



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

REGION II  
SAM NUNN ATLANTA FEDERAL CENTER  
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ATLANTA, GEORGIA 30303-8931

October 27, 2006

Tennessee Valley Authority  
ATTN: Mr. K. W. Singer  
Chief Nuclear Officer and  
Executive Vice President  
6A Lookout Place  
1101 Market Street  
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT - NRC INTEGRATED INSPECTION REPORT  
05000390/2006004 AND 05000391/2006004

Dear Mr. Singer:

On September 30, 2006, the United States Nuclear Regulatory Commission (NRC) completed an inspection at your Watts Bar Nuclear Plant, Units 1 and 2. The enclosed integrated inspection report documents the inspection results which were discussed on October 4, 2006, with Mr. M. Skaggs 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 license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

This report documents four NRC-identified findings of very low safety significance (Green) which were determined to involve violations of NRC requirements. However, because of their very low safety significance and because they are entered into your corrective action program, the NRC is treating these four findings as non-cited violations (NCVs) consistent with Section VI.A.1 of the NRC Enforcement Policy. If you contest any NCV in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the United States Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Watts Bar facility.

TVA

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Sincerely,

*/RA/*

Malcolm T. Widmann, Chief  
Reactor Projects Branch 6  
Division of Reactor Projects

Docket Nos. 50-390, 50-391  
License No. NPF-90 and Construction  
Permit No. CPPR-92

Enclosure: NRC Inspection Report 05000390/2006004, 05000391/2006004  
w/Attachment: Supplemental Information

cc w/encl: (See page 3)

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Report to K. W. Singer from Malcolm Widmann dated October 27, 2006.

SUBJECT: WATTS BAR NUCLEAR PLANT - NRC INTEGRATED INSPECTION REPORT  
05000390/2006004 AND 05000391/2006004

Distribution w/encl:

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos: 50-390, 50-391

License Nos: NPF-90 and Construction Permit CPPR-92

Report Nos: 05000390/2006004, 05000391/2006004

Licensee: Tennessee Valley Authority (TVA)

Facility: Watts Bar Nuclear Plant, Units 1 and 2

Location: Spring City, TN 37381

Dates: July 1, 2006 - September 30, 2006

Inspectors: J. Bartley, Senior Resident Inspector  
M. Pribish, Resident Inspector  
W. Bearden, Senior Resident Inspector, Browns Ferry, Unit 1 (Section 4OA5.4)  
F. Ehrhardt, Operations Engineer, Region II (Section 1R11.1)

Approved by: Malcolm T. Widmann, Chief  
Reactor Projects Branch 6  
Division of Reactor Projects

Enclosure

## SUMMARY OF FINDINGS

IR 05000390/2006-004, 05000391/2006-004; 07/01/2006 - 09/30/2006; Watts Bar, Units 1 & 2; Fire Protection, Maintenance Effectiveness, Maintenance Risk Assessments and Emergent Work Evaluation, and Operability Evaluations.

The report covered a three-month period of routine inspection by three resident inspectors and three operations engineers. Four NRC-identified Green findings, all of which were non-cited violations (NCVs), were identified. The significance of an issue is indicated by its color (Green, White, Yellow, Red) using the Significance Determination Process in Inspection Manual Chapter 0609, Significance Determination Process (SDP). The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, Reactor Oversight Process, Revision 3, dated July 2000.

### A. NRC-Identified Findings and Self-Revealing Findings

#### **Cornerstone: Mitigating Systems**

- Green. The inspectors identified an NCV of the Fire Protection Report Operating Requirement which requires that fire watches be established when portions of the fire protection system are disabled. As a result of improper procedure implementation, the diesel generator building corridor automatic sprinkler system was isolated for approximately five days without the required fire watches being established. The licensee promptly restored the system to operable status and entered the problem into their corrective action program.

The finding is more than minor because it is associated with the protection against external factors attribute of the Mitigating Systems Cornerstone and adversely affects the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events, such as fires. This finding is of very low safety significance because of the low number of potential fire ignition sources in the affected areas and also because of the duration that the sprinkler system was isolated. This finding has a cross-cutting aspect in the area of human performance because test personnel did not follow established test procedures. (Section 1R05)

- Green. The inspectors identified an NCV of Technical Specification (TS) 5.7.1 for failing to follow procedures while performing maintenance on an essential raw cooling water valve which supports the A-train electric boardroom (EBR) chiller. This deficiency rendered the A-train EBR chiller inoperable. The licensee entered the deficiency into their corrective action program for resolution.

The finding is more than minor because it is associated with the equipment performance attribute of the Mitigating Systems Cornerstone in that it affected the availability of the A train EBR chiller. This finding was determined to be of very low safety significance because there was no design or qualification deficiency, no loss of system safety function, no actual loss of safety function, and the finding was not potentially risk significant due to external events. This finding is associated with the cross-cutting area of human performance because

maintenance personnel did not follow an established maintenance procedure. (Section 1R12)

- Green. The inspectors identified an NCV of 10 CFR 50.65(a)(4) was identified for failure to perform an adequate risk assessment for maintenance and testing activities affecting the emergency gas treatment system (EGTS) and auxiliary building gas treatment system (ABGTS). The licensee inappropriately credited EGTS as being available when restoration actions for EGTS were not contained in a written procedure or work order. This resulted in the licensee being in a Yellow risk condition requiring risk management actions. The licensee entered the deficiency into their corrective action program for resolution.

