



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

February 10, 2016

Mr. Michael D. Skaggs
Senior Vice President
WBN Operations & Construction
Tennessee Valley Authority
6A Lookout Place
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Chattanooga, TN 37402-2801

**SUBJECT: WATTS BAR NUCLEAR PLANT UNIT 2 CONSTRUCTION - NRC INTEGRATED
INSPECTION REPORT 05000391/2015610**

Dear Mr. Skaggs:

On December 31, 2015, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection of construction and testing activities at your Watts Bar Unit 2 reactor facility. The enclosed integrated inspection report documents the inspection results, which were discussed on January 22, 2016, with Mr. Connors and other members of your staff.

This inspection examined activities conducted under your Unit 2 operating license as they relate to safety and compliance with the Commission's rules and regulations, the conditions of your operating license, and fulfillment of Unit 2 regulatory framework commitments. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

Based on the results of this inspection, the enclosed report documents two NRC-identified findings which were determined to involve violations of NRC requirements. However, because the findings were all Severity Level IV violations and were entered into your corrective action program, the NRC is treating the violations as non-cited violations (NCVs) consistent with Section 2.3.2 of the NRC Enforcement Policy.

If you contest the non-cited violations in the enclosed report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the United States Nuclear Regulatory Commission, ATTENTION: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Watts Bar Unit 2 Nuclear Plant

In accordance with 10 *Code of Federal Regulations* (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 website at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Should you have questions concerning this letter, please contact us.

Sincerely,

/RA/

James Baptist, Chief
Reactor Projects Branch 8
Division of Reactor Projects

Docket No. 50-391
License No. NPF-96

Enclosure: Integrated Inspection Report 05000391/2015610
w/ Attachment

cc w/encl: (See next page)

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 w/ Attachment

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Letter to Michael D. Skaggs from James Baptist dated February 10, 2016.

SUBJECT: WATTS BAR NUCLEAR PLANT UNIT 2 CONSTRUCTION - NRC INTEGRATED
INSPECTION REPORT 05000391/2015610

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PUBLIC

U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.: 50-391

License No.: NPF-46

Report No.: 05000391/2015610

Licensee: Tennessee Valley Authority (TVA)

Facility: Watts Bar Nuclear Plant, Unit 2

Location: Spring City, TN 37381

Dates: October 16, 2015 – December 31, 2015

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Approved by:

James Baptist, Chief
Reactor Projects Branch 8
Division of Reactor Projects

SUMMARY

Watts Bar Nuclear Plant, Unit 2

This integrated inspection included aspects of engineering and construction activities performed by the Tennessee Valley Authority (TVA) associated with the Watts Bar Nuclear (WBN) Plant Unit 2 construction project. This report covered an 11 week period of inspections in the areas of quality assurance (QA), identification and resolution of construction problems, engineering and construction activities, preoperational and startup testing, and follow-up of other activities. The inspection program for Unit 2 construction activities is described in Nuclear Regulatory Commission (NRC) Inspection Manual Chapter (IMC) 2517, "Watts Bar Unit 2 Construction Inspection Program." Information regarding the WBN Unit 2 Construction Project and NRC inspections can be found at <http://www.nrc.gov/info-finder/reactor/wb/watts-bar.html>.

Inspection Results

- The NRC identified a Severity Level (SL) IV non-cited violation (NCV) of 10 *Code of Federal Regulations* (CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures and Drawings," for the licensee's failure to identify loose flex conduit connections in accordance with their procedure for walkdown verification of construction area completion and damaged, loose, or missing hardware (DLMH). The inspectors determined that the failure to properly identify loose hardware, in accordance with procedure NC PP-35, was a performance deficiency. The inspectors determined that this performance deficiency was more than minor because it represented an inadequate quality oversight function that, if left uncorrected, could have adversely affected the quality of the construction of a safety-related component. The inspectors determined this finding to be of very low safety significance, SL IV, in accordance with Section 6.5 of the Enforcement Policy, because it represents a failure to meet a regulatory requirement, including one or more QA criteria that had more than minor safety significance. The inspectors reviewed this finding against cross-cutting area components as described in IMC 0310, and determined that no cross-cutting aspect applied. (Section OA.1.6)
- The inspectors identified a SL IV NCV of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures and Drawings," for the licensee's failure to adequately torque hardware on the Unit 2 auxiliary feedwater (AFW) trip and throttle valve and several essential raw cooling water (ERCW) relief valves in accordance with applicable work orders (WOs). The inspectors determined that the failure to assure that activities affecting quality were adequately accomplished in accordance with prescribed WOs was a performance deficiency. The inspectors determined that this performance deficiency was more than minor because it represented an improper or uncontrolled work practice that could have impacted quality or safety, involving safety-related components. The inspectors determined this finding to be of very low safety significance, SL IV, in accordance with Section 6.5 of the Enforcement Policy, because it represents a failure to meet a regulatory requirement, including one or more QA criteria that had more than minor safety significance. The inspectors reviewed this finding against cross-cutting area components as described in IMC 0310, and determined that no cross-cutting aspect applied. (Section OA.1.6)
- The inspectors concluded that issues pertaining to one Bulletin (BL), four Construction Deficiency Reports (CDRs), four Temporary Instructions (TIs), one Generic Letter (GL),

one Inspector Follow-up Item (IFI), four inspection procedures (IPs), and one Violation (VIO) have been appropriately addressed for WBN Unit 2.

- Other areas inspected were adequate with no findings identified. These areas included QA; preoperational and startup testing activities; fire protection; radiation safety; preservice inspection; relief and safety valve testing; and various NRC inspection procedures.

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REPORT DETAILS

Summary of Plant Status

During the inspection period covered by this report, Tennessee Valley Authority (TVA) performed construction completion as well as preoperational and startup testing activities on safety-related systems and continued engineering design activities of the Watts Bar Nuclear (WBN) Plant, Unit 2 (U2).

I. QUALITY ASSURANCE PROGRAM

Q.1.1 Identification and Resolution of Construction Problems (Inspection Procedure 35007)

a. Inspection Scope

The inspectors continued to review condition reports (CRs), as part of the licensee's corrective action program, to verify that issues being identified under the corrective action program were being properly identified, addressed, and resolved by the licensee.

The inspectors reviewed corrective actions for CR 1100604, 2-PCV-068-0340A and 0334B Installed Incorrectly. Instruction 2-MI-68.021, Pressurizer PORV Maintenance, Revision (Rev.) 0000, Page 17 of 30, Item [8], stated to install the valves (pressurizer power operated relief valves [PORVs]) in the piping system with the bonnet 45 degrees below horizontal. The valves were found to be installed vertically, 90 degrees below centerline. The licensee reinstalled the valves in the correct orientation. The inspectors performed a walkdown of the reinstalled valves to verify that the PORVs were correctly installed in accordance with 2-MI-68.021 and drawing 47W465-7, Reactor Coolant AUX & MISC Piping, Rev. 22.

The inspectors reviewed CRs 1088115, 1079772, and 1099063. Specifically, CR 1099063, WBN 2 System 064; ASME Section XI IWE Program; Steel Containment Vessel Leak Chase Channels Inspection, was written to address long-term corrective actions by revising programmatic inspection procedures to require the leak chase channel standpipes to be uncapped at least once every operating cycle and to inspect the leak chase channels using a borescope. The inspectors verified that corrective actions were identified to revise the Section XI program to include a periodic evaluation of the steel containment vessel leak chase channels.

The inspectors also reviewed and followed up on the corrective actions of several CRs discussed throughout various sections of this report.

b. Observations and Findings

No findings were identified.

c. Conclusions

The issues identified in the CRs reviewed were adequately identified, addressed, and resolved.

Q.1.2 Safety Conscious Work Environment (Inspection Procedure 35007 and Temporary Instruction 2512/015)

a. Inspection Scope

On November 12, 2015, the inspectors met with TVA employee concerns program coordinators to discuss the sample of employee concerns for the month of October. The inspectors reviewed existing program requirements and recent concerns identified by the licensee's and contractor's employee concerns program.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors did not identify any issues or concerns regarding the ability of the licensee to provide a safety-conscience work environment.

II. MANAGEMENT OVERSIGHT AND CONTROLS

C.1 Construction Activities

C.1.1 Unit 1 and Unit 2 Construction Activity Interface Controls

a. Inspection Scope

The inspectors independently assessed licensee controls, associated with Unit 2 construction and testing activities, to prevent adverse impact on Unit 1 operational safety. The inspectors attended routine Unit 1/Unit 2 interface meetings to assess the exchange and sharing of information between the two site organizations. Periodic construction and planning meetings were observed, at least once per week, to assess the adequacy of the licensee's efforts to identify those construction activities that could potentially impact the operating unit. This included the review of select work activities, which the licensee had screened as not affecting Unit 1, to verify the adequacy of that screening effort. Additionally, the inspectors independently assessed select construction activities to verify that potential impacts on the operating unit had been identified and adequately characterized with appropriate management strategies planned for implementation. Furthermore, the inspectors performed independent walkdowns of select construction work locations to verify that controls to protect the operating unit provided an adequate level of protection and had been properly implemented.

Specific work activity observed included work associated with:

- Work Order (WO) 116997925, "Dual Unit Emergency Lighting Test"
- WO 116997926, "Dual Unit Emergency Lighting Test"
- WO 116274390, "Dual Unit Emergency Lighting Test"
- WO 117055632, "2-PTI-262-03 ESF Testing"

Specific work activities that the licensee had screened out as not affecting Unit 1 included, but were not limited to, work activities as noted in this inspection report.

b. Observations and Findings

No findings were identified.

c. Conclusions

Overall, management oversight and controls were in place for observed construction activities that could potentially impact the operating unit.

C.1.2 Verification of As-Built (Inspection Procedure 37051)

a. Inspection Scope

Background: The closure of IP 37051 was documented in Integrated Inspection Report (IIR) 05000391/2014604, Section C.1.4 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML14177A214). The objective of this procedure was to determine whether as-built design and construction drawings and specifications correctly reflect the as-built condition of the plant. As part of construction TVA created several openings, to facilitate construction activities, through the concrete shield building. TVA closed the openings in the concrete shield building using a steel plate structural assembly.

Inspection Activities: Section 02.01.b4 of the Inspection Procedure (IP) required the selection of representative final design documents for structures, including detailed design drawings and construction specifications relative to the specified inspection items. The procedure required the selection of structural steel assemblies from Seismic Category I structures. During this inspection period the inspectors observed the installation of the reactor shield building steel plate assemblies. The inspectors observed the welding and bolting activities to verify that the assembly was installed in accordance with the final detailed construction drawings, approved work instructions, that the welding activities were completed in accordance with the Bechtel welding program, 254002-000GMX-GCE-001, "Special Program Manual," Rev. 6, and that the bolts were installed in accordance with procedure MAI-5.1B, Wedge Bolt Anchor Installation, Rev. 21.

- WO 11127345, "Steel Surface Mounted Plates El. 765.5"
- WO 11126184, "Steel Surface Mounted Plates El. 729"

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors concluded that as-built design and construction drawings and specifications reviewed during this inspection correctly reflect the as-built condition of the plant.

C.1.3 Instrument Components and Systems – Work Observation (Inspection Procedure 52053)

a. Inspection Scope

Background: Background details regarding IP 52053 were discussed in IIR 05000391/2015605 Section C.1.3 (ADAMS Accession No. ML15226A345). IP 52053 was closed in IIR 0500391/2015605. Additional inspection documented below was performed at the Nuclear Regulatory Commission's (NRC's) discretion.

Inspection Activities: The inspectors observed calibration work performed under surveillance instruction 2-SI-92-42, "18 Month Channel Calibration of Power Range Nuclear Instrumentation System Channel N-42," Rev. 1. For the testing and calibration, the inspectors verified that the (1) latest revisions of applicable procedures were available at the work location and used by qualified personnel performing the testing; (2) calibration and measuring and testing equipment (M&TE) used was properly identified, traceable, and calibrated; (3) components calibrated were able to obtain the set point and within the tolerance specified; (4) testing and calibration results were recorded during the activity; and (5) components were adequately identified.

The following sample was inspected:

- Section 02.02.f – one sample

b. Observations and Findings:

No findings were identified.

c. Conclusion:

The nuclear instrumentation calibration was completed in accordance with the approved procedures. Additional activities may be performed at the NRC's discretion.

C.1.4 Preservice Inspections – Observation of Work and Work Activities (Inspection Procedure 73053)

a. Inspection Scope

Inspection Activities: The inspectors reviewed the preservice inspection (PSI) program to ascertain whether the onsite preservice inspection of Class 1, 2, and 3 pressure retaining components are performed in accordance with regulatory requirements and licensee commitments. The inspectors observed personnel performing direct visual examinations of the pressurizer surge line supports, seismic supports 2-68-005 and 2-68-001. The inspectors noted that the examiners performed the task in accordance with Appendix B, "VT-3 Visual Examination," of the licensee's procedure, N-VT-1, "Visual Examination Procedure for ASME Section XI Preservice and Inservice," Rev. 46. The inspectors observed the personnel examining for proper clearances, potential damage, loose or missing parts, debris, wear and corrosion, and integrity of welded connections.

In addition, the inspectors reviewed examination results and verified the personnel performing the direct visual examination were using the approved drawing revision for the supports, DRA 52521-026, Rev. 92 and 52521-024, Rev. 92. The inspections were conducted to verify the visual examinations were performed and recorded in accordance with the American Society of Mechanical Engineers (ASME) Section XI.

b. Observations and Findings

No findings were identified.

c. Conclusions

Work associated with PSIs listed above were completed in accordance with the approved procedures and met the requirements of ASME Section XI.

P.1 Preoperational Activities

P.1.1 Preoperational Test Program Implementation Verification (Inspection Procedure 71302)

a. Inspection Scope

02.01 (Weekly Inspection Activities): The inspectors verified that the licensee's management control system was effectively discharging its responsibilities over the preoperational testing program by facility record review, direct observation of activities, tours of the facility, interviews, and discussions with licensee personnel. Preoperational testing activities during the inspection period included the following systems or portions thereof:

- System 074 – Residual Heat Removal
- System 070 – Component Cooling
- System 063 – Safety Injection
- System 099 – Reactor Protection

As systems became available for preoperational testing, inspectors toured the accessible areas of the facility to make an independent assessment of equipment conditions, plant conditions, security, and adherence to regulatory requirements. The inspectors also reviewed the following, as available and on a sampling basis, during the tours:

- general plant/equipment conditions;
- plant areas for fire hazards - examined fire alarms, extinguishing equipment, actuating controls, firefighting equipment, and emergency equipment for operability and also verified that ignition sources and flammable material were being controlled in accordance with the licensee's procedures;
- activities in progress (e.g., maintenance, preoperational testing, etc.) were being conducted in accordance with the licensee's procedures;
- watched for abuse of installed instrumentation such as stepping or climbing on the instrumentation that could affect the calibration or ability to function;
- listened for the public address system announcements to determine that blind spots do not exist; (i.e., cannot be heard clearly enough to be

- understood);
- construction work force was authorized to perform activities on systems or equipment; and
- looked for uncontrolled openings in previously cleaned or flushed systems or components.

02.02 (Monthly Inspection Activities) During this inspection period, the inspectors reviewed the turnover package for the Unit 2 portion of the residual heat removal (RHR) system and chemical and volume control system (CVCS) as part of procedure PP-37, "System Turnover to Operations," Rev. 6, to verify jurisdiction controls were appropriate and licensee procedures were followed. Additionally, the inspectors reviewed the turnover package to ensure required preventative maintenance was incorporated into a schedule for accomplishment.

The inspectors reviewed maintenance activities on safety-related equipment (WO 117379392, "PMT on 2-CKV-63-549" and WO 117399705, "PMT WBN 2-IPWR-092-N34 Source Rate Audio Counter") to verify that qualified personnel performed the activities, that the maintenance was scheduled in accordance with developed procedures, and that these procedures were adequate for the maintenance being performed.

02.02 (Quarterly Inspection Activities) The inspectors reviewed jurisdictional controls to verify that maintenance activities were performed by the proper group and sampled preventative maintenance activities to ensure satisfactory completion. The inspectors also witnessed preoperational test instruction (PTI) 2-PTI-262-03, and interviewed personnel to verify that the method for testing was current, that methods existed to assure personnel involved were knowledgeable of the test, that approved change methodologies were followed, that criteria for test interruptions were discussed, and that test deficiencies were properly documented. Additionally, the inspectors selected four pieces of M&TE to verify that calibration was current and administrative controls were implemented.

b. Observations and Findings

No findings were identified.

c. Conclusion

The licensee's implementation of the preoperational test program was in accordance with procedures for those activities observed during the inspection period.

P.1.2 Preoperational Test Procedure Review (Inspection Procedure 70300)

a. Inspection Scope

Background: The purpose of the inspections of preoperational test activities is to verify through direct observation, personnel interviews, and review of facility records that:

- systems and components important to the safety of the plant are fully tested to demonstrate that they satisfy their design requirements, and
- management controls and procedures, including QA programs, necessary for operation of the facility have been documented and implemented.

Inspection Manual Chapter (IMC) 2513 requires the procedural review of the preoperational test procedures to ensure they are consistent with regulatory requirements and licensee commitments. The following inspection was performed in relation to satisfying the required procedural reviews.

The purpose of this preoperational test procedure review was to ensure the procedure's technical and administrative adequacy and its ability to verify compliance with the Anticipated Transient Without SCRAM (ATWS) Rule, 10 CFR 50.52.

Inspection Activities: The inspectors reviewed 2-PTI-003B-06, "ATWS Mitigation System Actuation Circuitry (AMSAC)," Rev. 1. This PTI was composed to demonstrate the capability of the AMSAC to respond properly to simulated initiation signals. The inspectors verified that the PTI includes all the components required to be tested. In addition, the inspectors performed a review of administrative and human factors of this test procedure.

