation of the concerns, they were further broken down into elements (or subcategories). The evaluation of the concerns resulted in the issuance to NRC of a summary report, nine category reports, and 107 subcategory reports. These reports contain the summary of issues, findings, causes of the problems, and corrective actions taken or to be taken.

Detailed corrective actions were developed for concerns that were substantiated. These corrective actions were reviewed and concurrence was given by the ECSP. An independent review of these activities by outside experts was performed. Each

identified corrective action is tracked to completion and verified. Also, the reports are available to current and former nuclear employees.

The evaluation of the approximately 6000 employee concerns within the ECSP's scope confirmed that TVA's nuclear program before February 1986 did have some management and organizational inadequacies, some general weaknesses in implementing various programs and processes, and some technical problems. The majority of these weaknesses fell within the bounds of the corrective actions described in the CNPP.

Over three-fourths of the nearly 6000 employee concerns evaluated were not substantiated, were not a problem requiring action, or were already being addressed by line management prior to the evaluation. Employing a conservative approach, TVA identified specific actions as a result of ECSP evaluations; however, the majority of these actions did not require physical changes to the plants. A substantial number of actions involved document reviews, clarifications, and revisions. A few actions had a greater impact and resulted either in physical plant rework or in management policy changes throughout the organization.

The ECSP concluded that the overall, multitiered management program and methodology by which TVA's nuclear plants were designed, constructed, and operated was generally effective in accomplishing its intended purposes. Although specific problems were found by the ECTG in various practices and activities of the TVA management system, there were and are sufficient checks and balances in the system to offset these individual problems and avoid any condition constituting an unacceptable risk to the health and safety of the public. The evidence did not indicate that TVA had willfully allowed cost and schedule to override safety and quality considerations or that safety and quality had been compromised to the extent that the health and safety of the public could not be reasonably assured. However, managers may have succumbed to cost and schedule pressures on occasion without realizing that work quality might suffer as a result.

Overall, the ECSP concluded that completion of the specific actions identified by the program and continued adherence to the numerous actions outlined in the revised CNPP should lead to correction of the problems identified within the scope of concerns evaluated by the ECTG. The correction of these problems in turn plays an important role in TVA's overall effort to restore the nuclear program to normal operations.

Chapter V provides a detailed description of the ongoing ECP in effect since February 1986.

2.5 Generic Industry Issues

Generic industry issues were considered in the identification of nonconforming issues and development of corrective actions described in Chapter III. As part of WBN normal licensing activities, identification of generic design and construction issues applicable to WBN was accomplished through a review of the following industry documents:

- NRC IE Bulletins
- NRC Generic Letters
- NRC Information Notices
- INPO Plant Evaluation Reports
- Licensee Event Reports (LERs) - SQN/BFN

Lessons learned from industry experience and input received from the WBPT and several industry experts were considered in the development of the Systematic Evaluation plans and corrective actions. The WBPT visited nuclear plants that underwent verification programs similar to those that were being planned at WBN and interviewed personnel directly associated with such programs. The experience gained from these interviews was incorporated in developing the Systematic Evaluation. The WBPT reviewed the documented plans for issue discovery and issue resolution from a number of nuclear power plant projects which have recently undergone operating license review. The reviews, as well as recent experiences at SQN and BFN, were also used to develop the approach taken in the Systematic Evaluation.

2.6 WBN Task Force

In addition to the strengthening of the corporate organization and controls described in the CNPP, TVA established a WBN Task Force on March 19, 1986, to investigate plant-specific problems. The scope of this Task Force was to:

- Review the implementation of the CNPP at WBN.
- Review problems and deficiencies that were identified during design, construction, and preparations for operating WBN.
- Initiate specific actions to resolve identified problems and confirm that actions taken suitably address the root cause and resolve the problems.

The WBN Task Force was composed of individuals who had extensive experience in the nuclear industry. Its principal area of responsibility was to review the identified nonconforming issues and to ensure that appropriate corrective actions were established to resolve those issues. The WBN Task Force established criteria for

evaluating the issues and worked closely with line managers to develop corrective actions for the identified issues. WBN Task Force actions were guided by the CNPP and the industry experience of the WBN Task Force members. The WBN Task Force effort covered the nonconforming issues identified by sources such as the WBN QA program, employee concerns, the NRC, and the numerous independent reviews that were performed at WBN.

The WBN Task Force completed the analysis of known nonconforming issues and established several corrective actions. This initiative was the first action taken by TVA to consolidate issues and develop corrective actions (which the WBN Task Force originally identified as Special Programs) to address similar issues collectively through an integrated plan. Chapter III describes many of these nonconforming issues and corrective actions.

3.0 ISSUE IDENTIFICATION AND INTEGRATION

As described in Section 2 of this chapter, the issue discovery process resulted in identification of a number of nonconforming issues. Through the efforts of the WBN Task Force initially, and finally the WBPT, identified issues were consolidated into groups of similar issues and issues that affect the same population of hardware, e.g., cables, piping, conduit and conduit supports, and heating, ventilating, and air conditioning (HVAC) ducts and their supports. These consolidated issues were evaluated for root cause and generic applicability and bounded to form the basis of the CAPs and Special Programs described in Chapter III. This process of integrating and consolidating the issues into broad scope programs enables WBN management to manage and implement corrective actions more effectively and efficiently, and to assure a consistent approach for the resolution of various issues. Methods used to develop the CAPs and Special Programs are described in Section 4 of this chapter and also in Chapter III.