This finding is more than minor per MC 0609 Appendix E, example 7.e, because the licensee failed to perform an adequate risk assessment prior to conducting online maintenance. When correctly assessed, the risk would have put the plant into a higher risk category and require risk management actions. The licensee's risk assessment inappropriately credited EGTS restoration actions which were not proceduralized. The finding is of very low safety significance because the incremental large early release probability deficit was less than  $1 \text{ E-}7$ . The cause of this finding affected the cross-cutting aspect of human performance because the licensee did not appropriately plan work activities using risk insights by depending on restoration actions that were not proceduralized to reduce risk. (Section 1R13)

- Green. The inspectors identified an NCV of TS 3.0.4 for entering Modes 1 and 2 with the automatic auxiliary feedwater start signal for a loss of normal feedwater (TS 3.3.2.6.e) inoperable. The licensee inappropriately concluded this function was operable when a turbine-driven main feedwater pump trip bus was energized even though the pump was not running and supplying feedwater to the steam generators.

The finding is more than minor because it is associated with the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring that the operability, availability, reliability, or function of systems that respond to initiating events to prevent undesirable consequences is maintained. The licensee entered Modes 1 and 2 and operated up to 18% power without an auxiliary feedwater start signal for a loss of main feedwater when the stand-by main feedwater pump was the sole source of feedwater. Using MC 0609, Appendix A, the finding was determined to be of very low safety significance because the finding did not represent a loss of system safety function, did not represent actual loss of safety function of a single train for greater than its TS allowed outage time, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. (Section 1R15)

#### B. Licensee-Identified Violations

None.



## REPORT DETAILS

### Summary of Plant Status

Unit 1 operated at or near 100 percent power until July 31, 2006, when the unit automatically tripped due to a main generator automatic voltage regulator fault. Unit 1 returned to full power on August 7, 2006, and remained at or near 100 percent power until September 11, 2006, when the unit was manually tripped to start the Unit 1 Cycle 7 refueling and steam generator replacement outage. Unit 2 remained in a suspended construction status.

## **1. REACTOR SAFETY**

### **Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity**

#### 1R04 Equipment Alignment

##### .1 Quarterly Partial System Walkdowns

###### a. Inspection Scope

The inspectors conducted three equipment alignment partial walkdowns to evaluate the operability of selected redundant trains or backup systems, listed below, with the other train or system inoperable or out of service. The inspectors reviewed the functional system descriptions, Updated Final Safety Analysis Report (UFSAR), system operating procedures, and Technical Specifications to determine correct system lineups for the current plant conditions. The inspectors performed walkdowns of the systems to verify that critical components were properly aligned and to identify any discrepancies which could affect operability of the redundant train or backup system.

- B train containment spray (CS) in preparation for A-train CS pump maintenance
- 1A and 1B motor-driven auxiliary feedwater (MDAFW) pumps during turbine-driven auxiliary feedwater (TDAFW) scheduled maintenance
- 1A and 2A diesel generators (DGs) during 2B DG air start system corrective maintenance

###### b. Findings

No findings of significance were identified.

##### .2 Semiannual Complete System Walkdown

###### a. Inspection Scope

The inspectors conducted a detailed walkdown/review of the alignment and condition of the component cooling water system (CCS) to verify proper equipment alignment and to identify any discrepancies that could impact the function of the system and increase risk. The inspectors used licensee procedures, as well as licensing and design documents, to verify that the system alignment was correct. During the walkdown, the inspectors also verified, as appropriate, that: (1) valves were correctly positioned and did not exhibit

leakage that would impact the function(s) of any valve; (2) electrical power was available as required; (3) major portions of the system and components were correctly labeled, cooled, ventilated, etc.; (4) hangers and supports were correctly installed and functional; (5) essential support systems were operational; (6) ancillary equipment or debris did not interfere with system performance; (7) tagging clearances were appropriate; and (8) valves were locked as required by the licensee's locked valve program. Pending design and equipment issues were reviewed to determine if the identified deficiencies significantly impacted the system's functions. Items included in this review were the operator workaround list, the temporary modification list, system health reports, and outstanding maintenance work requests/work orders. In addition, the inspectors reviewed the licensee's corrective action program (CAP) to ensure that the licensee was identifying equipment alignment problems and that they were properly addressed for resolution. Specific documents reviewed are listed in the attachment.

b. Findings

No findings of significance were identified.

1R05 Fire Protection

Fire Protection - Tours

a. Inspection Scope

The inspectors conducted tours of 12 areas important to reactor safety, listed below, to verify the licensee's implementation of fire protection requirements as described in the Fire Protection Program, Standard Programs and Processes (SPP)-10.0, Control of Fire Protection Impairments, SPP-10.10, Control of Transient Combustibles, SPP-10.11, Control of Ignition Sources (Hot Work). The inspectors evaluated, as appropriate, conditions related to: (1) licensee control of transient combustibles and ignition sources; (2) the material condition, operational status, and operational lineup of fire protection systems, equipment, and features; and (3) the fire barriers used to prevent fire damage or fire propagation.

- Auxiliary instrument room (CB 708)
- 1A-A and 2A-A DGs
- 1B-B and 2B-B DGs
- A-train and B-train essential raw cooling water (ERCW) pumps
- A-train and B-train high pressure fire protection pumps
- A-train and B-train ERCW strainers
- ERCW traveling screens

b. Findings

Introduction: A Green non-cited violation (NCV) was identified by the NRC for failure of the licensee to enter the appropriate Fire Protection Report (FPR) Operating Requirement when the DG building corridor automatic sprinkler system was disabled.

Description: During a plant status tour of the DG building on June 20, 2006, the inspectors identified that valve 0-ISV-26-1083, supply to the DG building corridor sprinkler system, was shut rendering the sprinkler system inoperable. After questioning by the inspectors, fire protection personnel determined that no work was in progress that required the valve to be shut, nor were the required fire watches established. Fire protection personnel opened the valve to restore the sprinkler system to proper alignment. The licensee initiated problem evaluation report (PER) 105450 to determine the cause of the valve mis-position.