The inspectors also evaluated the adequacy of:

- test scope;
- acceptance criteria;
- preliminary actions;
- precautions, including considerations for interfaces with the operating unit;
- identification of M&TE requirements and system alignments;
- information about expected responses during testing with expected quantitative values;
- criteria for response times, logic and output relay actuation responses;
- actions for restoration from test evolutions; and
- procedure structure and flow.

b. Observations and Findings

No findings were identified.

c. Conclusion

The inspectors determined that preoperational test instruction 2-PTI-003B-06 was technically adequate to accomplish its stated purpose and implemented the licensee's program guidance. This completes the procedure review of preoperational test instruction 2-PTI-003B-06.

P.1.3 Preoperational Test Witnessing (Inspection Procedure 70312)

a. Inspection Scope

Background: The inspectors witnessed portions of the data storm testing on the digital control system (DCS). The DCS is a nonsafety-related digital control system used to control most of the balance of plant equipment. The licensee conducted a test on the DCS to demonstrate its continued reliability when subjected to a large amount of digital input. The test was performed under WO 117056933 and was performed on each of four network switches located in both the auxiliary instrument room and the auxiliary control room. The test subjected the equipment to one broadcast and one multicast storm to

simulate the worst case component failure on the DCS network. The objective of the test was to demonstrate that even during a network data storm the control processors and the controls remain functional.

Inspection Activities: The inspectors witnessed the worst case data storm testing on one of the four switches.

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified. During the data storm conditions there was some expected loss of redundancy and monitoring capability as anticipated; however, the controls all remained functional as demonstrated by operator manipulation during the test.

c. Conclusion

The inspectors concluded that the licensee's data storm test was performed successfully and met its objectives.

P.1.4 (Closed) ATWS Mitigation System Actuation Circuitry Preoperational Test Witnessing and Results Review (Inspection Procedures 70312 and 70400 and Temporary Instruction 2500/020)

a. Inspection Scope

Background: The purpose of the inspections of preoperational test activities is to verify through direct observation, personnel interviews, and review of facility records that:

- systems and components important to the safety of the plant are fully tested to demonstrate that they satisfy their design requirements, and
- management controls and procedures, including QA programs, necessary for operation of the facility have been documented and implemented.

IMC 2513 requires the preoperational test witnessing and test results review of the mandatory tests defined in IMC 2513 and five of the primal tests defined in IMC 2513. The following inspection was performed in relation to satisfying the required test witnessing and test results review.

Inspection Activities: The inspectors witnessed activities associated with the performance of preoperational test instruction 2-PTI-003B-06, "ATWS Mitigation System Actuation Circuitry (AMSAC) Test," Rev. 1, to verify that the testing was conducted in accordance with approved procedures and to verify the adequacy of test program records and preliminary evaluation of test results. Test Section 6.0 "Performance" was selected for inspection of this item.

Additionally, the inspectors reviewed the requirements established by generic letters (GL)-83-28 and 85-06 associated with ATWS. The generic letters requested licensees to install a plant modification that provided for the automatic actuation of the shunt trip attachment of the reactor trip breaker (RTB) following any automatic reactor trip signal. In addition, licensees were to establish a comprehensive program of preventive maintenance and surveillance testing to ensure reliable RTB operation. A third part of

the ATWS mitigation actions was to install the AMSAC. This test observed by the inspectors was a confirmation of signals provided by the AMSAC system to trip the turbine and start all auxiliary feed water pumps feeding the steam generators. The inspectors assessed the following attributes associated with this test observation:

- all test personnel were on station and had the latest revision of the procedure;
- test prerequisites were performed;
- plant systems were in service to support the test;
- minimum crew requirements were met;
- testing was performed in accordance with the approved procedure;
- test interruptions and continuations were handled in accordance with approved procedures and documented in the chronological test log;
- testing events and discrepancies were properly documented evaluated and recorded in the test deficiency log;
- testing was executed and coordinated properly;
- data was properly collected;
- temporary equipment was installed and tracked appropriately;
- administrative test controls were properly followed; and
- test personnel were using approved drawings and vendor manuals.

The inspectors observed the tests to verify that the overall test acceptance criteria were met. The inspectors conducted a review with the responsible test engineer to assure that the preliminary test evaluations were consistent with the inspector's observations. During the tests, the inspectors observed important data gathering activities to ensure the data was properly gathered and recorded. Test discrepancies were properly documented in test deficiency notices (TDNs).

The inspectors performed a detailed review of the test results documentation package for 2-PTI-003B-06, Rev. 1, dated November 9, 2015, to verify that the licensee's evaluation of the procedure performance and results were conducted in accordance with approved procedures. This review was performed to provide assurance that the test data was within the established acceptance criteria and the licensee's methods for identifying and correcting deficiencies were adequate. The inspectors performed the following activities associated with this test results review:

- reviewed all changes made to the test procedure to verify they were properly annotated, did not affect the objective of the test, and were performed in accordance with administrative procedures;
- reviewed all documented test deficiencies to verify they had been properly resolved, reviewed, and accepted;
- reviewed the test summary and evaluation to verify that the system was evaluated to meet design requirements and acceptance criteria; and
- the approval of the test results were reviewed for completeness to ensure that personnel charged with the responsibility for review and acceptance had documented their evaluation and corrected any identified discrepancies.

The inspectors conducted a review of reference documentation with the responsible test engineer to assure that the test evaluation was performed in accordance with established procedures and component operating characteristics.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's test procedure was performed in a manner consistent with the guidance of procedure SMP-9, "Watts Bar Nuclear Plant Unit 2, Conduct of Test," Rev. 5. The witnessing of this test confirmed that the ATWS mitigating systems complied with the 10 CFR 50.62 rule requirements for operational adequacy and reliability of the system, and completed the inspection requirements outlined by Temporary Instruction (TI) 2500/020. In addition, test results were processed in a manner consistent with the guidance of procedure SMP-10.0, "Watts Bar Nuclear Plant Unit 2 Packaging and Processing Test Results," Rev. 2. This completes the inspection of preoperational test procedure 2-PTI-003-06B. This inspection completed the inspection requirements of TI 2500/20, "Inspection to Determine Compliance with ATWS Rule, 10 CFR 50.62;" this TI is closed.

P.1.5 Engineered Safety Features Preoperational Test Witnessing (Inspection Procedures 70312 and 70315)

a. Inspection Scope

Background: The background for this preoperational test witnessing is the same as that in the background of Section P.1.4 above.

Inspection Activities: During this inspection, the inspectors witnessed preoperational tests performed based on approved test procedure 2-PTI-262-03, "Unit 2 Systems Safeguards Test," Rev. 1. The inspectors witnessed a portion of each section of the test. The inspectors interviewed responsible individuals conducting and directing the test during and following the performance of the different test sections to confirm that testing was being conducted in accordance with established administrative controls in the startup manual procedures and to understand and review test results. The inspectors discussed with the test directors the removal of thermal overload heaters to prevent undesired equipment operation during the testing. The inspectors verified that all identified test deficiencies were properly documented in TDNs and/or CRs as appropriate for problem evaluation, correction, or retesting.

Documents reviewed are listed in the Attachment.

b. Findings and Observations

No findings were identified. Copies of the latest revision of the test procedure was available and in use by the personnel conducting the test. Test directors had adequate knowledge of circuitry, operating characteristics, equipment responses, and anticipated results. Test interruptions and continuations were handled in accordance with approved procedures and recorded in the chronological test log.

c. Conclusion

The inspectors concluded that preoperational test 2-PTI-262-03 was conducted in accordance with established administrative controls in the startup manual procedures. This concludes NRC inspections of mandatory ESF test witnessing identified by IP 70315.

P.1.6 Preoperational Test Results Evaluation (Inspection Procedures 70400 and 70329)

a. Inspection Scope

Background: The purpose of IMC 2513, "Light Water Reactor Inspection Program - Preoperational Testing and Operational Preparedness Phase," issue date January 1, 1984, is to verify through direct observation, personnel interviews, and review of facility records that:

- systems and components important to the safety of the plant are fully tested to demonstrate that they satisfy their design requirements, and
- management controls and procedures, including QA programs, necessary for operation of the facility have been documented and implemented.

IMC 2513 defines the inspection program that supports the issuance of an operating license. IMC 2513 requires the preoperational test results review of the mandatory tests defined in IMC 2513 and five of the primal tests defined in IMC 2513. The following inspection was performed in relation to satisfying the required preoperational test results review.

Inspection Activities: The inspectors performed a detailed review of the results for preoperational test procedures:

- 2-PTI-003A-01, "Feedwater Isolation Valves," Rev. 0;
- 2-PTI-061-02, Ice Condenser Ice Loading, Rev. 1;
- 2-PTI-062-01, "Charging and Letdown Logic Test," Rev. 1;
- 2-PTI-062-03, "HFT – Charging and Letdown," Rev. 0;
- 2-PTI-067-03, "ERCW Valve Logic Test," Rev. 1; and
- 2-PTI-074-01, "RHR Pump/Valve Logic," Rev. 1.

These reviews were implemented to verify that the licensee's evaluation of the procedure performance and results were conducted in accordance with approved procedures. These reviews were performed to provide assurance that the test data was within the established acceptance criteria and the licensee's methods for identifying and correcting deficiencies were adequate. The inspectors performed the following activities associated with these test results reviews:

- reviewed all changes made to the test procedure to verify they were properly annotated, did not affect the objective of the test, and were performed in accordance with administrative procedures;
- reviewed all documented test deficiencies to verify they had been properly resolved, reviewed, and accepted;
- reviewed the test summary and evaluation to verify that the system was evaluated to meet design requirements and acceptance criteria;

- reviewed the original “as-run” copy of the test to verify completion of data sheets, calculations, and signatures/initials;
- QA inspection records were reviewed to verify they were completed as required by the test procedure; and
- the approval of the test results were reviewed for completeness to ensure that personnel charged with the responsibility for review and acceptance had documented their evaluation and corrected any identified discrepancies.

The inspectors reviewed the test results to verify that the overall test acceptance was met. The inspectors conducted a review with the responsible test engineer to assure that the test evaluation was performed in accordance with established procedures.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee’s test results were processed in a manner consistent with the guidance of procedure SMP-10.0, “Watts Bar Nuclear Plant Unit 2 Packaging and Processing Test Results,” Rev. 2. This completes the test results evaluation of the aforementioned preoperational test procedures.

P.1.7 Preoperational Test Results Evaluation (Inspection Procedures 70324 and 70400)

a. Inspection Scope

Background: The background for this preoperational test results evaluation is the same as that in the background of Section P.1.6 above.

Inspection Activities: The inspectors performed a detailed review of the results for preoperational test procedure 2-PTI-068-01, “HFT – Heatup and Cooldown Test,” Rev. 1, to verify that the licensee’s evaluation of the procedure performance and results was conducted in accordance with approved procedures. This review was performed to provide assurance that the hot functional testing (HFT) test data was within the established acceptance criteria and the licensee’s methods for identifying and correcting deficiencies were adequate. The inspectors performed the following activities associated with this test results review:

- reviewed all changes made to the test procedure to verify they were properly annotated, did not affect the objective of the test, and were performed in accordance with administrative procedures;
- reviewed all documented test deficiencies to verify they had been properly resolved, reviewed, and accepted;
- reviewed the test summary and evaluation to verify that the components and systems were evaluated to meet design requirements and acceptance criteria;
- reviewed the original “as-run” copy of the test to verify completion of data sheets, calculations, and signatures/initials;
- QA inspection records were reviewed to verify they were completed as required by the test procedure; and

- the approval of the test results were reviewed for completeness to ensure that personnel charged with the responsibility for review and acceptance had documented their evaluation and corrected any identified discrepancies.

The inspectors reviewed the test results to verify that the overall test acceptance was met. The inspectors conducted a review with the responsible test engineer to assure that the test evaluation was performed in accordance with established procedures.

b. Observations and Findings

No findings were identified. The integrated HFT (2-PTI-068-01) serves as a controlling procedure for multiple preoperational tests at varying temperature and pressure conditions (plateaus). Many of the individual tests were independently witnessed/reviewed by NRC staff to ensure their system specific acceptance criteria were satisfied. Specific 2-PTI-68-01 acceptance criteria primarily focused on successful operations of the plant and its systems under operating conditions commonly encountered during “normal” plant transients and conditions. Specific examples of the acceptance criteria verified using existing plant operating instructions included reactor coolant pump (RCP) operations, heatup and cooldown demonstrations, temperature and pressure limitations, and operations from outside the main control room (MCR).

c. Conclusions

The inspectors determined that the licensee’s test results were processed in a manner consistent with the guidance of procedure SMP-10.0, “Watts Bar Nuclear Plant Unit 2 Packaging and Processing Test Results,” Rev. 2. This completes the test results evaluation of preoperational test procedure 2-PTI-068-01.

P.1.8 Preoperational Test Results Evaluation (Inspection Procedures 70400 and 70325)

a. Inspection Scope

Background: The background for this preoperational test results evaluation is the same as that in the background of Section P.1.6 above.

Inspection Activities: The inspectors performed a detailed review of the completed test results package for the PTIs listed below to verify that the licensee’s evaluation of the PTI performance and test results was conducted in accordance with their approved procedures. This review was performed to provide assurance that the test data was within the established acceptance criteria and the licensee’s performance in identifying and correcting any test deficiencies was adequate. The inspectors performed the following activities associated with this test results review:

- reviewed the test results summary and results evaluation to verify that the test results were evaluated to meet test objectives, and acceptance criteria;
- reviewed the approval of the test results for completeness to ensure that personnel charged with the responsibility for review and acceptance had documented their evaluation and corrected any identified discrepancies.
- reviewed all changes made to the test procedure before and during the test to verify they were properly reviewed and approved, did not affect the objective of

the test, and were performed in accordance with established administrative procedures;

- reviewed all identified test deficiencies to verify they had been properly documented, reviewed, resolved, and accepted;
- reviewed the original “as-run” copy of the test to verify completion of data sheets, calculations, and signatures/initials; and
- the content and organization of the test results package was evaluated to verify it was completed as required by the testing administrative control procedures.

The PTI results reviewed during this inspection period are as follows:

- 2-PTI-099-03, “Reactor Protection System Operational Check,” Rev. 1;
- 2-PTI-099-04, “Safeguards System,” Rev. 1;
- 2-PTI-099-05, “Overpower Delta-T and Overtemperature Delta-T Turbine Runback”, Rev. 1;
- 2-PTI-099-08, “Safeguards System Test Panel,” Rev. 0.

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors concluded that the licensee’s test results reviewed were processed in a manner consistent with the guidance of procedure SMP-10.0, “Watts Bar Nuclear Plant Unit 2 Packaging and Processing Test Results,” Rev. 2. This completes the test results evaluation of the above listed PTIs.

P.1.9 Preoperational Test Results Evaluation (Inspection Procedures 70322 and 70326)

a. Inspection Scope

Background: The background for this preoperational test results evaluation is the same as that in the background of Section P.1.6 above.

Inspection Activities: The inspectors performed a detailed review of the completed test results package for the Unit 2 integrated safeguards test PTIs listed below to verify that the licensee’s evaluation of the PTI performance and test results was conducted in accordance with their approved procedures. The inspectors reviewed the adequacy of evaluations documented in the reports. The inspectors verified that acceptance criteria was met, procedure changes were properly made, and that testing results deviations were properly identified and resolved. The inspectors reviewed the licensee’s administrative practices with respect to test execution and data evaluation.

During this inspection, inspectors reviewed the following test result reports:

- Test Summary Report 2-PTI-262-01, Rev. 1 dated 12/9/2015
- Test Summary Report 2-PTI-262-02, Rev. 1 dated 12/9/2015

- Test Summary Report 2-PTI-262-03, Rev. 1 dated 12/2/2015.

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors concluded that the licensee's test results reviewed were processed in a manner consistent with the guidance of procedure SMP-10.0, "Watts Bar Nuclear Plant Unit 2 Packaging and Processing Test Results," Rev. 2. The inspectors concluded that overall, test result reports provided sufficient documentation to verify adequate test results evaluations were performed for 2-PTI-262-01, 02 and 03. This completes the test results evaluation of the above listed PTIs.

P.1.10 Preoperational Test Results Evaluation (Inspection Procedure 63050 and 70323)

a. Inspection Scope

Background: The purpose of IMC 2512, Light Water Reactor (LWR) Inspection Program – Construction Phase, issue date December 17, 1986, is to provide inspection requirements and policy for implementation of the inspection program during construction and major plant modifications. Appendix I of 2512 defines the current IPs that are applicable to construction and major modification activities which includes IP 63050, "Containment Structural Integrity Test," issue date July 1, 1983. The purpose of this IP is to determine whether the containment structural integrity test (SIT) program, instructions, procedures, actual test performance, and evaluation of test results are consistent with regulatory requirements and licensee commitments. The containment SIT demonstrates the capability of the primary reactor containment to withstand specified internal pressure loads.

The purpose of IMC 2513, LWR Inspection Program - Preoperational Testing and Operational Preparedness Phase, issue date January 1, 1984, is to verify through direct observation, personnel interviews, and review of facility records that systems and components important to the safety of the plant are fully tested to demonstrate that they satisfy their design requirements and management controls and procedures, including QA programs, necessary for operation of the facility have been documented and implemented. Appendix A, LWR – Preoperational Testing Phase, of IMC 2513 describes the inspection program to verify systems and components important to the safety of the plant are fully tested to demonstrate that they satisfy their design requirements. IP 70323, "Containment Leak Rate Test Results Evaluation," issue date October 3, 1985, is an IMC 2513, Appendix A, inspection procedure. The purpose of this IP is to verify that the licensee has adequately performed, reviewed, and evaluated preoperational and operational Type A containment tests [containment integrated leak rate test (CILRT)] and Type B or C containment tests [local leak rate test (LLRT)] for preoperational and operational plants.

