UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

May 13, 2011

Mr. Ashok S. Bhatnagar
Senior Vice President
Nuclear Generation Development and Construction
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT UNIT 2 CONSTRUCTION - NRC INSPECTION REPORT 05000391/2011606

Dear Mr. Bhatnagar:

On March 4, 2011, the U.S. Nuclear Regulatory Commission (NRC) completed a team inspection of construction activities at your Watts Bar Unit 2 reactor facility. The enclosed inspection report documents the inspection results, which were discussed on March 4, 2011, with Mr. Ed Freeman and other members of your staff and during a subsequent phone call on April 6, 2011.

The NRC team conducted an Independent Design Verification Program (IDVP) inspection and portions of an Electrical Distribution System Functional Inspection (EDSFI) as specified in NRC inspection procedures. This inspection examined activities conducted under your Unit 2 construction permit as they relate to safety and compliance with the Commission's rules and regulations, with the conditions of your construction permit, and with fulfillment of Unit 2 regulatory framework commitments. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

The EDSFI portion of this inspection attempted to review the loading on the various electrical sources e.g. diesels, batteries, shutdown board, etc. and the coordination and protection of safety related electrical equipment. Current TVA electrical calculations did not present that information together in concise and understandable documentation. As a result, NRC will need to perform further inspections of these topics to determine if the plant electrical design is acceptable for dual unit operation.

Based on the results of this inspection, this report documents one NRC-identified finding which was determined to involve a violation of NRC requirements. However, because the finding was a Severity Level IV violation and was entered into your corrective action program, the NRC is treating it as non-cited violation consistent with Section 2.3.2 of the NRC Enforcement Policy. If you contest the non-cited violation in the enclosed report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the United States Nuclear Regulatory Commission, ATTENTION: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of

Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Senior Resident Inspector at the Watts Bar Unit 2 Nuclear Plant.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Robert C. Haag, Chief
Construction Projects Branch 3
Division of Construction Projects

Docket No. 50-391
Construction Permit No: CPPR-92

Enclosure: Inspection Report 05000391/2011606 w/attachment

cc w/encl: (See next page)

Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Senior Resident Inspector at the Watts Bar Unit 2 Nuclear Plant.

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cc w/encl: (See next page)

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<u>cc w/encl:</u>

Mr. Gordon P. Arent
Manager, New Generation Licensing
Nuclear Generation Development
and Construction
WBN Nuclear Plant
P.O. Box 2000
Spring City, Tennessee 37381

Mr. David Stinson
Vice President
WBN Unit Two
WBN Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, Tennessee 37381

Mr. C. J. Reid
Manager
Licensing and Industry Affairs
WBN Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, Tennessee 37381

Mr. Preston D. Swafford
Chief Nuclear Officer
and Executive Vice President
Tennessee Valley Authority
3R Lookout Place
1101 Market Place
Chattanooga, Tennessee 37402-2801

County Executive
375 Church Street
Suite 215
Dayton, Tennessee 37321

Mr. W. D. Crouch, Manager
WBN Unit 2 Licensing
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, Tennessee 37381

Mr. Gregory A. Boerschig
Plant Manager, WBN Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, Tennessee 37381

Mr. T. J. Neissen
General Manager
NGDC Governance & Oversight
Tennessee Valley Authority
3A Blue Ridge Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Mr. R. M. Krich
Vice President
Nuclear Licensing
Tennessee Valley Authority
3R Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Mr. E. J. Vigluicci
Assistant General Counsel
Tennessee Valley Authority
6A West Tower
400 West Summit Hill Drive
Knoxville, Tennessee 37402

Mr. Lawrence E. Nanney, Director
Tennessee Department of Environmental
Health and Conservation
Division of Radiological Health
3rd Floor, L&C Annex
401 Church Street
Nashville, TN 37243-1532

Mr. D. E. Grissette
Site Vice President
WBN Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, Tennessee 37381

County Mayor
P.O. Box 156
Decatur, Tennessee 37322

<u>cc email distribution w/encl:</u>
Greg Scott
Tennessee Valley Authority
Electronic Mail Distribution

Watts Bar 2 Licensing
Tennessee Valley Authority
Electronic Mail Distribution

Letter to Ashok S. Bhatnagar from Robert C. Haag dated May 13, 2011.

SUBJECT: WBN NUCLEAR PLANT UNIT 2 CONSTRUCTION - NRC INSPECTION REPORT 05000391/2011606

Distribution w/encl:
L. Raghavan, NRR
S. Campbell, NRR
P. Milano, NRR
C. Evans, RII
L. Douglas, RII EICS
E. Guthrie, RII DRP
R. Monk, RII WBN Unit 1 SRI
OE Mail (email address if applicable)
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REGION II

Docket No.:	50-391
Construction Permit No.:	CPPR-92
Report No.:	05000391/2011606
Applicant:	Tennessee Valley Authority (TVA)
Facility:	Watts Bar Nuclear Plant, Unit 2
Location:	1260 Nuclear Plant Rd Spring City TN 37381
Dates:	February 14 – March 4, 2011
Inspectors:	Caudle Julian, Team Leader, Construction Inspection Branch 1 (CIB 1), Division of Construction Inspection (DCI) Region II (RII) G. Crespo, Senior Construction Inspector, CIB1, DCI, RII V. Ferrarini, Consultant N. Della Greca, Consultant G. Morris, Consultant T. Tinkel, Consultant
Approved by:	Robert C. Haag, Chief Construction Projects Branch 3 Division of Construction Projects

Enclosure

EXECUTIVE SUMMARY

Watts Bar Nuclear Plant, Unit 2

This inspection included aspects of engineering activities performed by TVA associated with the Watts Bar Nuclear (WBN) Plant Unit 2 construction project. This report covered a three week period of inspections in the areas of an Independent Design Verification Program (IDVP) inspection and portions of an Electrical Distribution System Functional Inspection (EDSFI) as specified in NRC inspection procedures. The inspection program for Unit 2 construction activities is described in NRC Inspection Manual Chapter (IMC) 2517. Information regarding the WBN Unit 2 Construction Project and NRC inspections can be found at http://www.nrc.gov/reactors/plant-specific-items/watts-bar.html.

Inspection Results

- A Severity Level (SL) IV, Violation of 10 *Code of Federal Regulations* (CFR) Part 50, Appendix B, Criterion III, "Design Control," was identified by the inspectors for Unit 2 engineering calculations that contain statements of electrical circuit breaker interrupt capability that are not supported by an adequate technical basis. (Section E.1.2)

- The inspectors observed a condition in a cable vault in the switchyard where the offsite power supply output cables from the C and D common station service transformers are routed in a common space and the cables crisscross each other. The existing Unit 1 and the proposed Unit 2 FSAR state that these cables are fire wrapped; however, the IB –B 6.9kV Shutdown Board normal and alternate main feeder cables in the cable vault are not fire wrapped. The inspectors also noted that some of the cables are touching each other. The applicable electrical drawing for these cables states that the cables will not touch each other. The NRC will perform additional inspections to determine the acceptability of the cable routing in the cable vault. (Section E.1.2)

- The inspectors could not confirm the technical adequacy and accuracy of various Unit 2 electrical engineering calculations. The EDSFI portion of this inspection reviewed the loading on the various electrical sources e.g. diesels, batteries, shutdown board, etc.; however, the various design documents related to electrical loading were not maintained in concise and understandable manner. The NRC will perform additional inspections to determine the acceptability of the electrical design of Watts Bar 2. (Section E.1.2)

