



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

January 22, 2019

Mr. Joseph W. Shea, Vice President
Nuclear Regulatory Affairs and
Support Services
Tennessee Valley Authority
1101 Market Street, LP 4A
Chattanooga, TN 37402-2801

**SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 2 – NUCLEAR REGULATORY
COMMISSION SUPPLEMENTAL INSPECTION REPORT 05000391/2018040**

Dear Mr. Shea:

On December 14, 2018, the U.S. Nuclear Regulatory Commission (NRC) completed a supplemental inspection using Inspection Procedure (IP) 95001, "Supplemental Inspection Response to Action Matrix Column 2 Inputs." The NRC inspection team discussed the results of this inspection with Mr. Paul Simmons and other members of your staff. The results of this inspection are documented in the enclosed report.

The NRC performed this inspection to review your station's actions in response to a White Unplanned Scrams per 7000 Critical Hours performance indicator (PI), which crossed the threshold from Green to White in the second quarter of 2018. Specifically, Watts Bar Unit 2 experienced reactor trips on March 20, 2017, December 11, 2017, April 12, 2018, and June 22, 2018. The PI remained White when a fifth reactor trip occurred on August 22, 2018. The details behind each reactor trip and an additional Unit 2 unplanned shutdown on March 23, 2017, were included in your staff's root cause evaluation.

On November 26, 2018, you informed us that your station was ready for the supplemental inspection. The NRC determined that your staff appropriately evaluated the collective performance issues associated with this White PI and identified the primary root cause as Watts Bar Nuclear personnel have not effectively identified and understood risk in that work activities were authorized in risk sensitive areas with inadequate work control, and known deficiencies posing a risk to plant operations were not adequately resolved. Your staff appropriately identified a contributing cause in that latent equipment issues from plant startup and construction activities were key contributors that resulted in conditions that led to plant trips. Your staff has appropriate corrective actions either implemented or planned to address the issues that led to this White PI. Their corrective action plan for the root cause is to improve risk management behaviors. This consists of three parts: 1) procedures are revised to improve

guidance on risk management; 2) training is conducted to reinforce the individual's responsibilities to have a self-critical, conservative bias on risk management; and 3) management performs observations to verify corrective actions have been effective and expectations are being met. Your staff's corrective action plan for the contributing cause is to identify latent startup equipment conditions where failure could lead to a reactor trip.

The NRC determined that completed or planned corrective actions were sufficient to address the performance issue that led to the White PI, thus satisfying all objectives found in IP 95001. The ROP directs that when all objectives of the 95001 inspection procedure have been met for the performance issue and the PI has returned to Green, the licensee then can be returned to the Licensee Response Column (Column 1). Watts Bar Unit 2 will remain in the Regulatory Response Column (Column 2), until the PI returns to Green, then a Regulatory Performance Meeting will be scheduled to further discuss implementation of your corrective actions.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at <http://www.nrc.gov/reading-rm/adams.html> and at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Anthony D. Masters, Chief
Reactor Projects Branch 5
Division of Reactor Projects

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

Enclosure:
IR 05000391/2018040
w/Attachment

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SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 2 – NUCLEAR REGULATORY
COMMISSION SUPPLEMENTAL INSPECTION REPORT 05000391/2018040

☒ PUBLICLY AVAILABLE ☐ NON-PUBLICLY AVAILABLE ☐ SENSITIVE ☒ NON-SENSITIVE

ADAMS: ☒ Yes ACCESSION NUMBER: **ML19022A291** ☒ SUNSI REVIEW COMPLETE ☒ FORM 665 ATTACHED

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Number: 50-391

License Number: NPF-96

Report Number: 05000391/2018040

Enterprise Identifier: I-2018-040-0006

Licensee: Tennessee Valley Authority (TVA)

Facility: Watts Bar Nuclear Plant, Unit 2

Location: Spring City, TN 37381

Inspection Dates: December 10 - 14, 2018

Inspectors: D. Orr, Senior Resident Inspector (Turkey Point)
W. Deschaine, Project Engineer

Approved By: A. Masters, Chief
Reactor Projects Branch 5
Division of Reactor Projects

Enclosure

SUMMARY

The NRC continued monitoring licensee performance by conducting a supplemental inspection at Watts Bar Nuclear Plant, Unit 2 in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to <http://www.nrc.gov/NRR/OVERSIGHT/ASSESS/index.html> for more information.