Because of the consecutive performance of the SIT and CILRT, the licensee developed a hierarchy of procedures and WOs that controlled similar prerequisites for the two tests, along with the series of actions for both containment pressurization and depressurization. The licensee also had specific procedures and WOs to perform the individual requirements for each of the containment tests. The inspectors previously performed the preoperational test procedure review and the preoperational test witnessing for the SIT and CILRT. These inspections were documented in the following IIRs:

- 05000391/2015608, Section P.1.3 (ADAMS Accession No. ML15287A166), and
- 05000391/2015608, Section P.1.8 (ADAMS Accession No. ML15287A166).

Inspection Activities: The inspectors performed Section 02.03, "Review of Test Records," of IP 63050 and performed IP 70323 in its entirety. The inspectors performed interviews and documentation reviews for the completed SIT/CILRT procedures and WO instructions to verify that the test results were satisfactory and met the applicable requirements. Applicable NRC requirements included: NUREG-0800, "Standard Review Plan," Rev. 3; Regulatory Guide 1.68; and the safety evaluation report (SER). Applicable code requirements included: commitments for American National Standards Institute (ANSI), American Nuclear Society (ANS), and American Society of Mechanical Engineers (ASME). Commitments were also outlined in the Final Safety Analysis Report (FSAR) and Technical Specifications (TS).

The inspectors specifically performed a detailed review of the tests results for the following preoperational test procedures and WOs:

- 2-PTI-064-02, "Containment Integrated Leak Rate Test (CILRT)," Rev. 1;
- WO 116347436, "Perform 2-PTI-64-02;"
- 2-SI-0-703, "Containment Integrated Leak Rate Test," Rev. 2, OTO-1 and OTO-2;
- WO 116348205, "Perform 2-SI-0-703;"
- 2- technical instruction (TI)-120, "CILRT Support Functions," Rev. 2, OTO-1 and OTO-2;
- WO 116585126, "Perform 2-TI-120;"
- 25402-000-GPP-0000-N3506, "Pressure Testing of Piping, Tubing, and Components (Bechtel)," Rev. 13;
- WO 115689350, "Structural Integrity Test;" and
- 25402-011-V1b-NEE0-00002-001, "Containment Vessel Structural Integrity Test Procedure (Graffel)," dated May 5, 2015.

The inspectors verified that the licensee's evaluation of the procedure performance and results was conducted in accordance with approved procedures. The inspectors also verified that the test data was within the established acceptance criteria and the licensee's methods for identifying and correcting deficiencies were adequate. The inspectors performed the following activities associated with the SIT/CILRT test results:

- reviewed all changes made to the test procedure to verify they were properly annotated, did not affect the objective of the test, and were performed in accordance with administrative procedures;
- reviewed all documented test deficiencies to verify they had been properly resolved, reviewed, and accepted;

- reviewed the test summary and evaluation to verify that the system was evaluated to meet design requirements and acceptance criteria;
- reviewed the original “as-run” copy of the test to verify completion of data sheets, calculations, and signatures/initials;
- reviewed QA inspection records to verify they were completed as required by the test procedure; and
- the approval of the test results were reviewed for completeness to ensure that personnel charged with the responsibility for review and acceptance had documented their evaluation and corrected any identified discrepancies.

The inspectors reviewed the completed SIT procedures and WOs to specifically verify the following:

- The evaluation and data analysis was performed by qualified and experienced personnel. The inspectors reviewed any discrepancies to verify that they were dispositioned by qualified personnel.
- The pressure gauges used were calibrated against a standard calibrated master gauge prior to the test. The inspectors noted these gauges were digital, and therefore consideration of graduation of gauge dials was not applicable to this SIT. The inspectors also noted that IP 63050 required the review of calibration records for strain measuring devices for concrete containment structures. These steps were not applicable to this SIT because Watts Bar Unit 2 has a metal containment structure.

The inspectors reviewed CR 1081214 that was written to document a lost temperature sensor used during the SIT. The sensor was lost while being returned to Graffel for post-use calibration. The inspectors performed a review of the temperature data collected during the SIT and determined that no abnormal readings were indicated. Based on the data collected from the temperature sensors and that there were multiple sensors used during the testing, the licensee determined that the lost sensor and missing post-use calibration information did not affect the results of the testing. Additionally, the Authorized Nuclear Inspector (ANI) reviewed and approved the licensee’s resolution.

- The SIT was conducted with a test pressure of more than 1.10 times the calculated maximum design basis loss of coolant accident internal containment pressure of 15 psig, and less than the specified maximum pressure, and the test pressure was maintained for 10 minutes or more. Specifically, the inspectors verified that the actual SIT pressure band was from 16.9 to 17.1 pounds per square inch gauge (psig) for one hour, which was greater than the ASME code requirement of ten minutes.
- The SIT was conducted with a test pressure of 1.25 times the maximum internal containment pressure of 15 psig and the test pressure was maintained for 10 minutes or more. Specifically, the inspectors verified that the SIT pressure was 16.9 psig for approximately one hour, which was greater than the ASME code requirement of ten minutes.

- During the SIT, the licensee verified leak tightness of the steel containment vessel welds added since the original testing of the vessel in 1978. The inspectors observed the licensee's examination for leakage at applicable joints and connections at 13.5 psig. The licensee's examination teams included Bechtel field engineers, quality control inspectors, and ANIs. The teams examined applicable joints, penetrations, connections and regions of high stress for leakage.
- There were no leaks identified during the testing and, as a result, no repairs or retesting was required to be performed for the SIT performance. In addition, the NRC inspectors did not observe any damage to the steel containment vessel as a result of the testing.

The inspectors reviewed completed CILRT procedures and WOs to specifically verify the following:

- The test records were approved in accordance with procedure SMP-3.0, "Watts Bar Nuclear Plant Unit 2 Joint Test Group (JTG) Charter," Rev. 6. The JTG function was defined in Section 14.2.2.5 of the FSAR, which stated in part, that the primary function of the JTG was the review and recommendation for approval of preoperational test procedures, test instruction revisions, and test results. The inspectors reviewed the CILRT test results, also called a Type A test, to verify that the analysis and interpretation of the leakage rate test data was performed adequately and by qualified personnel.

Type A Tests are defined in 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," as tests intended to measure the primary reactor containment overall integrated leakage rate (1) after the containment has been completed and is ready for operation, and (2) at periodic intervals thereafter.

- The licensee's report included a schematic of the leakage rate measurement system, a description of the instrumentation used, and a discussion of the applicable test program. The inspectors verified that random instrument error was taken into account for the as-left CILRT total measured leakage rate.
- The test method used was the absolute test method as documented in ANSI/ANS 56.8. The inspectors noted that this method was based upon the measurement of the temperature and the pressure of the primary containment atmosphere with correction for changing water vapor pressure.
- The maximum allowable containment leakage rate, L_a , for Watts Bar Unit 2 internal containment pressure of 15.0 psig, was 0.25 percent of the primary containment air weight per day, which equated to 240 standard cubic feet per hour (scfh). Section 5.7.2.19, "Containment Leakage Rate Testing Program," of TS, revision date October 22, 2015, states, in part, that during the first unit startup following testing in accordance with the CILRT program, the leakage rate acceptance criteria for Type A tests must be less than 75 percent of L_a , which equated to 184.5 scfh. The inspectors noted that the as-left CILRT total measured leakage rate was 11.9861 scfh at 15.32 psig, which met the required

leakage rate acceptance criteria of 184.5 scfh. The inspectors also verified the acceptance criteria of 24-hour time duration for the CILRT was met.

- The results of the supplemental verification test verified that the difference between the CILRT and verification test was within .25 L_a, which was used to validate the CILRT. The inspectors also verified the acceptance criteria of 4-hour time duration for the verification test was met.
- The required leakage rate computations were properly performed. The inspectors verified the Type A test leakage rate calculated during the performance of IP 70313, "Containment Integrated Leak Rate Test," was consistent with the final test data. Differences in the data sets were understood, specifically with respect to the additional leakage added as a result of the containment leak chase channel LLRT, as discussed below.
- Using IP 35007, "Quality Assurance Program Implementation During Construction and Pre-Construction Activities," issue date February 26, 2014, the inspectors verified that the licensee identified and evaluated any reported containment structural deterioration. This also included taking immediate corrective action, as applicable, and creating long-term corrective actions in accordance with the licensee's corrective action program. Specifically, the inspectors reviewed CR 1043737 and TDN 15-1559, for water found in the containment raceway leak chase channels boxes 3 and 4. Containment leak chase channels are dry channels that physically cover the welds of the steel containment liner. The channels were covered in concrete and were only accessible by uncapping the standpipe in the leak chase box. These channels were used by licensees to inspect the integrity of the liner welds.

On June 17, 2015, the licensee was performing in-service inspections of the containment raceway leak chase channels in preparation for containment, System 64, turnover to Operations. The licensee removed the standpipe caps for the leak chase channels and observed water in boxes 3 and 4, which were located in the same containment quadrant, 90 degree to 180 degree azimuth. The licensee generated CR 1043737 and performed troubleshooting under WO 115870771, which included water removal efforts and water chemistry analysis. Based upon the chemical analysis of the water found in the leak chase channels, the licensee concluded that the water did not indicate ground water intrusion. The licensee determined that the water was similar to secondary system water chemistry and concluded that during secondary system hydrostatic testing, non-contaminated water had spilled into uncapped standpipes in boxes 3 and 4.

During the performance of the CILRT, the standpipe caps for all leak chase channels were uncapped in order to expose the containment welds to test pressure in order to determine if leakage exists. Following the CILRT, the licensee examined all of the leak chases and identified that water was again present in boxes 3 and 4 of the raceway. The licensee performed extensive drying processes to remove water that had not been previously removed through the licensee's efforts. Once the leak chase channel was verified to be dry, the licensee performed a confidence run, by observing the channel for a period of time to verify the water had been removed. In addition, because having water in a channel could potentially mask additional leakage that had not been identified

during the CILRT, the licensee performed a LLRT on October 2, 2015. The leakage rate of the leak chase channel boxes 3 and 4 was 0.759 scfh. Following the completion of the LLRT, the licensee and the NRC inspectors verified that the channel was dry. The NRC inspectors also observed the LLRT performance and verified the additional leakage of 0.759 scfh was added to the CILRT results from August 28, 2015 of 11.2271 scfh for a total CILRT leakage rate of 11.9861 scfh.

During the period of troubleshooting and engineering evaluations, the licensee generated additional CRs 1088115, 1079772, and 1099063. Specifically, CR 1099063, "WBN 2 System 064; ASME Section XI IWE Program; Steel Containment Vessel Leak Chase Channels Inspection," was written to address long-term corrective actions by revising programmatic inspection procedures to require the leak chase channel standpipes to be uncapped at least once every operating cycle and to inspect the leak chase channels using a borescope. This issue was considered closed to actions taken and created in the licensee's corrective action program.

In addition to the Type A test results, the inspectors reviewed the completed Type B and C tests. As defined in 10 CFR 50, Appendix J, Type B tests are tests intended to detect local leaks and to measure leakage across each pressure-containing or leakage-limiting boundary for containment penetrations, air lock door seals, and doors whose design incorporates resilient seals, gaskets, or sealant compounds, piping penetrations fitted with expansion bellows, and electrical penetrations fitted with flexible metal seal assemblies. Type C tests are tests intended to measure containment isolation valve (CIVs) leakage rates. The CIVs included are those that provide a direct connection between the inside and outside atmospheres of the primary reactor containment under normal operation, such as purge and ventilation, vacuum relief, and instrument valves; are required to close automatically upon receipt of a containment isolation signal in response to controls intended to effect containment isolation; are required to operate intermittently under post-accident conditions; and are in main steam and feedwater piping and other systems which penetrate containment of direct-cycle boiling water power reactors.

The inspectors verified that the licensee conducted the required Type B and Type C tests prior to the completion of the CILRT (Type A test) or appropriately accounted for them in the CILRT leakage. The inspectors reviewed the LLRT results to verify that the overall test acceptance was met. The inspectors conducted a review with the responsible test engineer to assure that the LLRT evaluations were performed in accordance with established procedures.

During the performance of the LLRTs, the licensee identified several failed valve test results. The licensee repaired and retested the majority of these valves, however, some could not be repaired prior to the Type A test. The inspectors verified that for each system line that penetrated containment, there was at least one remaining CIV upstream or downstream of the containment boundary that did not have excessive leakage. The inspectors also verified that the licensee did not close any additional valves in that line-up that would potential mask the CILRT leakage rates. The licensee was tracking the repair and re-test of the following valves and applicable WOs:

- 2-FCV-31-327/2-CKV-31-3421; WO 116687422

- 2-FCV-31-306/2-CKV-31-3421; WO 117032779
- 2-CKV-68-868; WO 116903360
- 2-FCV-62-61/2-CKV-62-639; WOs 116612462 and 115878085
- 2-CKV-26-1296; WO 117019328
- 2-FCV-43-201; WO 117045457

The inspectors verified that the licensee performed an adequate summary analysis of the LLRTs performed and input the leakage values into the final CILRT leak rates, including using the proper LLRT correction factor to calculate the final CILRT leakage rate.

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's test results for the SIT and CILRT were processed in a manner consistent with the guidance of procedure SMP-10.0, "Watts Bar Nuclear Plant Unit 2 Packaging and Processing Test Results," Rev. 2. This completes the test results evaluation of the aforementioned preoperational test procedures. IPs 63050 and 70323 are closed.

SU.1 Startup Testing Activities

SU.1.1 Startup Test Procedure Review (Inspection Procedure 72300)

a. Inspection Scope

Background: The purpose of IMC 2514, "Light Water Reactor Inspection Program – Startup Testing Phase," issue date August 21, 1989, is to verify that the licensee is meeting the requirements and conditions of the facility license for precritical tests, initial fuel loading, initial criticality, low-power testing, and power ascension tests. This verification is to be achieved through reviewing procedures and records, direct observation, witnessing tests, reviewing test data, and evaluating test results.

Inspection Activities: The inspectors reviewed power ascension test procedure 2-PAT-1.11, "RVLIS Performance Test," Rev. 1, to verify that the test procedure adequately addressed NRC requirements and licensing commitments outlined in the FSAR, docketed correspondence, SER, TSs, and Regulatory Guide 1.68. Additionally, the inspectors reviewed power ascension test procedure 2-PAT-1.11, Rev. 1, to verify that the procedure contained the following administrative good practice attributes:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- procedure format is consistent with Regulatory Guide 1.68, Appendix C;
- a clear statement of procedure purpose/objectives;
- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements;

- acceptance criteria are clearly identified and evaluated against the source of the comparison of results with acceptance criteria;
- adequate initial test conditions are specified;
- the procedure includes a section listing references to appropriate FSAR sections, TSs, drawings, specification, codes, and other requirements;
- signoff requirements including concurrent and independent verification steps established where appropriate;
- actions to be taken within the steps are specifically identified;
- provision is made for recording details of the conduct of the test, including observed deficiencies, their resolution, and retest;
- procedure provides for identification of personnel conducting the testing and evaluating the test data;
- the procedure as issued is consistent with the test description provided in the FSAR;
- special precautions for personnel and equipment safety are specified;
- detailed instructions specify testing over the full operating range and under the maximum anticipated load change of the system/component; and
- provision is made for the data taker to indicate the acceptability of the data.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's power ascension test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of power ascension test procedure 2-PAT-1.11, Rev. 1.

SU.1.2 Startup Test Procedure Review (Inspection Procedure 72300)

a. Inspection Scope

Background: The background for this startup test procedure review is the same as that in the background of Section SU.1.1 above.

Inspection Activities: The inspectors reviewed power ascension test procedure 2-PAT-1.12, Common Q Post Accident Monitoring System, Rev. 1, to verify that the test procedure adequately addressed NRC requirements and licensing commitments outlined in the FSAR, docketed correspondence, SER, TSs, and Regulatory Guide 1.68. Additionally, the inspectors reviewed power ascension test procedure 2-PAT-1.12, Rev. 1, to verify that the procedure contained the following administrative good practice attributes:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- procedure format is consistent with Regulatory Guide 1.68, Appendix C;
- a clear statement of procedure purpose/objectives;
- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements;

- acceptance criteria are clearly identified and evaluated against the source of the comparison of results with acceptance criteria;
- adequate initial test conditions are specified;
- the procedure includes a section listing references to appropriate FSAR sections, TSs, drawings, specification, codes, and other requirements;
- signoff requirements including concurrent and independent verification steps established where appropriate;
- actions to be taken within the steps are specifically identified;
- provision is made for recording details of the conduct of the test, including observed deficiencies, their resolution, and retest;
- procedure provides for identification of personnel conducting the testing and evaluating the test data;
- the procedure as issued is consistent with the test description provided in the FSAR;
- special precautions for personnel and equipment safety are specified;
- detailed instructions specify testing over the full operating range and under the maximum anticipated load change of the system/component; and
- provision is made for the data taker to indicate the acceptability of the data.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's power ascension test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of power ascension test procedure 2-PAT-1.12, Rev. 1.

SU.1.3 Startup Test Procedure Review (Inspection Procedure 72300)

a. Inspection Scope

Background: The background for this startup test procedure review is the same as that in the background of Section SU.1.1 above.