- This inspection concluded that TVA's previously performed Independent Design Inspection was a competent and substantial engineering review activity and the follow-up actions were generally appropriate. (Section E.1.1)

- This inspection completed an IDVP review with a focus on the Essential Raw Cooling Water system and the High Head Safety Injection system. There were no findings of significance. (Section E.1.1)

REPORT DETAILS

II. Management Oversight and Control

E.1 Engineering Activities

E.1.1 Independent Design Verification Program (IDVP) and Design Baseline Verification Program Corrective Action Program (CAP) (IP 93814 & TI 2512/019)

1. Review of TVA's Independent Design Inspection (IDI)

a. Inspection Scope

During September 20 to October 7, 2010, TVA performed an IDI on Watts Bar 2. The purpose of the TVA effort was to support closure of the Design Baseline Verification Program CAP. The IDI inspection plan was very similar to the NRC IDVP inspection procedure. The purpose was to have an independent group of engineers perform a "vertical slice" inspection of the engineering design of two plant systems. The IDI focused on the Residual Heat Removal (RHR) and Component Cooling Water (CCS) systems. The NRC inspectors previously reviewed the resumes of the team members to confirm that they had not had extensive prior involvement in the engineering design of the Watts Bar plant.

The NRC team also reviewed attributes within the RHR system not reviewed under the IDI to ensure that the IDI sample was representative of plant design. The NRC team reviewed applicable portions of the Final Safety Analysis Report (FSAR), system design documents (SDD), component design documents, and drawings to identify design basis requirements for the RHR system for injection and recirculation modes of operation. Calculations were reviewed to determine whether RHR pumps had adequate net positive suction head (NPSH) during operation with suction from the Refueling Water Storage Tank (RWST) or the containment sump. The review included confirmation that the design considered vortex suppression during high discharge rates from the containment sump. Applicable portions of the FSAR, SDD, and system and vendor drawings were reviewed to identify design basis requirements for various active system valves. Design standards and procedures were reviewed to identify the methodology employed for sizing motor operated valve (MOV) operators. Detailed calculations were reviewed for specific double-disc gate valves to verify valve actuators were capable of operating the associated valve under design basis accident line and differential pressures. The reviews included analysis of required valve stem thrust, MOV actuator capability with degraded voltage, weak link, and pressure locking. Valve and actuator vendor manuals and drawings listed in the computerized component databases were reviewed to verify design information and valve and actuator data were available and retrievable. Containment sump arrangement drawings were reviewed to verify inclusion of a screen that divides the containment sump into two separate volumes as required by the FSAR. A walk-down of the area above the containment sump was performed.

The inspectors' review of the IDI final report observed that the listing of areas reviewed did not emphasize evaluation of the instrumentation and controls within the systems reviewed. To verify that the operation of the system conformed to the system description and to the requirements of the FSAR, the inspectors reviewed the controls of selected components in the RHR System, including the RHR pumps and the valves that interface with the High Head Safety Injection System. In particular, the inspectors reviewed the instrumentation and controls for the switchover from the injection phase to the recirculation phase, following a loss of coolant accident (LOCA). Additionally, the inspectors reviewed the environmental qualification of the level transmitters used for the control of the switchover and the surveillance procedure for the same transmitters and other loop components. The inspectors conducted a walk-down of the sump area to evaluate physical arrangement of the sump and the associated instrumentation.

During this inspection, the NRC team reviewed TVA's IDI report and supporting information to evaluate the completeness and adequacy of the IDI results and corrective actions. The inspectors reviewed the status of the PERs written as a result of the IDI to evaluate the adequacy of corrective actions taken by TVA in response to IDI results. Documents reviewed are included in the attachment.

b. Observations and Findings

The inspectors concluded that the IDI inspectors were independent of the Watts Bar plant, they had extensive prior industry experience in various engineering disciplines, and they performed a competent inspection.

RHR System Observations

Section 6.3.2.2 of the FSAR states that the containment sump design does not fully comply with the requirements of Regulatory Guide (RG) 1.82, Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident. This section states the sump was in the advanced stages of design when Rev. 0 of RG 1.82 was issued and provides some rationale why the sump design is satisfactory. This section further states that the containment sump is divided into two separate volumes by a fine ¼-inch mesh screen. The NRC team determined from review of plant drawings that the screen was part of the current sump design for WBN2. The inspectors requested that TVA confirm the WBN2 screen was physically present since construction temporary covering prevented viewing the sump during this inspection. The specific differences regarding RG 1.82 are discussed in the FSAR. TVA stated that in addition to the discussion of the differences in the FSAR, they plan to install an advanced sump strainer that is the subject of ongoing discussions between TVA and the NRC to resolve Generic Safety Issue (GSI) 191, Assessment of Debris Accumulation on PWR Sump Performance. The NRC's construction program for WBN2 has an activity to inspection the installation of the new sump strainer.

The RHR system is part of the Emergency Core Cooling System (ECCS) which provides emergency core cooling and reactivity control during a variety of plant accidents that involve loss of reactor coolant. RHR is a low pressure-high volume system. It starts automatically on a safety injection signal and, during the injection mode, injects borated water from the RWST into the reactor vessel through the cold water leg injection lines. In the recirculation mode, the RHR system provides long term reactor cooling by taking suction from the water accumulated in the containment sump, cools it, and injects it back into the Reactor Coolant System. The switchover occurs when the RWST inventory is nearly depleted and the sump has sufficient water to support recirculation. High containment sump level instrumentation is provided to indicate the capability of the sump inventory to support the recirculation mode.

The inspectors' review of the control logic and wiring schematics for the RHR pumps and the associated suction, discharge, and minimum flow valves determined that such controls were consistent with the system description and the FSAR.

Calculation WBNOSG4-071, Rev. 20, "RWST and Containment RHR Sump Safety Limits and Set Points," addresses available inventory at the time of the switchover and establishes the analytical limits for the level instrumentation. Regarding the upper analytical limit, Section 8.0.B (3) states that it "must be equal to or less than the calculated water level" and that "This limit is the instrument setpoint plus the instrument accuracy coincident with a harsh environment." The licensee properly calculated available water inventory, following a safety injection signal, based upon small and large LOCAs. The analysis concluded that two upper analytical limits exist, one for a small break LOCA (6.0 feet) and one for a large break LOCA (8.0 feet). Regarding the lower analytical limit, the same calculation section states that it "is determined to ensure that a switchover will not occur to a dry sump during a loss of RWST or refueling" and that "This limit is the instrument setpoint minus the instrument accuracy coincident with a harsh environment." For this lower limit, the calculation states that the instrument bellows are located six inches above the containment floor and selects the low analytical limit to be 7" above the containment floor. The calculation also concludes that "the RHR Containment Sump Setpoint can be anywhere between the upper and lower analytical limits."

The purpose of Calculation WBNOSG4-071 was to provide guidance for the selection of the instrument level setpoint. To evaluate the adequacy of the level setpoint, the inspectors reviewed three calculations: a) WCAP-17044-P, Rev. 0, "Westinghouse Setpoint Methodology for Protection Systems – Watts Bar Unit 2;" b) CN-CPS-09-127, Rev. 0, "Watts Bar Unit 2 Containment Sump Level Setpoint and Scaling Document (SSD) Supporting Calculations;" and c) 2-LT-063-0180, Rev. 1, "Demonstrated Accuracy Calculation for Wide Range Containment Sump Level Indication."

