UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
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ATLANTA, GEORGIA 30303-1257

June 13, 2012

Mr. Joseph W. Shea
Manager, Corp. Nuclear Licensing Programs
Tennessee Valley Authority
1101 Market Street, LP 4B-C
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT - NRC COMPONENT DESIGN BASES INSPECTION - INSPECTION REPORT 05000390/2012008

Dear Mr. Shea:

On, May 15, 2012, U. S. Nuclear Regulatory Commission (NRC) completed an inspection at your Watts Bar Nuclear Plant, Unit 1. The enclosed inspection report documents the inspection results, which were discussed on May 15, 2012, with Mr. David Gronek and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your licenses. The team reviewed selected procedures and records, observed activities, and interviewed personnel.

This report documents three NRC identified findings of very low safety significance (Green), which were determined to involve violations of NRC requirements. The NRC is treating these violations as non-cited violations consistent the NRC Enforcement Policy. If you contest these non-cited violations, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-001; 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 Resident Inspector at Watts Bar. Further, if you disagree with the cross-cutting aspect assigned to any finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region II, and the NRC Resident Inspector at Watts Bar. The information you provide will be considered in accordance with Inspection Manual Chapter 0305.

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/

Rebecca Nease, Chief
Engineering Branch 1
Division of Reactor Safety

Docket No. 50-390
License No. NPF-90

Enclosure:
Inspection Report 05000390/2012008,
w/Attachment: Supplemental Information

cc w/encl: (See page 3)

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos: 050000390

License Nos: NPF-90

Report Nos: 05000390/2012008

Licensee: Tennessee Valley Authority (TVA)

Facility: Watts Bar Nuclear Plant, Unit 1

Location: Spring City, TN 37381

Dates: January 30 – May 15, 2012

Inspectors: P. Higgins, Senior Reactor Inspector (Lead)
J. Eargle, Reactor Inspector
D. Mas-Penaranda, Reactor Inspector
R. Lewis, Resident Inspector
J. Dymek, Reactor Inspector
H. Campbell, Accompanying Personnel
G. Skinner, Accompanying Personnel

Approved by: Rebecca Nease, Chief
Engineering Branch 1
Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000390/2012-008; 01/30/2012 – 05/15/2012; Watts Bar Nuclear Plant, Unit 1; Component Design Bases Inspection.

This inspection was conducted by a team of five Nuclear Regulatory Commission (NRC) inspectors from Region II, and two NRC contract personnel. Three Green non-cited violations (NCV) were identified. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using the NRC Inspection Manual Chapter (IMC) 0609, "Significance Determination Process," (SDP). Findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," (ROP) Revision 4, dated December 2006.

NRC identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

- Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," for failure to perform capacity (volumetric flow) testing on the safety-related auxiliary control air subsystem (ACAS). The licensee had documented that, for worst case environmental conditions, the air compressor capacity had little margin when compared to required air demand, even for single unit operation. This issue was entered into the licensee's corrective action program as problem evaluation report 501941 for further evaluation of corrective actions.

  The team determined that the failure to perform capacity testing to ensure the ACAS would meet the required air demand in response to a design basis event was a performance deficiency. This performance deficiency was more than minor because it affected the mitigating systems cornerstone attribute of equipment performance to ensure the availability, reliability, and capability of safety systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee failed to develop a test procedure that would reliably ensure that the ACAS would meet required air demand for its safety-related loads during design basis accidents. The team performed a phase one significance determination process screening and determined the finding to have very low safety significance (green) utilizing the mitigating systems cornerstone column of IMC 0609, Attachment 4, "Phase 1-Initial Screening and Characterization of Findings." The inspectors determined that the finding had a cross- cutting aspect in the use of conservative assumptions in the decision-making component of the human performance area. Specifically, the licensee did not use conservative assumptions in making the decision to discontinue capacity testing of the ACAS system in 2002, and stated that if that decision had been made more recently (using available internal guidance and practices regarding the testing of safety-related systems), the resulting decision would have been the same [H.1(b)]. [Section 1R21.2.4]

- Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," for the licensee's failure to establish a test program that demonstrated the adequacy of the auxiliary feedwater (AFW) discharge check valves. Specifically, the licensee failed to develop a test program that would provide assurance that back leakage through the AFW discharge check valves would not prevent the system from providing design flowrates to the steam generators. This issue was entered into the licensee's corrective action program as problem evaluation report 499950. The licensee performed a functional evaluation and determined that the AFW system was operable based on the pumps not currently being degraded to the design limits, and the existence of additional conservatisms in the licensee's design basis hydraulic analysis.

  The team determined that the licensee's failure to establish a test program to ensure that back leakage through the AFW discharge check valves would not challenge the ability of the AFW system to provide design basis flow to the steam generators was a performance deficiency. The performance deficiency was more than minor because if left uncorrected, it could have the potential to lead to a more significant safety concern. Specifically, AFW check valve back leakage could challenge the system's ability to support removal of decay heat from the reactor, which would not be identified by the licensee's test program. The team performed a phase one significance determination process screening and determined the finding to have very low safety significance (green), utilizing the mitigating systems cornerstone column of IMC 0609, Attachment 4, "Phase 1-Initial Screening and Characterization of Findings." Because the licensee performed a self-assessment in December 2011 that included missed opportunities to identify that check valve leakage could negatively impact the AFW system, this finding was assigned a cross-cutting aspect in the self- and independent assessments component of the problem identification and resolution area [P.3 (a)]. [Section 1R21.2.6]

- Green. The team identified five examples of a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to correctly translate vendor specifications and design calculations into maintenance and surveillance procedures. The five examples were entered into the licensee's corrective action program.

  The inspectors determined that the failure to correctly translate vendor specifications and design calculations into maintenance and surveillance procedures, was a performance deficiency. The performance deficiency was more than minor because it affected the mitigating systems cornerstone attribute of design control, and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. In addition, the finding is similar to Inspection Manual Chapter 0612, Appendix E (example 4.a), because the failure to ensure correct translation of acceptance criteria into procedures was not isolated. The team performed a phase one significance determination process screening and determined the finding to have very low safety significance (green) utilizing the mitigating systems cornerstone column of IMC 0609, Attachment 4, "Phase 1-Initial Screening and Characterization of Findings." This finding had a cross-cutting aspect in the resources component of the human performance

area, because the licensee had not ensured that complete, accurate, and up-to-date procedures were consistent with vendor and design specifications; and therefore, the procedures were not available and adequate to assure nuclear safety [H.2(c)]. [Section 1R21.2.9]

Licensee-Identified Violations

None

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity

1R21 Component Design Bases Inspection (71111.21)

.1 Inspection Sample Selection Process

The team selected risk significant components and related operator actions for review using information contained in the licensee's probabilistic risk assessment. In general, this included components and operator actions that had a risk achievement worth factor greater than 1.3 or Birnbaum value greater than 1 $X10^{-6}$. The sample included 15 components, including one associated with containment large early release frequency, and four operating experience items.

The team performed a margin assessment and a detailed review of the selected risk-significant components and operator actions to verify that the design bases had been correctly implemented and maintained. Where possible, this margin was determined by the review of the design basis and Updated Final Safety Analysis Report (UFSAR) response times associated with operator actions. This margin assessment also considered original design issues, margin reductions due to modifications, or margin reductions identified as a result of material condition issues. Equipment reliability issues were also considered in the selection of components for a detailed review. These reliability issues included items related to failed performance test results, significant corrective action, repeated maintenance, maintenance rule status, Regulatory Issue Summary 05-020 (formerly Generic Letter 91-18) conditions, NRC resident inspector input regarding problem equipment, system health reports, industry operating experience, and licensee problem equipment lists. Consideration was also given to the uniqueness and complexity of the design, operating experience, and the available defense-in-depth margins. An overall summary of the reviews performed and the specific inspection findings identified is included in the following sections of the report.

.2 Component Reviews

.2.1 Essential Raw Cooling Water (ERCW) Discharge Check Valves (CKV-67-503F, -503H)

a. Inspection Scope

The team reviewed applicable portions of the plant's UFSAR, Technical Specifications (TS), system description document (SDD), and piping and instrumentation diagrams (P&IDs) to identify the design bases requirements of the ERCW check valves. The team examined system health reports, records of surveillance testing and maintenance activities, and applicable corrective actions to verify that potential degradation issues were being monitored, prevented and/or corrected. The team performed a walkdown of the ERCW system to review the installed configuration of the pumps, associated piping and check valves. Discussions with system and design engineers were conducted regarding pump and check valve design and performance requirements. A review of

ERCW pump curves and inservice testing procedures was used to evaluate potential back-leakage through the subject check valves.

For the following operator actions, the team performed a walkthrough of associated Abnormal Operating Instructions (AOIs), Annunciator Response Instructions (ARIs), Standard Operating Instructions (SOIs), and other applicable operations procedures (e.g. temporary instructions, etc.) with plant operators, maintenance personnel and engineers to assess operator knowledge level; adequacy of procedures; availability of special equipment when required; and the conditions under which the procedures would be performed. Detailed reviews were also conducted with operations and training department leadership to further understand and assess the procedural rationale and approach to meeting the design basis and UFSAR response and performance requirements. Selected operator actions associated with the following events/evolutions were reviewed:

- Crosstie opposite unit and train ERCW headers (1B-B strainer plugged) - [HAERCW1A]
- Operators fail to clear ERCW screens before plant trip - [DHAERCWS]

b. Findings

No findings were identified.

.2.2 Residual Heat Removal (RHR) Pump (1A-A, 1PMP-074-0010-A)

a. Inspection Scope

The team reviewed the UFSAR, system design criteria, current system health report, selected drawings, operating procedures, and past corrective action reports for the RHR pump. The team interviewed the RHR system engineer to discuss the overall health and condition of the RHR system and pumps. Further, the team interviewed inservice test engineers responsible for maintaining and updating the required TS surveillance procedures. Also, the team interviewed instrumentation and control engineers responsible for performing the associated instrumentation uncertainty calculations. Calculations addressing required RHR pump performance requirements during design bases accidents, calculations addressing the uncertainties of the instruments used to verify pump performance during required inservice test surveillances, quarterly and comprehensive surveillance procedures, and test results used to verify required RHR pump performance were reviewed. A sample of emergency operating procedures, which incorporated RHR pump, flow instrumentation and start logic were also reviewed.

The team verified by review of schematic drawings, that operation of the pump motors was consistent with the design basis and operational requirements. The team reviewed the protection coordination calculation for the RHR pump motor and verified that the circuit breaker ratings and protective device's trip settings and alarm functions were consistent with the licensing basis and operational requirements. The team verified that the brake horsepower required by the pump was within the motor rating. The team performed a walkdown of the RHR system to assess observable material condition of the pump motors. The team verified that the ambient conditions were consistent with vendor recommendation for the motors.

b. Findings

No findings were identified.