Inspection Activities: The inspectors reviewed power ascension test procedure 2-PAT-3.11, "Adjustment of Steam Flow Transmitters at Minimum Flow," Rev. 1, to verify that the test procedure adequately addressed NRC requirements and licensing commitments outlined in the FSAR, docketed correspondence, SER, TSs, and Regulatory Guide 1.68. Additionally, the inspectors reviewed power ascension test procedure 2-PAT-3.11, Rev. 1, to verify that the procedure contained the following administrative good practice attributes:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- procedure format is consistent with Regulatory Guide 1.68, Appendix C;
- a clear statement of procedure purpose/objectives;
- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements;

- acceptance criteria are clearly identified and evaluated against the source of the comparison of results with acceptance criteria;
- adequate initial test conditions are specified;
- the procedure includes a section listing references to appropriate FSAR sections, TSs, drawings, specification, codes, and other requirements;
- signoff requirements including concurrent and independent verification steps established where appropriate;
- actions to be taken within the steps are specifically identified;
- provision is made for recording details of the conduct of the test, including observed deficiencies, their resolution, and retest;
- procedure provides for identification of personnel conducting the testing and evaluating the test data;
- the procedure as issued is consistent with the test description provided in the FSAR;
- special precautions for personnel and equipment safety are specified;
- detailed instructions specify testing over the full operating range and under the maximum anticipated load change of the system/component; and
- provision is made for the data taker to indicate the acceptability of the data.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's power ascension test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of power ascension test procedure 2-PAT-3.11, Rev. 1.

SU.1.4 Startup Test Procedure Review (Inspection Procedure 72300)

a. Inspection Scope

Background: The background for this startup test procedure review is the same as that in the background of Section SU.1.1 above.

Inspection Activities: The inspectors reviewed power ascension test procedure 2-PAT-3.1, "Control Rod Drive Mechanism Timing and CERPI Initial Calibration," Rev. 1, to verify that the test procedure adequately addressed NRC requirements and licensing commitments outlined in the FSAR, docketed correspondence, SER, TSs, and Regulatory Guide 1.68. Additionally, the inspectors reviewed power ascension test procedure 2-PAT-3.1, Rev. 1, to verify that the procedure contained the following administrative good practice attributes:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- procedure format is consistent with Regulatory Guide 1.68, Appendix C;
- a clear statement of procedure purpose/objectives;
- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements;

- acceptance criteria are clearly identified and evaluated against the source of the comparison of results with acceptance criteria;
- adequate initial test conditions are specified;
- the procedure includes a section listing references to appropriate FSAR sections, TSs, drawings, specification, codes, and other requirements;
- signoff requirements including concurrent and independent verification steps established where appropriate;
- actions to be taken within the steps are specifically identified;
- provision is made for recording details of the conduct of the test, including observed deficiencies, their resolution, and retest;
- procedure provides for identification of personnel conducting the testing and evaluating the test data;
- the procedure as issued is consistent with the test description provided in the FSAR;
- special precautions for personnel and equipment safety are specified;
- detailed instructions specify testing over the full operating range and under the maximum anticipated load change of the system/component;
- provision is made for the data taker to indicate the acceptability of the data; and
- performance of automatic controls were reviewed to verify the controls were disabled during test performance.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's power ascension test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of power ascension test procedure 2-PAT-3.1, Rev. 1.

SU.1.5 Startup Test Procedure Review (Inspection Procedure 72300)

a. Inspection Scope

Background: The background for this startup test procedure review is the same as that in the background of Section SU.1.1 above

Inspection Activities: The inspectors reviewed power ascension test procedure 2-PAT-5.1, "Dynamic Automatic Steam Dump Control," Rev. 1, to verify that the test procedure adequately addressed NRC requirements and licensing commitments outlined in the FSAR, docketed correspondence, SER, TSs, and Regulatory Guide 1.68. Additionally, the inspectors reviewed power ascension test procedure 2-PAT-5.1, Rev. 1, to verify that the procedure contained the following administrative good practice attributes:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- procedure format is consistent with Regulatory Guide 1.68, Appendix C;
- a clear statement of procedure purpose/objectives;

- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements;
- acceptance criteria are clearly identified and evaluated against the source of the comparison of results with acceptance criteria;
- adequate initial test conditions are specified;
- the procedure includes a section listing references to appropriate FSAR sections, TSs, drawings, specification, codes, and other requirements;
- signoff requirements including concurrent and independent verification steps established where appropriate;
- actions to be taken within the steps are specifically identified;
- provision is made for recording details of the conduct of the test, including observed deficiencies, their resolution, and retest;
- procedure provides for identification of personnel conducting the testing and evaluating the test data;
- the procedure as issued is consistent with the test description provided in the FSAR;
- special precautions for personnel and equipment safety are specified;
- detailed instructions specify testing over the full operating range and under the maximum anticipated load change of the system/component;
- provision is made for the data taker to indicate the acceptability of the data; and
- performance of automatic controls, including response to step and ramp changes, is specified.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's power ascension test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of power ascension test procedure 2-PAT-5.1, Rev. 1.

SU.1.6 Startup Test Procedure Review (Inspection Procedure 72300)

a. Inspection Scope

Background: The background for this startup test procedure review is the same as that in the background of Section SU.1.1 above.

Inspection Activities: The inspectors reviewed power ascension test procedure 2-PAT-2.1, "Reactor System Sampling for Core Load," Rev. 1, to verify that the test procedure adequately addressed NRC requirements and licensing commitments outlined in the FSAR, docketed correspondence, SER, TSs, and Regulatory Guide 1.68. Additionally, the inspectors reviewed power ascension test procedure 2-PAT-2.1, Rev. 1, to verify that the procedure contained the following administrative good practice attributes:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- procedure format is consistent with Regulatory Guide 1.68, Appendix C;

- a clear statement of procedure purpose/objectives;
- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements;
- acceptance criteria are clearly identified and evaluated against the source of the comparison of results with acceptance criteria;
- adequate initial test conditions are specified; and
- the procedure includes a section listing references to appropriate FSAR sections.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's power ascension test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of power ascension test procedure 2-PAT-2.1, Rev. 1.

SU.1.7 Initial Fuel Loading Procedure Review (Inspection Procedures 72300 and 72500)

a. Inspection Scope

Background: The background for this startup test procedure review is the same as that in the background of Section SU.1.1 above.

Inspection Activities: The purpose of this inspection was to verify that the licensee had established an adequate procedure to be used for initial fuel loading and that it was consistent with FSAR commitments, regulatory requirements, regulatory guidance and applicable codes and standards. Specifically, the inspectors reviewed the initial fuel load procedure for compliance with FSAR Chapter 14, "Initial Test Program," and the requirements specified in Regulatory Guide 1.68, Rev. 2 to verify that controls were in place for the areas below:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- a clear statement of procedure purpose/objectives;
- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements;
- adequate initial test conditions are specified;
- specific commitments contained in the FSAR, Safety Evaluation Report, Docketed Letters from the licensee, and TSs have been included;
- the procedure has authorized management approval;
- the procedure has been reviewed by appropriate committee;
- appropriate procedure format;
- FSAR deficiencies related to fuel loading previously identified are resolved;
- the procedure includes step-by-step instructions for manipulating fuel and for recording the operations;
- fuel loading increments are included;
- the counting period for low count rates and minimum allowable signal to noise ratios is identified and compared with regulatory limits;

- the procedure requires a visual check of each assembly in each core position;
- the procedure requires documentation that each prerequisite has been met, that each limitation and precaution has been observed, and the person verifying these items is identified;
- the procedures require that all data is recorded and that the recorder is identified; and
- prerequisites and initial conditions include:
 - appropriate signs and warnings posted as per 10 CFR 20;
 - radiation work permits if required;
 - appropriate clean areas;
 - composition, responsibilities and duties of the fuel handling crew;
 - communication between control room and reactor building;
 - fuel inspection performed within the specified time prior to fuel loading;
 - valve lineup lists;
 - pump operability and lock-outs;
 - containment integrity;
 - the status of the reactor vessel, vessel internals, control rods, and control rod drives;
 - vessel water level;
 - reactor coolant system temperature and water quality limitations;
 - emergency boron addition system required to be operable and the status of all other systems required for fuel loading;
 - the operability of fuel handling cranes, equipment and tools;
 - reactor building purge system tested and operability recently verified;
 - status of protective systems including verification procedural steps;
 - calibration of in-core and ex-core flux monitors;
 - response check of in-core and ex-core flux monitors;
 - number of in-core and ex-core flux monitors;
 - neutron source locations;
 - audible count monitor or high count annunciator required for the control room;
 - radiation monitors for the initiation of purge isolation and control room isolation are identified and verified to be operable;
 - radiation monitors, nuclear instrumentation, manual initiation and other devices to actuate evacuation alarms tested prior to fuel loading; and
 - radiation monitors, nuclear instrumentation, manual initiation and other devices to actuate evacuation alarms tested prior to fuel loading.

The inspectors reviewed the Limitations and Precautions section to assure that it specified:

- minimum crew requirements as numbers of senior reactor operator (SRO), reactor operator (RO), and the involvement of each in the fuel loading operation;
- limitation on the number of people in the reactor building, control room, and limitations of access to the fuel loading operations area;
- the shift time limits for operators;
- personnel entrance procedures for the reactor building;
- independent verifications for the fuel assembly serial number and core position;
- special Inspection Procedures for fuel that is suspected of being damaged;
- maintenance of a reciprocal multiplication plot;
- procedural limitations for reactivity addition;

- limits for deviations between predicted data and measured data;
- approvals required for changes in sequence of fuel assembly loading, detector location or source locations;
- limitations on fuel loading in the event of communications failure;
- acceptance criteria for the positioning of fuel elements;
- restrictions on fuel movements prior to obtaining stable counts;
- the minimum requirements for flux monitors including audible monitors or annunciators, and minimum count rate for initial loading of fuel;
- requirements for suspension of operation until cause is determined if an unexpected increase or decrease in count rate occurs;
- administrative methods for resolving differences of opinion among personnel involved in fuel loading;
- minimum requirements for maintaining coolant circulation in the core;
- steps and conditions for emergency poison injection with either the boron addition;
- limitations on water levels in fuel pool and reactor vessel; and
- minimum numbers of monitors by location shall be indicated and action steps required to be taken if any become inoperative.

The focal procedure for initial fuel loading was 2-PET-105, "Initial Core Loading," Rev. 1; however, many of the above inspection items are in supporting procedures listed below:

- SPP-05.0, "Radiological and Chemistry Control," Rev. 5
- FHI-1, "Receiving, Returning, Inspecting, and Storing New Fuel and Inserts," Rev. 51
- 2-GO-7, "Refueling Operations," Rev. 1
- 2-FHI-7, "Fuel Handling and Movement," Rev. 0
- 2-TI-12.07B, "Containment Access Modes 5 & 6"
- 2-TI-28, "Verification of Core Load Prior to Vessel Closure," Rev. 1
- 2-TI-68.002, "Containment Penetrations and Closure Control," Rev. 1
- TRM 3.1.1, "Technical Requirements Manual"
- OPDP-1, "Conduct of Operations," Rev. 34
- SPP-08.1, "Nuclear Fuel Management," Rev. 11
- SPP-03.21, "Fatigue Management and Work Hour Limits," Rev. 16
- Supplemental Safety Evaluation Report 23

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's power ascension test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. The initial fuel loading procedure, 2-PET-105, "Initial Core Loading," Rev. 1, is consistent with FSAR commitments, regulatory requirements, regulatory guidance and applicable codes and standards. This completes the procedure review of power ascension test procedure 2-PET-105.

SU.1.8 Precritical Test Procedure Review (Protective Trip Circuit) (Inspection Procedures 72300 and 72564)

a. Inspection Scope

Background: The background for this startup test procedure review is the same as that in the background of Section SU.1.1 above.

Inspection Activities: The inspectors reviewed test procedure 2-PAT-3.10, "Reactor Trip System," Rev. 2, to verify that the test procedure adequately addressed NRC requirements and licensing commitments outlined in the FSAR, docketed correspondence, SER, TSs, and Regulatory Guide 1.68. Additionally, the inspectors reviewed power ascension test procedure 2-PAT-3.10 to verify that the procedure contained the following administrative good practice attributes:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- procedure format is consistent with Regulatory Guide 1.68, Appendix C;
- a clear statement of procedure purpose/objectives;
- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements, include jumper controls, minimum equipment warmup times, instrument calibrations, and reactor protection system (RPS) operability;
- the following acceptance criteria are clearly identified, evaluated against the source, and compared with the results;
 - demonstrated design protection functions for all design modes
 - manual scram demonstrated
 - trip settings verified
- adequate initial test conditions are specified ;
- the procedure includes a section listing references to appropriate FSAR sections, TSs, drawings, specification, codes, and other requirements;
- clearly identified and appropriate quality control (QC) verification;
- signoff requirements including concurrent and independent verification steps established where appropriate;
- actions to be taken within the steps are specifically identified ;
- provision is made for recording details of the conduct of the test, including observed deficiencies, their resolution, and retest;
- procedure requires that temporary connections, disconnections or jumpers be restored to normal, or references their control by another procedure;
- procedure provides for identification of personnel conducting the testing and evaluating the test data;
- the procedure as issued is consistent with the test description provided in the FSAR;
- special precautions for personnel and equipment safety are specified;
- detailed instructions specify testing over the full operating range and under the maximum anticipated load change of the system/component;
- provision is made for the data taker to indicate the acceptability of the data;
- performance of automatic controls, is specified; and
- test conditions provide that:

- all reactor protective system controller circuitry interlocks are checked
- all trip logic is verified in all logic paths
- a manual scram trip of each channel and of both channels is performed.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's power ascension test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of power ascension test procedure 2-PAT-3.10, Rev. 2.

SU.1.9 Precritical Test Procedure Review (Rod Drop Measurement) (Inspection Procedures 72300 and 72564)

a. Inspection Scope

Background: The background for this startup test procedure review is the same as that in the background of Section SU.1.1 above.

Inspection Activities: The inspectors reviewed test procedure 2-PAT-3.8, "Rod Drop Measurement and Stationary Gripper Release Timing," Rev. 1; and 2-SI-85-10, "Rod Drop Time Measurement Using CERPI Rod Drop Test Computer," Rev. 0 (2-PAT-3.8 supplements 2-SI-85-10); to verify that the test procedure adequately addressed NRC requirements and licensing commitments outlined in the FSAR, docketed correspondence, SER, TSs, and Regulatory Guide 1.68. Additionally, the inspectors reviewed power ascension test procedure 2-PAT-3.8 to verify that the procedure contained the following administrative good practice attributes:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- procedure format is consistent with Regulatory Guide 1.68, Appendix C;
- a clear statement of procedure purpose/objectives;
- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements, include jumper controls, minimum equipment warmup times, instrument calibrations, and RPS operability;
- special environmental conditions, if any, are identified;
- the following acceptance criteria are clearly identified, evaluated against the source, and compared with the results;
 - drop time is specified per TSs
 - proper operation of control rod decelerating devices
- adequate initial test conditions are specified;
 - control rod drive (CRD) mechanical tests previously completed
 - rod position indicators previously tested
 - reactor protective system in service
- the procedure includes a section listing references to appropriate FSAR sections, TSs, drawings, specification, codes, and other requirements;
- signoff requirements including concurrent and independent verification steps established where appropriate;

- actions to be taken within the steps are specifically identified;
- provision is made for recording details of the conduct of the test, including observed deficiencies, their resolution, and retest;
- procedure requires that temporary connections, disconnections or jumpers be restored to normal, or references their control by another procedure;
- procedure provides for identification of personnel conducting the testing and evaluating the test data;
- the procedure as issued is consistent with the test description provided in the FSAR;
- special precautions for personnel and equipment safety are specified;
- detailed instructions specify testing over the full operating range and under the maximum anticipated load change of the system/component;
- provision is made for the data taker to indicate the acceptability of the data;
- performance of automatic controls, including response to step and ramp changes, is specified; and
- test conditions (each rod) includes:
 - no flow cold
 - full flow, hot zero power (normal operating temperature & pressure)
 - minimum retest requirements.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of startup test procedure 2-PAT-3.8, Rev.1 and 2-SI-85-10, Rev. 0.

SU.1.10 Precritical Test Procedure Review (Pressurizer Effectiveness)(Inspection Procedures 72300 and 72566)

a. Inspection Scope

Background: The background for this startup test procedure review is the same as that in the background of Section SU.1.1 above.

Inspection Activities: The inspectors reviewed test procedure 2-PAT-3.2, "Pressurizer Spray Capability and Continuous Spray Flow Setting," Rev. 1, to verify that the test procedure adequately addressed NRC requirements and licensing commitments outlined in the FSAR, docketed correspondence, SER, TSs, and Regulatory Guide 1.68. Additionally, the inspectors reviewed power ascension test procedure 2-PAT-3.2 to verify that the procedure contained the following administrative good practice attributes:

- the title described the purpose of the procedure;
- the cover page had appropriate information and approval signatures;
- procedure format is consistent with Regulatory Guide 1.68, Appendix C;
- a clear statement of procedure purpose/objectives;

- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements;
- precautions include;
 - reactor coolant pressure maintained within limitations of the RCS pressure-temperature curve.
 - maintaining constant flow through each spray line to prevent cooling of the spray line below specified operating temperature
- special environmental conditions, if any, are identified;
- acceptance criteria are clearly identified, evaluated against the source, and compared with results;
 - procedure contains verification that pressurizer spray control is properly set and controls pressure as designed
- adequate initial test conditions are specified;
- test conditions include;
 - test of automatic controls for pressure
 - verification of acceptance criteria
- the procedure includes a section listing references to appropriate FSAR sections, TSs, drawings, specification, codes, and other requirements;
- signoff requirements including concurrent and independent verification steps established where appropriate;
- actions to be taken within the steps are specifically identified;
- provision is made for recording details of the conduct of the test, including observed deficiencies, their resolution, and retest;
- procedure requires that temporary connections, disconnections or jumpers be restored to normal, or references their control by another procedure;
- procedure provides for identification of personnel conducting the testing and evaluating the test data;
- the procedure as issued is consistent with the test description provided in the FSAR;
- special precautions for personnel and equipment safety are specified;
- detailed instructions specify testing over the full operating range and under the maximum anticipated load change of the system/component;
- provision is made for the data taker to indicate the acceptability of the data; and
- performance of automatic controls, including response to step and ramp changes, is specified.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors determined that the licensee's power ascension test procedure was written in a manner consistent with the guidance of procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of power ascension test procedure 2-PAT-3.2, Rev. 1.