Watts Bar Unit 2 experienced reactor trips on March 20, 2017, December 11, 2017, April 12, 2018, and June 22, 2018, and the White Unplanned Scrams per 7000 Critical Hours performance indicator (PI) crossed the threshold from Green to White in the second quarter of 2018. A fifth Unit 2 reactor trip occurred on August 22, 2018, and the PI remained White. TVA evaluated the collective performance issues associated with this White PI, as well as a March 23, 2017, unplanned Unit 2 shutdown. TVA identified the primary root cause as Watts Bar Nuclear personnel have not effectively identified and understood risk in that work activities were authorized in risk sensitive areas with inadequate work control, and known deficiencies posing a risk to plant operations were not adequately resolved. TVA also identified a contributing cause in that latent equipment issues from plant startup and construction activities were key contributors that resulted in conditions that led to plant trips. TVA's corrective action plan for the root cause is to improve risk management behaviors consisting of three parts: 1) procedures are revised to improve guidance on risk management; 2) training is conducted to reinforce the individual's responsibilities to have a self-critical, conservative bias on risk management; and 3) management performs observations to verify corrective actions have been effective and expectations are being met. TVA's corrective action plan for the contributing cause is to identify latent startup equipment conditions where failure could lead to a reactor trip.

The NRC inspectors determined that TVA appropriately evaluated the collective issues in the adverse Unit 2 scram trend and understood the root and contributing causes of the significant performance issue. The NRC inspectors also determined that completed or planned corrective actions were sufficient to address the performance issue that led to the White performance indicator.

List of Findings and Violations

No findings were identified.

INSPECTION SCOPE

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at <http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html>. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspectors reviewed selected procedures and records, observed activities, performed plant walkdowns, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

95001 - Supplemental Inspection Response to Action Matrix Column 2 Inputs

The supplemental inspection was performed in accordance with IP 95001 to assess TVA's evaluation of a Watts Bar Unit 2 White PI, which affected the Initiating Events cornerstone objective in the Reactor Safety strategic performance area. The White PI is associated with having greater than three reactor trips in 7000 critical hours. On June 22, 2018, the indicator transitioned from Green to White when Unit 2 had a fourth cumulative reactor trip within the current 7000 critical hours.

The inspection objectives were to:

- Assure that the root and contributing causes of the significant performance issue are understood
- Independently assess and assure that the extent of condition and extent of cause of the significant performance issue are identified
- Assure that corrective actions taken to address and preclude repetition of significant performance issues are prompt and effective.
- Assure that corrective action plans direct prompt actions to effectively address and preclude repetition of significant performance issues

The inspectors reviewed condition report (CR) 1415482, which documented the root cause analysis (RCA) for WBN2 Unplanned Plant Trips, and its constituent CRs. CR 1415482 evaluated the cause evaluations conducted under the following CRs:

- 1421462, U2 Reactor Trip March 20, 2017, Hotwell Pump Trip
- 1275870, U2 Forced Outage March 23, 2017, Structural Failure of Main Condenser B Zone
- 1367005, U2 Reactor Trip December 11, 2017 Dropped Rods
- 1404737, U2 Reactor Trip April 12, 2018, RCS Low Flow Indication
- 1425231, U2 Reactor Trip June 22, 2018, Spurious Differential Relay Actuation
- 1441438, U2 Reactor Trip August 22, 2018, Turbine Control System

The inspectors reviewed TVA's root causes, contributing causes, extent of condition, and extent of cause determinations. The inspectors assessed whether TVA's corrective actions to address the root and contributing causes were sufficient to prevent recurrence. The highlights of the performance review and NRC's assessment are documented below:

(1) Problem Identification

- a. IP 95001 requires that the inspectors determine that licensee's evaluation of the issue documents who identified the issue (i.e., licensee-identified, self-revealing, or NRC identified) and the conditions under which the issue was identified.

The RCA indicates that each of the six events were self-revealing and the white PI was licensee-identified since it was correctly characterized and reported by TVA administrative processes.

The inspectors determined this inspection objective was met.

- b. IP 95001 requires that the inspectors determine that the licensee's evaluation of each issue documents how long the issue existed and prior opportunities for identification.

The RCA discusses how long the white PI existed and describes the time frames for the other individual events. The RCA also states that the events are considered to have had previous opportunities to identify and take corrective action prior to each event.

The inspectors determined this inspection objective was met.

- c. IP 95001 requires that the inspectors determine that the licensee's evaluation documents the plant specific risk consequences, as applicable, and compliance concerns associated with the issue(s).

Section 3.B of the RCA states that a quantitative PRA analysis of each of the six events evaluated in the RCA found each had low safety significance. A PRA assessment of the aggregate risk from all six events found the overall risk was small.

The inspectors determined this inspection objective was met.

(2) Root Cause, Extent-of-Condition, and Extent-of-Cause Evaluation

- a. IP 95001 requires that the inspectors determine that the licensee evaluated the issue using a systematic methodology to identify the root and contributing causes

The RCA was conducted using a systematic methodology to identify the root and contributing causes. The main evaluation technique was an event and causal factor chart of the six events showing inappropriate actions. Analysis techniques included common cause analysis, barrier analysis, organizational and programmatic evaluation, and safety culture assessment. The RCA was completed in accordance with Watts Bar corrective action program (CAP) procedures.