.2.3 Standby Diesel Generator (SDG) Heat Exchangers (2B1 and 2B2)

a. Inspection Scope

The team reviewed the plant TS, UFSAR, SDDs and associated P&IDs to establish an overall understanding of the cooling water requirements for the SDG systems. Design calculations were reviewed to verify that the design basis and design assumptions had been appropriately translated into these documents. The team also reviewed 10 CFR Appendix A to Part 50; General Design Criteria (GDC) 44 “Cooling Water”, GDC 45, “Inspection of Cooling Water” and GDC 46 “Testing of Cooling Water” as well as Generic Letter 89-13 “Service Water System Problems Affecting Safety-Related Equipment.” Component walkdowns were performed to verify the equipment was installed in accordance with design drawings, system descriptions and that the system was being maintained in accordance with the design basis. The overall condition of areas containing this equipment was examined, and that cooling water flow control and throttling valves to the heat exchangers were in their correct positions and properly secured. Test procedures and results were reviewed against design basis documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and/or analyses served to validate component operation under accident/event conditions. Heat exchanger vendor documentation was reviewed to verify assumed flow rates, temperature differential(s) and fouling factor limits were accounted for in plant technical instructions and surveillances. System health reports, preventative and corrective maintenance, inservice testing and surveillance testing was reviewed to confirm that testing is being done in accordance with manufacturers requirements. Docketed plant correspondence was reviewed to determine plant commitments to Generic Letter 89-13 for initial baseline testing and periodic re-testing of open cycle service water systems against minimum frequency intervals as specified in Generic Letter 89-13.

b. Findings

No findings were identified.

.2.4 Auxiliary Control Air Subsystem (ACAS) (A-A and B-B)

a. Inspection Scope

The team reviewed applicable portions of the plant’s TS, UFSAR, SDD, and P&IDs to establish an overall understanding of the design bases of the safety-related ACAS. Design calculations were reviewed to verify that design basis air capacity flow rate requirements had been appropriately translated into these documents. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented. Also, current surveillance testing including start-logic, and previous testing, which included compressor air capacity testing, was

reviewed. Further, several discussions with both the current and former system engineers took place, with focus on maintenance practices and testing requirements and results of the ACAS.

For the following operator actions, the team performed a walkthrough of associated AOIs, ARIs, SOIs, and other operations procedures (e.g. temporary instructions, etc.) with plant operators, maintenance personnel and engineers to assess operator knowledge level; adequacy of procedures; availability of special equipment when required; and the conditions under which the procedures would be performed. Detailed reviews were also conducted with operations and training department leadership to further understand and assess the procedural rationale and approach to meeting the design basis and UFSAR response and performance requirements. Selected operator actions associated with the following event/evolution were reviewed:

- Restore Auxiliary Feedwater (AFW) control following initiator and loss of air [HAFR1]

b. Findings

Introduction: The team identified a green non-cited violation of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," for the failure to perform capacity (volumetric flow) testing on the safety-related auxiliary control air subsystem (ACAS). The licensee had documented that for worst case environmental conditions, the compressor capacity had little margin when compared to required air demand, even for single unit operation.

Description: The ACAS is a safety-related system required to supply air to safety-related equipment during design basis events (e.g., air is to be supplied at adequate pressure and capacity to auxiliary feedwater system level control valves and steam generator pressure control valves during postulated design basis accidents). Although the licensee's ACAS test procedures demonstrated start logic functionality and the capability to develop adequate system pressure, the test procedures did not evaluate or measure compressor air capacity. Capacity testing was previously performed on this system by the licensee, but was removed from the test program in 2002. Instead of capacity testing, the licensee relied upon the preventive maintenance program, during which various component parts were replaced, to ensure the system remained capable of operating at proper capacity. The licensee did not perform as-found capacity tests prior to such maintenance and did not perform post-maintenance capacity testing. The licensee had concluded that under design basis conditions, the ACAS capacity margin was less than 5 standard cubic feet per minute, and that this represents little margin (even for single unit operation). In response to the team's questions, this issue was entered into the licensee's corrective action program as problem evaluation report 501941.

Analysis: The team determined that the failure to perform capacity testing to ensure the ACAS would meet the required air demand in response to a design basis event was a performance deficiency. This performance deficiency was more than minor because it affected the mitigating systems cornerstone attribute of equipment performance to ensure the availability, reliability, and capability of safety systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee failed to develop a test procedure that would reliably ensure that the ACAS would meet required air demand for its safety-related loads during design basis

accidents. The team performed a phase one significance determination process screening and determined the finding to have very low safety significance (green) utilizing the mitigating systems cornerstone column of Inspection Manual Chapter 0609, Attachment 4, "Phase 1-Initial Screening and Characterization of Findings." The finding did not represent a design or qualification deficiency, did not represent a loss of system safety function, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. The inspectors determined that the finding had a cross-cutting aspect in the use of conservative assumptions in the decision-making component of the human performance area. Specifically, the licensee did not use conservative assumptions in making the decision to discontinue capacity testing of the ACAS system in 2002, and stated that if that decision had been made more recently (using available internal guidance and practices regarding the testing of safety-related systems), the resulting decision would have been the same [H.1(b)].

Enforcement: 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," states in part, that a program shall be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate acceptance limits contained in applicable documents. Contrary to this requirement, since 2002, the licensee had failed to establish a test control program to assure that the ACAS would perform satisfactorily in response to a design basis event. Specifically, the licensee did not have a test procedure to verify that ACAS capacity met design basis accident performance requirements. Because this violation was of very low safety significance and was entered into the licensee's corrective action program, this violation is being treated as an NCV, consistent with the Enforcement Policy: NCV 05000390/2012008-01, "Failure to Establish Test Procedures to Assure Satisfactory ACAS Performance during Design Basis Accidents."

.2.5 RHR Pump Room Coolers (A-A and B-B)

a. Inspection Scope

The team reviewed applicable portions of the plant's TS, UFSAR, SDDs, and P&IDs to establish an overall understanding of the design bases of the coolers. Design calculations were reviewed to verify that design basis heat removal requirements, capability, and flow rates had been appropriately translated into these documents. Test procedures and results were reviewed against design basis documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents, and that individual tests and/or analyses served to validate component operation under accident/event conditions. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented and the component replacement was consistent with inservice/equipment qualification life. Environmental qualification and seismic documents/calculations were reviewed to verify that the cooler was appropriately qualified. Component walkdowns were conducted to verify that the installed configurations would support their design basis function under accident conditions and had been maintained to be consistent with design assumptions.

b. Findings

No findings were identified.

.2.6 Auxiliary Feedwater Check Valve (3-805)

a. Inspection Scope

The team reviewed applicable portions of the plant's TS, UFSAR, SDDs, and P&IDs to establish an overall understanding of the design bases of the check valve. Design calculations (e.g., differential pressure) were reviewed to verify that the design basis and design assumptions had been appropriately translated into these documents. Operating procedures were reviewed to verify that operator actions involving the high-pressure fire protection system alignment of auxiliary feedwater (AFW) were feasible. Test procedures and results were reviewed against design basis documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and/or analyses served to validate component operation under accident/event conditions. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented and the component replacement was consistent with inservice/equipment qualification life. Seismic documents/calculations were reviewed to verify that the valve was appropriately qualified. Component walkdowns were conducted to verify that the installed configurations would support their design basis function under accident conditions and had been maintained to be consistent with design assumptions.

b. Findings

Introduction: The team identified a green non-cited violation of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," for the licensee's failure to establish a test program that demonstrated the adequacy of the AFW discharge check valves. Specifically, the licensee failed to develop a test program that would provide assurance that back leakage through the AFW discharge check valves would not prevent the system from providing design flowrates to the steam generators.

Description: The AFW system supplies feedwater to the steam generators in the event of a loss of main feedwater to remove reactor decay heat and avoid reactor coolant system over pressurization. The AFW system consists of two motor-driven pumps and one turbine-driven pump. Check valves are installed on the discharge of the pumps with design functions of (1) opening on an AFW initiation, and (2) closing on a pump failure to maintain the running pumps' flow path integrity. If a check valve or combination of check valves on a non-running pump were to leak, that flow would be re-circulated back to the condensate storage tank rather than being delivered to the steam generators.

The team determined that calculation HCGTBG091981, "Design Parameter for Motor and Turbine Driven AFW Pumps," Rev. 8, did not account for any check valve leakage losses. The team noted that at worst case allowable degradation of the pumps, little to no margin existed in meeting the system flow requirements for various system operating conditions. In this regard, under the worst case scenario of a loss of the turbine-driven AFW pump and a 5% degradation of both motor-driven AFW pumps (as accounted for in the

licensee's hydraulic analysis), the allowable loss due to check valve back leakage would be zero. The team determined that licensee has no testing provisions in place to ensure that the zero leakage condition was met for the configuration described above, or other possible system alignments.

This issue was entered into the licensee's corrective action program as problem evaluation report 499950. The licensee performed a functional evaluation and determined that the AFW system was operable based on the pumps' performance not currently being degraded to the design limit, and the existence of additional conservatisms in the licensee's hydraulic analysis. Additionally, the team noted that the licensee had performed a self-assessment in December 2011, to determine if check valve back leakage could challenge design basis analyses used to demonstrate the adequacy of system design. Although the licensee evaluated the essential raw cooling water system check valves for this potential vulnerability, the licensee had not applied the evaluation to other safety-related systems including AFW.

Analysis: The team determined that the licensee's failure to establish a test program to ensure that back leakage through the AFW discharge check valves would not challenge the ability of the AFW system to provide design basis flow to the steam generators, was a performance deficiency. The performance deficiency was more than minor because if left uncorrected, the performance deficiency could have the potential to lead to a more significant safety concern. Specifically, AFW check valve back leakage could challenge the system's ability to support removal of decay heat from the reactor and this condition would not be identified by the licensee's test program. The team performed a phase one significance determination process screening and determined the finding to have very low safety significance (green) utilizing the mitigating systems cornerstone column of IMC 0609, Attachment 4, "Phase 1-Initial Screening and Characterization of Findings." The finding did not represent a design or qualification deficiency, did not represent a loss of system safety function, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. Because the licensee performed a self-assessment in December 2011, that included missed opportunities to identify that check valve leakage could negatively impact the AFW system, this finding was assigned a cross-cutting aspect in the self- and independent assessments component of the problem identification and resolution area [P.3(a)].

Enforcement: Appendix B to 10 CFR Part 50, Criterion XI states in part, that a test program shall be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. Contrary to this requirement, since initial plant operation on February 7, 1996, the licensee failed to establish a test program that demonstrated that the AFW discharge check valves would perform satisfactorily in service. Specifically, the licensee failed to develop a test program that would provide assurance that back leakage through the AFW discharge check valves would not prevent the system from providing design flowrates to the steam generators. Because this violation was of very low safety significance and it was entered into the licensee's corrective action program, this violation is being treated as an NCV, consistent with the Enforcement Policy: NCV 05000390/2012008-02, "Failure to Adequately Test the AFW Discharge Check Valves."