SU.1.11 Initial Fuel Loading Witnessing (Inspection Procedure 72524)

a. Inspection Scope

Background: The purpose of IMC 2514, "Light Water Reactor Inspection Program Startup Testing Phase," issue date August, 21, 1989, is to verify that the licensee is meeting the requirements and conditions of the facility license for precritical tests, initial fuel loading, initial criticality, low-power testing, and power ascension tests. This verification is to be achieved through reviewing procedures and records, direct observation, witnessing tests, reviewing test data, and evaluating test results. The following inspection was performed in relation to satisfying the required initial fuel load witnessing procedure (IP 72524) as required by IMC 2514, Appendix A, Startup Test Program Inspection Procedures, issued October 11, 1994.

Inspection Activities: The inspectors performed the following inspection activities to verify conformance to license requirements:

- Identified all TS requirements and license conditions applicable during initial fuel loading.
- Verified that the licensee was meeting their license commitments, exclusive of staffing requirements, by independent inspection of all TS requirements and license conditions.
- Verified that nuclear instruments were properly calibrated and were operating with a measureable count rate through observance of instrument response to fuel insertions.

The inspectors performed the following inspection activities to verify conformance to administrative and procedural requirements:

- Verified that all prerequisites and initial conditions were met and/or those which were waived had been reviewed/approved in accordance with procedure/TS requirements.
- Verified that crew requirements were being met as defined in the procedures, communications were properly in place, and that staffing satisfied requirements of TS regarding licensed operators. (daily)
- Verified that the proper version of the procedure was in use and was being followed. (daily)
- Verified that inverse multiplication plots were being maintained in accordance with procedural requirements. (daily)
- Confirmed that boron concentration was being verified by proper sampling and analysis, and at the required frequency. (daily) Additionally, one sample was witnessed being taken and analyzed to ensure proper procedural adherence.
- Verified surveillance of monitoring instrumentation during interruptions of fuel loading.
- Observed shift turnovers for conformance with administrative procedures. (daily)
- Reviewed control of personnel access to the refueling floor. (daily)
- Observed the licensee tracking fueling status on the core load sequence diagram. (daily)
- Visited each fuel loading station and assured that personnel understood their specific responsibilities. (daily)
- Reviewed all shift work schedules for conformance with maximum work time limits. (daily)

The inspectors performed the following inspection activities to review the fuel loading procedure:

- Verified that a “master” copy of a technically adequate procedure was being assembled. (daily)
- Reviewed changes to the procedures for technical adequacy, for conformance with administrative procedures, and for proper management approval. (daily)
- Reviewed records of deficiencies or difficulties encountered to assure the adequacy of corrective action, and the review and approval of actions taken. (daily)
- Reviewed data sheet entries for legibility, traceability, and permanence. (daily)

The inspectors performed the following inspection activity to review control room logs.

- Reviewed the control room log for the 48-hour period preceding fuel loading and daily thereafter until fuel loading was complete.

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified. While verifying that the licensee was meeting all their license commitments, the inspectors noted that Unit 1 entered TS Limiting Conditions for Operation (LCO) 3.7.10, Condition B, for having an inoperable control room envelope (CRE) boundary in Mode 1, but that Unit 2 did not enter the LCO. The inspector determined that for Unit 2, TS LCO 3.7.10, Condition F, had been applicable when the CRE became inoperable in Mode 6 and that the required action for Condition F was to immediately suspend movement of irradiated fuel assemblies. Additionally, the inspectors determined that procedure OPDP-8, required, in part, that “An SRO enters the appropriate LCO(s) and required actions based on the current plant conditions and operating mode.” The licensee’s failure to enter the appropriate LCO and required actions in accordance with procedure OPDP-8 was determined to be a performance deficiency. The inspectors determined that this performance deficiency was a minor violation of 10 CFR Part 50, Appendix B, Criterion V, “Instructions, Procedures, and Drawings,” because at no time during the LCO had irradiated fuel assemblies been moved.

c. Conclusion

The inspectors determined that the licensee’s test procedure was performed in a manner consistent with the guidance of procedure 2-PAT-2.0, “Initial Core Load Sequencing,” Rev. 2.

SU.1.12 Inspection of the Initial Criticality Procedure (Inspection Procedures 72300 and 72570)

a. Inspection Scope

The purpose of this inspection was to verify that the licensee had established an adequate procedure to be used for initial criticality that it was consistent with FSAR commitments, regulatory requirements, regulatory guidance, and applicable codes and

standards. Specifically, the inspectors reviewed the initial criticality procedure for compliance with FSAR Chapter 14, "Initial Test Program;" the requirements specified in Regulatory Guide 1.68, Rev. 2; and the plant TS to verify that controls were in place for the areas below:

Ensure that the format of the procedure contained the following:

- test objectives,
- special precautions and limiting conditions,
- system initial conditions,
- environmental conditions,
- acceptance criteria,
- data collection provisions,
- step-by-step instructions,
- provision for step signoff, and
- provision for selective quality control verification.

Ensure that the procedure had been properly reviewed and approved for use in accordance with plant procedures and processes:

- verify review by the independent review group, and
- verify authorized management approval.

Ensure that the procedure contained:

- procedural steps to satisfy all items identified in Chapter 14 of the FSAR, Regulatory Guide 1.68, Rev. 2, and plant TSs;
- specific prerequisites to assure that:
 - nuclear instrumentation calibration meets surveillance requirements;
 - a manual scram test is conducted not more than 24 hours prior to initiation of Boron dilution;
 - acceptable signal-to-noise ratios and the minimum acceptable count rate are specified for special startup and source range channels;
 - a list of systems which are required to be operable is included;
 - special test instrumentation is identified;
 - temporary jumpers, lifted leads, etc., will be reviewed for impact;
 - reactor coolant system temperature and pressure are within TS limits for reactor startup;
 - a listing of RPS trips required to be in service, including reduced trip points if applicable;
- personnel and equipment precautions;
- identification of control rod pattern prior to and during Boron dilution;
- adequate acceptance criteria including a prediction of the Boron concentration at criticality with the defined control rod pattern;
- references to applicable facility blueprints, FSAR sections, TSs, etc.;
- requirements for maintaining inverse multiplication plots during dilution until criticality is achieved;
- limiting rates of nuclear power increase following attainment of criticality;
- frequency of Boron concentration determination and limits on Boron dilution rates;

- verification of overlap of source (startup) range and intermediate range nuclear instrumentation;
- a title which described the purpose of the procedure;
- a cover page that had appropriate information and approval signatures;
- a clear statement of procedure purpose/objectives;
- planning information such as prerequisites, precautions, required tools, reference documents, and coordination requirements; and
- adequate initial test conditions are specified.

The focal procedure for initial criticality is 2-PET-201, "Initial Criticality and Low Power Physics Testing," Rev. 0. However, some of the above inspection items are in supporting procedures listed below:

- 2-GO-2, "Reactor Startup," Rev. 0
- 0-PI-OPS-1.1, "Jumper Control Process," Rev. 9
- 2-PAT-2.0, "Initial Core Loading Sequence," Rev. 2

b. Observations and Findings

No findings were identified.

c. Conclusions

The initial criticality procedure, 2-PET-201, "Initial Criticality and Low Power Physics Testing," Rev. 0, is consistent with FSAR commitments, regulatory requirements, regulatory guidance, applicable codes and standards, and procedure 2-TI-438, "Watts Bar Nuclear Plant Unit 2 Power Ascension Test Program," Rev. 5. This completes the procedure review of startup test procedure 2-PET-201.

III. OPERATIONAL READINESS ACTIVITIES

F.1 Fire Protection

F.1.1 (Closed) Postfire Safe Shutdown, Emergency Lighting and Oil Collection Capability at Operating and Near-Term Operating Reactor Facilities; and Construction Deficiency Report 83-61, "Failure to Provide Self-contained Lights as Committed to the NRC" (Inspection Procedures 64100 and 70441B)

a. Inspection Scope

Background: In IIR 05000391/2015615, Section 02.03 (ADAMS Accession No. ML15287A022) the NRC staff discussed the inspection of the Watts Bar dual unit fire protection program. At the time of the inspection, the licensee had not completed the installation of the emergency lighting units required for dual unit operations which was also associated with Construction Deficiency Report (CDR) 83-61. As stated in the Watts Bar Fire Protection Report for dual unit operation, adequate illumination must be provided by 8-hour battery-pack emergency lighting units (ELU) when no other lighting is available. The emergency lights are credited to ensure that operator manual actions can be completed within the required time requirement. The licensee utilized WOs for the testing of the ELUs – the WOs were developed in accordance with guidance in 0-TI-

2018, "Demonstration of Appendix R Actions", Rev. 1, which stipulated the timed verification of operator manual actions that were required to be performed within 120 minutes from the initiation of a fire event.

The testing performed required coordinated, selective darkening of the switchboard rooms in the auxiliary building on the Unit 1 and Unit 2 side at elevations (El.s) 757' and 772' which were associated with fire areas A1, A2, A3, A4, A5, A9, A25, A26, A20, A23, A24, A30, A29, A28, and A31. The areas tested on the 757' elevation included the A and B train 6.9 kV board room, the auxiliary control rooms, vital battery rooms (I, II, III, and IV) and the 1A/1B 480V board rooms. The areas tested on the 772' elevation included the 480V shutdown board rooms (1A, 1B and 2A).

Inspection Activities: The inspectors witnessed activities associated with the emergency light testing to verify that sufficient illumination was provided by 8-hour battery-pack ELUs for the performance of operator manual actions during a fire event. The testing was conducted in accordance with WO 116997925, 116997926, and 116274390 "Dual Unit Emergency Lighting Test," Rev. 1. The inspectors observed that the licensee utilized trained operators to assess the adequacy of emergency lighting. The inspectors attended the pre-job briefing and witnessed the power shutdown of all the regular lighting in the test areas. With the ELUs providing the only source of lighting, the inspectors verified that the illumination of fire safe shutdown components was adequate for component identification and operation. The inspectors observed that testing was conducted in accordance with the approved WO. In addition, the inspectors reviewed the corrective actions and completed emergency lighting verification data sheets for CRs 1067477, 1105912, 1105911, and 1068191 that identified corrective actions for EL. 757 Unit 1 test results discrepancies; CRs 1099091 and 1109135 for EL. 757 Unit 2 test results discrepancies; and CR 1099088 for EL. 772 Unit 2 test results discrepancies.

Documents reviewed are listed in the Attachment.

b. Observations and Findings:

No findings were identified. An observation was provided to the test director regarding emergency lighting at several switchboards where the size and colors of nameplates could be enhanced to increase legibility. The licensee initiated CRs 1067477, 1068191, 1099091, and 1099088.

c. Conclusion:

The inspectors determined that the licensee's performance of emergency light testing was adequate. Additionally, the inspectors determined that inspection activities associated with CDR 83-61 were completed. CDR 83-61 is closed.

F.1.2 (Closed) Inspection of Watts Bar Nuclear Plant Fire Protection Corrective Action Program Plan (Temporary Instruction 2512/022)

a. Inspection Scope

Background: NRC letter "Readiness of Watts Bar Unit 2 to Receive an Operating License," dated October 15, 2015 (ADAMS Accession No. ML15288A305), stated that

additional NRC inspections would be performed to assess fire protection program corrective actions associated with TI 2512/022.

Inspection Activities: The inspectors reviewed CR 1022308, "Programmatic Breakdown of the Watts Bar Unit 1 Fire Protection Program for Fire Safe Shutdown (Root Cause Analysis)," Rev. 3, dated October 30, 2015, to review the licensee's revised root cause evaluation and to assess the adequacy of corrective actions associated with deficiencies identified during the Watts Bar Unit 2 fire protection licensing and inspection activities.

b. Observations and Findings:

No findings were identified.

c. Conclusion:

CR 1022308, Rev. 3, adequately addressed programmatic issues that were identified during Watts Bar Unit 2 fire protection licensing and inspection activities. The inspection activities associated with TI 2512/022 are complete. TI 2512/022 is closed.

F.1.3 Fire Protection Program (Inspection Procedure 64704)

a. Inspection Scope

Background: In IIR 05000391/2015615 (Section 02.04), the NRC staff discussed the inspection of the Watts Bar dual unit fire protection program. At the time of the inspection, work related to the installation of the RCP fire protection features had not been completed.

Inspection Activities: The inspectors inspected the as-built configuration of the RCP 1 and 2 fire protection sprinkler system and associated detectors to verify that the components were installed in accordance with engineering document construction release (EDCR) 54655, "Modifications Required for Reactor Building Fire Detection Systems as Identified in 10 CFR 50 Appendix R," applicable design requirements, drawings, and vendor requirements. In addition, the inspectors reviewed the licensee's corrective actions associated with CR 1084922 and CR 1025119, which identified missing foreign material exclusion (FME) covers on the oil collection system piping. The inspectors inspected the RCP oil collection drainage system to verify that the required FME covers were installed to protect the piping during construction. Also, the inspectors reviewed the completed clean plans to verify that the oil collection system piping was free of foreign material and cleaned in accordance with the approved procedures.

b. Observations and Findings:

No findings were identified.

c. Conclusion:

The RCP fire protection features were installed in accordance with the applicable design documents, drawings, and procedures. The corrective actions associated with CRs 1084922 and 1025119 were adequate.

F.1.4 Fire Protection Program (Inspection Procedure 64704)

a. Inspection Scope

Background: NRC letter “Readiness of Watts Bar Unit 2 to Receive an Operating License,” dated October 15, 2015, stated that the NRC would review additional samples of TVA’s ongoing implementation of in-plant modifications that were credited in the fire protection program.

Inspection Activities: The inspectors reviewed two modifications to verify that the as-built configuration of the plant was consistent with the assumptions in the site’s fire protection program. The selected modifications were implemented by the licensee as corrective actions for cable separation deficiencies that were identified during the Watts Bar Unit 2 fire protection licensing and inspection activities.

- AA DCN 65325, Reroute Cable 1PM111 for RCP Flow Indicator FI-62-93C, Rev. AA1

The inspectors reviewed AA DCN 65325 which installed electrical conduit to permit the re-routing of cable 1PM111 such that the fire protection program separation requirements could be achieved. For a fire in Fire Area 713-A1A East, credit was taken for RCP seal injection flow indicator FI-62-93C (cable 1PM111). Cable 1PM111 was less than the required 10 feet to the west of the specified boundary as identified on the fire safe shutdown elevation diagram. The inspectors also reviewed WO 116695520, which implemented EDCR 55948 that added a pneumatic relay in the circuit that will isolate the air supply to valve WBN-2-FCV-062-0009 and vent the actuator on decreasing header pressure.

- DCN 65325, Protect Conduit 1VC3346A for 1-PCV-68340A-A in 125V Vital Battery Board Room II, Rev. AA1

During the performance of a fire protection program corrective action review, the licensee identified a fire scenario that could cause the spurious opening of a pressurizer power operated relief valve (PORV). As a result, the licensee implemented DCN 65325 which re-routed cables (1V5607 and 1V5608) and installed a three-hour fire wrap to power and backup cables associated with the pressurizer PORV. The three-hour fire wrap surrounded the conduit for the “A” train PORV cables in the U2 125V Vital Battery Room II, which is a “B” train room. The inspectors performed a walk-down of the as-built modification to verify the adequacy of the installation. The pressurizer PORV cables were adequately protected from postulated fire damage with the 3-hr fire wrap adequately installed and the licensee’s crediting of fire detection and water suppression in the Vital Battery Board Room.

b. Observations and Findings:

No findings were identified.

c. Conclusion:

The inspectors determined that the sampled modifications were implemented in accordance with the design documents.

F.1.5 (Closed) Fire Protection Program (Inspection Procedure 64704)

a. Inspection Scope

Inspection Activities: The licensee identified fire barrier penetration seals that were not functional prior to the initial fuel load for Unit 2. The inspectors reviewed a sample of these seals to verify that the non-conformances were addressed in accordance with the Watts Bar Fire Protection Program. The inspectors verified that the non-functional penetration seals were listed in the shift manager's daily operating requirements tracking log, a fire protection impairment permit number was assigned, and applicable compensatory measures (e.g., fire watches) had been implemented.

b. Observations and Findings:

No findings were identified.

c. Conclusion:

Based on the results of this inspection, inspection listed in Sections F.1.1, F.1.2, F.1.3, and F.1.4 of this report, and previous fire protection inspection efforts, the inspectors determined that activities associated with IP 64704, "Fire Protection Program," are complete. IP 64704 is closed.

R.1 Radiation Safety

R.1.1 (Closed) Control of Radioactive Materials and Contamination, Surveys, and Monitoring (Preoperational and Supplemental) (Inspection Procedure 83526)

a. Inspection Scope

The inspectors reviewed preoperational testing records for the following radiation monitors unique to Unit 2:

- Personnel Air Lock, 2-RE-90-2
- Containment Refueling Floor, 2-RE-90-59
- Containment Refueling Floor, 2-RE-90-60
- Lower Compartment Instrument Room, 2-RE-90-61
- Reactor Building Upper Compartment Post Accident, 2-RE-90-271/272
- Reactor Building Lower Compartment Post Accident, 2-RE-90-273/274
- Reactor Building Particulate, Iodine, Noble Gas, 2-RE-90-106/112

The inspectors also walked down selected radiation monitoring system (System 90) components and performed follow-up on the outstanding items identified in IIR 05000391/2015608 (ADAMS Accession No. ML15287A166). Specifically, review of preoperational testing records for the above listed components and verification of installation of the 2-RE-90-2 radiation monitor and the 2-RE-90-106/112 sample lines (including heat tracing).