Based on a safety analysis limit of 0.5% of the instrument span, 13.4% calculated channel statistical allowance, and 2.2% margin, Table 3.21 of the Westinghouse document indicates that the level trip setpoint should be 16.1% of the span. Since the instruments calibrated span is 0 – 200 inches of water, the stated 16.1% setpoint corresponds to 32.2 inches of water. Additionally, since the instrument bellows are located six (6) inches above the floor, the level setpoint established in the Westinghouse document is 38.2 inches above the floor.

The inspectors' review of the applicable calculations concluded that setting of the high containment sump level and the associated analytical limits were not adequately supported. The inspectors reached this conclusion because none of the three calculations adequately addressed the basis for the analytical limits, particularly for the lower one, and the selected high level setpoint was based on the Westinghouse calculation without demonstrating its adequacy against the analytical limits. The inspectors' observations were documented in PERs 334094 and 334077. This is the first example of an Unresolved Item (URI) 05000391/2011606-01, Electrical Design Issues Requiring Additional Review.

Followup on IDI Corrective Actions

A finding from the IDI involved unverified assumptions (UVAs) in calculations not being tracked in the open item tracking system Watts Bar Integration Task Equipment List

(WITEL) in a consistent way to ensure future closure as required by TVA Engineering Procedure 81, Engineering Document Construction Release, and Procedure 37, Design Calculations.

As a follow-up for the TVA IDI finding, the inspectors reviewed a sample of calculations to determine whether the calculations had identified UVAs and whether these UVAs were being tracked. All the identified UVAs were verified by the NRC team to be tracked in the Calculation Cross-Reference Information System (CCRIS) and WITEL as required by procedure. When a calculation is approved, the fact that it contains one or more UVAs is loaded into the CCRIS system which automatically feeds that information into WITEL.

The inspectors concluded that even though not all individual UVAs were being tracked as specific line items in WITEL, calculations which contain UVAs were appropriately tracked in WITEL. The inspectors found this practice satisfactorily met the requirements in TVA procedures 81 and 37.

Another finding of the IDI was that examples were found where industry operating experience was not being referred to the Unit 2 organization by the Unit 1 Corrective Action Review Board (CARB) as required by procedure. The inspectors reviewed this matter and concluded that there is currently no TVA procedural requirement for the CARB to initiate a PER for an individual operating experience item to be considered for Unit 2 applicability. The inspectors observed there is currently a Unit 2 representative involved in routine operating experience reviews and a sample of PERs resulting from those reviews was found to be acceptable.

Design calculation procedure EDPI 25402-3DP-G04G-00037 indicated that, if a calculation depends upon a sequence in relation to other calculations, design input, etc., prerequisites shall be identified as “Special Requirements/Limiting Conditions” and listed within the calculation to be visible and obvious to organizations outside engineering. Two calculations reviewed by the NRC team were found to list special requirements/limiting conditions, and the team questioned how special requirements are tracked and ultimately satisfied. TVA concluded that the special requirements listed in those calculations were unnecessary and PER 326554 was issued to address the matter. The team observed examples where other special requirements/limiting conditions were being tracked in WITEL.

c. Conclusions

The inspectors concluded that TVA’s IDI was a competent and substantial review of Watts Bar 2 design and related engineering activity. The results of the IDI were appropriate. Numerous PERs were initiated to place the IDI results in the corrective action program. The followup and resolution of these PERs was generally adequate. Based on the limited oversight inspection performed by the NRC team, the findings and conclusions of TVA’s IDI that regulatory requirements have been appropriately addressed for the RHR system appear satisfactory.

2. NRC’s IDVP

A purpose of this inspection was to perform an IDVP team inspection to determine if the design process used for the facility effectively implemented NRC regulations and the applicant's licensing design commitments. The inspectors focused on the Essential Raw Cooling Water (ERCW) system and High Head Safety Injection (HSSI) system.

<u>ERCW System</u>

a. <u>Inspection Scope</u>

The ERCW system is a shared system for Watts Bar Units 1 and 2. The NRC team reviewed applicable portions of the FSAR, SDD, component design specifications, and drawings to identify design basis requirements for ERCW system. The inspectors reviewed design documents to evaluate the consistency of design information and the adequacy of design of the electrical system support for ERCW. The inspectors selected a sample of ERCW components and reviewed their power supply association, physical separation, and control circuits. Vendor test curves for the new ERCW pumps were reviewed to identify head-flow capabilities, NPSH requirements, and maximum horsepower requirements over the range of required pump operation. Calculations were reviewed to determine whether the pumps were capable of providing design basis head/flow requirements during worst case accident scenario. Calculations were reviewed to verify pressure drop and heat removal flow capability for components served by the system. Calculations were also reviewed to verify that the ERCW pump intake elevation was capable of providing necessary pump NPSH during worst case low water level associated with a downstream dam break. Valve and actuator vendor manuals and drawings listed in the computerized component databases were reviewed to verify design information and that data was available and retrievable. System design features aimed at mitigating effects of microbiologically induced corrosion were reviewed.

The inspectors reviewed control logic and schematic wiring diagrams for the traveling screens, the screen wash pumps, the ERCW pumps, and selected valves associated with the ERCW system. The inspectors also addressed environmental qualification of selected components, reviewed the system operating procedures, and evaluated a sample of instrument loop setpoint calculations for the ERCW system. The instrument loops evaluated included the traveling screen differential pressure 0-PDT-67-447 and screen wash pump discharge pressure 2-PS-67-451. Additionally, the inspectors also evaluated the setting of selected thermal control valves associated with cooling of safety related components.

The inspectors reviewed the piping and pipe support design criteria documents for consistency with the Watts Bar licensing criteria specified in the FSAR in addition to good industry design practices. The inspectors chose two (2) pipe stress analysis calculations N3-67-73R and N-67-88A for a detailed review and confirmation that the design requirements contained in the piping and pipe support procedures were being incorporated into the calculations. The piping walk down package (WBN2-PD-067-370-00) for calculation N3-67-73R was reviewed and compared to the current as-built isometric drawing to determine if the walk down information had been incorporated. Items checked for proper consideration were pipe support type and configuration, operational conditions including temperature and pressure, seismic inputs, correct boundary conditions, loading combinations and valve modeling.

The pipe stress analyses selected included connections to the Steel Containment Vessel (SCV). The appropriate calculations were reviewed to ensure that the as-built piping loads were considered in the evaluation of the SCV attachments. Selected pipe support calculations were reviewed to verify that the correct loads from the current as-built piping analysis were utilized. The supports reviewed included supports with integral welded attachments, concrete anchor bolts, embedded plates, and various welded structural shapes.

The ERCW pumps were being replaced with new pumps that have increased capacity. The new pumps were designed to be able to replace the existing pumps without any modification to the attached piping. The pipe stress analysis for the attached discharge piping was reviewed to determine the piping loads that will be applied to the new pumps. The seismic calculation for the new ERCW pumps was reviewed.

The calculations for both the new and existing ERCW pumps were reviewed. The validity of the rigidity assumptions at the boundary anchors was verified. The review included the structural adequacy for the pumps for all loading conditions including piping and seismic loads. The review also included structural support of the pumps including the cast in place concrete anchor bolts. The inspectors verified that the loads on the pumps and the loads on the structure were properly considered and transmitted to structural engineers for structural review.

The team reviewed a plant modification design change notice (DCN) package to verify that important elements of configuration management were addressed. To examine implementation of plant design changes, DCN 56341 was selected for detailed review. This DCN is one of many required to achieve dual unit operation. Among other things, this DCN addressed changing the operational configuration of four ERCW supply valves for the diesel generator coolers. These valves had been de-energized (power removed) to constantly maintain the valves in an open position. In preparation for dual unit operation and to provide more ERCW flow for other components, the DCN changes the configuration so that the valves are normally closed and open on receipt of a diesel start signal.