.2.7 Component Cooling Water Heat Exchangers

a. Inspection Scope

The team reviewed applicable portions of the plant's TS, UFSAR, SDDs, and P&IDs to establish an overall understanding of the design bases of the heat exchangers. Design calculations were reviewed to verify that design basis heat removal requirements, capability, and flow rates had been appropriately translated into these documents. Test procedures and results were reviewed against design basis documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents, and that individual tests and/or analyses served to validate component operation under accident/event conditions. Control panel indicators were observed and operating procedures reviewed to verify that component operation and alignments were consistent with design and licensing basis assumptions. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored, or prevented, and the component replacement was consistent with inservice/equipment qualification life. Component walkdowns were conducted to verify that the installed configurations would support their design basis function under accident conditions and had been maintained to be consistent with design assumptions.

For the following operator actions, the team performed a walkthrough of associated AOIs, ARIs, SOIs, and other operations procedures (e.g., temporary instructions, etc.) with plant operators, maintenance personnel, and engineers to assess operator knowledge level; adequacy of procedures; availability of special equipment when required; and the conditions under which the procedures would be performed. Detailed reviews were also conducted with operations and training department leadership to further understand and assess the procedural rationale and approach to meeting the design basis and UFSAR response and performance requirements. Selected operator actions associated with the following event/evolution were reviewed:

- Align and initiate alternate cooling to centrifugal charging pump A [HACCSR2]

b. Findings

No findings were identified.

.2.8 Auxiliary Feedwater Pressure Control Valve (3-132)

a. Inspection Scope

The team reviewed applicable portions of the plant's TS, UFSAR, SDDs, and P&IDs to establish an overall understanding of the design bases of the valve. Design calculations (i.e., differential pressure and required torque/thrust) were reviewed to verify that the design basis and design assumptions had been appropriately translated into these documents. Test procedures and results were reviewed against design basis documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and/or analyses served to validate

component operation under accident/event conditions. Control panel indicators were observed and operating procedures reviewed to verify that component operation and alignments were consistent with design and licensing basis assumptions. The team also reviewed instrument loop diagrams, loop setpoints and scaling documents, and loop accuracy calculations to verify that the valve controls were consistent with design bases assumptions. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented and the component replacement was consistent with inservice/equipment qualification life. Component walkdowns were conducted to verify that the installed configurations would support their design basis function under accident conditions and had been maintained to be consistent with design assumptions.

b. Findings

No findings were identified.

.2.9 Shutdown Board (1B-B)

a. Inspection Scope

The team reviewed bus loading calculations to determine whether the 6.9 kilovolt (kV) system had sufficient capacity to support its required loads under worst case accident loading and grid voltage conditions. The team reviewed the design of the degraded voltage protection scheme to determine whether it afforded adequate voltage to safety related devices at all voltage distribution levels. This included review of degraded voltage relay setpoint calculations, review of the degraded voltage logic scheme, and the licensee's response to NRC Information Notice 95-05, "Undervoltage Protection Relay Settings Out of Tolerance Due to Test Equipment Harmonics." The team reviewed the overcurrent protection scheme for the 6.9 kV buses including drawings and calculations to determine whether loads were adequately protected and immune from spurious tripping. The team reviewed 125 volt direct current (VDC) system voltage drop calculations to determine whether 6.9 kV bus circuit breakers had adequate control voltage. The team reviewed the load shedding and load sequencing schemes to determine whether they were consistent with the design bases and design calculations. The team reviewed maintenance schedules and procedures for the 6.9 kV bus and its associated circuit breakers to determine whether the equipment was being properly maintained. This included reviewing acceptance criteria in procedures for consistency with vendor recommendations and design calculations. The team reviewed the fast bus transfer scheme, including drawings, calculations and procedures, to determine whether the transfer capability described in the UFSAR could be achieved without adverse effects on equipment and systems. The team reviewed calculations for switchgear temperature rise to determine to assess the effect of a loss of ventilation. The team reviewed corrective action documents and maintenance records to determine whether there were any adverse operating trends. In addition, the team performed a visual inspection of the 6.9 kV safety buses to assess material condition and the presence of hazards.

For the following operator actions, the team performed a walkthrough of associated AOIs, ARIs, SOIs, and other operations procedures (e.g., temporary instructions, etc.) with plant operators, maintenance personnel and engineers to assess operator knowledge level; adequacy of procedures; availability of special equipment when required; and the

conditions under which the procedures would be performed. Detailed reviews were also conducted with operations and training department leadership to further understand and assess the procedural rationale and approach to meeting the design basis and UFSAR response and performance requirements. Selected operator actions associated with the following event/evolution were reviewed:

- Operator action to crosstie shutdown boards [HASBXT]

b. .1 Findings and Observations

Introduction: The team identified a green non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," with five examples, for the licensee's failure to correctly translate vendor specifications and design calculations into maintenance and surveillance procedures.

Description: The team identified the following instances where the design as documented in calculations and vendor instructions was not properly translated into maintenance procedures:

6.9 kV and 480 volt (V) Breaker Operating Voltage
Maintenance procedure MI-57.002 provided instructions for checking the operating voltage of 480 V DS type circuit breaker close coils at reduced voltage. A note associated with the applicable step stated that if the minimum voltage exceeds 100 VDC then a problem evaluation report (PER) may be required. The minimum close coil voltage specified by the manufacturer and used as acceptance criteria in calculation WBN EEB-MS-TI11-0004 was 90 VDC. Consequently, an operating voltage of 100 VDC may not be adequate to ensure proper breaker operation under design basis conditions at the start of an accident. A similar discrepancy existed in maintenance procedure MI-57.001 for 6.9 kV Magne-blast circuit breakers, which also cited an acceptance criteria of 100 VDC versus the 90 VDC used in the design basis. In response to this concern, the licensee initiated PER 507645, and performed a partial review (approximately 85%) of maintenance records to confirm that no test results for installed breakers had failed to meet the manufacturer's rating of 90 VDC.

4160 V to 480 V Transformer Insulation Resistance
Maintenance procedure MI-57.200 provided acceptance criteria for the 4160 V to 480 V transformer insulation resistance (IR) as 1.5 mega-ohm secondary and 30 mega-ohm primary. Vendor manual VTD W120 2356 specified the minimum IR as 32 mega-ohm for 1.2 kV class windings and 230 mega-ohm for 8.7 kV insulation class windings. In response to this concern, the licensee issued PER 511469 and confirmed that the last performance of maintenance procedure MI-57.200 for each 480 V shutdown board transformer showed actual IR readings above the manufacturer's minimum recommendations.

Breaker Closing Time
Maintenance procedure MI-57.001, dated July 5, 2011, provided for as-left testing for the closing time of 6.9kV circuit breakers after maintenance and provided acceptance criterion of less than or equal to 84 milliseconds (5 cycles). Calculation WBN EEB-MS-TI06-0027 evaluated the effects of the fast transfer capability of the 6.9 kV systems and determined that a dead bus time of approximately 4.1 cycles could result in exceeding the industry standard evaluation criteria of 1.33 Volt/Hertz. The acceptance criteria in

procedure MI-57.001 was not consistent with the maximum desirable dead bus time determined in the calculation. In addition, maintenance procedure MI-57.001, Step 6.2 [23] did not provide any acceptance criteria for as-found closing time testing. The team noted that the last test for the alternate source breaker for 6.9 kV bus 1B-B, was 72 milliseconds, which was consistent with the dead bus time evaluated in calculation WBN EEB-MS-TI06-0027. In response to this concern, the licensee issued PER 517095.

480 V Breaker Service Life Limitations
The vendor manual for Westinghouse type 'DS' circuit breakers specified breaker and subcomponent service life limits. Maintenance procedure MI-57.002 identified the service life limit for the breaker (either 4000 or 1500 cycles, depending on model), but did not reference the more limiting service life limits for breaker subcomponents such as the direct trip actuator (400 cycles) and overcurrent trip switch (400 cycles). In response to this concern the licensee initiated PER 511010 and provided data to justify that no subcomponents have exceeded their service life limits.

Specification for Harmonic Distortion Limits for Relay Test Sets
Vendor manual WBN-VTD-AS04-0080 for Asea Brown Boveri (ABB) type 27N degraded voltage relays specified the use of a calibration voltage source with a maximum harmonic distortion of 0.3%. Surveillance procedure 1-SI-211-5-B, Step 4.2 [2] specified the use of a Doble relay test set with a maximum harmonic distortion of 2%, which was non-conservative with respect to the vendor specification. In response to this concern, the licensee issued PER 513893 and confirmed that the Doble test sets actually available and used for calibrating the degraded voltage relays conformed to the vendor's specifications.

Analysis: The inspectors determined that the failure to correctly translate vendor specifications and design calculations into maintenance and surveillance procedures was a performance deficiency. The performance deficiency was more than minor because it affected the mitigating systems cornerstone attribute of design control, and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. In addition, the finding is similar to Inspection Manual Chapter 0612, Appendix E (example 4.a), because the failure to ensure correct translation of acceptance criteria into procedures was not isolated. The team performed a phase one significance determination process screening and determined the finding to have very low safety significance (green) utilizing the mitigating systems cornerstone column of IMC 0609, Attachment 4, "Phase 1-Initial Screening and Characterization of Findings." The finding did not represent a design or qualification deficiency, did not represent a loss of system safety function, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. This finding had a cross-cutting aspect in the resources component of the human performance area, because the licensee had not ensured that complete, accurate, and up-to-date procedures were consistent with vendor and design specifications; and therefore, the procedures were not available and adequate to assure nuclear safety [H.2(c)].

Enforcement: Appendix B to 10 CFR 50, Criterion III, "Design Control," requires in part, that measures be established to assure that the design basis is correctly translated into specifications, drawings, procedures, and instructions. Contrary to this requirement, since the revision of maintenance procedure MI-57.001 on July 5, 2011, the licensee's design control measures had failed to assure that vendor specifications and design

calculations were correctly translated into specifications relied on in maintenance and surveillance procedures. Specifically, the licensee failed to implement measures to ensure that specifications for circuit breaker control voltage, transformer insulation resistance, circuit breaker closing times, circuit breaker service life limitations, and relay test set harmonic distortion were correctly reflected in maintenance and surveillance procedures. Because this violation was of very low safety significance and it was entered into the licensee's corrective action program, this violation is being treated as an NCV, consistent with the Enforcement Policy: NCV 05000390/2012008-03, "Inadequate Acceptance Criteria in Maintenance and Surveillance Procedures (5 Examples)."

b. .2 Findings and Observations

Introduction: The team identified an issue of concern and an unresolved item related to the effect of electrical system harmonics on safety-related degraded voltage relays. Specifically, in 1993, the licensee identified that harmonic distortions adversely affected the 6.9 kilovolt (kV) bus overvoltage relays by causing them to alarm unnecessarily. The licensee entered this issue into their corrective action program and modified the overvoltage relays to minimize the effects. However, the licensee did not identify (or otherwise evaluate) the adverse effect that harmonics could have on the ability of the degraded voltage relays to perform their safety function, as required by limiting condition for operation 3.3.5 of the plant's technical specifications.