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified. The inspectors observed that all the System 90 components listed above had been installed and tested. In addition, the outstanding items identified in IIR 05000391/2015608 were reviewed and evaluated.

c. Conclusions

Based on the aforementioned inspection activities, no further inspection is required. IP 83526 is closed.

**R.1.2 (Closed) Liquids and Liquid Wastes (Preoperational and Supplemental)
(Inspection Procedure 84523)**

a. Inspection Scope

The inspectors reviewed testing records for liquid waste processing system (System 77) components included in the following document packages:

- 2-PTI-077-01, "Liquid Waste Processing System"
- 2-PTI-077-03, "Liquid Waste Collection"

As part of the document review, the inspectors performed follow-up on the outstanding items identified in IIR 05000391/2015608. Specifically, evaluation of preoperational testing records for the reactor coolant drain tank, containment sumps, and associated pumps and valves (including those relied upon to isolate containment).

b. Observations and Findings

No findings were identified. The inspectors observed that all the System 77 components contained in the documents listed above had been installed and tested. In addition, the outstanding items identified in IIR 05000391/2015608 were reviewed and evaluated.

c. Conclusions

Based on the aforementioned inspection activities, no further inspection is required. IP 84523 is closed.

**R.1.3 (Discussed) Gaseous Waste System (Preoperational and Supplemental)
(Inspection Procedure 84524)**

a. Inspection Scope

The inspectors reviewed testing records for the following components associated with gaseous waste:

- Containment Purge Air Exhaust Effluent Monitors, 2-RE-90-130/131
- Flow Element for the Emergency Gas Treatment System Exhaust, 2-FE-90-400D
- Components contained in 2-PTI-077-02, "Gaseous Waste Disposal System"

The review included follow-up on the outstanding items identified in IIR 05000391/2015608. Specifically, review of 2-RE-90-130/131 testing records and

evaluation of new flow monitoring instrumentation installed in the shield building vent release pathway.

b. Observations and Findings

No findings were identified. The inspectors observed that all the components listed above had been installed and tested. This included one of the outstanding items identified in IIR 05000391/2015608 (2-FE-90-400D). New flow elements for reactor building purge trains A & B were installed to support Unit 2 operation; however, the testing records for these components were not provided to the inspectors prior to the inspection report deadline.

c. Conclusions

To date, the licensee's efforts regarding the gaseous waste system have been adequate. However, additional inspection is required to close IP 84524. Future inspection efforts should include review of preoperational testing records for the newly installed flow monitoring devices and verification that flow calculations include allowance for charcoal/ High Efficiency Particulate Arrestance (HEPA) filtration systems. IP 84524 will remain open.

IV. OTHER ACTIVITIES

OA 1.1 (Discussed) Generic Letter 89-04: Guidance on Developing Acceptable In-Service Testing Programs; Temporary Instruction 2515/114: Inspection Requirements for Generic Letter 89-04, Acceptable In-Service Testing Programs; Temporary Instruction 2515/110: Performance of Safety-Related Check Valves

a. Inspection Scope

Background: Previous inspection activities and background information regarding GL 89-04, TI 2515/110, and TI 2515/114 were documented in IIR 05000391/2015608 Section OA.1.1 (ADAMS Accession No. ML15287A166).

Inspection Activities: The inspectors selected a sample of check valves from the Watts Bar Unit 2 In-Service Test (IST) program and reviewed the pre-service test procedures 2-SI-63-906, "Safety Injection Check Valve Full-Flow Test," Rev. 2, and 2-SI-63-905, "Boron Injection Check Valve Flow Test," Rev. 3, to verify the sampled check valves were properly implemented into the IST program. The inspectors observed the check valve flow tests for 2-CKV-63-526, 2-CKV-63-530, 2-CKV-63-524, and 2-CKV-63-528 to verify that the check valve tests were completed in accordance with the approved procedures, the tests met the requirements of ASME Operation and Maintenance (OM) Code 2004 Edition through 2006 Addenda, and the check valves opened to provide full design flow. The inspectors reviewed the test results for 2-SI-63-917, "Testing of Cold Leg Accumulator Check Valves," Rev. 0, to verify the test results were properly documented and the check valves fully opened. In addition, the inspectors conducted a walkdown of 2-CKV-63-530, 2-CKV-63-528, 2-CKV-63-547, 2-CKV-63-562, and 2-CKV-63-625, and reviewed the design documentation for each check valve to verify that the valve configuration met the approved drawings, and design specifications.

The inspectors reviewed the pre-service test procedure for the 2A-A and 2B-B centrifugal charging pump preservice tests. In addition, the inspectors observed the pre-service test for the 2A-A and 2B-B centrifugal charging pumps, and reviewed the test records for the 2A-A and 2B-B residual heat removal pumps, 2A-A and 2B-B centrifugal charging pumps, and the 1B and CS component cooling water pumps to verify that the tests were completed in accordance with the approved test procedure, acceptance criteria was established and met. In addition, the inspection was completed to verify the test instrumentation and requirements of ASME OM Code 2004 Edition through 2006 Addenda were met.

The following samples were inspected:

- TI 2515/110 Section 03.01.b – one sample
- TI 2515/110 Sections 03.02.e,f,g,h,i,j – five samples
- TI 2515/114 Section 03.02.b,d,g,h – six samples
- TI 2515/114 Section 03.03.a,b – six samples
- TI 2515/114 Section 03.06.a,b,c,d,e – six samples

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified.

c. Conclusions

The pre-service tests completed for the check valves and pumps were completed in accordance with the approved procedures and met the requirements of ASME OM Code 2004 Edition through 2006 Addenda.

OA.1.2 (Discussed) Three Mile Island Action Item II.D.1: Relief and Safety Valve Test Requirements (Inspection Procedures 50073 and 50075)

a. Inspection Scope

Background: Following the 1979 event at Three Mile Island (TMI) Unit 2, the NRC formed a Lessons Learned Task Force to provide recommendations from the accident, which were released in NUREG-0578 (ADAMS Accession No. ML090060030). TMI Action Items were developed as a result of those recommendations and published in NUREG-0660 Volumes 1 and 2, "NRC Action Plan Developed as a Result of the TMI-2 Accident (ADAMS Accession Nos. ML072470526 and ML0727470524)." Specifically, TMI Action Item II.D.1 established the requirements for licensees and applicants to conduct testing in order to qualify reactor coolant system (RCS) relief and safety valves under expected operating conditions for design basis transients and accidents, including under ATWS conditions. NUREG-0737 (ADAMS Accession No. ML051400209) clarified this statement, adding the qualification of pressurized water reactor (PWR) block valves as a new requirement.

As previously documented in IIR 05000391/2014609 (ADAMS Accession No. ML15287A199), the inspectors concluded that the licensee's criteria for success and failure of valves tested was adequate to complete TMI Action Item II.D.1, Section A.3. For Section A.2, the inspectors determined that the licensee had a program in place to

demonstrate the functionality of the relief and safety valves as required; however, the analysis of the effect of discharge piping on valve operability remained to be inspected.

For TMI Action Item II.D.1, Section A.1, the inspectors reviewed the approval of relief request IST-RR-4 in a letter dated October 21, 2014 (ADAMs Accession No. ML 14289A222), which allowed TVA to have the safety valves tested at a vendor facility rather than testing the safety valves in-place. Also for Section A.1, the inspectors reviewed the results of PORV testing performed during the licensee's HFT. During the performance of 2-PTI-068-15, "Pressurizer Pressure and Level Control," the licensee identified many test deficiencies associated with the PORVs, block valves, temperature and pressure indicators, and alarms. As a result, the licensee generated 18 procedure change notices in order to reperform and/or revise testing procedure steps or sequencing. Also the PORVs were sent to an offsite facility for retesting. The inspectors reviewed the licensee's test plan for the PORVs at the testing facility and verified that the test plan contained sufficient testing to show functionality of the valves at all possible operating and accident conditions. However, it was later determined that the facility testing conditions did not exactly replicate operating RCS flow conditions, and that pre-operational testing of the PORVs during HFT could be credited towards TMI Action Item II.D.1, Section A.1.

Inspection Activities: The inspectors reviewed licensee actions to satisfy the requirements of TMI Action Item II.D.1, Sections A.1, A.2, B, and C.

For Section A.1, the inspectors reviewed the licensee's evidence supported by tests of safety and relief valve functionality for expected operating and accident (non-ATWS) conditions to verify the valves would open and reclose under the expected flow conditions. Specifically, the inspectors reviewed the test procedure and test reports from National Technical Systems (NTS) labs for testing the pressurizer code safety valves to verify that the valves operated successfully and were set to the pressure required by the Watts Bar Unit 2 FSAR and ASME Boiler and Pressure Vessel Code (BPVC) Section III.

Related to the PTI performed during HFT, the inspectors reviewed (1) the generated TDNs to verify all of the issues were adequately captured and dispositioned through their corrective action program; (2) the implemented change notices (CNs) to verify that they were made in accordance with the licensee's processes and did not adversely impact the results of the tests, adversely impact the plant and applicable equipment, or change the original acceptance criteria; and (3) the JTG approved test instruction to verify all the acceptance criteria were met or would be met during the Mode 5 surveillance (see conclusion). The inspectors also reviewed the pressurizer pressures and pressurizer relief tank (PRT) levels, pressures, and temperatures during testing, as well as acoustic monitoring indications and temporary temperature M&TE data, to verify the PORVs opened and fully reclosed with no leakage indications.

For Section A.2, the inspectors reviewed the plant specific evaluation for the discharge piping to verify that the effect of the as-built piping on valve operability was taken into account. Specifically, the inspectors reviewed several licensee evaluations, including a fluid transient analysis as well as static and dynamic calculations for pipe conditions with no fluid and conditions full of water, to verify that the piping, nozzles, and supports from the pressurizer relief nozzle to the pressurizer relief tank were adequate and would withstand the actuation of the valves. For each calculation, the inspectors reviewed the

abstract, assumptions, inputs, and results to verify that the analysis was correctly performed and that the discharge piping would not have an effect on valve operability.

For Section B, the inspectors reviewed test results for the PORV block valves to verify that the valves were proven to operate, close, and open under expected operating and accident conditions. Specifically, the inspectors reviewed the JTG approved test instruction (2-PTI-068-15) and the resolution of several TDNs to verify all the acceptance criteria were met regarding the block valves during HFT. The inspectors also reviewed the data gathered from the temporary temperature M&TE set up downstream of the block valves to determine there was no detectable leakage at operating conditions and verify the valves had isolation capability.

For Section C, the inspectors reviewed system descriptions and design basis documents to determine the function of the relief and safety valves during ATWS conditions. The inspectors reviewed the functional requirements of systems and components during ATWS scenarios, and compared these with ATWS testing parameters identified in NUREG-0737.

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified.

c. Conclusion

The inspectors concluded that the work performed by the licensee was adequate to complete TMI Action Item II.D.1, Sections A.2 and B. Therefore, those sections are considered closed.

Based on the review of the licensee's system descriptions and design basis documents, the inspectors determined that the relief and safety valves are not required during an ATWS condition because the current system design meets conditions discussed in NUREG-0737 without relying on the relief and safety valves. Therefore, TMI Action Item II.D.1, Section C is considered closed.

The inspectors previously considered TMI Action Item II.D.1, Section A.3 closed in IIR 05000391/2014609 (ADAMS Accession No. ML15287A199).

During Mode 5, with a steam bubble in the pressurizer, the licensee plans to perform surveillance instructions 2-SI-68-904-A, "Reactor Coolant System Valve Position Indication Verifications (Train A)," and 2-SI-68-904-B, "Reactor Coolant System Valve Position Indication Verifications (Train B)," to meet surveillance requirement 3.4.11.2 of the Watts Bar Unit 2 Technical Specifications for PORVs 340A and 334 respectively. The inspectors will witness those surveillances to verify the PORVs fully open and close within the required stroke times as well as functionality of the reed switches on the valves and corresponding light indications in the control room. Section A.1 will remain open until surveillance instructions 2-SI-68-904-A and 2-SI-68-904-B are complete.

OA.1.3 (Closed) Inspection of Watts Bar Nuclear Plant Mechanical Equipment Qualification Special Program (Temporary Instruction 2512/038)

a. Inspection Scope

Background: The Mechanical Equipment Qualification (MEQ) Special Program (SP) was created to meet the requirements of 10 CFR Part 50 Appendix A, General Design Criterion 4.

For Unit 1, the licensee evaluated the non-metallic parts of safety-related equipment in harsh environments and produced a controlled MEQ binder to establish and maintain the qualification status of equipment in the plant.

For Unit 2, the licensee has committed to following the same process as Unit 1. Previous inspection activities of TI 2512/038 have been performed and documented in IIRs 05000391/2012603 (ADAMS Accession No. ML12123A156), Section OA.1.7; 05000391/2013604 (ADAMS Accession No. ML13179A079), Section OA.1.14; and 05000391/2015605 (ADAMS Accession No. ML15226A345), Section OA.1.1.

Inspection Activities: The inspectors met with the licensee's responsible staff to evaluate the implementation status of the program. The inspectors sampled components and subcomponents from the chemical and volume control system and residual heat removal system to verify that the licensee properly identified, categorized, and created their preventative maintenance programs in accordance with the approved MEQ program.

The inspectors reviewed functional requirements, service life calculations, and environmental drawings to verify MEQ components were properly identified and categorized. For components with a finite service life, the inspectors verified preventative maintenance and replacement intervals were consistent with vendor manuals and service life calculations. The inspectors reviewed the licensee's MEQ Binder, which documents qualification of applicable mechanical equipment. The inspectors inspected the licensee's process for verifying as-built MEQ equipment met design requirements. The inspectors reviewed the licensee's MEQ binder change process and verified updates to the MEQ binder were properly controlled and contained all information required by approved procedures.

The inspectors reviewed a sample of inspections performed by the licensee to determine if equipment experienced degradation from the period of extended construction and lay-up. Additionally, the inspectors reviewed the licensee's process for exempting components from the MEQ list and a sample of MEQ exempt items was reviewed to ensure the components met the requirements to be exempt from the MEQ list.

Documents reviewed are in the Attachment.

b. Observations and Findings

No findings were identified.

c. Conclusion

Based on the samples and documents inspected during this inspection period, as well as previous inspection efforts, the inspectors determined that the licensee has satisfactorily

implemented the Mechanical Equipment Qualification Special Program. Temporary Instruction 2512/038 is closed.

OA.1.4 (Closed) Inspection of Watts Bar Nuclear Plant Radiation Monitoring System Special Program (Temporary Instruction 2512/041)

a. Inspection Scope

Background: In 1989, the Watts Bar Nuclear Performance Plan (NPP) established an SP to provide programmatic corrective actions for deficiencies with the design, documentation, installation, and application of hardware used in the liquid and gaseous radiation monitoring systems (RMS). The SP provided actions to address three primary concerns; specifically, (1) ensure that criteria in design-basis documents include applicable requirements of Regulatory Guide 1.97, "Post Accident Monitoring;" (2) evaluate the RMS design, documentation, and installation against the updated design criteria to verify acceptable installation; and (3) ensure installation deficiencies are modified or reworked and are documented to show correction of the deficiencies.

The previous inspection of this SP for Unit 2 was documented in IIR 05000391/2015608 (ADAMS Accession No. ML15287A166). That report determined that further inspection would be required to verify measures implemented under the SP for radiation monitoring systems have progressed sufficiently to demonstrate the historical concerns have been addressed.

Inspection Activities: In this inspection, the inspectors interviewed engineering personnel and reviewed records of results from preoperational testing of the following radiation monitoring systems:

- 2-RE-090-02, Upper Containment Personnel Airlock Access Area Monitor
- 2-RE-090-59, Containment Upper Deck Area Monitor
- 2-RE-090-60, Containment Upper Deck Area Monitor
- 2-RE-090-61, Seal Table Area Monitor
- 2-RE-090-106, Containment Lower Compartment Monitor
- 2-RE-090-112, Containment Upper Compartment Monitor
- 2-RE-090-119, Condenser Vacuum Exhaust Radiation Monitor (normal range)
- 2-RE-090-130, Containment Purge Air Exhaust Monitor
- 2-RE-090-131, Containment Purge Air Exhaust Monitor

The interviews and reviews of test records were performed to verify work was accomplished as prescribed by written instructions, including procedures for sampling and alarm response. The inspectors verified acceptance criteria were met, equipment calibrations were properly controlled, deviations from specified requirements were addressed, and that records were complete, legible, and identifiable as to the activity that was performed.

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified.

c. Conclusion

Based upon the samples obtained in this inspection and earlier inspections, the inspectors determined that the licensee has implemented appropriate measures to assure historical concerns associated with design, documentation, installation, and application of hardware used in the liquid and gaseous radiation monitoring systems have been adequately addressed for Unit 2. The inspectors determined inspections of the SP for radiation monitoring systems are complete and that TI 2512/041 is closed.

OA.1.5 (Closed) Construction Deficiency Report 50-391/86-11: Thermal Expansion of Liquid Sample Piping (Inspection Procedures 52053 and 52055)

a. Inspection Scope

Background: CDR 391/86-11 was created to address deficiencies in design provisions to accommodate thermal expansion in liquid sample piping in System 43 (sampling and water quality system) and System 90 (radiation monitoring system). The corrective action scope stated the licensee would perform a thermal evaluation/analysis of safety-related radiation sampling and radiation monitoring lines that have maximum operating temperatures which exceed 120°F and modify supports and tubing configurations as necessary to assure proper thermal qualification. WBN Design Criteria WB-DC-40-31.7 was revised to change the thermal cutoff limit to greater than 130°F, which was approved by the NRC in Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2 (NUREG-0847) Supplement No. 18.