4.0 WATTS BAR PROGRAM TEAM

As discussed in Section 2 of this chapter, by September 1987 significant progress had been made toward the discovery of nonconforming issues that required corrective actions. However, TVA recognized the need for an integrated systematic evaluation of WBN and established the WBPT with the objective to look beyond the known problems and perform an overall evaluation of plant design and construction in order to identify the necessary corrective actions to provide reasonable assurance that WBN meets licensing requirements and TVA commitments.

In order to meet its objective, the WBPT reviewed considerable data from a variety of sources, including internal and external discovery programs performed in the past at WBN and the numerous resulting corrective action programs. The WBPT visited several nuclear plants that have had verification programs similar to those considered by the WBPT for WBN and interviewed personnel directly associated with such programs. Based on these reviews, the WBPT developed the WBPP, which described an overall

plan for the Systematic Evaluation and development of corrective actions for WBN. The WBPP described the composition and responsibilities of the WBPT, the objective and scope of the WBPP, program principles and methodology, and the Systematic Evaluation process, including the plan to perform a VSR of WBN design and construction. The WBPP was submitted to the NRC on May 27, 1988 (Ref. 33), and the plan was endorsed by NRC on June 27, 1988 (Ref. 10). This section will briefly discuss the contents of the WBPP.

4.1 Composition and Responsibilities of WBPT

The WBPT is composed of both TVA employees and contractors and includes a chairman and members with experience in the general categories of engineering, construction, quality assurance, licensing, and electrical/instrumentation and controls. The WBPT members were appointed by the Senior Vice President, Nuclear Power and were selected on the basis of their experience and independence from WBN design and construction.

The WBPT was responsible for developing the WBPP and recommending actions to be taken to assure licensability of WBN. The WBPT's responsibility also included the development of the WBNPP. The WBPT made recommendations to the Senior Vice President, Nuclear Power for specific work to be conducted by the line organizations at WBN as part of the Systematic Evaluation and for actions to be taken to correct identified nonconforming issues.

To provide additional assurance that the WBPP was properly developed and executed, six senior independent oversight advisors were appointed by the Senior Vice President, Nuclear Power from outside TVA to review the program activities periodically and report to him individually. The oversight advisors reviewed the completeness of coverage provided by the Systematic Evaluation and the adequacy of defined corrective actions to assure licensability of WBN.

4.2 Watts Bar Program Plan

The objective, scope, and methodology of the WBPP developed by the WBPT are described in the following sections.

4.2.1 Objective

The objective of the WBPP was to perform a Systematic Evaluation of WBN design and construction, to develop corrective actions as required, and to prepare the WBNPP.

4.2.2 Scope

The scope of the WBPP included TVA design and construction of safety-related structures, systems, and components, their interface with the Nuclear Steam Supply System and vendor-furnished equipment, and any other areas directed by the Senior Vice President, Nuclear Power.

4.2.3 Program Methodology and Process

The WBPP was comprised of three phases: Planning, Evaluation, and Development of Corrective Actions. The activities performed in the three phases are depicted in Figure II-1, and are described in the following paragraphs.

- Phase I: Planning

During the planning phase, the WBPT prepared the WBPP, which was approved by the Senior Vice President of Nuclear Power and endorsed by the NRC.