Description: The Watts Bar degraded voltage protection scheme features three ABB type 27N relays for each 6.9 kV safety bus, arranged in a two out of three tripping scheme. The ABB instruction bulletin 7.4.1.7-7 contained in vendor manual WBN-VTD-AS04-0080 states that (1) the relay employs a peak voltage detector, and (2) harmonic distortion on the AC waveform can have a noticeable effect on the relay operating point and the measuring instruments used to calibrate the relay. The bulletin also notes that the relay is available with an internal harmonic filter for applications where waveform distortion is a factor. The team noted that calculation WBPE2119202001, "6.9kV Shutdown & Logic Boards Undervoltage Relay Requirements/Demonstrated Accuracy Calculation," identified the relay as a model not equipped with a harmonic filter, but did not address the basis for excluding harmonic distortion as a factor which affected relay accuracy. In response to the team's inquiries, the licensee provided PER 930397 that addressed spurious actuations of the ABB type 59H overvoltage relays which are similar in design to the ABB type 27N degraded voltage relays. Troubleshooting tests performed to identify the cause of the 59H spurious actuations revealed that high levels of 6.9 kV system harmonics from sources both external and internal to the station accompanied the spurious operations. The 'causal factor' section of PER 930397 stated that the relays sometimes trip on harmonic distortion although the root mean square voltages are at acceptable levels. Corrective actions consisted of replacing the type 59H overvoltage relays with a model equipped with harmonic filters. The team further noted that the 'extent of condition' section of PER 930397 did not identify or address whether the degraded voltage relay's operating point could also be affected by the same harmonics implicated in the maloperation of the overvoltage relays.

The team was concerned that harmonics on the 6.9 kV system could cause the degraded voltage relays to fail to actuate at the setpoint specified by technical specifications. Persistent harmonics can be produced by factors external to the nuclear site or by internal phenomena. A typical internal source of harmonics at nuclear power

plants is motor defects. The team was also concerned that transient harmonics could cause the relays to spuriously reset during an actual degraded voltage event, thereby delaying the protective function beyond the 10 seconds stipulated in technical specification limiting condition for operation 3.3.5. Specifically, the degraded voltage relay's design features an 'instantaneous' reset characteristic that could allow reset of the degraded voltage relay in less than two cycles in the presence of harmonics, thereby reinitiating the external 10 seconds timer. The reset function of the existing degraded voltage relays is identical to the tripping function of the overvoltage relays that actuated due to transient harmonics in 1993. In 1993, transient harmonics were measured at levels of greater than 10% total harmonic distortion during the troubleshooting for PER 930397 versus the 0.3% distortion deemed acceptable by the relay vendor. The transient harmonics documented in PER 930397 were attributed to events that included the trip of the nearby Sequoyah generating station, and to breaker operations at the Watts Bar station. The team noted that similar conditions could exist during an accident scenario when proper performance of the degraded voltage scheme time delay would be critical with respect to satisfying the response time assumptions in the accident analysis.

In response to the team's concerns, the licensee provided information regarding condition monitoring of large motors that consisted of periodic measurement and analysis of motor bearing vibration from which various defects that may produce harmonics could be identified. The team noted, however, that there was no written guidance or acceptance criteria for these tests that would prompt engineering to investigate whether suspected motor defects could produce harmonics that would adversely affect the accuracy of degraded voltage relays. Specifically, there was no recognition in design or maintenance documents regarding the susceptibility of the degraded voltage relays to harmonic distortion, or the need to investigate suspected motor defects with respect to this susceptibility. The team further noted that during normal bus voltage conditions when voltage is above the degraded voltage relay reset setpoint, harmonics would shift system peak voltage away from the degraded voltage relay operating setpoint rather than closer to it, and so the presence of harmful harmonics would not 'self-reveal' by spurious actuations. The overvoltage relays are now equipped with harmonic filters so they will also not reveal the presence of either transient or persistent harmonics. Based on the team's observations, the licensee has entered these concerns into their corrective action program as PER 515413 and PER 546072.

Summary: The team determined that additional review of information recently received from the licensee regarding Watts Bar's design and licensing bases was necessary to determine if the licensee's performance constituted a violation of NRC regulatory requirements. Additionally, the team determined that additional consultation with the Office of Nuclear Reactor Regulation was warranted before reaching a final disposition of the unresolved item. This unresolved item is open pending (1) the review of additional information from the licensee regarding the design and licensing basis of the degraded voltage relays and (2) consultation with the Office of Nuclear Reactor Regulation: URI 05000390/2012008-04, "Effect of System Harmonics on Degraded Voltage Relay Function."

.2.10 Shutdown Transformer (1A1-A)

a. Inspection Scope

The team reviewed load flow calculations to determine whether the transformer was applied within its specified ratings. The team reviewed maintenance schedules, vendor recommendations, and procedures to determine whether the transformers were being properly maintained. This included reviewing acceptance criteria in procedures for consistency with vendor recommendations and design calculations. The team reviewed protective relaying schemes and calculations to determine whether the transformer was adequately protected and whether it was susceptible to spurious tripping. The team reviewed maintenance and corrective action histories to determine whether there have been any adverse operating trends. In addition, the team performed a walkdown of the installed equipment to determine whether the installed configuration is consistent with design documents including drawings, and calculations, and to assess the presence of hazards.

b. Findings

No findings were identified.

.2.11 Component Cooling System Pump Motor (1A-A)

a. Inspection Scope

The team reviewed maintenance schedules, and procedures, and completed work orders to determine whether the motor was being properly maintained. The team review protective relaying schemes and calculations to determine whether the motor was adequately protected and whether it was susceptible to spurious tripping. The team reviewed maintenance and corrective action histories to determine whether there have been any adverse operating trends. The team also reviewed the component cooling system pump 1A-A motor circuit breaker. Corrective action and maintenance records were reviewed to determine if there had been any adverse operating trends. In addition, the team performed a walkdown of the installed equipment to determine whether the installed configuration is consistent with design documents including drawings, and calculations, and to assess the presence of hazards.

b. Findings

No findings were identified.

.2.12 Auxiliary Feedwater Level Control Valves (3-156, -164)

a. Inspection Scope

The TS, UFSAR, SDs, and P&IDs, were reviewed to establish an overall understanding of the design bases of the valves. Design calculations (e.g., differential pressure and required torque/thrust) were reviewed to verify that the design basis and design assumptions had been appropriately translated into these documents. Test procedures

and results were reviewed against design basis documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and/or analyses served to validate component operation under accident/event conditions. Control panel indicators were observed and operating procedures reviewed to verify that component operation and alignments were consistent with design and licensing basis assumptions. The team also reviewed instrument loop diagrams, loop setpoints and scaling documents, and loop accuracy calculations to verify that the valve controls were consistent with design bases assumptions. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented and the component replacement was consistent with inservice/equipment qualification life. Component walkdowns were conducted to verify that the installed configurations would support their design basis function under accident conditions and had been maintained to be consistent with design assumptions.

b. Findings

No findings were identified.

.2.13 Refueling Water Storage Tank LCVs (62-135A, -136B)

a. Inspection Scope

The team reviewed applicable portions of the plant's TS, UFSAR and system descriptions to identify design basis requirements for LCV-62-135A/136B. The team reviewed the calculations that establish control circuit voltage drop, short circuit, and protection/coordination including thermal overload sizing and application to verify adequate protection during design bases scenarios. The team verified by review of control diagrams, that the operation of the LCV was consistent with the design basis and operational requirements. The team interviewed the system engineer to discuss the valve analysis as well as operational and maintenance history to verify that potentially degraded conditions were being appropriately addressed. Test procedures and recent test results were reviewed against design bases documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and analyses served to validate component operation under accident conditions. The team examined maintenance rule documentation to verify that the valves were properly scoped, and monitored. Vendor documentation, system health reports, preventive and corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored, or prevented, and that scheduled component replacements were consistent with vendor recommendations and equipment qualification life. Component walkdown was conducted to verify that the installed configurations would support the design basis function under accident conditions and had been maintained to be consistent with design assumptions. The team conducted a non-intrusive visual inspection of LCV-62-135A/136B to verify that any potentially degraded material conditions were being appropriately addressed. Also, the team verified testing and calibration of instruments related to the valve.

b. Findings

No findings were identified.

.2.14 125 Volt Battery Boards (I and II)

a. Inspection Scope

The team reviewed the design basis documentation and UFSAR to identify the loading requirements for the vital batteries. The team reviewed the inputs to the battery sizing analysis and the battery voltage study, TS and maintenance allowable terminal load resistance, and panel load schedules to verify the adequate sizing of the battery. The battery voltage study was reviewed to verify adequate voltage was available to critical components. The vendor manual was reviewed to verify battery installation and operating instructions were implemented. Battery TS surveillance test and inspection results were reviewed to verify degradation was identified and anomalies were addressed and corrected. The equipment history as indicated by corrective work orders and condition reports was reviewed to verify that identified equipment problems were corrected. A field walkdown was performed to assess observable material conditions of the batteries.

Also, the team reviewed schematic diagrams and calculations for the normal supply breakers to determine whether equipment operation was consistent with the design bases. The team reviewed calculations for protective device settings to determine whether the breakers were subject to spurious tripping, and whether the breakers were selectively coordinated with upstream devices. Also, the team reviewed associated corrective action history to verify that degraded conditions were being appropriately addressed. In addition, the team interviewed the system engineer and performed a non-intrusive visual inspection of the direct current bus to assess the installation configuration and verify that degraded material conditions were being appropriately addressed.

b. Findings

No findings were identified.

.2.15 Hydrogen Igniters [large early release frequency]

a. Inspection Scope

The team reviewed applicable portions of the plant's TS, UFSAR and system descriptions to identify design basis requirements for the hydrogen igniters. The team interviewed the system engineer to discuss operation and maintenance history to verify that potentially degraded conditions were being appropriately addressed. Operation procedures for emergency power to the hydrogen igniters were reviewed to verify that component operation and power supply alignment were consistent with the design. Test procedures and recent test results were reviewed against design bases documents to verify that acceptance criteria for tested parameters were supported by calculations or other engineering documents and that individual tests and analyses served to validate component operation. Vendor documentation, system health reports, preventive and

corrective maintenance history, and corrective action system documents were reviewed in order to verify that potential degradation was monitored or prevented and that scheduled component replacements were consistent with vendor recommendations and equipment qualification life.

b. Findings

No findings were identified.

.3 Operating Experience

a. Inspection Scope

The team reviewed four operating experience issues for applicability at Watts Bar Nuclear Plant. The team performed an independent review for these issues and where applicable, assessed the licensee's evaluation and dispositioning of each item. The issues that received a detailed review by the team included:

- NRC Generic Letter 1988-14, "Instrument Air Supply System Problems Affecting Safety-Related Equipment"
- NRC Regulatory Information Summary 2000-05, "Spring Actuated Safety and Relief Valve Reliability"
- NRC Information Notice 1992-29, "Potential Breaker Miscoordination Caused by Instantaneous Trip Circuitry"
- NRC Information Notice 1987-08, "Degraded Motor Leads in LIMITORQUE DC Motor Operators"

b. Findings

No findings were identified.