During a previous inspection, documented in IIR 05000391/2010605 (ADAMS Accession No. ML110410680), the inspectors determined that through EDCRs, the piping would be field routed and installed. The as-installed configurations would then be sketched in detail and submitted to design engineering for stress analysis. After completing the analysis and making any necessary field modifications, engineering would incorporate the sketches into final as-built isometric drawings.

The inspectors previously reviewed licensee actions to address CDR 391/86-11 for System 43 in IIR 05000391/2010607 (ADAMS Accession No. ML15273A452).

Inspection Activities: The inspectors selected two sample lines, RE-90-106 and RE-90-112, to verify proper implementation of the corrective actions of CDR 391/86-11 for System 90. Specifically, the inspectors reviewed 19 isometric drawings, six calculations, two work orders, and the associated EDCR and Field Change Request (FCR). The inspectors performed walkdowns of the two system lines to ensure the as-built condition matched the dimensions and locations shown in the final isometric drawings. The inspectors also confirmed the support types, gap requirements, and locations were as described in the isometrics and pipe support design manual.

The licensee completed rigorous calculations for radiation sampling and radiation monitoring lines with temperatures exceeding 130°F and typical support calculations for lines with temperatures less than 130°F. The inspectors reviewed the stress model calculations to verify the appropriate variables were used to reflect accurate pipe dimensions, support types, and maximum operating temperatures. The inspectors confirmed that the lines were properly thermally qualified to meet the corrective actions listed in CDR 391/86-11.

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified.

c. Conclusions

Based on a review of the licensee's piping design and analysis activities, the inspectors determined that the licensee has taken steps to adequately correct the discrepancies of System 90 as noted in CDR 391/86-11. This determination was made for System 43 in IIR 05000391/2010607 (ADAMS Accession No. ML15273A452). Therefore, Construction Deficiency Report 50-391/86-11: Thermal Expansion of Liquid Sample Piping is considered closed.

OA.1.6 (Closed) Construction Deficiency Report 391/89-09: Significant Trend Associated with Damaged, Loose, or Missing Hardware; and Construction Deficiency Report 391/93-02: Loose Flexible Conduit Fittings (Inspection Procedure 35007)

a. Inspection Scope

Background: On November 15, 1989, TVA notified the NRC, in accordance with 10 CFR 50.55.e, of a significant trend associated with damaged, loose, or missing hardware (DLMH) at WBN Unit 1. The issue was documented under Significant Corrective Action Report (SCAR) WBP890502SCA and CDR 390/89-11 for Unit 1 and 391/89-09 for Unit 2. To address these issues for Unit 1, a program was developed to systematically walkdown many of the systems, structures, and components. To prevent recurrence, training was developed, plant procedures and work plans were revised, and controls were reestablished through system turnovers. NRC Inspection Report (IR) 50-390/95-77 and 50-391/95-77 (ADAMS Accession No. ML072610797), dated December 6, 1995, provided closure for CDR 390/89-11. TVA also initiated Problem Evaluation Report (PER) 145010 to track the historical condition adverse to quality and its applicability to Unit 2. In response, for Unit 2, the licensee utilized existing procedures, developed new construction procedures, and provided training to assure correction of damaged, loose, or missing hardware before systems transition to operations.

During a QA assessment of Watts Bar Unit 1, loose flexible conduit fittings were identified as part of the Electrical Issues Corrective Action Program (CAP). To address this issue, Watts Bar issued SCAR WBSA930071, which was recorded as CDR 50-390/93-02 for Unit 1 and 50-391/93-02 for Unit 2. During an evaluation to determine the acceptability of the conduit installation and conditions, additional flexible conduit was identified as not being tightened in accordance with Modification/Addition Instruction (MAI) 3.1, "Installation of Electrical Conduit Systems & Conduit Boxes." PER 549197 was initiated to document these conditions, and corrective actions included personnel training and revision of site installation procedures to ensure that the newly installed flexible conduit would be installed in accordance with the requirements. All previously installed flexible conduits were walked down to validate tightness and repair, if needed. CDR 390/93-02 was closed in IR 50-390/95-33 and 50-391/95-33 (ADAMS Accession No. ML072760514) dated June 19, 1995.

The inspectors previously reviewed procedures for (1) verifying the final installation of components, (2) preventing recurrence of the identified deficiencies, and (3) system and room turnover. The inspectors also previously observed training associated with the implementation of corrective actions. These inspection activities were documented in the following integrated inspection reports:

- 05000391/2013605, Section OA.1.9, (ADAMS Accession No. ML13220A640)
- 05000391/2014604, Section OA.1.2, (ADAMS Accession No. ML14177A214)
- 05000391/2014608, Section OA.1.9, (ADAMS Accession No. ML14322A182).

Inspection Activities: The inspectors performed independent walkdowns of the following selected areas to verify adequate implementation of procedures NC PP-35, "Walkdown Verification for Construction Area Completion and Damaged, Loose, or Missing Hardware," and TI-338, "Unit 2 Area Turnover Supporting Operational Readiness":

- 713' pipe chase
- accumulator room 2
- accumulator room 3
- annulus at various elevations
- essential raw cooling water (ERCW) pipe chase tunnel
- north fan room
- south fan room
- turbine driven auxiliary feedwater pump (TDAFP) room.

The inspectors reviewed the licensee's area deficiency logs to verify the licensee was adequately identifying damaged, loose, or missing hardware during their walkdowns of the listed areas. Furthermore, the inspectors used the logs to identify issues observed during the inspectors' walkdowns not captured during the licensee's walkdowns. The inspectors identified several issues which were not captured during TVA's implementation of the NC PP-35 and TI-338 procedures or that were created after the licensee's walkdowns were completed. The inspectors reviewed the following CRs to determine whether the issues associated with safety-related systems and components were properly captured in the licensee's corrective action program:

- 1105205
- 1105626
- 1110192
- 1110209
- 1111713
- 1111775
- 1113254
- 1113496.

b. Observations and Findings

As described below, the inspectors identified two violations when conducting the area walkdowns.

b.1 Failure to Identify Loose Flexible Conduit Connections in Accordance with Procedures during DLMH Walkdowns

Introduction: The inspectors identified a Severity Level (SL) IV non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures and Drawings," for the licensee's failure to identify loose flex conduit connections in accordance with their procedure for walkdown verification of construction area completion and damaged, loose, or missing hardware.

Description: During a walkdown inspection of the south fan room, the inspectors observed a loose flex conduit connection for flow transmitter 2-FT-001-0028B. In response to this issue being identified, the licensee found three other flex conduit connections that were loose for level transmitters 2-LT-003-0038, 2-LT-003-0107, and 2-LT-003-0164. The licensee generated CR 1110192 to capture the issue and created WO 117377953 to tighten all four connections in accordance with General Construction Specification G-40, "Installation, Modification and Maintenance of Electrical Conduit, Cable Trays, Boxes, Containment Electrical Penetrations, Electric Conductor Seal Assemblies, Lighting, and Miscellaneous Systems," which requires flexible conduit fittings to be wrench tight.

The inspectors determined that the licensee's failure to properly identify loose hardware, in accordance with procedure NC PP-35, was a performance deficiency. This performance deficiency was considered to be more than minor because the finding represented an inadequate quality oversight function, that if left uncorrected, could have adversely affected the quality of the construction of a safety-related component, in accordance with Appendix C, Minor Violations and Findings, of IMC 2517, "Watts Bar Unit 2 Construction Inspection Program," dated June 6, 2013. The inspectors determined this finding to be of very low safety significance, SL IV, in accordance with Section 6.5 of the Enforcement Policy, because it represents a failure to meet a regulatory requirement, including one or more QA criteria that had more than minor safety significance. The inspectors reviewed this finding against cross-cutting area components as described in IMC 0310, "Components Within the Cross-Cutting Areas," and determined that no cross-cutting aspect applied.

Enforcement: 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," requires, in part, that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings.

NC PP-35, Section 3.3.C for performing the walkdown, requires, in part, personnel to record observed deficiencies on the Deficiency Log utilizing (but not limited to) the checklists in Attachments 1-4 for the respective discipline. Attachment 1, "DLMH Electrical Walkdown Checklist," states, under "Conduit and Flex Conduit," to verify rigid and flex conduit fittings, screws, bolts, conduit covers and clips are tight in accordance with Attachment 7. Attachment 7, "Re-verification of Bolting Tightness," lists G-40 as an applicable specification and requires, in part, when field re-verification of bolts, nuts, or other threaded commodities is performed at a later date for the purpose of detecting looseness, re-verification should be performed (by hand) using rotational force in the direction of tightening, and that any movement on the part of the threaded commodity would then be indicative of a loose condition requiring rework.

Contrary to the above, the licensee failed to accomplish activities affecting quality in accordance with their procedures. Specifically, the licensee failed to identify and record four loose safety-related flex conduit connections during their DLMH walkdown of the south fan room in accordance with NC PP-35.

This finding was determined to be a SL IV violation using Section 6.5 of the NRC Enforcement Policy. Because this was a SL IV violation and the issue was entered into the licensee's corrective action program as CR 1110192, this violation is treated as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy. This NCV is identified as NCV 05000391/2015610-01, "Failure to Identify Loose Flexible Conduit Connections in Accordance with Procedures during DLMH Walkdowns."

b.2 Failure to Adequately Torque Hardware in Accordance with Work Order Instructions

Introduction: The inspectors identified a SL IV NCV of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures and Drawings," for the licensee's failure to adequately torque hardware on the Unit 2 AFW trip and throttle valve and several relief valves in accordance with applicable WOs.

Description: During DLMH walkdown inspections of the Unit TDAFWP room and north fan room, the inspectors identified loose hardware on the auxiliary feedwater (AFW) trip and throttle valve, WBN-2-FCV-001-0051-S, and three ERCW relief valves, WBN-2-RFV-067-1022B-B, WBN-2-RFV-067-1025B-B, and WBN-2-RFV-067-1025C-A. Specifically, the inspectors identified that a socket head cap screw which fastens the operator to the trip and throttle valve was not adequately torqued. Similarly, the inspectors identified loose nuts on the inlet rubber gaskets of the three relief valves.

However, these issues are not considered licensee DLMH walkdown misses. For the trip and throttle valve, WO 114900340 was initiated to install test equipment and conduct differential pressure testing and Motor-Operated Valve Analysis and Test System (MOVATS) testing on the valve. WOs 116869813, 116869911, and 116869922 were initiated to remove the three relief valves listed above, respectively, in order to check their set points. All four WOs were generated and completed after the licensee's DLMH walkdowns were performed, implying these issues did not exist at the time of the walkdowns and would not have been identified through the licensee's DLMH procedure and process.

All four issues were entered into the licensee's corrective action program, and new WOs were initiated to adequately torque the hardware in the field. Specifically, CR 1105626 and WO 117365158 were initiated to capture and fix the issue with the trip and throttle valve; and CR 1110209 and WOs 117408331, 117408329, and 117408330 were initiated to capture and fix the issues with relief valves WBN-2-RFV-067-1022B-B, WBN-2-RFV-067-1025B-B, and WBN-2-RFV-067-1025C-A, respectively.

The inspectors determined that the licensee's failure to assure that activities affecting quality were adequately accomplished in accordance with prescribed WOs was a performance deficiency. The performance deficiency was determined to be more than minor because it represented an improper or uncontrolled work practice that could have impacted quality or safety, involving safety-related components, in accordance with Appendix C, Minor Violations and Findings, of IMC 2517, "Watts Bar Unit 2 Construction

Inspection Program,” dated June 6, 2013. The inspectors determined this finding to be of very low safety significance, SL IV, in accordance with Section 6.5 of the Enforcement Policy, because it represents a failure to meet a regulatory requirement, including one or more QA criteria that had more than minor safety significance. The inspectors reviewed this finding against cross-cutting area components as described in IMC 0310, “Components Within the Cross-Cutting Areas,” and determined that no cross-cutting aspect applied.

Enforcement: 10 CFR Part 50, Appendix B, Criterion V, “Instructions, Procedures, and Drawings,” requires, in part, that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings.

Contrary to the above, the licensee failed to assure that activities affecting quality were adequately accomplished in accordance with the applicable prescribed WOs. Specifically, hardware on the trip and throttle valve was not adequately torqued through WO 114900340, which stated to torque actuator mounting bolts to 30 foot-pounds in accordance with WBN-VTD-G157-0050, “Gimple Corporation Disassembly Instructions for Standard Top Mechanism Trip Throttle Valve.” Similarly, hardware on the relief valves were not adequately torqued through WOs 116869813, 116869911, and 116869922, which required torque of fasteners to be performed in accordance with MMTP-104, “Guidelines and Methodology for Assembling and Tensioning Threaded Connections.”

This finding was determined to be a SL IV violation using Section 6.5 of the NRC Enforcement Policy. Because this was a SL IV violation and the issue was entered into the licensee’s corrective action program as CR 1105626 and CR 1110209, this violation is treated as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy. This NCV is identified as NCV 05000391/2015610-02, “Failure to Adequately Torque Hardware in Accordance with Work Order Instructions.”

c. Conclusions

Based on previous inspections documented above, a review of the licensee’s DLMH area deficiency logs, and independent walkdown inspections of eight areas, the inspectors determined that the licensee has taken steps to adequately correct the discrepancies captured in CDRs 391/89-09 and 391/93-02. Therefore, Construction Deficiency Report 391/89-09, “Significant Trend Associated with Damaged, Loose, or Missing Hardware,” and Construction Deficiency Report 391/93-02, “Loose Flexible Conduit Fittings,” are considered closed.

OA.1.7 (Closed) Generic Letter 88-14: Instrument Air Supply System Problems Affecting Safety-Related Equipment and Inspector Follow-up Item 86-10-03: U2 Instrument Air Preoperational Test (Inspection Procedures 92701 and 92717)

a. Inspection Scope

Background: These items originated from local and generic methodologies of testing the plants safety-related instrument air system. This item was previously inspected in IIR 05000391/2013605 (ADAMS Accession No. ML13220A640) and it was determined that

to satisfy completion of these two items, the inspectors needed to review preoperational test results for the instrument air system.

Inspection Activities: Based on the information provided in the background section, the objective of this inspection was to review testing data to make a determination as to whether TVA had adequately addressed GL 88-14 and Inspector Followup Item (IFI) 86-10-03. The inspections reviewed the approved results from 2-PTI-032-02, "Loss of Air Test," Rev. 1, reviewed the resolution of the issues in the Final Engineering Completion Closure packages, and held discussions with the system engineer regarding system health.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors reviewed the licensee's final closure report and various completed actions associated with GL 88-14 and IFI 86-10-03 to verify the adequacy of the licensee's actions. The inspectors concluded that the licensee's efforts were sufficient to satisfy the intent of the respective items. Items GL 88-14 and IFI 86-10-03 are considered closed.

OA.1.8 (Closed) NRC Bulletin 80-06: Engineered Safety Features Reset Controls (Inspection Procedure 92701)

a. Inspection Scope

Background: This Bulletin (BL) originated from industry events where it was suspected that Engineered Safety Feature (ESF) equipment could return to its normal mode following the reset of an ESF signal; thus, protective actions of the affected systems could be compromised once the associated actuation signal was reset. The commitment from Watts Bar Unit 2 was to test the reset function during preoperational testing of the ESF systems to validate that the design was not vulnerable to this concern. This commitment was communicated in TVA to NRC letter dated January 29, 2008 "WATTS BAR NUCLEAR PLANT (WBN) – UNIT 2 REGULATORY FRAMEWORK FOR THE COMPLETION OF CONSTRUCTION AND LICENSING ACTIVITIES FOR UNIT 2." (ADAMS Accession No. ML080320443)

Inspection Activities: Based on the information provided in the background section, the objective of this inspection was to witness the performance of ESF tests and review testing data to verify that TVA had adequately demonstrated the ESF systems would perform as designed. The inspectors witnessed the performance of 2-PTI-262-01, "Unit 2 Integrated Safeguards Test – Train 2B," and 2-PTI-262-02, "Unit 2 Integrated Safeguards Test – Train 2A," in IIR 05000391/201608 (ADAMS Accession No. ML15287A166). 2-PTI-262-03, "Unit 2 Systems Safeguards Test" was witnessed and documented in IIR 05000391/2015609 (ADAMS Accession No. ML15287A199). Additionally, the inspectors reviewed the approved results from 2-PTI-262-01, 2-PTI-262-02, and 2-PTI-262-03 as documented in Section P.1.9 of this report.

b. Observations and Findings

No findings were identified.

c. Conclusions

The inspectors reviewed the licensee's final closure report to verify the adequacy of the licensee's actions. The inspectors concluded that the licensee's efforts were sufficient to satisfy the intent of the respective item. BL 80-06 is considered closed.

OA.1.9 (Closed) Violation 05000391/2015607-02: Failure to Maintain Complete and Accurate Information for Anchor Bolt Installation (Inspection Procedure 92702)

a. Inspection Scope

The inspectors reviewed the licensee's response to the SL IV Violation (EA-15-112) described in NRC IIR 05000391/2015607 (ADAMS Accession No. ML15273A452) and identified as violation (VIO) 05000391/2015607-02: "Failure to Maintain Complete and Accurate Information for Anchor Bolt Installation." The SL IV Violation was associated with an individual who had deliberately removed a QC data sheet containing a QC reject associated with reactor coolant drain tank anchor bolts in a quality-related WO.

The inspectors reviewed the licensee's apparent cause evaluation, associated PER, and verified that all corrective actions were completed. Corrective actions that were verified included the revision of site and fleet procedures to either clarify or enhance the requirement of 10 CFR 50.9 and training for staff regarding 10 CFR 50.9. The inspectors also reviewed the engineering evaluations performed to verify that the base plate (anchor bolt configuration) supporting the reactor coolant drain tank pump was adequately supported. In addition, the inspectors reviewed the extent of condition evaluation to verify that no other evidence of a data sheet being removed or no indication of tampering with work order documentation had been identified.

Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings were identified. TVA had communicated to its employees the importance of quality records, highlighting the role of quality assurance/QC and their functions.

c. Conclusions

The licensee's causal analysis and corrective actions for VIO 05000391/2015607-02 were adequate, fully implemented, and compliance with the associated regulatory requirements has been restored. VIO 05000391/2015607-02, "Failure to Maintain Complete and Accurate Information for Anchor Bolt Installation," is closed.

V. MANAGEMENT MEETINGS

X1 Exit Meeting Summary

An exit meeting was conducted on January 22, 2016, to present inspection results to Mr. Connors and other members of your staff. The inspectors identified that no proprietary

information had been received during the inspection and none would be used in the inspection report. The licensee acknowledged the observations and provided no dissenting comments.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee personnel

J. Adair, TVA - Engineer
G. Bonine, CILRT Test Director
J. Boykin, Bechtel - Quality Assurance
D. Charlton, TVA – Licensing
M. Cooper, TVA – Unit 2 Project Director
B. Enis, TVA Engineering Oversight
P. Harless, TVA - Startup Test Engineer
J. Harris, Test Director
J. Iqbal, Betchel – Engineering Supervisor
G. Johnson, CILRT Test Director
F. Koontz, TVA – Engineering
K. McCormack, TVA– Preoperational Test Coordinator
S. Michael, Test Engineer
G. Mills, Bechtel – Unit 2 Mechanical Engineering
J. Newton, TVA – Startup
J. O’Dell, TVA - Regulatory Compliance
J. Ortiz, TVA - Programs Oversight Engineer
L. Peterson, TVA – Start-up Engineer
D. Phillips, Bechtel - SIT Test Director
R. Phillips, Bechtel - Engineer
J. Polickoski, TVA - Fire Protection Recovery Project Team Lead
D. Prater, TVA – Unit 2 MEQ
R. Proffitt, TVA – Licensing
T. Ramis, Bechtel - SIT Test Director
D. Shutt, TVA - Licensing
M. Skaggs, TVA – Senior Vice President
J. Smith, Bechtel - Engineer
P. Stephens, TVA - Chemistry Manager
J. Sterchi, TVA - Engineer
K. Studder, TVA - Maintenance Director
J. Swanson, Startup Test Lead
D. Wade, Bechtel - Test Director
T. Washburn, TVA – Startup Supervisor
N. Welch, TVA – Preoperational Startup Manager
R. Wigall, TVA - Engineering Manager
M. Young, TVA – Senior Stress Engineer

INSPECTION PROCEDURES USED

IP 35007	Quality Assurance Program Implementation During Construction and Pre-Construction Activities
IP 37051	Verification of As-Builts
IP 50073	Mechanical Components - Work Observation
IP 50075	Safety Related Components - Records Review
IP 52053	Instrument Components and Systems - Work Observation
IP 52055	Instrument Components and Systems - Record Review
IP 63050	Containment Structural Integrity Test
IP 64100	Postfire Safe Shutdown, Emergency Lighting and Oil Collection Capability at Operating and Near-Term Operating Reactor Facilities
IP 64704	Fire Protection Program
IP 70300	Preoperational Test Procedure Test Review
IP 70312	Preoperational Test Witnessing
IP 70315	Engineered Safety Features Test Preoperational Test Witnessing
IP 70322	Preoperational Test Results Evaluation - ESF
IP 70323	Containment Leak Rate Test Results Evaluation
IP 70325	Preoperational Test Results Evaluation - Reactor Protection System
IP 70326	Preoperational Test Results Evaluation - Loss of Offsite Power
IP 70329	Preoperational Test Result Evaluation Verification
IP 70400	Preoperational Test Results Evaluation
IP 70441B	Emergency / Standby Power Supply System Test - Preoperational Test Witnessing
IP 71302	Preoperational Test Program Implementation Verification
IP 72300	Startup Test Procedure Review
IP 72524	Initial Fuel Loading Witnessing
IP 72564	Precritical Test Procedure Review Protective Trip Circuit or Rod Drop Measurement
IP 72566	Precritical Test Procedure Review RCS Leak Test or Pressurizer Effectiveness
IP 72570	Initial Criticality Procedure Review (PWR)
IP 73053	Preservice Inspection - Observation of Work and Work Activities
IP 83526	Control of Radioactive Materials and Contamination, Surveys, and Monitoring (Preoperational and Supplemental)
IP 84523	Liquids and Liquid Wastes (Preoperational and Supplemental)
IP 84524	Gaseous Waste System (Preoperational and Supplemental)
IP 92701	Followup
IP 92702	Followup on Corrective Actions for Violations and Deviations
IP 92717	IE Bulletins for Information and IE Information Notice Followup
TI 2500/020	Inspection to Determine Compliance with ATWS Rule, 10 CFR 50.62
TI 2512/015	Inspection of Watts Bar Nuclear Plant Employee Concerns Program
TI 2512/022	Inspection of Watts Bar Nuclear Plant Fire Protection Corrective Action Program Plan
TI 2512/038	Inspection of Watts Bar Nuclear Plant Mechanical Equipment Qualification Special Program
TI 2512/041	Inspection of Watts Bar Nuclear Plant Radiation Monitoring System Special Program
TI 2515/110	Performance of Safety-Related Check Valves
TI 2515/114	Inspection Requirements for Generic Letter 89-04, Acceptable Inservice Testing Programs

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Opened and Closed

05000391/2015610-01	NCV	Failure to Identify Loose Flexible Conduit Connections in Accordance with Procedures during DLMH Walkdowns (Section OA.1.6)
05000391/2015610-02	NCV	Failure to Meet Design Requirements in Accordance with General Engineering Specifications (Section OA.1.6)

Closed

80-06	BL	Engineered Safety Features Reset Controls (Section OA.1.8)
63050	IP	Containment Structural Integrity Test (Section P.1.10)
50-391/83-61	CDR	Failure to Provide Self-contained Lights as Committed to the NRC (Section F.1.1)
64704	IP	Fire Protection Program (Section F.1.5)
83526	IP	Control of Radioactive Materials and Contamination, Surveys, and Monitoring (Preoperational and Supplemental) (Section R.1.1)
84523	IP	Liquids and Liquid Wastes (Preoperational and Supplemental) (Section R.1.2)
50-391/86-11	CDR	Thermal Expansion of Liquid Sample Piping (Section OA.1.5)
50-391/89-09	CDR	Significant Trend Associated with Damaged, Loose, or Missing Hardware (Section OA.1.6)
50-391/93-02	CDR	Loose Flexible Conduit Fittings (Section OA.1.6)
2500/020	TI	Inspection to Determine Compliance with ATWS Rule, 10 CFR 50.62 (Section P.1.4)
2512/022	TI	Inspection of Watts Bar Nuclear Plant Fire Protection Corrective Action Program Plan (Section F.1.2)

2512/038	TI	Inspection of Watts Bar Nuclear Plant Mechanical Equipment Qualification Special Program (Section OA.1.3)
2512/041	TI	Inspection of Watts Bar Nuclear Plant Radiation Monitoring System Special Program (Section OA.1.4)
05000391/2015607-02	VIO	Failure to Maintain Complete and Accurate Information for Anchor Bolt Installation (Section OA.1.9)
88-14	GL	Instrument Air Supply System Problems Affecting Safety-Related Equipment (Section OA.1.7)
86-10-03	IFI	U2 Instrument Air Preoperational Test (Section OA.1.7)
<u>Discussed</u>		
89-04	GL	Guidance on Developing Acceptable In-Service Testing Programs (Section OA.1.1)
2515/110	TI	Safety-Related Check Valves (Section OA.1.1)
2515/114	TI	Inspection Requirements for Generic Letter 89-04, Acceptable In-Service Testing Programs (Section OA.1.1)
II.D.1	TMI	Relief and Safety Valve Test Requirements (Section OA.1.2)

LIST OF DOCUMENTS REVIEWED

II. MANAGEMENT OVERSIGHT AND CONTROLS

P.1 Preoperational Activities

P.1.3 Preoperational Test Witnessing (Inspection Procedure 70312)

NC-PI-98-03 Foxboro I/A Network Storm Test, Rev 0

P.1.5 Engineered Safety Features Test Preoperational Test Witnessing (Inspection Procedure 70312 and 70315)

2-PTI-262-03, Rev. 01, "Unit 2 Systems Safeguards Test"

P.1.8 Preoperational Test Results Evaluation (Inspection Procedure 70400 and 70325)

SMP-8.0, Watts Bar Nuclear Plant Unit 2 Administration of Preoperational Test Instructions, Rev. 011

SMP-9.0, Watts Bar Nuclear Plant Unit 2 Conduct of Test, Rev. 06

SMP-10.0. Watts Bar Nuclear Plant Unit 2 Test Deficiency Notices, Rev. 07

P.1.9 Preoperational Test Result Evaluation (Inspection Procedures 70322 and 70326)

Test Summary Report 2-PTI-262-01, Rev. 1 dated 12/9/2015

Test Summary Report 2-PTI-262-02, Rev. 1 dated 12/9/2015

Test Summary Report 2-PTI-262-03, Rev. 1 dated 12/2/2015

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SMP-9.0, Watts Bar Nuclear Plant Unit 2 Conduct of Test, Rev. 06

SMP-10.0. Watts Bar Nuclear Plant Unit 2 Test Deficiency Notices, Rev. 07

P.1.10 Preoperational Test Results Evaluation (Inspection Procedure 63050 and 70323)

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1078677

1078710

1079772

1080398

1080605

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885874

940543, Rev. 0 and 1

1043737

1062157

1073506

1079772
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 1099063

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 25402-000-GPP-0000-N3506, Pressure Testing of Piping, Tubing, and Components (Bechtel),
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 25402-011-V1b-NEE0-00002-001, Containment Vessel Structural Integrity Test Procedure
 (Graftel), dated May 5, 2015.
 2-PTI-064-02, Containment Integrated Leak Rate Test (CILRT), Rev. 0
 2-SI-0-703, Containment Integrated Leak Rate Test, Rev. 2, OTO-1, and OTO-2
 2-SI-88-4, General Visual Inspection of Steel Containment Vessel, Rev. 2
 2-TI-120, CILRT Support Functions, Revs. 2, OTO-1, and OTO-2
 2-TI-360.01, WBN Leak Rate Programs, Rev. 1
 Chapter 6.10, Misc. Liquid Sampling Methods, Rev. 22
 Chapter 8.0, Laboratory Operations, Rev. 24
 SMP-8.0, Watts Bar Nuclear Plant Unit 2 Administration of Preoperational Test Instructions,
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 Watts Bar Unit 2, Technical Specifications, 5.7.2.19, Containment Leakage Rate Testing Program, dated October 22, 2105

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 ANSI/ANS N45.4-1972, Leakage - Rate Testing of Containment Structures for Nuclear Reactors
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SU.1 Startup Testing Activities

SU.1.11 Initial Fuel Loading Witnessing (Inspection Procedure 72524)

Licensing and Design Bases

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 2-CM-6.24, Sampling CVCS Mixed Bed Demineralizers, Rev. 1
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 2-FHI-3, Fuel Transfer System, Rev. 2
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 2-PAT-2.0, Initial Core Load Sequence, Rev. 2
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 2-PAT-2.2, Response Check Of Core Load Instrumentation After 8 Hour Delay In Fuel Movement, Rev. 1
 2-PET-102, Pre-Power Escalation NIS Calibration Data, Rev. 0
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 RCI-159, Radiation Baseline Surveys, Rev. 1

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III. OPERATIONAL READINESS ACTIVITIES

F.1 Fire Protection

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53587-103, Drawing Revision Authorization, RCP 2 Sprinkler piping, 5/12/15

65750-A, Field Change Request, RCP Detector Installation, 9/9/15

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47W492-7, Mechanical Fire Protection, Rev 25

48W914-1, Miscellaneous Steel Fire Protection RCP Hood, Rev 16

Modifications

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DCN 65325, Protect Conduit 1VC3346A for 1-PCV-68340A-A in 125V Vital Battery Board Room II, Rev. AA1

EDCR 55948, Control Air Pneumatic Relay for 2-FCV-062-0009

EDCR 54655 "Modifications Required for Reactor Building Fire Detection Systems as Identified in 10CRF50 Appendix R"

WO 116874064, DCN 65325 (PORV) Install 3M 50 Series 3 Hour Fire Wrap on 1VC3346A, Rev. 1

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R.1 Radiation Safety

R.1.1 Control of Radioactive Materials and Contamination, Surveys, and Monitoring (Preoperational and Supplemental)

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 2-PTI-090-02, 2-RE-90-106 Reactor Building Lower Compartment Particulate and Gas Radiation Monitor, Rev. 0, 11/22/15
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R.1.2 Liquids and Liquid Wastes (Preoperational and Supplemental)

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 Work Order 115448035, 2-PTI-077-03, Liquid Waste Collection, Rev. 1

R.1.3 Gaseous Waste System (Pre-Operational and Supplemental)

Offsite Dose Calculation Manual, Rev. 25
 DCN 54207-A, Installation of Additional Flow Elements in Ductwork Feeding the Shield Building Exhaust Vent (SBEV), 6/30/10
 Work Order 115858031, 2-ODI-90-82, 18Month Channel Calibration of the Shield Building Vent EGTS Flow 2-FE-90-400D
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 2-PTI-090-06, 2-RE-90-130 and 2-RE-90-131 Containment Purge Gas Radiation Monitors, Rev. 0, 9/9/15

IV. OTHER ACTIVITIES

OA 1.1 Generic Letter 89-04: Guidance on Developing Acceptable In-Service Testing Programs; Temporary Instruction 2515/114: Inspection Requirements for Generic Letter 89-04, Acceptable In-Service Testing Programs; Temporary Instruction 2515/110: Performance of Safety-Related Check Valves

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 WO 115892647, 2-SI-62-916-B, Centrifugal Charging Pump 2B-B Preservice Pump Test
 WO 115880870, 2-SI-63-906, Safety Injection Check Valve Full-Flow Testing During Refueling Outages
 WO 115880861, 2-SI-63-905, Boration Check Valve Flow Test During Refueling Outages
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 TI-100.001, 15-PV-0260, Centrifugal Charging Pump 2A (Group A Test)
 TI-100.001, 15-PV-0263, Centrifugal Charging Pump 2B (Comprehensive Test)
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Procedures

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LIST OF ACRONYMS

ADAMS	Agencywide Documents Access and Management System
AFW	Auxiliary Feedwater
AMSAC	ATWS Mitigation System Actuation Circuitry
ANI	Authorized Nuclear Inspector
ANS	American Nuclear Society
ANSI	American National Standards Institute
ATWS	Anticipated Transient Without SCRAM
ASME	American Society of Mechanical Engineers
BL	Bulletin
BPVC	Boiler and Pressure Vessel Code
CAP	Corrective Action Program
CDR	Construction Deficiency Report
CFR	Code of Federal Regulations
CILRT	Containment Integrated Leak Rate Test
CIV	Containment Isolation Valve
CN	Change Notice
CR	Condition Report
CRD	Control Rod Drive
CRE	Control Room Envelope
CVCS	Chemical and Volume Control System
DCS	Digital Control System
DLMH	Damaged, Loose, or Missing Hardware
EDCR	Engineering Document Construction Release
EL	Elevation
ELU	Emergency Lighting Unit
ERCW	Essential Raw Cooling Water
ESF	Engineered Safety Features
FCR	Field Change Request
FME	Foreign Material Exclusion
FSAR	Final Safety Analysis Report
GL	Generic Letter
HEPA	High Efficiency Particulate Arrestance
HFT	Hot Functional Test
IFI	Inspector Follow-up Item
IIR	Integrated Inspection Report
IR	Inspection Report
IMC	Inspection Manual Chapter (NRC)
IP	Inspection Procedure
IST	In-Service Test
JTG	Joint Test Group
L _a	Maximum Allowable Containment Leakage Rate
LCO	Limiting Conditions for Operations
LLRT	Local Leak Rate Test
LWR	Light Water Reactor
M&TE	Measuring and Test Equipment
MAI	Modification/Addition Instruction
MCR	Main Control Room
MEQ	Mechanical Equipment Qualification
MOVATS	Motor-Operated Valve Analysis and Test System
NCV	Non-Cited Violation
No.	Number
NPP	Nuclear Performance Plan

NRC	Nuclear Regulatory Commission
OM Code	ASME Operation and Maintenance Code
OR	Operating Requirements
PARS	Publically Available Records
PER	Problem Evaluation Report
PORVs	Power Operated Relief Valves
PRT	Pressurizer Relief Tank
PSI	Preservice Inspection
psig	Pounds Per Square Inch Gauge
PTI	Preoperational Test Instruction
PORV	Power Operated Relief Valve
PWR	Pressurized Water Reactor
QA	Quality Assurance
QC	Quality Control
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
Rev.	Revision
RHR	Residual Heat Removal
RMS	Radiation Monitoring System
RPS	Reactor Protection System
RTB	Reactor Trip Breaker
SCAR	Significant Corrective Action Report
scfh	Standard Cubic Feet per Hour
SER	Safety Evaluation Report
SIT	Structural Integrity Test
SL	Severity Level
SP	Special Program
TDAFP	Turbine Driven Auxiliary Feedwater Pump
TDN	Test Deficiency Notice
TI	Technical Instruction
TI	Temporary Instruction (NRC)
TMI	Three Mile Island
TS	Technical Specifications
TVA	Tennessee Valley Authority
U2	Unit 2
VIO	Violation
WBN	Watts Bar Nuclear Plant
WO	Work Order
10 CFR	Title 10 to the Code of Federal Regulations