A selected Operating Experience (OE) issue, applicable to WBN, was reviewed to verify that OE reviews are included in the WBN design review process. The team performed a walk-down of the ERCW pump station to review the physical condition of the equipment and verify nameplate data. The team also witnessed one of eight new ERCW pumps being installed to improve ERCW flow in preparation for dual plant operation.

b. Observations and Findings

The review found no significant design errors with the ERCW system. The as-built drawings agreed with the design input for the mechanical calculations and no discrepancies were identified. The inspectors confirmed adequate electrical independence between redundant ERCW components and adequate physical separation in redundant component cable routing. The inspectors' review of the control logics and schematic wiring diagrams found that the operation of screens, pumps, and valves was consistent with the system description and the description in the FSAR. The setpoint calculations used standard setpoint calculation techniques and no discrepancies were identified. The DCN package appeared complete and contained the various change documents required to update the design basis in the FSAR, SDD, and drawings.

The team determined that the piping and pipe support criteria documents were consistent with the Watts Bar licensing criteria specified in the FSAR. All inputs to the reviewed piping calculations were verified as correct and sources were identified within the calculation. The review indicated that walk-down information was correctly included into the as-built piping isometric. It was determined that the loads from the piping analyses were properly used in the pipe support calculations.

Calculation WCG-1-1010 contains the evaluation of the ERCW pump anchorage. In preparation for this NRC inspection, TVA identified that the calculation had not been revised for the latest pump loads and issued Service Request 331833 to address this issue. TVA reviewed the existing calculation and determined that the concrete anchorage is acceptable for the new ERCW pump anchor bolt loads. The inspectors reviewed this work and found it acceptable.

An important issue addressed in NRC Information Notice (IN) 2007-05 was the failure of material grade 410 stainless steel parts in deep draft vertical raw water cooling pumps. Since this NRC IN was potentially applicable to Watts Bar, DCN 52920, that addresses installation of new ERCW pumps at Watts Bar, was reviewed with specific emphasis on whether past operating experience and lessons learned had been incorporated. Based on review of procurement specifications, pump drawings, and discussion with ERCW pump and system engineers, the NRC team verified that suspect 410 stainless steel material had been removed from the design.

Past operating experience demonstrated that the system with the old pumps did not provide sufficient ERCW flow for dual plant operation. The NRC team verified that the design pump head for the new pumps had increased to 230 ft as compared to 210 ft for the old pumps. This change will increase the overall pump flow capability for the ERCW system.

c. Conclusions

Based on the samples reviewed, the team concluded that the design of the ERCW system was acceptable, implemented NRC regulations and the applicant's licensing design commitments, and is capable of performing its intended safety functions. The inspectors concluded that the ERCW components had adequate electrical independence, physical separation and electrical power availability from both the offsite power supply and the onsite emergency diesel generators. Based on review of calculations and preliminary test curves for the new ERCW pumps, ERCW system design changes should be capable of providing additional ERCW flow required for dual unit operation. ERCW flow balance tests scheduled for later will provide the ultimate confirmation of the flow capability of the ERCW system with new pumps.

HHSI System

a. Inspection Scope

The NRC team reviewed applicable portions of the FSAR, safety injection system (SIS) and chemical & volume control system (CVCS) SDDs, component design specifications, and drawings to identify design basis requirements for the HHSI system. Design documents were reviewed to evaluate consistency of design information and adequacy of the design of the electrical system support for the HHSI system. The inspectors selected a sample of HHSI components in the high head injection path and reviewed their power supply association, physical separation, and control circuits.

The inspectors chose pipe stress calculations N36232A and N36252A for a detailed review and confirmation that the design requirements contained in the piping and pipe support procedures were being incorporated into the calculations. The piping calculations were for the suction and discharge of the HHSI pumps. The team reviewed the seismic calculations for the HHSI pumps including pump anchorage. Calculation WCG-1-1010 was reviewed for anchorage of the HHSI Pump. The team reviewed the design calculation for the RWST for compliance with design criteria specified in the FSAR.

The inspectors reviewed the calculation WBNOSG4071 which analyzed the safety limits, analytical limits, and the level instrumentation and setpoints associated with the RWST. The inspectors also reviewed Calculations CN-SUA-10-2 and 2-LT-063-0060 which addressed the accuracy of the RWST level instrumentation. Additionally, the inspectors reviewed control logic and schematic wiring diagrams for pumps and valves associated with the HHSI system, evaluated environmental qualification of selected components, and reviewed system operating procedures. The inspectors performed a walk-down of the RWST to verify that freeze protection and heat tracing had been installed on the tank and instrumentation.

Drawings were reviewed to confirm the presence of isolation valves for system header piping penetrating containment. Pump curves were reviewed to determine head-flow relationships, NPSH requirements, and maximum horsepower requirements over the range of required pump operation. Calculations were reviewed to determine whether the high head centrifugal charging pumps (CCPs) were capable of providing design basis head/flow during various LOCA scenarios. Calculations were reviewed to verify the CCPs have adequate NPSH during operation with suction on the refueling water storage tank or with suction on the residual heat removal pump discharge. The review included confirmation that the design considered vortex suppression during high discharge rates and low levels in the RWST. Design standards and procedures were reviewed to identify the methodology employed for sizing the MOV operators for selected active system valves. Detailed calculations for specific double-disc gate valves were reviewed to verify actuators were capable of operating the associated valve under design basis accident line and differential pressures. The reviews included analysis for required valve stem thrust, MOV actuator capability with degraded voltage, weak link, and pressure locking. Valve and actuator vendor manuals and drawings listed in the computerized component databases were reviewed to verify design information and data required for calculations and procedures were available and retrievable. No walk-down of this system was performed because key system components including the two CCPs were not installed at the time of this inspection.

b. <u>Observations and Findings</u>

The review found no significant design errors with the HHSI system. The inspectors found a minor inconsistency in the identification of the power supply for one HHSI valve on the electrical schematic diagram. The inspectors confirmed adequate electrical independence between redundant HHSI components and adequate physical separation in redundant component cable routing.

The piping analysis review indicated that the calculations followed the design criteria. All pipe support types and configuration checked were found to be consistent with the information provided on the references documents. The loads on the CCP nozzles were tabulated and compared to the TVA standard allowable nozzle loads for the CCPs. The nozzle loads exceeded the TVA standard allowable nozzle loads and were transmitted to the Civil engineering group for review and are properly identified in the calculation as an unverified assumption. The inspectors determined that the RWST calculations were consistent with the Watts Bar 2 licensing criteria specified in the FSAR.

The inspectors' review of the control logics and schematic wiring diagrams found that automatic operation of pumps and valves was consistent with the system description and the description in the FSAR. However, the inspectors noted that schematic diagrams were not always properly revised to reflect plant changes contained in issued EDCRs. An example involved EDCR 53287-A/FCR 55769-A, EDCR53292/FCR 56127 and EDCR 54870-A, which intended to remove indicating lights in the control circuits of valves 2-FCV-63-39-A and 2-FCV-63-40-B. Associated wiring diagram 2-45W760-63-3 was not properly revised to reflect removal of the indicating lights. If the change had been made to the control circuits using the wiring diagram, it would have created a short circuit that would have prevented the opening and closing of the valves. Another example involved the deletion of local switches for valve 2-FCV-63-11-B per EDCR 54850-A/FCR 56059-A. If the change had been made using wiring diagram 2-45W760-63-5, it would have shorted out manual controls of valve 2-FCV-63-11-B from the control room and shutdown panel. While the inspectors verified that both of these examples involved proposed modifications and that the drawing errors had not been introduced into plant control circuits, they were concerned that the design control process failed to ensure that drawings associated with plant changes were properly revised. The inspectors concluded that, in order to properly evaluate the significance of this problem, additional inspection would be required. This is the second example of electrical issues requiring additional inspection and is identified as URI 05000391/2011606-01, Electrical Design Issues Requiring Additional Review.