4. OTHER ACTIVITIES

4OA6 Meetings, Including Exit

On May 15, 2012, the team presented the inspection results to Mr. David Gronek and other members of the licensee's staff. Proprietary information that was reviewed during the inspection was returned to the licensee or destroyed in accordance with prescribed controls.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee personnel:
C. Borelli, Manager, WBN PRA
K. Dutton, Director, Site Engineering
D. Gronek, Plant Manager
D. Guinn, Manager, Site Licensing
R. Kirkpatrick, Manager, Design Engineering
T. Morgan, Site Licensing
W. Nesmith, Design Engineering

NRC personnel
R. Nease, Chief, Engineering Branch Chief 1, Division of Reactor Safety, Region II
S. Schaeffer, Chief, Project Branch 6, Division of Reactor Project, Region II
S. Sandal, Senior Reactor Inspector, Division of Reactor Safety, Region II
B. Monk, Senior Resident Inspector, Division of Reactor Projects, Watts Bar Resident Office
R. Mathew, Team Leader, Division of Engineering, Office of Nuclear Reactor Regulation
G. Matharu, Senior Electrical Engineer, Division of Engineering, Office of Nuclear Reactor Regulation

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened and Closed

05000390/2012008-01	NCV	Failure to Establish Test Procedures to Assure Satisfactory ACAS Performance during Design Basis Accidents [Section 1R21.2.4]
05000390/2012008-02	NCV	Failure to Adequately Test the AFW Discharge Check Valves [Section 1R21.2.6]
05000390/2012008-03	NCV	Inadequate Acceptance Criteria in Maintenance and Surveillance Procedures (5 Examples) [Section 1R21.2.9]

Opened

05000390/2012008-04	URI	Effect of System Harmonics on Degraded Voltage Relay Function [Section 1R21.2.9]

LIST OF DOCUMENTS REVIEWED

Calculations

NAME	TITLE	REVISION/ DATE
048018AFW	System Level Review For Watts Bar Auxiliary Feedwater System Air Operated Valves	4
048-018-BAL	Evaluation Of Required Thrust For Balanced Disk Globe AFW Turbine Driven LCVs AT Watts Bar Nuclear Power Station	0
048018MUL	Evaluation Of Required Thrust For Multistage Unbalanced Disk Globe AOVs At Watts Bar Nuclear Power Station	2
048018UNB	Evaluation Of Required Thrust For AFW Motor Driven Large LCVs AT Watts Bar Nuclear Power Station	3
1-F-74-12	Demonstrated Accuracy Calculation for 1-F-74-12, 1-F-74-24	2
1-L-3-156A	Setpoint and Scaling Document For MDAFW Pump 1A-A Level Control Valves 1-LCV-3-156 and 1-LCV-3-156A	1
1-LT-3-148	Demonstrated Accuracy Calculation For Steam Generator Narrow Range Level Control Loops	12
1-PD-3-132A	Setpoint And Scaling Document For Pressure Control Valves 1-PCV-3-132-B	1
2-F-67-280	Emergency Diesel Heat Exchanger 2B2 Discharge Flow	0
85KS002	IPS ERCW Strainer Sliding Base/HPFP Strainer Anchorage and ERCW Discharge Overflow Structure Ladder	2
E31 920108 300	Relay Setting Manual Tab 1A.27	2
E31850221300	6.9kV Shutdown Board Normal And Alternate Feeders.	4
EBASCO Services Inc.	Equipment Seismic Qualification Of System 003	11/07/92
EDQ000236200 70003	125V DC Vital Battery System Analysis	4 & 13
EPM-AF-080188	System Safety Limits For The Auxiliary Control Air Subsystem (ACAS) Safety Related Instrumentation	21
EPMJJL081689	Auxiliary Building EL 676 RHR Pump Rooms HVAC Cooling Load During Unit 1/Unit 2 LOCA	4
EPMJN010890	Performance Of CCS Heat Exchangers	14
EPM-MECB-111886A	RHR SYS Net Positive Suction Head (NPSH) Calculations	4
EPM-MGF-080789	ACAS Compressor Capacity For Normal And DBA Conditions	5
EPMOED070391	Equations For AFW Pump Performance Curves	9
EPM-PFS-053191	Minimum Fluid Velocity Through Check Valves	02/11/11
EPMPTC120594	Essential Raw Cooling Water System Pressure Drop Calculations	14
EPMRM062289	Process Safety Limits For SG Narrow And Wide Range Level Instrumentation Setpoints	5
HCGTBG091981	Design Parameters For Motor And Turbine Driven AFW Pumps	8
MDQ001003200 20070	Component Level Review Calculation For Watts Bar AFW Air Operated Valves	5

MDQ1003990045	Analysis Of Leaking Main And Auxiliary Feedwater Valves	2
MQD 000 082 2003 0077	Emergency Diesel Generator Jacket Water Heat Exchanger Evaluation	2
SSD 1-F-63-91B	Setpoint And Scaling Document 1-F-63-91B	3
SSD 1-F-63-92B	Setpoint And Scaling Document 1-F-63-92B	3
SSD-1-LPL-62-129A	Scaling And Setpoint Document Loop Cover Sheet	6
Walworth Company	Seismic Calculation No. 281	1
WAT-D-11490	TVA Watts Bar Nuclear Plant Unit 1 ECCS Analysis	08/22/06
WB-DC-30-28	6.9KV SB RHR Pump Relay Setting	2
WBN EEB 1-LT-3-148	Demonstrated Accuracy Calculation For Steam Generator Narrow Range Level Control Loops	12
WBN EEB 1-PDT-3-132A-B	Demonstrated Accuracy Calculation For MDAFW Pump Differential Control Loops	4
WBN0SG4136	Steady State DBE LOCA Temperatures For The Auxiliary Building	21
WBNEBMSTI110004	125V DC Voltage Analysis	64
WBNEEBEDQ1999010001	AC Auxiliary Power System Analysis	72 & 76
WBN-EEB-EDQ1999-010001	Unit 1 SI Phase B Grid Drop 164-153KV Shutdown CSST A &D Page 1	11/04/09
WBN-EEB-MS-T108-0008	480V 1E Coordination/Protection	150
WBNEEBMSTI060008	480V 1E Coordination/Protection	151
WBNEEBMSTI060027	WBN Fast Transfer Analysis	0
WBNEEBMSTI060029	Degraded Voltage Analysis	33
WBNEEBMSTI070005	125V DC Protection And Coordination Calculation	60
WBNOSG4242	6.9 kV and 480 V Board Room Temperature Analysis	3
WBNSSG4002	WBN Hydrogen Volume Percent In Containment Following A LOCA	10
WBPE2119202001	6.9kV Shutdown & Logic Boards Undervoltage Relay Requirements / Demonstrated Accuracy Calculation	9
WCGACQ0127	Seismic Qualification for ERCW Strainers 1A-A/2 A-A/1B-B/2B-B	3
WCGACQ543	Seismic Evaluation Of 125 Volt Battery Rack	0

Completed Procedures

NAME	TITLE	REVISION/ DATE
08-820491	Perform Procedure 1-SI-74-901-A, Residual Heat Removal Pump 1A-A Quarterly Performance Test	02/01/09
08-820919	Perform Procedure 1-SI-63-907, RHR Hot Leg And Cold Leg Injection Check Valve Testing During Refueling	10/03/09
0-SI-236-21	125VDC Vital Battery I Quarterly Inspection	10/20/11
0-SI-236-22	125VDC Vital Battery II Quarterly Inspection	09/28/11
0-SI-236-31	125VDC Vital Battery I Annual Inspection	06/04/11
0-SI-236-32	125VDC Vital Battery II Annual Inspection	06/29/10
0-SI-236-41	125VDC Vital Battery I 18 Months Service Test and 125VDC Vital Charger I Test	06/13/11
0-SI-236-42	125VDC Vital Battery II 18 Months Service Test and 125VDC Vital Charger II Test	04/07/11
0-SI-236-51	125VDC Vital Battery I 60 Months Service Test and 125VDC Vital Charger I Test	05/31/11
0-SI-236-52	125VDC Vital Battery II 60 Months Service Test and 125VDC Vital Charger II Test	06/09/11
10-814341	Perform Procedure TI-104, Instrument Air Quality, (Rev. 11)	12/09/10
10-815772	Perform Procedure 1-SI-63-907, RHR Hot Leg and Cold Leg Injection Check Valve Testing During Refueling	04/04/11
111591196	Perform Procedure 1-SI-74-901-B, RHR Pump 1B-B Quarterly Performance Test	03/09/11
112016541	Perform Procedure TI-104, Instrument Air Quality, (Rev. 11)	09/19/11
1-SI-3-906-A	Valve Testing during Hot Standby-Auxiliary Feedwater System (Train A)	05/18/11
1-SI-3-923-A	Auxiliary Feedwater Pump 1A-A Comprehensive Pump Test	05/11/11
1-SI-3-923-A	Auxiliary Feedwater Pump 1A-A Comprehensive Pump Test	10/13/09
PTI-063-03	Safety Injection System Charging, SI, and RHR Flow Balance Test, (Pre-operational Test, 12/16/94)	4
TI-79.821	Diesel Generator 1A-A Jacket water Cooler Performance Test	05/13/10
TI-79.824	Diesel Generator 2B-B Jacket Water Cooler Performance Test	05/09/09

Completed Work Orders

NAME	TITLE	REVISION/ DATE
03-005702-000	OVHL Inspection of GE AK-50 Circuit Breakers PMUG M0566W	04/05/04
03-020188-000	OVHL Inspection of GE AK-50 Circuit Breakers PMUG M0566W	06/18/05
04-813376-000	6.9KV Circuit Breaker Inspection Perform MI-57.001	07/06/04
05-816107-000	Provide Substitute Breaker during PM Performance This Breaker is the Normal Feeder for RHR Pump 1B-B	07/24/06
05-820315-000	Periodic Required Replacement Of MEQ Belts	05/04/07
05-822154-000	Replace Belts And Each Fan Shaft Bearing	10/11/06
06-822047-000	6.9KV Circuit Breaker Inspection and Overhaul MI-57.006 Perform MI-57.006. 6.9KV SD BD 1A-A RHR PMP 1A-A	05/03/09