The licensee's investigation determined that the valve was inappropriately closed on June 15, 2006, during the performance of licensee procedure 0-FOR-13-620, 6 Month Fire Detection Test Panel L620. One of the test performers, without referencing the test procedure, shut valve 0-ISV-26-1083 on the assumption that the valve was to be closed later in the test procedure. This valve was not part of the test procedure being performed. The valve remained shut until discovered by the inspectors.

Analysis: The finding is more than minor because it is associated with the protection against external factors attribute of the Mitigating Systems Cornerstone and adversely affects the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events, such as fires, due to the DG corridor automatic fire suppression system being unable to mitigate the effects of a fire. The inspectors evaluated this finding and determined that it was of very low safety significance (Green) because of the duration that the sprinkler system was isolated and because critical distances were exceeded between potential ignition sources and damage targets. Additionally, the areas affected were monitored by smoke detection instrumentation, and there were nearby hose stations which could be used for fire suppression activities. This finding has a cross-cutting aspect in the area of human performance because test personnel did not follow established test procedures.

Enforcement: Facility Operating License NPF-90 for Watts Bar Nuclear Plant Unit 1, Condition 2.F, requires that TVA shall implement and maintain in effect all provisions of the approved fire protection program as described in the FPR. Operating Requirement 14.3.1.a.2 required restoration of inoperable suppression equipment within one hour or establishing a roving fire watch with backup suppression equipment. Contrary to this, between June 15, 2006, and June 20, 2006, the DG building corridor sprinkler system was isolated without establishing the required fire watches. Because this finding is of very low safety significance and because it was entered into the licensee's CAP as PER 105450, this violation is being treated as an NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy: NCV 05000390/2006004-01, Fire Header Inoperable Due to Failure to Follow Procedure.

## 1R11 Licensed Operator Requalification

### .1 Annual Review of Licensee Requalification Examination Results

#### a. Inspection Scope

On September 1, 2006, the licensee completed the requalification annual operating tests, required to be given to all licensed operators by 10 CFR 55.59(a)(2). The inspectors performed an in-office review of the overall pass/fail results of the individual operating tests and the crew simulator operating tests. These results were compared to the thresholds established in Manual Chapter 609 Appendix I, Operator Requalification Human Performance Significance Determination Process.

#### b. Findings

No findings of significance were identified.

### .2 Quarterly Review by Resident Inspectors

#### a. Inspection Scope

On July 13, 2006, the inspectors observed operators in the plant's simulator during licensed operator annual requalification examinations to verify operator performance was adequate, evaluators were identifying and documenting crew performance problems, and training was being conducted in accordance with procedures TRN-1, Administering Training, and TRN-11.4, Continuing Training for Licensed Personnel. The inspectors observed a shift crew's response to scenario 3-OT-SRE0022A, Feedwater malfunction followed by a large break loss of coolant accident.

#### b. Findings

No findings of significance were identified.

## 1R12 Maintenance Effectiveness

#### a. Inspection Scope

The inspectors reviewed the two performance-based problems listed below. The focus of the reviews was to assess the effectiveness of maintenance efforts that apply to scoped structures, systems, or components (SSCs) and to verify that the licensee was following the requirements of TI-119, Maintenance Rule Performance Indicator Monitoring, Trending, and Reporting 10 CFR 50.65, and SPP-6.6, Maintenance Rule Performance Indicator Monitoring, Trending, and Reporting 10 CFR 50.65. Reviews focused, as appropriate, on (1) appropriate work practices; (2) identification and resolution of common cause failures; (3) scoping in accordance with 10 CFR 50.65; (4) characterization of reliability issues; (5) charging unavailability time; (6) trending key parameters; (7) 10 CFR 50.65 (a)(1) or (a)(2) classification and reclassification; and (8) the appropriateness of performance criteria for SSCs classified as (a)(2) or goals and

corrective actions for SSCs classified as (a)(1). Specific documents reviewed are listed in the Attachment.

- Cooling Tower (a)(1) action plan
- A-train electric boardroom (EBR) chiller diaphragm failure

b. Findings

Introduction: A Green NCV of TS 5.7.1 was identified by the NRC regarding a failure to follow an established maintenance procedure which resulted in the unplanned unavailability of the A-train EBR chiller.

Description: On August 29, 2006, the inspectors identified that the A-train EBR chiller temperature control valve (TCV), 0-TCV-67-1050-A, was approximately 50% open with the chiller not running. The inspectors contacted the responsible system engineer who determined that the TCV would not stroke fully closed. The EBR air conditioning subsystem is a safety-related, risk-significant, non-TS system consisting of two 100% trains designed to provide cooling for spaces located on the 692.0' and 708.0' elevations of the control building which contain instrumentation important to safe plant operation. On August 30, 2006, an engineering evaluation determined that the A-train EBR chiller was not able to meet its 100-day mission time, and the chiller was declared inoperable. When the TCV was disassembled, it was discovered that the valve diaphragm had failed due to being installed backwards. The diaphragm was installed on July 13, 2006, using work order (WO) 05-812975-000. The licensee replaced the failed diaphragm and entered the procedural noncompliance into their CAP for resolution as PER 110032.

Analysis: The finding was more than minor because it is associated with the equipment performance attribute of the Mitigating Systems Cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events due to the EBR chiller not being able to meet its 100-day mission time. The inspectors determined that this finding was of very low safety significance (Green) because the finding was not a design or qualification deficiency, there was no loss of system safety function, there was not an actual loss of safety function, and the finding was not potentially risk significant due to external events. This finding has a cross-cutting aspect in the area of human performance because maintenance personnel did not follow an established maintenance procedure.