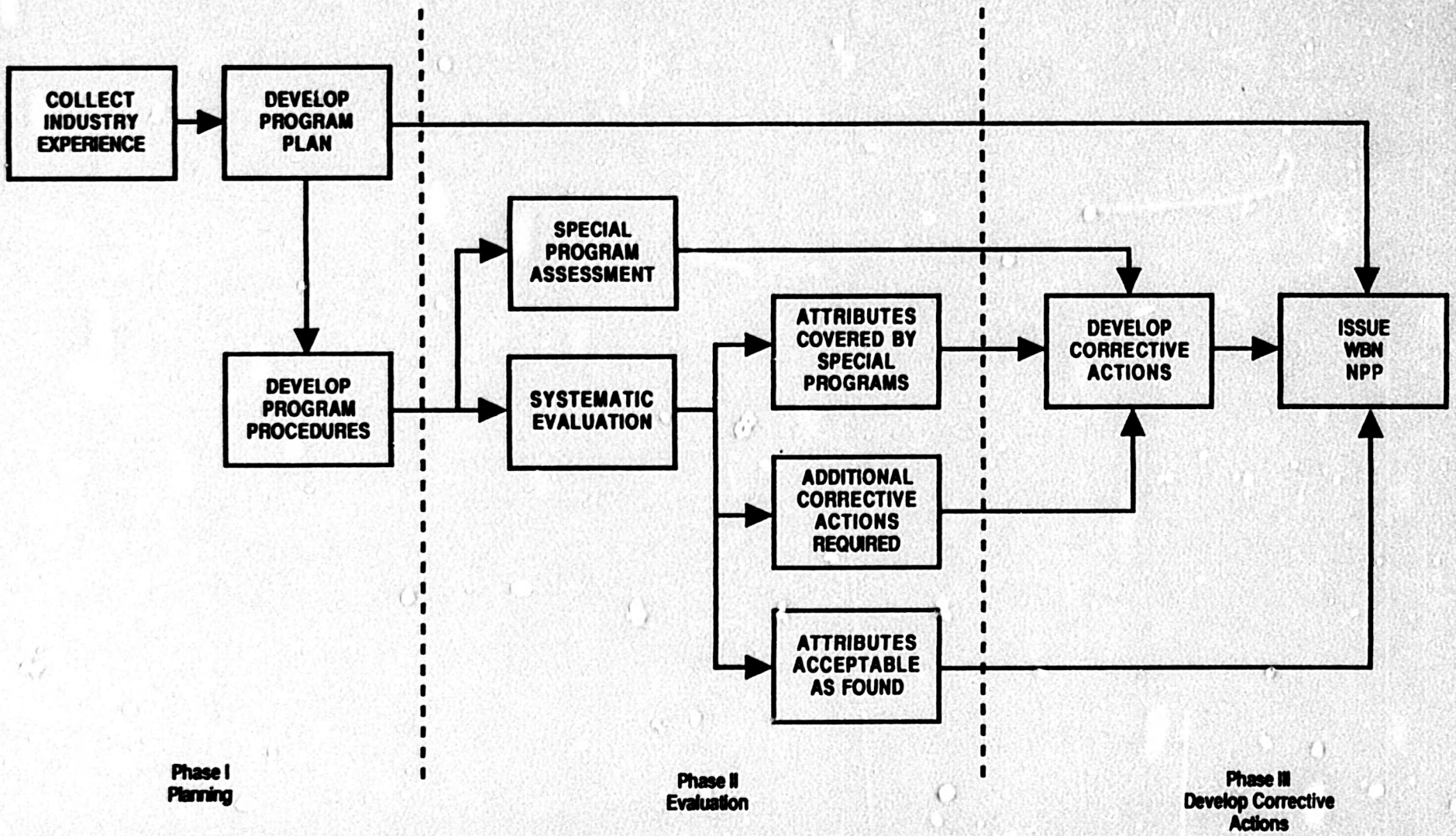
The WBPT incorporated in this Plan information obtained from other utilities' experiences with similar issues, and information from other sources such as industry experts, as well as SQN, BFN, and Bellefonte Nuclear Plant (BLN).

- Phase II: Evaluation

During Phase II, a Systematic Evaluation was performed to identify which plant elements and attributes related to design, construction, and QA/QC records were acceptable as found, which were adequately covered by the existing Special Programs, and which required additional corrective actions. Particular attention was given during the Systematic Evaluation to how specific issues previously identified at other nuclear plants, including SQN, BFN, and BLN, were addressed at WBN. As part of this Systematic Evaluation, a VSR was performed. The Systematic Evaluation is discussed in detail in Section 5 of this chapter, and the VSR is discussed in Section 6.

- Phase III: Development of Corrective Actions

Phase III involved the development of corrective actions, as necessary, to bound and resolve the identified nonconforming issues. The WBPT reviewed Special Programs developed as a result of the WBN Task Force effort. It also reviewed the corrective actions identified in various CAQ documents. These reviews were conducted to group the corrective actions of a broad, generic, and programmatic nature into CAPs. Other significant corrective actions were covered by Special Programs. The single-issue, specific corrective actions are addressed by the TVA CAQ system. The discrepancies identified by the VSR are either covered by the scope of CAPs, Special Programs, and existing CAQ documents or new corrective actions have been developed to resolve the specific discrepancies. The CAPs and Special Programs were reviewed by the WBPT for their thoroughness to resolve the issues, applicable acceptance criteria, consistency with industry approaches taken for issue resolution, and assurance that recommended corrective actions comply with WBN licensing requirements and TVA commitments. These CAPs and Special Programs are described in Chapter III.



WATTS BAR PROGRAM PLAN

FIGURE II-1

4.3 Continuation of WBPT Activities

The WBPT will remain onsite following the issuance of this WBNPP to provide advice and assistance to assure that the WBNPP is being effectively implemented. In fulfilling this role, the WBPT will review and approve changes to CAPs and Special Programs and will provide any necessary recommendations for changes to this WBNPP to the Senior Vice President of Nuclear Power. As the corrective action plans are implemented using the methods outlined in this WBNPP, the need for continued WBPT involvement will be evaluated by the Senior Vice President of Nuclear Power.