The inspectors review of Calculation WBNOBSG4071, "RWST and Containment RHR Sump Safety Limits, Analytical Limits and Set Points," found the sections related to the determination of RWST low and low-low level setpoints to be generally acceptable and consistent with current standards for determination of instrument accuracy. The low-low level setpoint was calculated using an assumed loop accuracy of +/- 5% of the calibrated span and was determined to be 52.4 inches +/- 19.4 inches. In calculating the low level setpoint, the licensee added water volumes based on expected outflow during automatic system actuation and operator actions and using the same assumed 5% loop accuracy.

The review of calculations CN-SUA-10-2, Rev. 0, "Watts Bar Unit 2 RWST Level Setpoint and Scaling Document Supporting Calculation Note," and 2-LT-063-0050, Rev. 0, "PAM Demonstrated Accuracy Calculation for R.G. 1.97 Refueling Water Storage Tank (RWST) Level," confirmed that the assumed 5% accuracy used in the setpoint calculation above was reasonable and identified no areas of concern.

c. Conclusions

Based on the samples reviewed, the team concluded that the design of the HHSI system was acceptable, in accordance with NRC regulations and the applicant's licensing design commitments and is capable of performing its intended safety functions. The drawing errors identified in the instrumentation and control area are an example of an unresolved item concerning design review, requiring future NRC followup. The licensee issued PERs, as appropriate to document these issues in their corrective action program.

The inspectors concluded that the HHSI components in the high head injection path had adequate electrical independence, physical separation and electrical power availability from both the offsite power supply and the onsite emergency diesel generators.

E.1.2 Electrical Distribution System Functional Inspection (EDSFI) Temporary Instruction (TI 2515/107)

a. Inspection Scope

Background: In 1979, the NRC published Generic Letter 79-36 to ask licensees to examine undervoltage protection of safety related electric equipment for potential damage as a result of sustained degraded voltage from the offsite electric grid system. This generic letter was issued in response to events at a number of operating nuclear plants that brought into question the conformance of the station electric distribution system to 10 CFR 50, Appendix A – General Design Criteria – 17, Electric Power Systems. Temporary Instruction 2515/107 – EDSFI was issued on October 19, 1990 to provide a comprehensive NRC team inspection focused primarily on the Electrical Distribution System (EDS) at operating nuclear plants to address the concerns raised by Generic Letter 79-36. This inspection performed a portion of TI 2515/107 at Watts Bar 2.

The inspectors reviewed the applicant's engineering drawings, calculations, reports, testing information, maintenance procedures, and electrical system studies to assess the capacity of the EDS to perform its intended functions during all plant operating and accident conditions. The inspectors interviewed responsible engineering staff to address NRC questions generated from the review of the engineering documentation. The inspectors reviewed surveillance and test procedures for vital battery banks, DC system components, and circuit breakers.

Using the guidance of TI 2515/107, the inspectors examined the electrical distribution path supplying Shutdown Board 2B-B. The inspectors reviewed available design basis information and conducted plant walk-downs to assess the capacity of the electrical distribution system to perform its safety functions.

b. Observations and Findings

The drawings reviewed by the inspectors were in agreement with regulatory requirements, licensing commitments and applicable industry standards. The configuration identified in the drawings matched the actual configuration of the equipment examined. The capacity and characteristics identified in the drawings match those indicated in the nameplate information for the equipment reviewed. The inspectors determined that Diesel Generator flow diagrams for cooling water, starting air, fuel oil, and lube oil systems adequately represent the installed equipment for proper configuration and component capacities.

The inspectors found the 6.9kV Shutdown Board 2B-B, Common Station Switchgear D, and Diesel Generator 2B-B all operating at appropriate voltage levels. The 6.9kV switchgear short-circuit withstand ratings are 39,500 amps or 500 MVA, which is greater than available grid capabilities. There are identified exceptions for 6.9 kV breakers used in Reactor Coolant Pumps (RCP) boards and these situations are addressed within the calculations. The frequency at this voltage and equipment configuration is maintained at a steady 60 cycles per second (Hertz) as determined by the off-site distribution grid. Loading of these switchgears and service transformers is within their rating.

Based on equipment walk-downs, the inspectors noted that the installed configuration of the electrical distribution system corresponds to the design requirements and facility documents. The inspectors verified, on a sampling basis, that equipment ratings are adequate and that testing of circuit breakers and distribution components are being performed for 480 volts and 6.9kV equipment. The inspectors verified that vital battery monitoring consisting of voltage measurements, visual inspections, and connection resistance measurements are performed on a regular schedule.

The battery performance tests measure the remaining capacity in each battery compared to the battery rating at 77 degrees F. The battery performance capacity tests are performed every 5 years until either: 1) the batteries reach 85% of design life; 2) the measured capacity drops below 90%; or 3) the capacity drops more than 10% from the previous capacity test. If any of the three conditions are met, the frequency changes to an annual test. The inspectors observed that safety-related batteries III and IV and spare battery V were installed in 1995 and are due to change the frequency of the performance test from every 5 years to every year before the Unit 2 scheduled startup in 2012. Battery I capacity was recorded as 90%. The performance test must be performed on an annual frequency when the battery capacity drops below 90%.

During any battery discharge, the voltage at the terminals of the battery will drop. Upon restoration of the battery charger, the charging voltage will be above the discharge voltage of the battery. The difference in voltage will cause the battery charger to go into its current limit mode. At Watts Bar, the current limit is set at 125% of the nameplate rating of the battery charger. The inspectors found that the diesel generator loading calculations did not consider the battery charger load to be at current limit. The inspectors concluded that in order to properly evaluate the significance of the diesel generator loading calculation not including worst-case electrical loads additional inspection would be required. This is the third example of electrical issues requiring additional inspection and is identified as URI 05000391/2011606-01, Electrical Design Issues Requiring Additional Review.

Battery charger calculations were not up-to-date to include information on the performance capability of the new battery chargers. The calculations for the chargers do not establish agreement between system load at the output of the charger and the required ampacity output to achieve battery recharge time limits of 12 hours for a 30 minute battery discharge condition or 36 hours for a 4 hour battery discharge condition as stated in the FSAR. Additional inspection is required to determine the adequacy of the battery charger calculations. This is the fourth example of electrical issues requiring additional inspection and is identified as URI 05000391/2011606-01, Electrical Design Issues Requiring Additional Review.

The electrical power system voltage drop calculations reviewed by the inspectors address minimum DC voltage requirements to operate individual components, short circuit current rating, battery sizing, cable sizing, load sequencing, and load profiles. The inspectors determined that separate calculations were developed for Unit 1 and Unit 2 independently. However, those calculations have not been merged to address multi-unit load analysis assuming a postulated accident in one unit and the simultaneous capability to safely shutdown the second unit. After TVA has finished updating these calculations to address two-unit operation, they will be reviewed during the EDSFI follow-up inspection.