The inspectors determined this inspection objective was met.

- b. IP 95001 requires that the inspectors determine that the licensee's RCA was conducted to a level of detail commensurate with the significance of the issue.

TVA conducted a Level 1 evaluation to collectively review the five Unit 2 reactor scrams since the beginning of commercial operation and the Unit 2 condenser failure that resulted in an unplanned shutdown. A Level 1 evaluation is the highest level of effort in root cause evaluation that can be assigned in TVA's CAP. Additionally, TVA completed a self-assessment, fleet challenge board, and mock inspection using IP 95001, to assure the RCA was complete, accurate, and appropriate for the significant performance issue.

The inspectors determined this inspection objective was met.

- c. IP 95001 requires that the inspectors determine that the licensee's RCA included a consideration of prior occurrences of the issue and knowledge of Operating Experience.

TVA's RCA included a consideration of prior occurrences and operating experience within each evaluation of the five reactor trips and the March 23, 2017 unplanned shutdown. Operating experience and consideration of prior occurrences were also evaluated in the common cause analysis worksheets, the barrier analysis worksheets, and the safety culture assessment. TVA considered industry operating experience for other fleet nuclear units that had previously crossed the Green to White threshold in the Unplanned Scrams per 7000 Hours PI.

The inspectors determined this inspection objective was met.

- d. IP 95001 requires that the inspectors determine that the licensee's RCA addresses the extent of condition and extent of cause of the issue.

TVA's RCA extent of condition included all Unit 2 plant trips since commercial operation as well as the condenser structural failure on March 23, 2017, because it resulted in reduced plant operating time while critical. The reduced plant operating time, i.e. reduced critical hours contributed to exceeding the performance indicator threshold. TVA also considered other Unit 1 and Unit 2 ROP PIs and previous Unit 1 and Unit 2 trips but concluded that they did not warrant further evaluation.

The extent of cause was evaluated by TVA using five methodical approaches:

- Performing a CR search for risk issues involving work in the plant
- Reviewing the equipment condition mitigating and bridging strategies
- Identification of systems that may have latent startup equipment conditions
- Reviewing results of an INPO scram analysis visit
- Performing a CR review for personal, radiological, and environmental safety

Results of the extent of condition and extent of cause reviews were appropriately entered into the RCA and CAP. The inspectors determined this inspection objective was met.

- e. IP 95001 requires that the inspectors determine that the licensee's root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture traits in NUREG-2165, "Safety Culture Common Language," referenced in IMC 0310, "Aspects Within the Cross-Cutting Areas."

TVA performed an analysis which looked at the 35 aspects from IMC 0310. The analysis determined that two cross-cutting aspects were associated with the root cause:

- H.5 Work Management: The organization implements a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work and the need for coordination with different groups or job activities (WP.1).
- P.3 Resolution: The organization takes effective corrective actions to address issues in a timely manner commensurate with their safety significance (PI.3).

Additional aspects from IMC 0310 were associated with the contributing cause. The corrective action plan within the RCA addressed both the causes for the unplanned trips and the related safety culture aspects.

The inspectors determined this inspection objective was met.

(3) Corrective Actions Taken and Planned

- a. IP 95001 requires that the inspectors determine that: (1) the licensee specified appropriate corrective actions for each root and/or contributing cause, or (2) an evaluation that states no actions are necessary is adequate.

The corrective action plan developed for the root cause is to improve risk management behaviors. This consists of three parts: 1) procedures are revised to improve guidance on risk management; 2) training is conducted to reinforce the individual's responsibilities to have a self-critical, conservative bias on risk management; and, 3) management performs observations to verify corrective actions have been effective and expectations are being met. In the RCA, TVA included a Cause to Action Matrix to assure all identified root, contributing and extent of causes were appropriately addressed with timely and effective corrective actions. Additionally, all safety culture aspects identified in the RCA as associated with the root or contributing causes were included in the Cause to Action Matrix.

The inspectors determined this inspection objective was met.

- b. IP 95001 requires that the inspectors determine that the licensee prioritized corrective actions with consideration of risk significance and regulatory compliance.

The Cause to Action Matrix appropriately prioritized corrective actions and published due dates consistent with the CAP and responsible organizations. The inspectors determined this inspection objective was met.

- c. IP 95001 requires that the inspectors determine that the licensee's corrective actions taken or planned, preclude repetition of significant performance issues and are prompt and effective.

In addition to several corrective actions, TVA developed three specific corrective actions to prevent recurrence (CAPR) of the adverse reactor trip trend, two CAPRs improve the quality of procedures for risk management and identification of trip sensitive equipment, and one CAPR provides training to appropriate plant department personnel to reinforce the individual's responsibilities to have a self-critical, conservative bias on risk management. The inspectors determined this inspection objective was met.