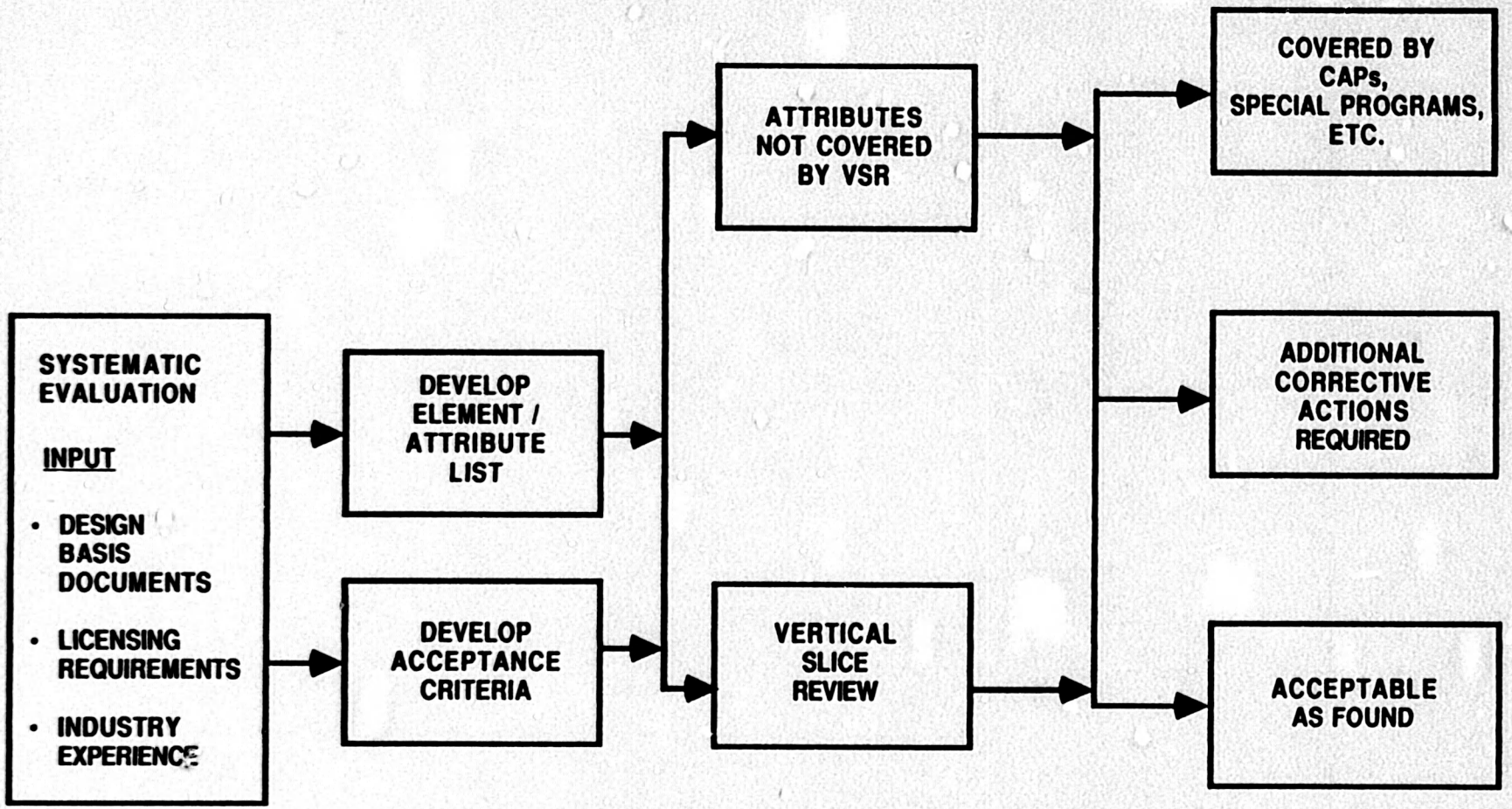
5.0 SYSTEMATIC EVALUATION

The Systematic Evaluation process is shown in the flow chart shown in Figure II-2. As shown on the flow chart, an E/A List and acceptance criteria were developed based on design basis documents (DBDs), licensing requirements, and industry experience. The plant elements and associated attributes were systematically evaluated through the VSR or other programs, and nonconforming issues requiring corrective actions were identified. These corrective actions were either covered by CAPs, Special Programs, and existing CAQs, or new corrective actions were developed as discussed in Chapter III. The VSR, discussed in detail in Section 6 of this chapter, was a principal program used in this process. The Systematic Evaluation process is discussed in more detail in the following subsections.

5.1 Development of E/A List

To facilitate the performance of the Systematic Evaluation, an Element/Attribute (E/A) List was developed that was comprised of elements and attributes associated with the design, construction, and QA/QC records of WBN safety-related structures, equipment, and components. The plant elements include individual safety-related structures, equipment, and components, (e.g., masonry walls, pumps, and cables, respectively). The attributes are quality characteristics of an element related to the capability of the element to perform its intended function. For example: for an element such as pumps, specified mounting details are design attributes, the installed mounting details are construction attributes, and the inspection records associated with the installed mounting details are QA/QC records attributes. As an example, Figure II-3 illustrates the design, construction, and QA/QC records attributes for the element group cable trays and risers. The E/A List contains approximately 80 elements and over 3,300 attributes.