Completed Work Orders

NAME	TITLE	REVISION/ DATE
07-815593-000	Disassemble Clean & Inspect CCs HX B Perform M4049F & MI-70.02WM4049F	03/25/09
07-816062-000	ESFA System Slave Relay Go Test Train A	03/21/08
07-816064-000	ESFA System Slave Relay Go Test Train A	03/17/08
07-817941-000	6.9KV Circuit Breaker Inspection and Overhaul MI-57.006 Perform MI-57.006. 6.9KV SD BD 1B-B CMPT 14 RHR PMP 1B-B	07/30/08
07-820240-000	Relay and Indication Instrument Test Perform MI-236010	11/24/08
07-820818-000	GE AK50 Circuit Breaker Inspection Per MI-57.004. 125V Vital Batt BD 2 CMPT 109 Vital Batt II Tie to Vital Batt BD II	11/06/09
07-820818-001	GE AK50 Circuit Breaker Inspection Performance MI-57.004	11/06/09
08-812842-000	Inspect / Lube of Valve Stems for MOV's EQ and 89-10 Includes Gear Case Lube Check for 10 Specific MOV's	10/09/09
08-812883-000	Bridge Megger & Hypot Testing MPM WM1992V	09/07/09
08-814211-000	480V Breaker Inspection Perform MI-57.002	04/23/10
08-816283-000	GE AK50 Circuit Breaker Inspection Per MI-57.004 Load: Discharge Test Breaker 0-BKR-236-4/108-G	06/12/09
08-820009-000	125V Vital Battery Charger and BD Inspection and Cleaning Train B	09/02/09
08-820443-000	92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	01/29/09
08-820596-000	125V Vital Battery Charger and BD Inspection and Cleaning Train A Wang 0406F Multi-Equip	11/18/09
08-820624-000	ESFA System Slave Relay Go Test Train A	10/23/09
08-820822-000	ESFA System Slave Relay Go Test Train B	10/12/09
08-820923-000	AFW Check Valve Testing During hot Standby TDAFW	10/18/09
08-820924-000	AFW Pump 1A-S Comprehensive Pump Test	10/18/09
08-820939-000	92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	10/15/09
08-820949-000	Inspection Of MDAFW Train Check Valves	09/23/09
08-821019-000	Inspection Of TDAFW Train Check Valves	09/23/09
08-821030-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	10/15/09
08-821120-000	Component Cooling System Heat Exchanger C Performance Test	10/22/09
09-810430-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	04/01/09
09-810731-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	05/04/09
09-812024-000	1-SI-211-4-B 92 Day Trip Actuating Device Operational Test on Undervoltage Relays for 1B-B 6.9 kV Shutdown Board	07/01/09
09-812029-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	07/02/09
09-812383-000	Dry Boron Packing Leak	03/12/09
09-812719-000	92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	07/31/09

09-815903-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	10/15/09
09-816178-000	92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	10/15/09
09-818104-000	1-SI-211-6-B Channel Calibration Test on Loss of Voltage Relays for 6.9kV Shutdown Board 1B-B	12/28/09
09-818105-000	1-SI-211-5-B Channel Calibration Test on Degraded Voltage Relays for 6.9kV Shutdown Board 1B-B	12/28/09
09-818107-000	1-SI-211-7-B Channel Calibration Test on Load Shed and Diesel Start Undervoltage Relays for 6.9kV Shutdown Board 1B-B	12/29/09
09-818110-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	12/30/09
09-818846-000	1-SI-268-1-A 92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	02/01/10
09-820542-000	Received Alarm Window 1B-B 125 DC Vital Battery BD II	11/05/09
09-820846-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	03/31/10
09-821129-000	Relay and Indication Instrument Test Perform MI-236011	04/05/10
09-821285-000	Sample and Lube of Comp Cool Water Pump Mtr MPM 4694F	04/23/10
09-821285-000	Sample and Lube of Comp Cool Water Pump Mtr MPM 4694F	04/23/10
09-821286-000	Long term Bend Radius Program Plan Meggering 480V Class 1E Greater Than or Equal to 100HP Motors	04/23/10
09-821291-000	Relay and Indication Instrument Test Perform MI-236010	08/20/10
10-810289-000	92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	04/29/10
10-811575-000	Troubleshoot/ Correct Cause of Low Voltage on ‘A’ Phase	02/03/10
10-812051-000	Disassemble Clean & Inspect CCs HX A Perform M4049F & MI-70.02WM4049F	03/06/11
10-812051-000	Disassemble Clean & Inspect CCs HX C Perform M4049F & MI-70.02WM4049F	07/20/09
10-812115-000	Disassemble Clean & Inspect CCS HX B PerformM4049F & MI-70.02WM4049F	03/06/11
10-812310-000	Inspect / Lube of Valve Stems for MOV’s EQ and 89-10 Includes Gear C	04/22/11
10-812441-000	Inspection of Switchgear Bus and MCC Perform MI-57.200	04/21/11
10-812648-000	125V Vital Battery Charger and BD Inspection and Cleaning Train B Wang 0516W Multi-Equip	12/29/10
10-812985-000	OD- Add Baker Explorer EP-2 Accessory Device to Allow Condition	-
10-813381-000	1-SI-211-7-B Channel Calibration Test on Load Shed and Diesel Start Undervoltage Relays for 6.9kV Shutdown Board 1B-B	06/29/10
10-813384-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	07/01/10
10-813689-000	92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	07/28/10
10-814471-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	09/30/10
10-814767-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	11/01/10

10-815526-000	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	01/06/11
10-815683-000	ESFA System Slave Relay Go Test Train B	05/12/11
10-815685-000	ESFA System Slave Relay Go Test Train A	05/11/11
10-815706-000	18 Month Channel Calibration of Volume Control Tank Level Loop 1-LPL-62-129A	04/21/11
10-815736-000	Check Valve Testing During Hot Standby Auxiliary Feedwater System (Train A)	04/04/11
10-815769-000	ESFA System Slave Relay Go Test Train A	05/14/11
10-815790-000	18 Month Permanent Hydrogen Mitigation System Train A Operability Test	05/09/11
10-815875-000	18 Month Permanent Hydrogen Mitigation System Train B Operability Test	05/10/11
10-815878-000	18 Month Channel Calibration Of Steam Generator 1 Auxiliary Feedwater Level Loop 1-LPL-164	08/16/11
10-815878-000	18 Month Chanel Calibration Of Steam Generator 1 Auxiliary Feedwater Level Loop	05/08/11
10-816014-000	Component Cooling System Heat Exchanger A Performance Test	05/16/11
10-816045-000	Auxiliary Feedwater Pump 1A-A Comprehensive Pump Test	05/12/11
10-8813379-000	1-SI-211-5-B Channel Calibration Test on Degraded Voltage Relays for 6.9kV Shutdown Board 1B-B	06/28/10
111057630	Inspect Clean and Lube of RHR Motor	03/08/11
111202479	0-BD-236-0001 125 Vital Battery Board	10/21/10
111429781	125V Vital Battery Charger and BD Inspection and Cleaning Train A Wang 0406F Multi-Equip	07/18/11
11-1516647-000	Check Valve Setup For Problems & Correct As Required	11/17/10
111552771	1-SI-268-1-A 92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	01/24/11
111608627	1-SI-268-1-A 92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	05/09/11
111691841	1-SI-268-1-B 92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	04/01/11
111984456	Relay and Indication Instrument Test Perform MI-236011	09/30/11
112015903	1-SI-268-1-B 92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	07/01/11
112015907	1-SI-268-1-B 92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	12/28/11
112016754	1-SI-268-1-A 92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	07/27/11
112016755	1-SI-268-1-A 92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	11/03/11
11-2017336-000	1-SI-3-901-B MDAFW Pump 1B-B Quarterly Performance Test	11/04/11
112164566	Sample and Lube of Comp Cool Water Pump Mtr MPM 4694F	11/14/11
112210971	Failure 1-LCV-62-136	04/29/11
11-2260678-000	1-SI-3-906-A Check Valve Testing During Hot Standby AFW System (Train A)	05/18/11
96-124835-000	MDAFW Pump 1B-B Quarterly Performance Test	09/11/96
980855500	TI-50.018, Auxiliary Air Compressor B-B Capacity and Check Valve Test (Train B)	03/27/99

WBN Master PM 1013W	Perform Motor Current Signature Analysis on Safety Related Motors	0

Corrective Action Documents

NAME	TITLE	REVISION/ DATE
WBSCA910278	Significant Corrective Action Report Westinghouse DS Circuit Breaker Discriminator Circuit	12/03/91
II-S-91-120	Inadequate Circuit Breaker Coordination	01/02/92
129486	ASME Code Class Boundary Deficiency	-
165582	Battery Cell 60 Not Monitored During 0-SI-236-44	-
171904	Unqualified Cable Connectors - C and D	-
200971	125V DC Vital Battery System Analysis Calculation	-
203658	1-LT-62-129A Was Found Out of As Found Tolerance	-
210812	CDBI Self-Assessment PER Regarding Typo in TRM Table 3.3.2-1	-
220754	Install TACF Vertical Support Plates On All 4 ERCW Strainer Base Plates	03/12/10
221018	Strainer Anchorage Qualification Cannot Be Located	03/15/10
223677	A Calculating Evaluating the ERCW Strainers Was Not Included in CCRIS	04/01/10
231297	MDAFW Pump B-B Discharge Pressure Control Valve Found Closed With MDAFW Pump Running Post Trip	05/25/10
246447	Increasing Trend In 1-PCV-3-132 Stroke Times	08/26/10
294604	1-PCV-3-132 Spring Rate	12/08/10
297829	1-LSV-3-164-A Has The Wrong UNID Was Hanging On The Solenoid	12/15/10
320932	1-PCV-3-132 Failed Stroke Time During 1-SI-3-901-B	02/09/11
328153	Inspect Sheave On Motor And Fan And Replace As Necessary	02/24/11
330125	Did Not Get To Start PMT	02/28/11
345893	Vital Charger II Not Functioning Properly	-
349207	Noticed The Flow To The #3 And #4 S/G Drop Dramatically	04/04/11
357399	PER To Document Presence Of 3 Live Clams Approximately 5/8 Inch In Diameter In CCS HTX A	04/20/11
361423	After restoration of 1B-1B RXMOV BD 1-LCV-62-136 had no indication of being energized and would not operate from the control room hand switch	-
363217	C CCS Heat Exchanger Will Not Allow Adequate Flow	05/03/11
370468	Controller Will Not Control In Automatic	05/17/11
415215	TI-104 gaps, size of particulates > 25 micron needs to be documented	08/10/11
436594	Inboard Motor Bearing Degraded	09/22/11
438578	Cover Installed On Wrong Heat Exchanger	09/27/11
441625	Received alarm window 17-B and could not determine the cause of the alarm after board walkdown. Troubleshoot to determine cause and resolve issue to clear MCR alarm. When a WO is created it should be categorized as a Control Room Deficiency	-

444994	All AFW LCW Will Not Maintain SG Levels Within Specified Control Bands Per Procedures In Auto	10/11/11
445835	AFW Level Control Valves Will Not Control In Auto	10/12/11
445838	Aux Feedwater Level Control Valve Will Not Control In Auto	10/12/11
445839	Aux Feedwater Level Control Valve Will Not Control In Auto	10/12/11
446464	AFW Level Control Valves Will Not Control In Auto	10/13/11
468950	WBN has adverse capacity degradation for Vital Battery III and IV	-
500697	Margin Management: Increasing Trend In 1-PCV-3-132 Stroke Times	02/03/12
930397	Overvoltage Condition on 6.9kV Shutdown Bds.	10/28/93