- d. IP 95001 requires that the inspectors verify that the licensee has determined appropriate quantitative or qualitative measures of success for taken and planned corrective actions.

The inspectors noted that effectiveness review plans and criteria in the RCA appropriately employed a MAST strategy, i.e. Method, Attributes, Success, and Timeliness. However, the success and attribute criteria of the effectiveness review plans at the mid-term and long-term were less stringent compared to the early detection effectiveness review plan in that they did not include a CR search for documented risk management issues and did not include a sample of corrective maintenance work orders for first time PMs and orders merged late into the work process schedule. In response to this observation, TVA promptly initiated CRs 1475066 & 1475068 to improve the quality and consistency of their effectiveness review for taken and planned corrective actions. The inspectors determined this inspection objective was met.

- e. IP 95001 requires that the inspectors determine that each Notice of Violation (NOV) related to the supplemental inspection is adequately addressed in corrective actions taken or planned.

There were not any NOVs related to the supplemental inspection.

(4) Evaluation of IMC 0305 Criteria for Treatment of Old Design Issues

The Unit 2 Unplanned Scrams per 7000 Critical Hours White PI is not associated with an old design issue.

(5) Overall Assessment of Evaluation and Corrective Actions

The NRC inspectors determined that TVA appropriately evaluated the collective issues in the adverse Unit 2 scram trend and understood the root and contributing causes of the significant performance issue. The NRC inspectors also determined that completed or planned corrective actions were sufficient to address the performance issue that led to the White performance indicator. Thus meeting all objectives in IP 95001. The ROP directs that when all objectives of the 95001 inspection procedure have been met for the

performance issue and the PI has returned to Green, the licensee then can be returned to the Licensee Response Column (Column 1). Watts Bar Unit 2 will remain in the Regulatory Response Column (Column 2), until the PI returns to Green, then a Regulatory Performance Meeting will be scheduled to further discuss implementation of your corrective actions.

EXIT MEETINGS AND DEBRIEFS

No proprietary information was retained by the inspectors or documented in this report.

On December 14, 2018, the inspectors presented the supplemental inspection results to Mr. Paul Simmons, Site Vice President, and other members of the licensee staff.

DOCUMENTS REVIEWED

Condition Reports

Designation	Description
1415482	WBN2 Unplanned Plant Trips
1421462	U2 Reactor Trip 3/20/2017 Hotwell Pump Trip
1275870	U2 Forced Outage 3/3/2017 Structural Failure of Main Condenser B Zone
1367005	U2 Reactor Trip 12/11/2017 Dropped Rods
1404737	U2 Reactor Trip 4/12/2018 RCS Low Flow Indication
1415691	QA PDS – Elevation Risk Recognition and Management
1425231	U2 Reactor Trip 6/22/2018 Spurious Differential Relay Actuation
1441438	U2 Reactor Trip 8/22/2018 Turbine Control System
1466567	QA ID: Level 1 Escalation to WBN Plant Manager for Risk Performance
1474302	Engineering Training for the 95001 Case Study

Condition Reports Generated as a Result of NRC Inspection

Designation	Description
1474402	A Potential Gap Was Identified in the Method to Track Long-Term Supplemental Supervisors in NSP
1474758	Shift Walkdown of 0-TI-12.10, Control of Sensitive Equipment
1474829	201812 WBN U2 95001 Inspection – NRC Identified Condition
1475057	201812 WBN U2 95001 Inspection Observation
1475066	201812 WBN U2 95001 Inspection Observation
1475068	201812 WBN U2 95001 Inspection Observation
1475207	201812 WBN U2 95001 Inspection Observation
1475322	WBN U2 95001 Inspection Observation
1475347	201812 WBN U2 95001 Inspection Observation
1475848	WBN U2 95001 Inspection Observation

Procedures

Designation	Description	Revision
0-TI-12.10	Control of Sensitive Equipment	2
0-TI-12.10	Control of Sensitive Equipment	1
NPG-SPP-01.3	Housekeeping	6
NPG-SPP-06.1	Work Order Process	7
NPG-SPP-06.10	NPG Fix It Now (FIN) Team Process	3
NPG-SPP-07.3	Work Activity Risk Management Process	26
NPG-SPP-07.3	Work Activity Risk Management Process	25
NPG-SPP-07.3	Work Activity Risk Management Process	24
NPG-SPP-10.2	Clearance Procedure to Safely Control Energy	21

Miscellaneous

Designation	Description	Date
	Plant Health Committee package	12/12/2018

Procedures

Designation	Description	Revision
	Management Review Committee package	12/13/2018
NSP300.300 LMS # 50007470	WBN Unit 2 Unplanned Trips Case Study lesson plan	12/3/2018