Input for the development of the E/A List was derived from the WBN licensing requirements, safety-related design documents, and industry experience. The E/A List was prepared by an experienced architect/engineer firm and was reviewed by the TVA line organizations. The E/A List was also reviewed by the WBPT to assure that it represents essential plant elements and attributes such that



SYSTEMATIC EVALUATION PROCESS

FIGURE II - 2

E/A LIST
TVA - WATTS BAR NUCLEAR PLANT
DESIGN, CONSTRUCTION, QA/QC RECORDS

ATTRIBUTE	SUB-ATTRIBUTE

ELEMENT GROUP: CABLE TRAYS AND RISERS

DESIGN

- CABLE BENDING RADIUS
- CABLE SUPPORT
- CABLE WEIGHT LOADING/CABLE FILL
- CONFIGURATION
- COVERS (TOP AND BOTTOM)
- GROUNDING
- LOADS, LOAD COMBINATIONS, AND ALLOWABLE STRESSES
- MATERIALS
- ROUTING
- SEALS AND WRAPS
- SEGREGATION
- IDENTIFICATION (CORRECTLY ASSIGNED)
- SEISMIC QUALIFICATION
- SEPARATION (PHYSICAL)
- TOLERANCES
- TYPE (SIZE)

E/A LIST
TVA - WATTS BAR NUCLEAR PLANT
DESIGN, CONSTRUCTION, QA/QC RECORDS

ATTRIBUTE	SUB-ATTRIBUTE
ELEMENT GROUP: CABLE TRAYS AND RISERS	
CONSTRUCTION	
- CABLE PROTECTION	- EDGE PROTECTION/HALF ROUNDS
- CABLE SUPPORT	
- CONDUIT TERMINATIONS	
- CONFIGURATION	
- COVERS	- TYPE AND SIZE INSTALLED
- GROUNDING	
- PHYSICAL DAMAGE	- TRAY
- SEGREGATION IDENTIFICATION	- CORRECTLY ASSIGNED/INSTALLED
- SEPARATION (PHYSICAL)	
- SPLICE PLATES	- CORRECT BOLTS TORQUED TO DESIGN VALUES
- SPLICE PLATES	- TYPE AND SIZE
- UNDOCUMENTED ATTACHMENTS ON TRAY	

E/A LIST
TVA - WATTS BAR NUCLEAR PLANT
DESIGN, CONSTRUCTION, QA/QC RECORDS

ATTRIBUTE	SUB-ATTRIBUTE
ELEMENT GROUP: CABLE TRAYS AND RISERS	
QA/QC RECORDS	
- DESIGN RECORDS	- AS-DESIGNED DRAWINGS
	- DESIGN CALCULATIONS
	- DESIGN CHANGE REQUESTS
	- DESIGN REPORTS
	- SYSTEMS DESCRIPTIONS/DESIGN CRITERIA
- INSTALLATION-CONSTRUCTION RECORDS: GENERAL	- AS-CONSTRUCTED DRAWINGS AND RECORDS
- INSTALLATION-CONSTRUCTION RECORDS: ELECTRICAL AND I&C	- FIELD WORKMANSHIP CHECKLIST OR EQUIVALENT LOGS
- INSTALLATION-CONSTRUCTION RECORDS: GENERAL	- FINAL INSPECTION RESULTS AND RELEASES
- INSTALLATION-CONSTRUCTION RECORDS: GENERAL	- SPECIFICATIONS AND DRAWINGS
- MANUFACTURING RECORDS	- CERTIFICATES OF COMPLIANCE
- MANUFACTURING RECORDS	- VENDOR DRAWINGS AND RECORDS
- PROCUREMENT RECORDS	- PROCUREMENT SPECIFICATION/ PURCHASE ORDERS/AMENDMENTS

the Systematic Evaluation based on this List would detect design and construction issues that are in nonconformance with licensing requirements and TVA commitments.

5.2 Acceptance Criteria

Acceptance criteria for the conduct of the Systematic Evaluation were based on the fundamental principle that elements and attributes must be confirmed to be in compliance with licensing requirements and TVA commitments. The acceptance criteria were also based on DBDs and industry experience. The adequacy of elements and attributes was evaluated in a number of ways including VSR, CAPs, Special Programs, ECSP, or other special assessments. The WBPT used the acceptance criteria in reviewing the adequacy of the CAPs and Special Programs, rather than the individual elements and attributes covered by these programs. The VSR Team (VSRT) used the acceptance criteria in evaluating the adequacy of various elements and attributes reviewed by them. For design, the acceptance criteria were extracted from DBDs, e.g., design criteria and system descriptions. For construction, the acceptance criteria were extracted from design output documents, such as drawings, procurement specifications, and construction specifications. For QA/QC records, the acceptance criteria for these evaluations were extracted from procedures based on the licensing requirements with particular emphasis given to those which establish the adequacy of the as-constructed condition in the plant.