Drawings

NAME	TITLE	REVISION/ DATE
0-75W1508-1	500kV Switchyard Main Single Line	1
1-15E500-1	Key Diagram Station Aux Power System	35
1-15E500-2	Station Auxiliary Power System	41
1-15E500-3	Transformer Taps & Voltage Limits Aux Power System	23
1-45W700-1	Key Diagram 120V AC & 125V DC Vital Plant Control Power System	31
1-45W703-1	Wiring Diagrams 125V DC Vital Battery Board I, SH 1	51
1-45W703-10	Wiring Diagrams 125V DC Vital Battery Board I Instrument Loading, SH 1	4
1-45W703-11	Wiring Diagrams 125V DC Vital Battery Board I Instrument Loading, SH 2	6
1-45W703-12	Wiring Diagrams 125V DC Vital Battery Board II Instrument Loading, SH 3	3
1-45W703-13	Wiring Diagrams 125V DC Vital Battery Board II Instrument Loading, SH 4	6
1-45W703-2	Wiring Diagrams 125V DC Vital Battery Board II Single Line, SH 2	38
1-45W703-5	Wiring Diagrams 125V DC Vital Battery Board I Panel 4 Connection Diagram, SH 5	34
1-45W703-5A	Wiring Diagrams 125V DC Vital Battery Board I Panel 4 Connection Diagram, SH 5A	28
1-45W703-6	Wiring Diagrams 125V DC Vital Battery Board II Panel 4 Connection Diagram, SH 6	21
1-45W703-6A	Wiring Diagrams 125V DC Vital Battery Board II Panel 4 Connection Diagram, SH 6A	25
1-45W724-1	6900V Shutdown Board 1A-A Single Line	25
1-45W724-2	6900V Shutdown Board 1B-B Single Line	24
1-45W749-1	Wiring Diagrams 480V Shutdown Board 1A1-A Single Line	58
1-45W749-2	Wiring Diagrams 480V Shutdown Board 1A2-A Single Line	54
1-45W749-3	Wiring Diagrams 480V Shutdown Board 1B1-B Single Line	57
1-45W749-4	Wiring Diagrams 480V Shutdown Board 1B2-B Single Line	63
1-45W751-1	Wiring Diagrams 480V Reac MOV BD 1A1-A Single Line, SH 1	50
1-45W751-2	Wiring Diagrams 480V Reac MOV BD 1A1-A Single Line, SH 2	30

1-45W751-3	Wiring Diagrams 480V Reac MOV BD 1A1-A Single Line, SH 3	44
1-45W751-7	Wiring Diagrams 480V Reac MOV BD 1B1-B Single Line, SH 2	54
1-45W751-8	Wiring Diagrams 480V Reac MOV BD 1B1-B Single Line, SH 1	27
1-45W751-9	Wiring Diagrams 480V Reac MOV BD 1B1-B Single Line, SH 3	39
1-45W760-211-1	Wiring Diagram 6900V Shutdown Power Schematic Diagram	18
1-45W760-211-17	Wiring Diagram 6900V Shutdown Power-Train B Schematic Diagram	10
1-45W760-211-20	Wiring Diagram 6900V Shutdown Power Schematic Diagram	7
1-45W760-211-21	Wiring Diagram 6900V Shutdown Power Schematic Diagram	9
1-45W760-211-7	Wiring Diagram 6900V Shutdown Power-Train A & B Schematic Diagram	15
1-45W760-62-7	Wiring Diagrams Chemical & Volume Control System Schematic Diagrams	13
1-45W760-70-1	Wiring Diagrams Component Cooling System Schematic Diagrams	25
1-45W760-70-9	Wiring Diagrams Component Cooling System Schematic Diagrams	14
1-45W760-74-1	Wiring Diagram RHR System Schematic Diagrams	12
1-47W610-32-2	Electrical Control Diagram Control Air System	22
1-47W610-62-3	Electrical Control Diagram Chemical & Volume Control System	25
1-47W610-74-1	Electrical Control Diagram RESIDUAL HEAT REMOVAL SYSTEM	17
1-47W611-62-4	Electrical Logic Diagram Chemical and Volume Control System	12
1-47-W611-65-1	Electrical Logic Diagram Emergency Gas Treatment System	11
1-47W611-74-2	Electrical Logic Diagram RHR System	5
1-47W803-1	Flow Diagram Feedwater	58
1-47W803-2	Flow Diagram Auxiliary Feedwater	59
1-47W803-3	Flow Diagram Main and Auxiliary Feedwater	31
1-47W810-1	Flow Diagram Residual Heat Removal System	19
1-47W811-1	Flow Diagram Safety Injection System	55
1-47W813-1	Flow Diagram Reactor Coolant System	43
1-47W845-1	Mechanical Flow Diagram Essential Raw Cooling Water System (IPS, Yard, DGB)	57
1-47W845-2	Mechanical Flow Diagram Essential Raw Cooling Water System (Aux Bldg)	82
1-47W845-4	Flow Diagram Essential Raw Cooling Water	32
1-47W848-1	Mechanical Flow Diagram Control Air	26
1-47W850-2	Flow Diagram Fire Protection Raw Service Water	35
1-47W859-1	Flow Diagram Component Cooling System	52
1-47W881-4	Flow Diagram Diesel Cooling Water System	3
25402-011-V1A-MPVT-00086-001	SULZER Pump Curve, (100022172 Final Performance Test Results)	02/16/11

37VD206-46-1	Valve Data Sheet, Figure CVIG-2015-SCE-N	1
37W206-2	Mechanical Intake Pumping Station & Equipment	29
47A373-7	Heating Ventilation & Air Conditioning Air Cooling Units	08/08/74
47-W920-1	Heating Ventilating & Air Conditioning	37
6036F04001	Schematic Diagram-Jacket Water Heat Exchanger, (Morrison Knudsen Power Systems Division Drawing)	-
6036F04002	Heat Exchanger Location w/pipe details, (Morrison Knudsen Power Systems Division Drawing)	-
720002869	Control Valve 4” Model 37-20721	B
E-272992	4” Class 900 Valve	4
N04-2215-500-1	Assembly-20”-150 ANSI CVIB Check Valve ASME Sec. III, Class 3	B
T-36290-1	ERCW Pump B-A Original Performance Curve, (BYRON JACKSON TEST)	11/22/76
T-36307-1	ERCW Pump D-A Original Performance Curve, (BYRON JACKSON TEST)	12/02/76

Modifications

NAME	TITLE	REVISION/ DATE
DCN 18152-A	Disable Discriminator Circuit Device	A
DCN 57975	1-PCV-003-0122, 0132/003B Partially Open	05/20/11

Miscellaneous

NAME	TITLE	REVISION/ DATE
1 FE 610 RHR	MINIFLOW Watts Bar Unit No. 1 SP. SHT. 6.52, (Orifice Plates and Flanges) PAGE 27	0
17460-25	Final Qualification Plan for Tayco Hydrogen Igniters for Tennessee Valley Authority for use in Sequoya and Watts Bar Nuclear Power Generating Stations	07/12/82
1FE 971 RHR	HX. NO. 1 Outlet Fl. Watts BAR No. 1 SP.SHT 9.52, (Orifice Plates and Flanges) PAGE 42	0
3-OT-JPMA047A	Local Control of SG Levels (AFWT A-S)	1
3-OT-JPMA098	Alignment of ERCW to 1A-A CCP Lube Oil Heat Exchanger per AOI-15	7
Atlas Industrial Mfg. Co.	Jacket Water Cooler Heat Exchanger Specification Sheet	04/16/74
DS-1935-2584	Check and Isolation Valves for High-Pressure and ERCW Valves	4
ES-1.1	SI Termination	17
GL 88-14	Instrument Air Supply System Problems Affecting Safety-Related Equipment	08/08/88
IN 89-26	Instrument Air Supply to Safety-Related Equipment	04/07/89
IN 92-29	Potential Breaker Miscoordination Caused by Instantaneous Trip Circuitry	04/17/92
IN 95-05	Undervoltage Protection Relay Settings Out of Tolerance Due to Test Equipment Harmonics	01/20/95

IN 97-90	Use of Non-conservative Acceptance Criteria in Safety-Related Pump Surveillance Tests	12/30/97
L44 890223 305	TVA Response to GL 88-14	02/23/89
L44 900712 802	Revised Response to GL 88-14	07/12/90
N3-32-4002	Compressed Air System	8
N3-63-4001	Safety Injection System	27
N3-67-4002	Essential Raw Cooling Water System	25
N3-74-4001	Residual Heat Removal System	4
N3-82-4002	Standby Diesel Generator System	16
NER 92 0038	Inadequate Circuit Breaker Coordination	01/13/92
NP5479	Application Guide for Check Valves in Nuclear Power Plants	1
NPG-DCD-WB-DC-30-27	AC and DC Control Power System – (Unit 1/ Unit 2)	33
NRC Bulletin No. 88-04	Potential Safety-Related Pump Loss	05/05/88
NRC letter to TVA	Watts Bar Nuclear Station – Response to Generic Letter (GL) 89-13 - Service Water System Problems Affecting Safety-Related Equipment	07/09/90
OE 5548	Operating Experience Program Information Transmittal	09/17/92
SSD-1-SPF-63-91B	Scaling Setpoint Document, RHR Pump A-A to RCS 2 & 3 CL	5
SSD-1-SPF-63-91C	Scaling Setpoint Document, RHR Pump A-A to RCS 2 & 3 CL	3
SSD-PI-74-18-D	RHR Pump Outlet Pressure	0
SSD-PI-74-22-D	RHR Pump Inlet Pressure	0
TI-100.001	Appendix A, 09-PV-0013, RHR Pump 1A-A, Pump Reference Value Worksheet	17
TI-100.001	Appendix A, 09-PV-0013, RHR Pump 1B-B	10
TI-100.11	Inservice Testing Bases Document	23
TI-79.821	Diesel Generator 1A-A Jacket water Cooler Performance Test	2
TI-79.824	Diesel Generator 2B-B Jacket water Cooler Performance Test	2
TTL No. IRA-03	Seismic Qualification of Air Receiver, (for TVA, Watts Bar, Ingersoll-Rand Air Power Compressor Division)	10/11/77
TVA letter to NRC	Sequoyah, Browns Ferry and Watts Bar Nuclear Plants-Response to Generic Letter (GL) 89-13, Service Water System Problems Affecting Safety-Related Equipment	01/26/90
TVA letter to NRC	Watts Bar Nuclear Station – Response to Generic Letter (GL) 89-13, Service Water System Problems Affecting Safety-Related Equipment	07/09/90
TVA letter to NRC	Watts Bar Nuclear Plant Unit 1s-Response to Generic Letter (GL) 89-13, Service Water System Problems Affecting Safety-Related Equipment, Request for Additional Information (RAI) Concerning TVA's Amended Commitment	03/23/94
TVA letter to NRC	Watts Bar Nuclear Plant Unit 1s-Response to Generic Letter (GL) 89-13, Service Water System Problems Affecting Safety-Related Equipment, Revised Methodology and Schedule	07/30/97
TVA letter to NRC	Watts Bar Nuclear Plant Unit 1-Response to Generic Letter (GL) 89-13, Service Water System Problems Affecting Safety-Related Equipment, Revised Methodology and Schedule	11/05/97