The inspectors reviewed 125V DC Vital Battery System Analysis calculation EDQ00023620070003, Rev. 10 and associated ETAP Calculation WBN EEB-EDQ-000-236-2007-0003, Rev. 0. Both documents calculate battery loading profiles and total amp-hour discharge for the individual battery strings. However, the inspectors noted that the results of these two calculations did not appear to match. Calculation EDQ00023620070003 does not consider aging nor temperature deratings which are applied in the ETAP calculations. The inspectors noted that even when applying the ETAP calculation aging and derating factors to calculation EDQ00023620070003, the resulting total amp-hour values do not match between the two calculations. The inspectors concluded that in order to properly evaluate the adequacy of these two 125V DC vital battery calculations, additional inspection would be required. This is the fifth example of electrical issues requiring additional inspection and is identified as URI 05000391/2011606-01, Electrical Design Issues Requiring Additional Review.

The inspectors found that the time-current curve used for the protective relays for the Unit 2 6600V motors used a GE Multilin digital relay curve to replicate the GE IAC and IFC electromechanical relays. The correlation between the IAC/IFC time-current curves with the Multilin curves had not been included in the calculation. The inspectors determined that in order to properly evaluate the usage of time-current curves for relay analysis additional inspection would be required. This is the sixth example of electrical issues requiring additional inspection and is identified as URI 05000391/2011606-01, Electrical Design Issues Requiring Additional Review.

The inspectors observed a condition in a cable vault in the switchyard where the offsite power supply outputs from the C and D common station service transformers (CSSTs) are routed through a common space and the cables crisscross each other. The existing Unit 1 and the proposed Unit 2 FSARs, page 8.2-15 states that the cables in the cable vault are fire wrapped. However, the inspectors observed that all the cables are not fire wrapped. Specifically the inspectors noted that the 1B-B 6.9kV Shutdown Board normal and alternate main feeder cables were not fire wrapped. The inspectors also noted that some of the cables in the vault are touching each other which is contrary to specifications of plant drawing 45W3000.

The inspectors were concerned that routing both redundant offsite power paths through a common cable vault may not meet 10CFR 50 Appendix A, General Design Criteria 17. Specifically, Criteria 17 requires that electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. The inspectors concluded that in order to properly evaluate the adequacy of the separation for the two independent offsite power supplies and whether General Design Criteria 17 of 10CFR50 Appendix A is satisfied, additional inspection would be required. This is the seventh example of electrical issues requiring additional inspection and is identified as URI 05000391/2011606-01, Electrical Design Issues Requiring Additional Review.

The inspectors found that the CCP motor performance curve indicated the CCP would accelerate to full speed within 6 seconds at 100% of rated voltage and 9.5 seconds at 80% of rated voltage. The sequence step loading of the diesel generator has the safety injection pump coming on 5 seconds following start of the CCP. This would result in a minimum overlap of one second and the overlap could be higher based on the tolerances of the timing relays that sequence diesel generator loading. Based on questions from the inspectors and TVA's responses, it appears that the overlap starting of two motors and the effect it could have on the diesel generator has not been analyzed. The inspectors concluded that in order to adequately evaluate whether diesel generator loading has been properly analyzed additional inspection would be required. This is the eighth example of electrical issues requiring additional inspection and is identified as URI 05000391/2011606-01, Electrical Design Issues Requiring Additional Review.

Diesel generator transient loading could not be confirmed for the first 60 seconds of operation following a loss of offsite power (LOOP) event and a concurrent LOCA. The summary of results in calculation EDQ000-999-2008-0014 appears to be missing the following information:

- Data provided on motor starting characteristics does not appear to include all safety injection equipment motor starting currents in the sequence indicated for the first 60 seconds of operation.
- There is incomplete information provided on the loads supported by the two 2000 KVA 480V Shutdown Boards 2B1-B & 2B2-B. Information on the timing for these loads to be applied on the generators is not specifically clear but time sequence information in the calculations identifies these loads as being applied at time 0 seconds or instantaneously.
- The diesel generator loading calculations do not including the battery chargers loaded to their current limit levels following a battery discharge.
- The calculations are not clear in identifying the method used to determine peak transient loads and steady state loads.

Regarding diesel generator loading, TVA calculations do not provide sufficient details on LOCA and loss of offsite power loading to allow verification that the generator capacity ratings are not exceeded. The Unit 2 FSAR, page 8.3-17, includes a diesel generator continuous rating at 4400 kW, a two (2) hour rating at 4840 kW, a "cold engine" rating for the first three (3) minutes at 4785 kW, and "hot engine" rating of 5073 kW, which is more than 110% of nominal rating for the diesel generators. The Unit 1 FSAR page 8.3-20 has the same continuous and 2 hour ratings and different larger values marked as "Historical Information". The inspectors asked for the technical basis for these higher ratings and were provided a 1994 letter from a diesel generator vendor endorsing Revision 0 of the above listed TVA calculation which derived the higher ratings from a unit conversion of the engine horsepower. The inspectors questioned if this was an adequate basis to increase the vendor ratings of the diesel generators.

The inspectors concluded that in order to properly evaluate the diesel generator transient loading analysis and adequacy of TVA's stated diesel generator load capability additional inspection would be required. This is the ninth example of electrical issues requiring additional inspection and is identified as URI 05000391/2011606-01, Electrical Design Issues Requiring Additional Review.

The inspectors identified the following non-cited violation (NCV):

<u>Introduction</u>: On March 4, 2011, the inspectors identified a violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," for failure to establish design control measures to assure that the design basis for those structures, systems, and components covered by Appendix B are correctly translated into specifications, drawings, procedures and instructions.

Description: The inspectors examined specifications for B train shutdown boards and transformers. The inspectors determined that molded case circuit breakers, ITE model EF3 – 14kA at 480VAC, which are used in Motor Control Centers, have a potential short circuit current in excess of their interrupting rating. Calculation EDQ00299920080004 "480V Class 1E Protection, Coordination and Thermal Overload heater Calculation – Unit 2," Rev. 12 states in section 5.1.8 that "The EF3 and FJ3 breakers have an effective interrupting rating of 22kA if used with a motor starter assembly." The same words are repeated in section 5.1.8 of Calculation WBNEEBMSTI080008, "480V 1E Coordination/Protection," Rev. 141. Calculation WBN-EEB-ED-Q000-999-2007-0002, "AC Auxiliary Power System Analyses," Rev. 18, attachment 11.3.e, lists multiple instances where this model breaker is used in applications with an available short circuit current that exceed the manufacturer's rating of 14kA. The inspectors asked for a technical basis for the 22kA interrupting rating. They were given a 1990 letter from an equipment vendor referencing a phone conversation. The letter stated that some circuit breaker type combination starters had been tested at 480V for 22kA short circuit interruption in August 1979, however, the attached data sheet did not refer to ITE model EF3 breakers. The inspectors found this letter to be an insufficient technical basis to upgrade the interrupting rating of this model breaker above that supplied by the vendor of the breaker. The applicant issued PER 352247 to address this issue identified by the NRC inspectors.

The inspectors determined that this issue was more than minor in accordance with Inspection Manual Chapter (IMC) 2517, because it represents an inadequate process, procedure, or quality oversight function which, if left uncorrected, could adversely affect the quality of analysis of a safety-related component. The finding was of very low safety significance because of the very low probability of a short circuit incident that would exceed the manufacture's rating actually occurring. The inspectors did not identify a cross-cutting aspect with regard to the apparent cause of this finding.

Enforcement: 10 CFR 50, Appendix B, Criterion III, "Design Control," states that measures shall be established to assure that the design basis, as defined in 10 CFR50.2 for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures and instructions.