Enforcement: TS 5.7.1.1.a requires that written procedures shall be implemented and maintained covering the activities in the applicable procedures recommended by Regulatory Guide (RG) 1.33, Revision 2, Appendix A, of which part 9.a states that maintenance that can affect the performance of safety-related equipment should be properly preplanned and performed in accordance with written procedures, documented instructions, or drawings appropriate to the circumstances. Contrary to this, on July 13, 2006, the assembly of the A-train EBR chiller TCV was not performed in accordance with written procedures which resulted in the valve diaphragm failing due to its incorrect orientation. Because this violation was determined to be of very low safety significance and has been entered into their CAP as PER 110032, this violation is being treated as an NCV consistent with Section VI.A.1 of the NRC Enforcement Policy, and is identified as NCV 05000390/2006004-02, Failure to Follow Procedure During Preventive Maintenance.

### 1R13 Maintenance Risk Assessments and Emergent Work Evaluation

#### a. Inspection Scope

The inspectors evaluated, as appropriate for the four work activities listed below to verify: (1) the effectiveness of the risk assessments performed before maintenance activities were conducted; (2) the management of risk; (3) that, upon identification of an unforeseen situation, necessary steps were taken to plan and control the resulting emergent work activities; and (4) that maintenance risk assessments and emergent work problems were adequately identified and resolved. The inspectors verified that the licensee was complying with the requirements of 10 CFR 50.65 (a)(4); SPP-7.0, Work Control and Outage Management; SPP-7.1, Work Control Process; and TI-124, Equipment to Plant Risk Matrix. Specific documents reviewed are listed in the Attachment.

- A-shutdown board room (SDBR) chiller removed from service concurrently with the 1A safety injection pump inoperable
- B-train auxiliary building gas treatment system (ABGTS) removed from service for maintenance concurrent with B-train emergency gas treatment system (EGTS) testing requiring manual operation
- Emergent work to repair failed temperature control valve on A-train EBR chiller
- Emergent work to replace non-qualified diaphragm in A-train EBR chiller temperature control valve

#### b. Findings

Introduction: A Green NRC-identified NCV of 10 CFR 50.65(a)(4) was identified for failure to perform an adequate risk assessment for maintenance and testing activities affecting the EGTS and ABGTS.

Description: On August 15, 2006, the inspectors reviewed the licensee's risk assessment for one train ABGTS being inoperable for maintenance and one train EGTS being inoperable for testing due to a pressure controller being in manual. This condition existed for approximately 2 1/2 hours. Watts Bar Technical Instruction (TI) - 124,

Equipment to Plant Risk Matrix, Section 6.2.2, Large Early Release Frequency, specified that this condition was a Yellow risk for incremental large early release probability (ILERP). The licensee risk assessment took credit for restoration actions to maintain EGTS available and the ILERP remained Green.

The inspectors reviewed the licensee's manual operator actions to verify that they met the requirements specified in TI-124. TI-124 required that restoration actions must be contained in the written procedure/work order. The inspectors determined that the procedural actions for restoration were to return the system to standby and would not have worked for restoring the system after an automatic actuation caused by a safety injection or containment phase A isolation signal. Discussions with the Shift Manager, who had authorized the work, revealed that he thought the procedural guidance required by the risk assessment was to restore the system to a standby configuration. The Shift Manager recognized that the written guidance would not work after an automatic actuation and had verbally briefed the dedicated EGTS operator on the required restoration actions. The inspectors determined these actions were appropriate to restore the system after an automatic actuation, however, they did not meet the requirement for being contained in a written procedure/work order. The licensee initiated PER 108886 to address this issue.

Analysis: The inspectors determined that the finding was more than minor using MC 0609 Appendix E, example 7.e, because the licensee failed to perform an adequate risk assessment prior to conducting online maintenance which, if correctly assessed, would have put the plant into a higher risk category. The licensee's risk assessment inappropriately credited EGTS restoration actions which were not proceduralized. The inspectors determined the finding was of very low safety significance because the ILERP deficit was less than  $1 \text{ E-}7$ . The cause of this finding affected the cross-cutting aspect of human performance because the licensee did not appropriately plan work activities using risk insights by depending on restoration actions that were not proceduralized to reduce risk.

Enforcement: 10 CFR 50.65 (a)(4), Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants, requires, in part, that before performing maintenance activities, the licensee shall assess and manage the increase in risk that may result from the proposed maintenance activities. Contrary to the above, on August 15, 2006, an adequate risk assessment for testing on the A-train EGTS and concurrent maintenance on the A-train ABGTS was not performed in that operator restoration actions credited for availability of EGTS were not proceduralized as required by licensee procedure TI-124. Because this violation was determined to be of very low safety significance and has been entered into the licensee's CAP as PER 108886, this violation is being treated as an NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy: NCV 05000390/2006004-03, Inappropriate Crediting of Operator Restoration Actions Causes Inadequate Risk Assessment.

1R14 Personnel Performance During Non-routine Plant Evolutionsa. Inspection Scope

On July 31, 2006, Unit 1 automatically tripped due to a generator fault. The inspectors reviewed operator logs, plant computer data, completed procedures, and the reactor trip report, and interviewed operators to determine what occurred and how the operators responded. In addition, the inspectors verified that the operator response was in accordance with plant procedures. Further details associated with this event are documented in Section 4OA3. Additional documents reviewed are listed in the attachment.

b. Findings

No findings of significance were identified.

1R15 Operability Evaluationsa. Inspection Scope

The inspectors reviewed five operability evaluations affecting risk-significant mitigating systems, listed below, to assess, as appropriate: (1) the technical adequacy of the evaluations; (2) whether continued system operability was warranted; (3) whether other existing degraded conditions were considered as compensating measures; (4) whether the compensatory measures, if involved, were in place, would work as intended, and were appropriately controlled; (5) where continued operability was considered unjustified, the impact on TS Limiting Conditions for Operation and the risk significance in accordance with the Significance Determination Process SDP. The inspectors verified that the operability evaluations were performed in accordance with SPP-3.1, Corrective Action Program. Additional documents reviewed are listed in the Attachment.