5.3 Coverage of E/A List

Evaluation of the design and construction of WBN was performed principally by means of the VSR as described in Section 6 of this chapter. The objective of the Systematic Evaluation was to cover the elements and attributes included in the E/A List, and the VSR provided coverage for a majority of the elements and attributes. In addition to the coverage provided by the VSR, many of the elements and attributes were covered by CAPs and Special Programs. As part of the Systematic Evaluation, the WBPT reviewed CAPs and Special Programs for adequacy, as described in Chapter III, and the coverage provided by these programs to the elements and attributes was recorded in a Systematic Evaluation Matrix. This matrix also recorded the widespread coverage of elements and attributes provided by the VSR.

The adequacy of elements and attributes not covered by the VSR or other programs was addressed by Attribute Coverage Reports (ACRs). The ACRs demonstrated adequacy of the attributes, or recommended additional reviews. Fewer than 20 of the more than 3,300 attributes require additional reviews. These reviews will be performed to provide an additional demonstration of adequacy of these attributes. Appropriate corrective actions will be developed for nonconforming issues identified. Most of the ACRs were prepared by the VSRT, which benefited from its knowledge of the reviews already performed as part of the VSR. This also ensured an independent evaluation of the elements and attributes covered by the ACRs.

Through the above process, a documented evaluation of the plant elements and their associated attributes has been completed. Therefore, an overall conclusion about the adequacy of WBN design and construction can be made. These conclusions are stated in Section 7 of this chapter.

5.4 Systematic Evaluation Matrix

The Systematic Evaluation Matrix shows the coverage of elements and attributes contained in the E/A List by various programs, e.g., VSR, CAPs, Special Programs, ECSP. Because of the large data base, the Matrix is computerized. In addition to listing the programs providing coverage for the elements and attributes, the Matrix also shows whether the evaluation found an attribute to be acceptable or discrepant. For the discrepant attributes, the document that provides corrective actions (e.g., CAQ) is also listed. Thus, the Systematic Evaluations Matrix provides comprehensive documentation of the results of the Systematic Evaluation.

6.0 VERTICAL SLICE REVIEW

As described in the previous sections, the VSR was a principal element of the Systematic Evaluation. The VSR provided an independent, systematic, structured, and comprehensive evaluation of the adequacy of the design and construction of WBN structures, systems, and components. The VSR was performed during late 1988 and early 1989.

The VSR utilizes a top down review approach which is conducted by comparing licensing requirements and DBDs to design output documents (e.g., drawings and construction specifications) and finally to installed hardware and associated QA/QC records for representative elements of the systems selected. Figure II-4 illustrates this process. The system numbers in this figure are for illustration purposes only. It may be noted that normally a VSR is limited to the review of plant design, but at WBN, the VSR was expanded by the WBPT to include a review of the construction and QA/QC records as well.

Based on its independence from WBN design and construction, its experience in nuclear plant design and its experience with such independent reviews, the architect/engineer firm of Sargent & Lundy was selected to perform the VSR. The VSR was performed under a strict protocol, with the WBPT acting as a third-party intermediary to ensure the independence of the VSRT.

The VSR was conducted in accordance with a plan approved by the WBPT. The NRC staff's review of the plan, documented in its letter dated August 31, 1988 (Ref. 34), concluded that the staff "considers the methodology as proposed by Sargent & Lundy to be reasonable for a project of this nature." The VSR included vertical and horizontal design,