TVA Valve Specification No. 38-83015	Attachment B, Rev.2	08/20/76
WAT-D-9911	RHR Pump K_{min} ECCS Evaluation	01/13/95
WBN Cables Standard Report	Cable 1V207A	07/15/92
WBNEQ-MOV-001	Limitorque Motorized Valve Operator with Type RH Insulated Motor, Sheet 5a	02/10/89
WBN-SDD-N3-3B-4002	Auxiliary Feedwater System	16
WBN-SDD-N3-82-4002	Standby Diesel Generator System	16
WBN-VTD-AS04-0080	Instructions for Asea Brown Boveri Single Phase Voltage Relay Type 27N High Accuracy Undervoltage Relay and Type 59N High Accuracy Overvoltage Relay	0
WBN-VTD-C770-0020	Cutler Hammer Instruction Sheet Bulletin 10250 Heavy Duty Oil Tight Control Units Renewal Parts	0
WBN-VTD-G080-1170	GE Instructions for Low Voltage Power Circuit Breakers (PUB. # GEK-7303C)	4
WBN-VTD-O015-0020	CCS Heat Exchanger Data Sheets	-
WBN-VTD-W030-0020	Walworth Company Maintenance Manual Cast Steel Bolted Bonnet Gate, Globe and Swing Check Valves	01/31/86
WBN-VTD-W120-0590	Instruction Book Motor Equipment RHR Pump Motor	0
WBN-VTD-W120-2356	Westinghouse Instructions for Determination of Dryness and Drying Out of Transformers	1
WBN-VTD-W120-2958	Westinghouse Motor Operated Gate Valves Manually Operated Gate Valves Swing Check Valves	9
WBN-VTD-W120-3023	Westinghouse MPM-DS Maintenance Program Manual for Safety Related Type DS Low Voltage Metal Enclosed Switchgear (Pub #MPM-DS)	12
WBN-VTM-W090-0080	Weschler Electric Co. K-241 Switchboard Instruments	1
WBN-VTM-W120-0480	Westinghouse 125VDC Vital Battery Board 1 thru IV and Kemco Unit Control Inc. 125 VDC Vital Battery Board V and Distribution Panels A, B and O	17
WBN-VTM-W120-0490	Instructions for Westinghouse AB DE-ION Circuit Breakers Types EB, EHB, FB and Mark 75 Type HFB	0
WBN-VTM-W120-0500	Instructions for Westinghouse AB DE-ION Circuit Breakers Types LBB, LB and Mark 75 Type HLB	0
WBPER 148716	Review NRC IN-1997-21	03/10/09
WPN-DS-501433-0201	Check and Isolation Valves for ERCW System, (includes seismic evaluation)	5

Procedures

NAME	TITLE	REVISION/ DATE
0-MI-0.026	Heat Exchanger Cleaning And Inspection	1
0-MI-0.34	Non-Intrusive Check Valve Testing	0

0-MI-57.036	Electric Motor/Generator Replacement and Bearing Maintenance	2
0-MI-57.108	Insulation Resistance And Continuity Tests For Rotating Machinery Valves Cables Buses and Transformers	3
0-SI-32-902-B	Aux Air Compressor Cooling Water Valve Full Cycle Exercising During Normal Operation – Train B	12
1-SI-211-5-B	Channel Calibration Test on Degraded Voltage Relays for 6.9kv Shutdown Board 1B-B	5
1-SI-268-1-A	92 Day Permanent Hydrogen Mitigation System Train A Igniter Availability Test	3
1-SI-268-1-B	92 Day Permanent Hydrogen Mitigation System Train B Igniter Availability Test	3
1-SI-268-2-A	18 Month Permanent Hydrogen Mitigation System Train A Operability Test	4
1-SI-268-2-B	18 Month Permanent Hydrogen Mitigation System Train B Operability Test	4
1-SI-3-906-A	Check Valve Testing During Hot Standby – Auxiliary Feedwater System (Train A)	13
1-SI-3-906-B	Check Valve Testing During Hot Standby – Auxiliary Feedwater System (Train B)	13
1-SI-3-911	Non-Intrusive Testing Of Motor Driven AFW Pump Check Valves During Refueling	4
1-SI-3-912	AFW Check Valve Testing During Hot Standby Turbine Driven Flowpath	15
1-SI-3-917	Non-Intrusive Testing TD AFW Check Valves During Refueling	4
1-SI-3-923-A	Auxiliary Feedwater Pump 1A-A Comprehensive Pump Test	6
1-SI-3-923-S	Auxiliary Feedwater Pump 1A-S Comprehensive Pump Test	5
1-SI-63-907	Residual Heat Removal Hot Leg and Cold Leg Injection Check Valve Testing During Refueling	24
AOI-10	Loss of Control Air	40
AOI-13	Loss of Essential Raw Cooling Water	39
AOI-15	Loss of Component Cooling Water (CCS)	33
AOI-40	Station Blackout	15 & 16
AOI-7.06	Alignment of HPFP Water to the Steam Generators	4
ARI-223-229	ERCW	7
ARI-230-240	CLRS ERCW SUP	15
ARI-241-253	CCS	11
ARI-254-264	CCS	4
ARI-95-101	Reactor Coolant Pumps	33
ECA-0.0	Loss of Shutdown Power	22
EDMG-2	Serious Event Mitigation	0
ES-1.2	Post LOCA Cooldown and Depressurization	15
ES-1.2	Post LOCA Cooldown and Depressurization, (HP-WOG Document)	HP-Rev. 2
FR-H.1	Loss Of Secondary Heat Sink	-
GO-2	Reactor Startup	40
MI-17.018	Flood Preparation-High Pressure Fire protection System Spool Pieces	10
MI-70.002	Component Cooling Heat Exchanger Maintenance And Testing	13

NEDP-22	Operability Determinations And Functional Evaluations	11
NETP-107	Medium Voltage Motor Testing and Maintenance Program	4
NPG-SPP-03.1.4	Corrective Action Program Screening And Oversight	3
OPDP-8	Limiting Conditions For Operation Tracking	5
SOI-2&3.01	Condensate And Feedwater System	116
SOI-3.02	Auxiliary Feedwater System	50
SOI-67.01	Essential Raw Cooling Water System	114
SOI-84.01	Flood Mode Boration Make-Up System	9
TI-100.001	Inservice Testing of Pumps	17
TI-104	Instrument Air Quality	11
TI-31.02	Plant Equipment Vibration Monitoring & Vibration Diagnostics Program	22
TI-79.000	Program for Implementing NRC Generic Letter 89-13	11
TI-79.703	Component Cooling System Heat Exchanger C Performance Test	8
TI-8.06	Check Valve Program	2
WOG Document	ERG-EOP Step Deviation Document EOP Document Form, (EOP No. ES-1.2)	12/13/10

Service Requests/Problem Evaluation Reports Initiated Due to CDBI Activity

NAME	TITLE	REVISION/ DATE
499225	NRC Identified-Housekeeping in Unit 1 Terry Turbine Room	02/01/12
499275	NRC Inspector Observed Unsecured Wrench during CDBI Walkdown at the IPS	02/01/12
499950	CDBI 2012; IST Program Check Valve Classification	02/02/12
500684	2012 CDBI Identified, Evaluate Auxiliary Control Air System (ACAS) testing	03/03/12
500697	Margin Management: Increasing Trend In 1-PCV-3-132 Stroke Times	02/03/12
500726	2012 CDBI-HPFP System Description Deficiency	02/03/12
501737	CDBI Walkdown 219-Unsecured Unlabeled Ladder on Floor of AB 692’ Pen Room	02/06/12
501792	2012 CDBI 47W821 Series Drawings have Extraneous Outdated Information Depicted	02/06/12
501941	2012 CDBI NRC Identified Evaluate Auxiliary Control Air System (ACAS) Testing	02/06/12
502543	Issue relating from an NRC CDBI 2012 Question on ERCW Check Valves, (minimum flow required to maintain the ERCW pump discharge check valve discs in the fully open position)	02/07/12
503052	NRC Identified- Unrestrained Temporary Equipment	02/08/12
503187	Issue Resulting from an NRC CDBI 2012 Question on ERCW Check Valves	02/08/12
506577	CDBI-2012; IST Program ERCW Check Valve Classification	02/15/12
507667	CDBI-2012 IST Program ERCW Check Valve Classification	02/16/12
507675	CDBI - NRC Identified Degraded Breaker Control Voltage Issues with Maintenance Procedures	02/12/12
508099	CDBI Misc HO Lock Tabs Identified on Floor behind 1-L-565/C	02/17/12
508115	CDBI Identified Housekeeping Issues during CCS Walkdown	02/17/12

Service Requests/Problem Evaluation Reports Initiated Due to CDBI Activity

NAME	TITLE	REVISION/ DATE
510299	CDBI-Housekeeping Issue Identified during Walkdown of AB 737’	02/22/12
510729	CDBI-The IPS Floor Drain Trench is Clogged with Trash	02/06/12
510956	NRC CDBI Identified – Generic Letter 89-13 testing requirements not per Program intent	02/23/12
511010	CDBI -gap between DS breaker procedure documentation and Westinghouse service life limitations	02/22/12
511469	CDBI - Acceptance criteria in 0-MI-57.200 appears to be inconsistent with vendor information.	02/22/12
511507	NRC CDBI Identified – Diesel Generator Jacket Water Heat Exchanger Performance Test Results	02/24/12
511679	CDBI Identified-Generic Letter 89-13 Testing Requirements not per Program Intent	02/24/12
511701	NRC CDBI Identified-Diesel Generator Jacket Water Heat Exchanger Performance Test Results	02/24/12
513893	CDBI 2012 Issue Discrepancy between the vendor test recommendations and SI required M&TE	02/27/12
514049	CDBI Concern on EOP Transition Points Lacking Specific Guidance on Values for Decision Making	02/29/12
514360	NRC-Identified (during CDBI) - Rust Stains on Support Steel for RHR Pump 1B-B Seal Water Cooler	03/01/12
514586	NRC-Identified (during CDBI) Issue – Condensation from CCS piping creates water puddles on floor.	03/01/12
514730	2012 CDBI-Wording on CCS Heat Exchanger Test Procedures	03/01/12
514798	CDBI Question Concerning Number of PER’s on MDAFW LCV Behavior	03/01/12
514799	2012 CDBI Stow Flexible Remote Operator Concerns Bend Radius Maintenance Clamps	03/01/12
515302	CDBI Concern on EOP Transition Points Lacking Specific Guidance on Valves for Decision Making	03/02/12
515385	CDBI Issue-Rust Stains on Support Steel for RHR Pump 1B-B Seal Water Heat Exchanger	03/02/12
515389	CDBI-No Documentation of Megger Testing of Cable to Connect MA-1 Diesel Generator	02/02/12
515407	CDBI-2012-NRC identified Maintenance Procedure acceptance criteria issues	03/01/12
515411	During the 2012 CDBI Inspection the Inspector Determined that 1PCV-3-132 was Returned to Operable Status W/O Meeting NEDP-22	02/12/12
515413	2012 CDBI Issue NRC Identified Harmonic Distortion Issue	03/01/12
516562	CDBI – MDAFW Pump 1B-B Anomalous Condition	03/02/12
517095	CDBI -2012-NRC Apparent Discrepancy between 6.9KV Breaker Closure Time	03/06/12
605645	CDBI-NRC Identified Degraded Breaker Control Voltage Issues with Maintenance Procedures	02/16/12