- PER 106175, Operation with A train SDBR chiller TCV manually opened
- PER 106457, 2B 480v board room air conditioning system solenoid valve 2-FSV-31-447-B coil replacement
- PER 108571, Steam generator level trip time delay Channel III tuning constant discrepancies
- PER 109655, A-EBR chiller TCV diaphragms were not dedicated as safety related
- PER 110770, AFW auto-start on the loss of all main feed pumps

b. Findings

Introduction: A Green NCV of TS 3.3.2 was identified for failing to have an auxiliary feedwater (AFW) start signal during startup operations when using the standby main feedwater (SBMFW) pump in lieu of a turbine-driven main feedwater (TDMFW) pump.

Description: TS 3.3.2, Table 3.3.2-1, Item 6.e, requires an AFW start signal on a trip of all main feedwater (MFW) pumps. The AFW auto start circuit for a loss of all MFW pumps receives inputs from an oil pressure switch on each TDMFW pump's control oil



header. When both oil pressure switches indicate its respective TDMFW pump is tripped, the circuit generates a start signal for both MDAFW pumps and the TDAFW pump. There is no autostart signal into the circuit from the SBMFW pump. The bases for TS 3.3.2, Item 6.e, states that "A trip of both turbine driven MFW pumps is an indication of a loss of MFW and the subsequent need for some method of decay heat and sensible heat removal to bring the reactor back to no load temperature and pressure." It further states that "This Function must be OPERABLE in MODES 1 and 2. This ensures that at least one SG is provided with water to serve as the heat sink to remove reactor decay heat and sensible heat in the event of an accident." Taking these statements together, it is clear that the bases of the TS is for an automatic start of AFW for a loss of MFW, not just a loss of MFW due to a trip of the TDMFW pumps. This automatic actuation is an anticipatory AFW start signal. The accident analysis for loss of MFW in the UFSAR does not take credit for AFW pump start on loss of MFW. It assumes the AFW pumps start when the steam generators reach the low-low level setpoint.

The licensee's practice on startups has been to use the motor-driven SBMFW pump during startups up to approximately 15 - 18% power at which time a TDMFW pump was started. The licensee determined that they complied with TS 3.3.2 by energizing one TDMFW pump trip circuit and resetting all trip signals so the oil pressure switch would indicate the TDMFW pump was not tripped. The TDMFW pump would be ready to start but not running, therefore the AFW start circuitry would see one TDMFW pump tripped and the other not tripped. In this configuration the SBMFW pump could trip resulting in a loss of MFW with no immediate automatic actuation of AFW.

Analysis: The finding is more than minor because it is associated with the configuration control attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events. The cornerstone was impacted since the licensee operated in Modes 1 and 2 up to 18% power without an AFW start signal for a loss of MFW when the SBMFW pump was the sole source of feedwater. The finding was determined to be of very low safety significance because the finding did not represent a loss of system safety function, did not represent actual loss of safety function of a single Train for greater than its TS allowed outage time, and is not potentially risk significant due to a seismic, flooding, or severe weather initiating event. The inspectors determined that there was not a loss of safety function for the system or single train because the AFW start on low-low steam generator was functional.

Enforcement: TS 3.3.2 requires that the engineered safeguards features actuation system's instrumentation for each function in Table 3.3.2-1 shall be operable. Table 3.3.2-1, item 6.e, requires that an AFW start signal for a trip of all MFW pumps be operable in Modes 1 and 2. TS 3.3.2 Condition J requires that with one MFW pumps trip channel inoperable the licensee has 48 hours to restore the channel to an operable status or be in Mode 3 within 54 hours.

TS 3.0.4 requires that entry into a Mode or other specified condition in the Applicability shall only be made when the associated actions to be entered permit continue operation in the Mode to be entered for an unlimited period of time; after performance of a risk assessment addressing the inoperable systems and components, consideration of the results, determination of the acceptability of entering the Mode, and establishment of risk management actions if necessary; or when an allowance is specifically stated in the individual value, parameter, or other Specification.

Contrary to the above, for plant startups between initial power operations until September 2006, the licensee entered Modes 1 and 2 with both MFW pumps trip channels inoperable when the associated actions did not permit an unlimited period of time; a risk assessment was not performed; and there was no allowance specifically stated in the individual value, parameter, or other specification. Because this violation was determined to be of very low safety significance and has been entered into the licensee's CAP as PER 110770, this violation is being treated as an NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy: NCV 05000390/2006004-04, Failure to Have an AFW Autostart Signal on Loss of All MFW Pumps During Plant Startup.

#### 1R19 Post-Maintenance Testing

##### a. Inspection Scope

The inspectors reviewed seven post-maintenance test (PMT) procedures and/or test activities, as appropriate, for selected risk-significant mitigating systems to assess whether: (1) the effect of testing on the plant had been adequately addressed by control room and/or engineering personnel; (2) testing was adequate for the maintenance performed; (3) acceptance criteria were clear and adequately demonstrated operational readiness consistent with design and licensing basis documents; (4) test instrumentation had current calibrations, range, and accuracy consistent with the application; (5) tests were performed as written with applicable prerequisites satisfied; (6) jumpers installed or leads lifted were properly controlled; (7) test equipment was removed following testing; and (8) equipment was returned to the status required to perform its safety function. The inspectors verified that these activities were performed in accordance with SPP-8.0, Testing Programs; SPP-6.3, Pre-/Post-Maintenance Testing; and SPP-7.1, Work Control Process.