Vertical Slice Review – General Concept

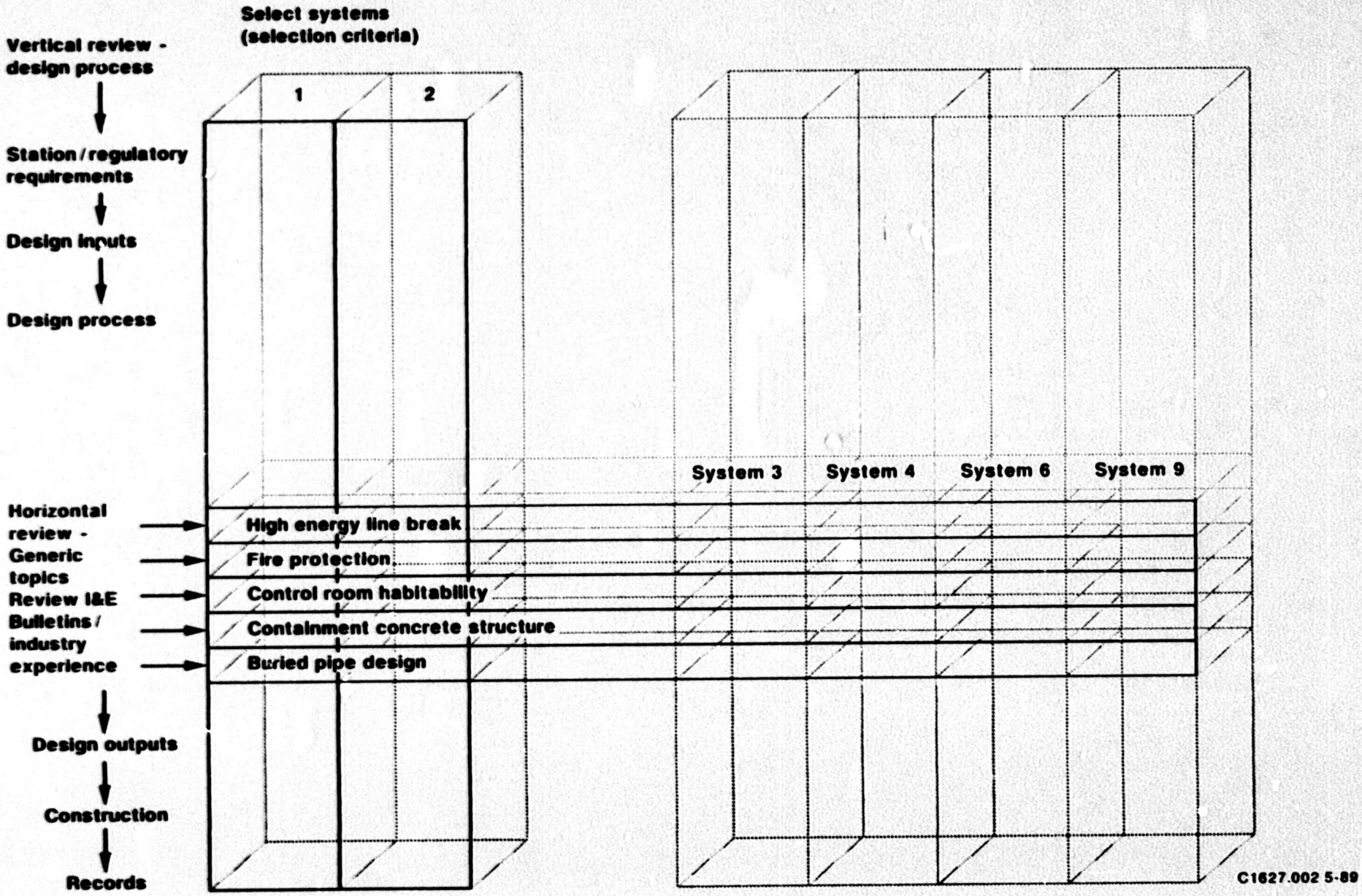


FIGURE II-4

construction, and record verification in each of the three principal engineering disciplines of the WBN design (i.e., mechanical, civil/structural, and electrical). The vertical review consisted of a detailed assessment of two representative safety-related systems, the component cooling water system and the electrical emergency auxiliary power system. The horizontal review included an evaluation of the four plant design areas not covered by the vertical review. These four design areas were high-energy line break, fire protection, control room habitability, and buried pipe and electrical duct bank design.

Five areas, selected by the WBPT based on its review of the Special Programs, were excluded from the scope of the VSR. The WBPT determined that these areas were adequately covered by the existing, well-defined Special Programs. These five programs are the Hanger and Analysis Update Program (HAAUP), Concrete Quality, Equipment Qualification, Control Room Design Review, and Welding. These programs are described in Chapter III. The NRC staff agreed in their letter providing results of their review of the WBPP (Ref. 10) that "sufficient bases exist for the exclusion." In response to NRC staff's comment in their letter providing the results of their review of the VSR Plan (Ref. 34), TVA confirmed that "the VSRT has concluded that the exclusion of the five identified programs will not invalidate the intent of the VSR program because the design interfaces with the exclusion programs are being reviewed, where applicable, by the VSRT." (Ref. 35).

The VSR was a comprehensive review, involving the expenditure of approximately 70,000 hours by the VSRT, and 200,000 hours by the TVA line organizations in providing requested documents, in interfacing with the VSRT, and in responding to the VSR findings. The VSRT reviewed over 450 components under engineering review, approximately 400 under construction review, and approximately 130 under QA/QC Records review, using 186 detailed checklists and a review of over 3,500 documents. Many of the components reviewed for construction and records verification were common to those for engineering verification, so that the interface between engineering, construction, and records could be adequately reviewed.

6.1 Methodology

The VSR entailed a detailed review of design, construction, and QA/QC records for selected structures, systems, and components. The potential discrepancies were documented by the VSRT reviewers in the Observation Reports (ORs). The Internal Review Committee (IRC), which was comprised of the Sargent & Lundy Mechanical, Structural, and Electrical Design Directors and chaired by the Head, Quality Assurance Division, reviewed each OR and determined whether or not the observation was a valid discrepancy. A discrepancy was defined as a design, construction, or records-related condition that was confirmed, after the IRC's review, to be in nonconformance with the licensing or other safety-related documents. Discrepancies were documented in Discrepancy Reports (DRs).

The DRs were sent to the WBN line organizations for resolution, with copies to the WBPT. For each discrepancy, the line organizations determined the design and safety significance of the discrepancy, the extent-of-condition, and the action necessary to correct the discrepancy. For design significant discrepancies, the root cause and action necessary to prevent recurrence was also provided. These were all documented by the line organizations in a Resolution Report (RR).