Contrary to the above, as of March 4, 2011, Calculation EDQ00299920080004 "480V Class 1E Protection, Coordination and Thermal Overload heater Calculation – Unit 2, Rev. 12 and WBNEEBMSTI080008, 480V 1E Coordination/Protection, Rev. 141, and other engineering documents contain the statement that "The EF3 and FJ3 breakers have an effective interrupting rating of 22kA if used with a motor starter assembly." A sufficient technical basis was not provided for this statement and the resulting increase in the interrupting rating from the vendor specified value of 14 kA. These calculations reflect that this model of breaker is used in applications where short circuit currents could reach as high as 17.3 kA.

Because this was a SL IV violation and it was entered into the applicant's corrective action program, this violation is being treated as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy, NCV 05000391/2011606-02; Failure to Provide an Adequate Technical Basis for an Increase in Circuit Breaker Interruption Rating.

c. Conclusions

This purpose of this inspection was to review the loading on the various electrical sources e.g. diesels, batteries, shutdown board, etc. However, the inspectors could not complete this inspection satisfactorily because TVA was unable to provide adequate information to resolve the inspector's questions. The inspectors determined that in general the calculations were not sufficiently detailed such that a person technically qualified in the subject could review and understand the analyses and verify the adequacy of the results without additional information. TVA did not present that information together in concise and understandable documentation. There are numerous electrical design items that require further NRC review including review of loading on the diesel generators and the safety related batteries during design basis events concurrent with the loss of off-site power.

An NCV of 10 CFR50 Appendix B, Criteria III Design Control was identified for crediting ITE model EF3 molded case circuit breakers in calculations with an interrupting capacity of 22KA without sufficient technical basis.

V. Management Meetings

X.1 Exit Meeting Summary

On March 4, 2011, the inspectors presented the inspection results to Mr. Ed Freeman and other members of his staff. Although some proprietary information may have been reviewed during the inspection, no proprietary information was included in this inspection report. The inspectors stated that further NRC inspection will be needed to confirm the adequacy of the electrical design. Subsequently on April 6, NRC contacted TVA by phone and conducted another exit meeting to describe the results of the inspection and that a NCV for the EF3 molded case circuit breakers interrupting capacity would be issued. TVA representatives stated that they did not agree that the violation was valid.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Applicant personnel

J. Adair, TVA Oversight
G. Arent, General Manager NGDC, TVA
A. Bangalore, Electrical Design Manager, Bechtel
R. Baron, Unit 2 Nuclear Assurance Project Manager, TVA
A. Broussard, Bechtel Site Manager
D. Charlton, Licensing, TVA
P. Cox, Electrical Design Engineer, Bechtel
B. Crouch, Unit 2 Licensing Manager, TVA
J. Curns, Electrical Design Engineer, Bechtel
W. Elliott, TVA Oversight
E. Freeman, Unit 2 Engineering Manager, TVA
R. Goines, Mechanical Engineer Lead, Bechtel
D. Haggerty, Project Engineer, Bechtel
D. Helms, Mechanical Design Engineer, TVA
S. Hilmes, Unit 2 Lead Electrical Engineer, TVA
J. Inglis, Mechanical Calculations Engineer, Bechtel
J. Iqbal, Plant Design Engineer, Bechtel
M. Johnson, MOV Engineer, TVA
V. Kapoor, Plant Design Lead, Bechtel
I. Khan, Electrical Engineer, Washington Group
D. Malone, Unit 2 Quality Assurance, TVA
K. Moore, Licensing Liason Engineer, Bechtel
D. Needham, Electrical Field Engineer, Bechtel
K. Peterman, Mechanical Calculations Group Leader, Bechtel
B. Perkins, Civil Engineer, Bechtel
T. Raley, I&C Engineer, Bechtel
J. Schlessel, Unit 2 Construction Manager, TVA
R. Schmook, Operations Shift Manager, Bechtel
R. Schouggins, Mechanical Engineer, Bechtel
G. Scott, Licensing, TVA
J. Smith, Pump Engineer, Bechtel
R. Smith, Engineering Manager, Bechtel

INSPECTION PROCEDURES USED

IP 93814, Independent Design Verification Program (IDVP)

TI 2515/107, Electrical Distribution System Functional Inspection (EDSFI)

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

05000391/2011606-01	URI	Electrical Design Issues (SectionE.1.1 & E.1.2)
05000391/2011606-02	NCV	Crediting ITE model EF3 molded case circuit breakers in calculations with an interrupting capacity of 22KA without sufficient technical basis.(Section E.1.2)

Discussed

2515/107	TI	Electrical Distribution System Functional Inspection

Closed

93814	IP	Independent Design Verification Program (IDVP)

LIST OF DOCUMENTS REVIEWED

Problem Evaluation Reports

261531 EDCR 53171A was closed without closing UVAs in associated stress calculations
261915 Operating experience not evaluated for Unit 2
262878 Typo in procedure TI-404
261932 Failure to coordinate with Plant Design group prior to issuing EDCR
261413 Failure to sign stress calculation prior to issuing EDCR.
261412 Wrong valve weight in issued stress calculation
260927 WITEL item coded 99 vs 35
257776 E-mail used to address HFE checklist in EDCR
257752 E-mail from vendor used as design input
256168 System description error on valve design pressure
255656 Error in system description design pressure value

Problem Evaluation Reports Generated During This Inspection

332015 NRC questioned P and R cable separation inside conduit vault
325122 Minor errors in electrical drawings
326554 NRC identified un-necessary special requirements were added to two calculations
334073 NRC identified that MOV calculation failed to document an unverified assumption
332162 NRC inspector noted that PER Actions were closed inappropriately
261531 (Supplement) EDCR 53171A was closed without closing UVAs in associated stress calculations
334082 NRC identified failure to account for battery charger current limiting mode in diesel loading calculation
334092 NRC identified ETAP Star plot for protective relays needs to be validated with vendor supplied
334070 Electrical drawing discrepancies
334094 No technical basis for assumed 15% instrument error in RWST setpoint calculation WBNOSG4071
332715 No technical basis for containment sump setpoint instrument accuracies
335955 reviewed Calculation WCG-1-1010 to determine that concrete anchorage is acceptable for new ERCW pump anchor bolt loads
352247 ITE EF3 Molded case circuit breaker interrupting capacity questioned

LIST OF DOCUMENTS REVIEWED FOR IDI FOLLOWUP

QA Audits and Surveillances

25402-WBN-SR-10-1304
Engineering Document Construction Release (EDCR)

EDCR 53554, Rev. A,“Install power and control cables for Flow control Valves 2-FCV-67-89-A, 2-FCV-67-97-A, 2-FCV-67-105-B, 2-FCV-67-113-B,”

LIST OF DOCUMENTS REVIEWED FOR IDVP

LIST OF DOCUMENTS REVIEWED FOR RHR

Calculations

MDQ00106320060110, Rev. 2, CCP, SIP, CSP, and RHR Pump NPSH Evaluation
MDQ00107220060104, Rev. 0, Containment Spray System Hydraulic Analysis
TDI-6010-06, Rev. 4, Sump Strainer Total Head Loss – TVA/Watts Bar Nuclear Plant
CN-CPS-09-127, Rev. 0, Watts Bar Unit 2 Containment Sump Level Setpoint and Scaling Document (SSD) Supporting Calculations
CN-SUA-10-2, Rev. 0, Watts Bar Unit 2 RWST Level Setpoint and Scaling Document (SSD) Supporting Calculation Note
EDQ00299920100002, Rev. 0, Essentially Mild Calculation for ASCO Solenoid Valves
EDQ00299920100006, Rev. 0, Essentially Mild (EM) Calculation for Unit 2 Limitorque Actuators
WBN-EM-58, Rev. 14, Essentially Mild Calculation Elevation 692 Room A7, A25
WBN-EM-71, Rev. 14, Essentially Mild Calculation Elevation 692 Room A1
WBNOSG4071, Rev. 20, RWST and Containment RHR Sump Safety Limits, Analytical Limits and Set Points
WCAP-17044-P, Rev. 0, Westinghouse Setpoint Methodology for Protection Systems – Watts Bar Unit 2
2-LT-063-0180, Rev. 1, Demonstrated Accuracy Calculation for Wide Range Containment Sump Level Indication
2-LT-063-0050, Rev. 0, PAM Demonstrated Accuracy Calculation for R.G. 1.97 Refueling Water Storage Tank (RWST) Level