- WO 06-817047-000, Troubleshoot and repair TDAFW level control valve 1-LCV-3-172
- WO 06-817014-000, Troubleshoot and repair B-SDBR chiller temp control valve
- WO 06-817402-000, Troubleshoot and repair 1B MDAFW pump flow control valve 1-FCV-3-359-B

- WO 04-819708-000, Troubleshoot and repair hydrogen recombiner 1A-A thermocouple loop
- WO 06-817678-000, Repair pinhole leak in socket weld of 1-CKV-063-0586, Loop 1 cold leg safety injection line
- WO 05-820054, Open and close the containment shield building dome penetrations to transport material into the annulus
- WO 04-813734, Train-B permanent hydrogen mitigation system transformer capacitor replacement

b. Findings

No findings of significance were identified.

1R20 Refueling and Outage Activities

.1 Forced outage due to generator trip

a. Inspection Scope

The licensee began a forced outage on June 31, 2006, after the unit tripped on a generator fault. The inspectors observed portions of the trip response, cooldown to low in Mode 3, maintenance activities, and startup activities to verify that the licensee maintained defense-in-depth (DID) commensurate with the applicable TS. The inspectors monitored licensee controls over the outage activities listed below. Additional documents reviewed are listed in the attachment.

- Licensee configuration management, including daily outage reports, to evaluate DID and compliance with the applicable TS when taking equipment out of service.
- Controls over the status and configuration of redundant safety systems (DGs and standby residual heat removal pump) to ensure risk was minimized.
- Decay heat removal processes to verify proper operation and that steam generators, when relied upon, were a viable means of backup cooling.
- Heatup and startup activities to verify that TS, license conditions, and other requirements, commitments, and administrative procedure prerequisites for mode changes were met prior to changing modes or plant conditions. Reactor coolant system (RCS) integrity was verified by reviewing RCS leakage calculations, and containment integrity was verified by reviewing the status of containment penetrations and containment isolation valves.
- Containment closure activities, including a partial containment walkdown that focused on the areas of the Loop 1 cold leg injection line leak repair, to verify that debris had not been left which could affect the performance of the containment sump or ice condenser.

b. Findings

No findings of significance were identified.

2. Steam Generator Replacement (SGR) and Refueling Outage (RFO) 7

a. Inspection Scope

The inspectors reviewed the outage risk control plan for the upcoming Unit 1 Cycle 7 (U1C7) RFO to assess whether the licensee had appropriately considered risk, industry experience, and previous site-specific problems, and to also confirm that the licensee had mitigation/response strategies for losses of key safety functions.

The licensee began its U1C7 refueling outage RFO on September 11, 2006. From that date through the end of the report period, the inspectors observed portions of the shutdown, cooldown, defueling and maintenance activities to verify that the licensee maintained defense-in-depth (DID) commensurate with the outage risk plan and applicable TS. The inspectors monitored licensee controls over the outage activities listed below. Additional documents reviewed during the inspection are listed in the attachment.

- Licensee implementation of clearance activities to ensure equipment was appropriately configured to support the function of the clearance
- Installation and configuration of reactor coolant instruments to provide accurate indication and an accounting for instrument error
- Controls over the status and configuration of electrical systems and switchyard to ensure that TS and outage safety plan requirements were met
- Decay heat removal processes to verify proper operation and that steam generators, when relied upon, were a viable means of backup cooling
- Controls to ensure that outage work was not impacting the ability to operate the spent fuel pool cooling system during and after-core offload
- Reactor water inventory controls including flow paths, configurations, and alternative means for inventory addition, and controls to prevent inventory loss
- Reactivity controls to verify compliance with TS and that activities which could affect reactivity were reviewed for proper control within the outage risk plan
- Licensee control of containment penetrations and closure requirements in accordance with TS

b. Findings

No findings of significance were identified.

1R22 Surveillance Testinga. Inspection Scope

The inspectors witnessed four surveillance tests and/or reviewed test data of selected risk-significant SSCs, listed below, to assess, as appropriate, whether: the SSCs met the requirements of the TS; the UFSAR; SPP-8.0, Testing Programs; SPP-8.2, Surveillance Test Program; and SPP-9.1, ASME Section XI. The inspectors also determined whether the testing effectively demonstrated that the SSCs were operationally ready and capable of performing their intended safety functions.

- WO 06-811223-000, 1-SI-68-32, RCS water inventory balance\*
- WO 06-810485-000, 1-SI-30-26-B, Containment air return fan 1B-B quarterly operability test
- WO 06-810430-000, 1-SI-211-4-B, 92-day trip activating device operational test on undervoltage relays for 1B-B 6.9kv shutdown board
- WO 06-810518-000, Turbine driven auxiliary feedwater pump 1A-S quarterly performance test\*\*

\*This procedure included RCS leak detection

\*\*This procedure included inservice testing requirements

b. Findings

No findings of significance were identified.

1R23 Temporary Plant Modificationsa. Inspection Scope

The inspectors reviewed temporary alteration control form 1-06-0015-030, Operation of the containment purge system during fuel movement in the auxiliary building, against the requirements of SPP-9.5, Temporary Alterations, and SPP-9.4, 10 CFR 50.59 Evaluation of Changes, Test, and Experiments, and verified that the modification did not affect system operability or availability as described by the TS and UFSAR. In addition, the inspectors verified that the installation of the temporary modification was in accordance with the work package, that adequate configuration control was in place, procedures and drawings were updated, and post-installation tests verified operability of the affected systems.

b. Findings

No findings of significance were identified.