The VSRT reviewed the RRs. The reasons for accepting or rejecting TVA's resolution of the discrepancy were documented by the IRC in a Completion Report (CR). The IRC also performed a trend analysis of all valid discrepancies by evaluating their nature, significance, and frequency of occurrence.

WBN line organizations also documented the discrepancies and their resolutions using the CAQ process in accordance with the site procedures. Because of the importance of VSR conclusions to the licensability of WBN, VSR corrective actions will be provided with supplemental controls in addition to TVA CAQ program controls. Site procedures have been developed to provide the controls for tracking and implementing the VSR corrective actions as described in Section 3 of Chapter IV.

6.2 Results

A total of 505 DRs, representing 1,040 specific discrepancies, resulted from the VSR. There were 60 DRs determined to be design significant because the discrepancies were found to be in nonconformance with the appropriate code, standard, or licensing requirements; however, none of these 60 DRs was found to be safety significant. A safety-significant discrepancy is a condition which, if it remained undetected, could result in the loss of capability of the affected system or structure to perform its intended safety function. Where a discrepancy was covered by an existing corrective action, in many cases the significance was not determined prior to the time the VSR Report was issued. These discrepancies are being evaluated for significance as part of the CAQ process and none have been found to be safety significant to date.

The VSR identified a number of issues of which TVA was already aware and was in the process of correcting. However, the technical requirements and method of implementation for many of these programs had not been fully developed at the time of the VSR. The results of the VSR provide specific technical information to assist TVA in the development and implementation of these programs.

The engineering verification determined that most licensing commitments have been appropriately implemented in the WBN design, although some commitments were not fully implemented. Most discrepancies were resolved by documentation corrections and some resulted in a requirement for field modifications. The most significant issue identified was the adequacy of engineering calculations. Due to the incomplete status of the design documents,

including engineering calculations, the VSRT could not verify the technical adequacy of the systems. However, the VSRT concluded that the corrective actions related to the engineering calculations and the licensing verification activities of the DBVP (see Chapter III, Section 2.3) are reasonable, and when fully scoped, technically defined, and implemented should provide a basis to confirm that the structures, systems, and components are adequate.

When the construction of WBN is viewed as a whole, the VSRT concluded that the main elements of the plant were conservatively designed and adequately constructed. However, design documents were found to lack specific details in some areas, and controls were not adequately implemented during construction to ensure engineering acceptance of field changes. The VSRT agreed that completion of corrective actions identified by TVA in the RFs should ensure that the as-constructed, or modified, components will meet TVA's licensing commitments.

In the QA/QC records area, the VSRT concluded that the records reviewed by the VSRT generally conform to the controlling procedures. However, a concern was identified that a number of construction discrepancies identified by the VSRT were not reflected in the original inspection records examined by the VSRT as part of its records review. The VSRT believed that, due to the extent of many CAPs involving construction verification programs, this issue will be addressed during the implementation of these programs. The VSRT concluded that the identified corrective action in this area should result in a set of records that support TVA's licensing commitments.

Seven DRs remained unresolved when the final VSR report was issued (Ref. 36). The WBPT coordinated resolution of these between the VSRT and the line organizations. These DRs are now fully resolved and the resolutions have been accepted by the VSRT.

The WBPT reviewed each of the 60 design significant DRs for adequacy of resolution and recommended enhancement to 3 DRs. These enhancements have been reviewed and accepted by the VSRT.

The VSR Final Report (Ref. 36) includes several recommendations which go beyond the corrective actions required to resolve DRs. These recommendations, which the VSRT believes should help in successful completion of WBN, are being evaluated by the TVA line organizations for implementation.

6.3 Conclusion

The VSR Final Report stated the following in Section 2.1.4, "Overall Plant Assessment":

> "As a result of the extent-of-condition and root cause assessment for the discrepancies, it is possible to draw an overall assessment of the WBN based on the VSR. Assuming successful completion of the planned corrective action programs, as modified by the VSR commitments, the VSRT concludes that there is sufficient assurance that the design, construction, and records should comply with the applicable licensing requirements and be technically adequate."

The 16-volume VSR Final Report (Ref. 36) was submitted by Sargent & Lundy on March 8, 1989, with copies sent directly to the NRC for its information and use. The VSRT presented the results of the VSR to NRC in a meeting on March 22, 1989.

7.0 CONCLUSION

Prior to the establishment of the WBPT, many nonconforming issues and associated corrective actions had been identified at WBN through various internal and external reviews. However, in late 1987 the WBPT undertook a Systematic Evaluation of WBN to look beyond the already known issues to provide reasonable assurance that remaining nonconforming issues were identified and corrective actions defined. The evaluation was performed independently and comprehensively, with auditable documentation developed. Based on the evaluations performed, it is concluded that there is reasonable assurance that upon completion of the corrective actions to resolve the identified issues, WBN design and construction will meet the licensing requirements and TVA commitments.

No new safety significant issues have been identified to date as a result of the Systematic Evaluation. The WBPT has reviewed the identified nonconforming issues and corrective actions have been developed to thoroughly resolve these issues. Root cause determinations have been performed for the significant issues, and recurrence control measures have been identified. These are described in Chapter III.