Drawings

2-47W810-1, Rev. 4, Flow Diagram Residual Heat Removal
48N918, Sht. 2, Rev. 5, WBN Unit 2 Miscellaneous Steel Sump Liner
48N919, Sht. 2 and 3, Rev. 15, WBN Unit 2 Miscellaneous Steel Sump Liner
53580-402, Rev. 5, DRA for 48N918
53580-414, Rev. 15, DRA for 48N919
2-45W760-74-1, Rev. 2, Wiring Diagrams Residual Heat Removal System Schematic Diagrams
2-45W760-74-2, Rev. 1, Wiring Diagrams Residual Heat Removal System Schematic Diagrams
2-45W760-74-3, Rev. 1, Wiring Diagrams Residual Heat Removal System Schematic Diagrams
2-45W760-270-2, Rev. 0, Wiring Diagram Miscellaneous System Schematic Diagram
2-47W611-74-1, Rev. 2, Electrical Logic Diagram Residual Heat Removal System
2-47W611-74-2, Rev. 1, Electrical Logic Diagram Residual Heat Removal System

Licensing and Design Basis Documents

FSAR (Section 6.0, 9.0)
NUREG-0847, Supplement 22, Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2, Section 3.11
Watts Bar, Unit 1, Technical Specification Section 3.3.2, Table 3.3.2-1 and Technical Bases

System Descriptions

WBN2-74-4001, Rev. 3, System Description for Residual Heat Removal System
WBN2-63-4001, Rev. 1, Safety Injection System Sys 63

Miscellaneous

Memo Arnold to File, Sequoyah and Watts U1 and U2 RWST Vortex Test 11/19/1976
127424, Ingersoll-Rand Pump for RHR 2B-B dated 10/2/1975
127425, Ingersoll-Rand Pump for RHR 2A-A dated 10/3/1975
Certificate of Compliance for ASCO Part Nos.206-380-2RU and 206-380-2RVU
DS-M18-14-1, Revision 1, Design Standard for Environmental Qualification of Electrical Equipment in Harsh Environments
Performance Curves for Centrifugal Charging Pump, Safety Injection Pump, Residual Heat Removal Pump, and Containment Spray Pump
WB-DC-40-54, Rev. 4, Environmental Qualification to 10CFR50.49
WBNEQ-ILT-002, Rev. 5, Environmental Qualification Documentation Package – Gulton/Statham Transmitters
WBNEQ-MOV-001, Rev. 18, Environmental Qualification Documentation Package – Limitorque Motorized Valve Operators with Type RH Insulated Motor
WBNEQ-MOV-001-52796, Rev. 0, Change Supplement to Environmental Qualification Documentation Package – Limitorque Motorized Valve Operators with Type RH Insulation
WBNEQ-MOV-001-54850, Rev. 0, Change Supplement to Environmental Qualification Documentation Package – Limitorque Motorized Valve Operators with Type RH Insulation
WBNEQ-MOV-001-54903, Rev. 0, Change Supplement to Environmental Qualification Documentation Package – Limitorque Motorized Valve Operators with Type RH Insulation
WBNEQ-SOL-005, Rev. 27, Environmental Qualification Documentation Package – ASCO Solenoid Valves Model 206-380 Series.
WBNEQ-SOL-005-53986, Rev. 0, Change Supplement to Environmental Qualification Documentation Package – Asco Solenoid Valves Model 206-380 Series.
WBNEQ-SOL-005-54903, Rev. 0, Change Supplement to Environmental Qualification Documentation Package – Asco Solenoid Valves Model 206-380 Series.
Work Order 08-821143-000, 09/02/09, 18 Month Channel calibration Containment Sump Level Channel I, Loop 1-LPL-63-180 (L-920)

Procedures

2-TSD-63-5, Rev. 1, WB2 Safety Injection System Integrated Test: Pump/Valve Logic Test
2-SOI-74.01, Rev. 0, System Operating Instructions – Residual Heat Removal System
1-SI-63-1, Rev. 10, 18 Monthly Channel calibration Containment Sump Level Channel I, Loop 1-LPL-63-180 (L-920)

LIST OF DOCUMENTS REVIEWED FOR ERCW

System Descriptions

WBN2-67-4002, Rev. 1, NPG System Description Document, Essential Raw Cooling Water System, System 67

Drawings

1-45W760-67-2, Rev. 15, Essential Raw Clg Water Sys, Schematic Diagrams
1-45W760-212-2, Rev. 12, 480V Shutdown Power Schematic Diagrams
1-45W760-212-4, Rev. 16, 480V Shutdown Power Schematic Diagrams
1-47W845-2, Rev. 69, Mechanical Flow Diagram ERWC System
1-47W845-5, Rev. 32, Mechanical Flow Diagram ERWC System

1-47W845-7, Rev. 14, Mechanical Flow Diagram ERWC System
2-47W845-2, Rev. 0, Essential Raw Cooling Water System
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CCP	Centrifugal Charging Pump
CCRIS	Calculation Cross-Reference Information System
CFR	Code of Federal Regulations
CSST	Common Station Service Transformer
CVCS	Chemical and Volume Control System
DCN	Design Change Notice
EDCR	Engineering Document Construction Release
EDSFI	Electrical Distribution System Functional Inspection
ERCW	Emergency Raw Cooling Water System
FSAR	Final Safety Analysis Report
GL	Generic Letter
HHSI	High Head Safety Injection System
HVAC	Heating, Ventilation, and Air Conditioning
IDI	Independent Design Inspection
IDVP	Independent Design Verification Program
IMC	Inspection Manual Chapter (NRC)
IN	NRC Information Notice
IP	Inspection Procedure (NRC)
IR	Inspection Report (NRC)
LOCA	Loss of Coolant Accident
LOOP	Loss of Offsite Power
MCC	Motor Control Center
MOV	Motor-Operated Valve
NCV	Non-Cited Violation
NDE	Non-Destructive Examination
NPG	Nuclear Power Generation
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
NRR	NRC Office of Nuclear Reactor Regulation
OE	Operating Experience
PER	Problem Evaluation Report
QA	Quality Assurance
QC	Quality Control
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR	Residual Heat Removal System
RPV	Reactor Pressure Vessel
RWST	Refueling Water Storage Tank
SCV	Steel Containment Vessel
SDD	System Design Document
SI	Safety Injection
SIS	Safety Injection System
SL	Severity Level
SR	Service Request
SSD	Setpoint and Scaling Document
TI	Temporary Instruction (NRC)
TVA	Tennessee Valley Authority
URI	Unresolved Item

UVA	Unverified Assumption
VIO	Violation
WBN	Watts Bar Nuclear Plant
WITEL	Watts Bar Integration Task Equipment List