## Cornerstone: Emergency Preparedness

### 1EP6 Drill Evaluation

#### a. Inspection Scope

The inspectors observed two licensee-evaluated emergency preparedness drills to verify that the emergency response organization was properly classifying the events in accordance with Emergency Plan Implementing Procedure (EPIP)-1, Emergency Plan Classification Flowchart, and making accurate and timely notifications and protective action recommendations in accordance with EPIP-2, Notification of Unusual Event; EPIP-3, Alert; EPIP-4, Site Area Emergency; EPIP-5, General Emergency; and the Radiological Emergency Plan. In addition, the inspectors verified that licensee evaluators were identifying deficiencies and properly dispositioning performance against the performance indicator criteria in Nuclear Energy Institute (NEI) 99-02, Regulatory Assessment Performance Indicator Guideline.

- July 27, 2006: Licensed operator annual requalification exam scenario 3-OT-SRE0004A, Feedwater isolation followed by a steam generator tube rupture
- July 13, 2006: Licensed operator annual requalification exam 3-OT-SRE022A, Feedwater malfunction followed by large break loss of coolant accident

## 4. OTHER ACTIVITIES

### 4OA2 Identification & Resolution of Problems

#### Review of Items Entered into the Corrective Action Program

As required by Inspection Procedure 71152, Identification and Resolution of Problems, and in order to help identify repetitive equipment failures or specific human performance issues for follow-up, the inspectors performed a daily screening of items entered into the licensee's CAP. This review was accomplished by reviewing daily PER summary reports and attending daily PER review meetings.

### 4OA3 Event Followup

#### a. Inspection Scope

The inspectors responded to an automatic reactor trip on July 31, 2006, initiated by a fault in the main generator automatic voltage regulator. The inspectors observed control room operator performance of mitigating systems, and the licensee's event notification process. The inspectors observed the licensee stabilize the unit in Mode 3 (hot standby). The inspectors reviewed the licensee's event critique and PER 107805, which documented this event in the CAP.

b. Findings

No findings of significance were identified.

4OA5 Other.1 SGR Inspection Overview

This inspection report documents completion of inspections required by Inspection Procedure (IP) 50001, Steam Generator Replacement Inspection, some of which were completed in accordance with baseline inspection procedures. The table below identifies and correlates specific IP 50001 inspection requirements examined during this inspection period with the corresponding sections of this report. Specific documents reviewed are listed in the attachment.

IP 50001 Section	Inspection Scope	Section of This Report
02.02.d.1	Security considerations associated with vital and protected area barriers that may be affected during replacement activities	4OA5.2
02.03.e.1.	Establishment of operating conditions including defueling, RCS draindown, system isolation and safety tagging	1R20, 4OA5.3
02.03.e.4.	Installation, use, and removal of temporary services	4OA5.3

.2 SGR Security Considerationsa. Inspection Scope

As required by IP 50001, Section 02.02.d.1, the inspectors reviewed the security considerations associated with vital and protected area barriers affected by the SGR project.

b. Findings

No findings of significance were identified.

.3 SGR Operating Conditions and Temporary Servicesa. Inspection Scope

As required by IP 50001, Section 02.03.e, the inspectors routinely inspected the following activities as they occurred throughout this inspection period:

- Establishment of operating conditions including defueling, RCS draindown, and system isolation. The inspectors observed portions of the defueling and RCS draindown activities. The inspectors also routinely verified that key safety

functions were maintained throughout performance of control room walkdowns and review of the licensee's DID status sheets. Additional outage-related inspections are documented in Section 1R20 of this report.

- Installation, use, and removal of temporary services directly related to SG replacement activities. The inspectors reviewed the licensee's plans for temporary power to verify that the power sources utilized would not impact safety-related equipment in the event of faults occurring on the temporary power supplies.

b. Findings

No findings of significance were identified.

.4 Unit 2 Layup Inspection

a. Inspection Scope

The inspectors observed the condition of Unit 2 equipment in layup condition, inspected preservation and foreign material exclusions practices, and observed the general condition of the steel containment and concrete shield building as well as Unit 2 areas inside the auxiliary and turbine buildings. The inspectors reviewed maintenance, housekeeping and preservations procedures; reviewed status lists of equipment maintained in layup; and reviewed records of preventive maintenance performed on several components. Specific documents reviewed are listed in the attachment.

b. Findings

No findings of significance were identified.

.5 Temporary Instruction 2515/161, Transport of Control Rod Drive (CRD) in Type A Packages

a. Inspection Scope

This temporary inspection was completed on November 3, 2005, and due to an administrative error was not included in Inspection Report 05000390/2005005 as originally planned. The inspectors reviewed shipping logs and discussed shipment of CRDs in Type A packages with the shipping staff. The inspectors reviewed shipments made since January 1, 2002, and noted that no shipments of CRDs in Type A packages were made during this time period.



b. Findings

No findings of significance were identified.

4OA6 Meetings, including Exit

.1 Exit Meeting

The inspectors presented the inspection results to Mr. M. Skaggs and other members of licensee management at the conclusion of the inspection on October 4, 2006. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. One proprietary document was identified.

.2 Regulatory Performance Meeting

A meeting was held on August 29, 2006, at the Watts Bar site between Mr. M. Skaggs, WBN Site Vice President, and Mr. M. Widmann, Chief, Reactor Projects Branch 6, of the NRC Region II office. The purpose of the meeting was to discuss a White finding, related to the failure to implement shutdown procedures which resulted in multiple actuations of pressurizer power operated relief valves (PORVs) in February 2005, and the results of the associated NRC Supplemental Inspection that was completed on June 2, 2006, at the Watts Bar site (see NRC Supplemental Inspection Report No. 05000390/2006010). The corrective action implementation plan for the issue and the corrective action program lessons learned from the finding were discussed. The meeting constituted the Regulatory Performance Meeting for the finding. Both the Supplemental Inspection and the Regulatory Performance Meeting are required per the NRC Action Matrix (contained in NRC Manual Chapter 305, Operating Reactor Assessment Program) for a licensee in the Regulatory Response Column. At the conclusion of the meeting, all of the Action Matrix requirements for the White Finding were completed.

ATTACHMENT: SUPPLEMENTAL INFORMATION

## SUPPLEMENTAL INFORMATION

### KEY POINTS OF CONTACT

#### Licensee personnel

B. Briody, Maintenance and Modifications Manager  
M. DeRoche, Nuclear Assurance Manager  
D. Feldman, Training Manager  
J. Hinman, Manager of Projects  
A. Hinson, Engineering Manager  
G. Laughlin, Plant Manager  
P. Pace, Licensing and Industry Affairs Manager  
P. Sawyer, Radiation Protection Manager  
M. Skaggs, Site Vice President  
S. Smith, Operations Superintendent  
D. White, Operations Manager

### **ITEMS OPENED, CLOSED, AND DISCUSSED**

#### Opened and Closed

50-390/2006004-01	NCV	Fire Header Inoperable Due to Failure to Follow Procedure (Section 1R05)
50-390/2006004-02	NCV	Failure to Follow Procedure During Preventive Maintenance (Section 1R12)
50-390/2006004-03	NCV	Inappropriate Crediting of Operator Restoration Actions Causes Inadequate Risk Assessment (Section 1R13)
50-390/2006004-04	NCV	Failure to Have an AFW Autostart Signal on Loss of All MFW Pumps During Plant Startup (Section 1R15)

#### Closed

2515/161	TI	Transport of Control Rod Drive (CRD) in Type A Packages (Section 4OA5.5)
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#### Discussed

None

## LIST OF DOCUMENTS REVIEWED

### **Section 1R04: Equipment Alignment**

- AOI-7.01, Maximum Probable Flood
- MI-17.021, Installation of Spool Pieces between ERCW System and CCS

### **Section 1R11: Licensed Operator Requalification**

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### **Section 1R12: Maintenance Effectiveness**

- WBN Master PM 0465W, Periodic Refurbishment of Metrex Model FTVA-300-WAT 3" Temperature Control Valves

### **Section 1R13: Maintenance Risk Assignment & Emergent Work Evaluation**

- SOI-65.02, Emergency Gas Treatment System
- 1-ODI-90-82, 18 Month Channel Calibration of Shield Building Vent EGTS Flow 1-FE-90-400D
- 47W611-65-3, Electrical Logic Diagram Emergency Gas Treatment System

### **Section 1R14: Personnel Performance During Nonroutine Evolutions**

- E-0, Reactor Trip or Safety Injection
- ES-0.1, Reactor Trip Response
- TI-127, Reactor/Turbine Trip Report

### **Section 1R15: Operability Evaluations**

- 47W611-3-1, Electrical Logic Diagram Feedwater Pump Turbine Auxiliaries
- 1-SI-3-25, 18 Month Channel Calibration, TADOT, and Response Time Test AFW Initiation from Main Feedpump Turbine 1A Trip
- SOI-2&3.01, Condensate and Feedwater System
- SPP-4.2, Material Receipt and Inspection

### **Section 1R20: Refueling/Outage Activities**

- General Operating Instruction (GO) - 2, Reactor Startup
- GO-5, Unit Shutdown from 30% Reactor Power to Hot Standby
- GO-6, Unit Shutdown from Hot Standby to Cold Shutdown
- GO-10, Reactor Coolant System Drain and Fill Operations
- Technical Instruction (TI) - 68.002, Containment Penetrations and Closure Control
- TI-65, Breaching the Containment Annulus, ABSCE, or Control Building Pressure Boundaries
- Maintenance Instruction (MI) - 88.003, Opening Primary Containment Penetrations and Shield Building Penetrations for Maintenance Activities

- TI-5.009, Alternate Ventilation for Spent Fuel Pool or Fuel Transfer Canal

### **Section 40A5: Other Activities**

#### SGR Inspections

- Calculation WCG-1-1945, Evaluation of Shield Building Dome Access Openings
- SSI-14-SGRO, Post Requirements and Responsibilities for Steam Generator Replacement (SGRO)
- TACF 1-06-0003-271, Install three-phase disconnect to line side of polar crane main breaker
- MI-57.028, Shift Inspection of Polar, Auxiliary, Turbine Building 200 Ton and Turbine Building 15 Ton Cranes

#### Unit 2 Layup Inspection

##### Procedures, Guidance Documents and Manuals

- Maintenance Requirements Code Book, Unit 2, Rev 7
- TI-273, Preventative Maintenance for Non-Transferred Features, Rev 1
- TVA-NQA-PLN89-A, Nuclear Quality Assurance Plan, Rev 13
- Site-Specific Engineering Specification, N3M-935, Plant Layup/Equipment Preservation

##### Records and Data

- List of Active Unit 2 components, Watts Bar Unit 2
- TI-273 Appendix A, WBNP Unit 2 PM Maintenance Records for the following components:
  - 2-MTR-062-104-B, Centrifugal Charging Pump Motor 2B-B
  - 2-MTR-063-010-A, Safety Injection Pump Motor 2A-A
  - 2-MTR-074-010-A, Residual Heat Removal Pump Motor 2A-A
  - 2-MTR-003-128-B, Auxiliary Feedwater Motor Driven Pump Motor 2B-B

##### Corrective Action Program Documents

- 64843, not all Unit 2 preventive maintenance activities assigned to multi-skill shop A were not performed by their reschedule dates
- 67426, failure to perform final review and properly transmit completed Unit 2 PM records
- 73492, documentation of equipment PMs to be placed in inactive status
- 76117, inadequate storage of Unit 2 ice condenser equipment in EGTs room
- 110058, failure to perform Unit 2 PM activities