

determined that Browns Ferry Nuclear Plant, Unit 1 will be transitioned to the Licensee Response Column (Column 1) of the Action Matrix as of September 21, 2023, considering the absence of additional Action Matrix inputs.

No findings or violations of more than minor significance were identified during this inspection.

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 Title 10 of the *Code of Federal Regulations* 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,



Signed by McKown, Louis
on 11/02/23

Louis J. McKown, II, Chief
Reactor Projects Branch #5
Division of Reactor Projects

Docket No. 05000259
License No. DPR-33

Enclosure:
As stated

cc w/ encl: Distribution via LISTSERV

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNIT 1 – 95001 SUPPLEMENTAL INSPECTION SUPPLEMENTAL REPORT 05000259/2023040 AND FOLLOW-UP ASSESSMENT LETTER Dated November 02, 2023

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DATE	11/02/2023	11/02/2023	11/02/2023		

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**U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report**

Docket Number: 05000259

License Number: DPR-33

Report Number: 05000259/2023040

Enterprise Identifier: I-2023-040-0006

Licensee: Tennessee Valley Authority

Facility: Browns Ferry Nuclear Plant, Unit 1

Location: Athens, Alabama

Inspection Dates: September 18, 2023, to September 21, 2023

Inspectors: K. Pfeil, Resident Inspector
A. Ruh, Reactor Inspector

Approved By: Louis J. McKown, II, Chief
Reactor Projects Branch #5
Division of Reactor Projects

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a 95001 supplemental inspection at Browns Ferry Nuclear Plant, Unit 1, 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 <https://www.nrc.gov/reactors/operating/oversight.html> for more information.

List of Findings and Violations

No findings or violations of more than minor significance were identified.

Additional Tracking Items

Type	Issue Number	Title	Report Section	Status
NOV	05000259/2023090-01	Browns Ferry Unit 1 HPCI Inoperable on July 12, 2022 EA-22-122	95001	Closed
LER	05000259/2022-002-00	LER 2022-002-00 for Browns Ferry Nuclear Plant, Unit 1, High Pressure Coolant Injection System Declared Inoperable Due to a Corroded Actuator	95001	Closed

INSPECTION SCOPES

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, 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 (Regulatory Response) Inputs

The inspectors reviewed and selectively challenged aspects of the licensee's problem identification, causal analysis, and corrective actions in response to the Unit 1 HPCI failure on July 12, 2022, as documented in NRC Inspection Reports 05000259/2023090 (ADAMS Accession No. ML23048A062) dated March 2, 2023, and 05000259/2023091 (ADAMS Accession No. ML23115A000) dated May 8, 2023, and Licensee Event Report (LER) 05000259/2022-002-00.

Supplemental Inspection Response to Action Matrix Column 2 (Regulatory Response) Inputs (1 Sample)

- (1) From September 18 to September 21, 2023, the inspectors conducted an inspection to verify all objectives of the inspection procedure were met. Additionally, LER 05000259/2022-002-00, High Pressure Coolant Injection System Declared Inoperable Due to a Corroded Actuator (ADAMS Accession No. ML22255A227), was reviewed. The inspection conclusions associated with this LER are documented in the Notice of Violation enclosed in Inspection Report 05000259/2023091. This LER is closed.

INSPECTION RESULTS

Assessment	95001
1. Problem Identification. <ol style="list-style-type: none">a. <u>Identification</u>. This issue was self-revealed when the Unit 1 HPCI failed to operate during a quarterly surveillance test on July 12, 2022. The licensee's Level 1 evaluation for condition report (CR) 1829973 appropriately assessed how the issue was identified.b. <u>Exposure Time</u>. The issue was assumed to have existed for one-half of the time period since the last successful functional operation of the component plus the repair time totaling 48 days. The licensee's evaluation appropriately assessed the exposure time.	

- c. Identification Opportunities. The licensee conservatively identified 12 missed opportunities that could have potentially mitigated the significant performance issue. Many of these centered around changes to preventive maintenance practices and evaluation of industry operating experience over long periods with satisfactory operating history. In most instances, the licensee's action or inaction was not necessarily inappropriate based on the information available and industry practices that existed at the time. The best opportunity to identify degraded EGR conditions existed at the time of the 1R12 outage in 2018 when an engineer performed an internal visual inspection of the component. Afterward, additional engineers became aware of unusual oil sump conditions and had an opportunity to either discover and review previous photographs or perform a second inspection. An additional opportunity existed when a significant change to industry guidance for acceptable lube oil moisture content was published. The licensee's evaluation sufficiently identified these missed opportunities.
- d. Risk and Compliance. The licensee's evaluation demonstrated an appropriate understanding of the risk and compliance aspects of the issue. Specifically, that the failure to identify conditions adverse to quality with the unit 1 HPCI EGR caused a reduction in defense-in-depth since HPCI is one of the primary systems used to mitigate consequences of an accident by providing inventory makeup to the reactor pressure vessel.

NRC Assessment: The inspectors determined that the licensee appropriately evaluated and documented problem identification, including adequate considerations of identification credit, how long the condition had existed, missed opportunities for self-identification, and risk insights.

2. Causal Analysis.

- a. Methodology. The licensee's evaluation employed systematic, evidence-based methodologies to determine the root and contributing causes of the White performance issue, including: Organizational Effectiveness and Programmatic Checklist, Previous Similar Events Checklist, Human Performance Investigation Checklist, Equipment Failure Investigation, Event and Causal Factor Chart, Performance Analysis Worksheet, and Barrier Analysis.
- b. Level of Detail. Inspectors determined the initial root cause evaluation did not contain an adequate level of detail to identify the root and contributing causes. In response, Tennessee Valley Authority (TVA) revised the evaluation to incorporate an additional contributing cause. The inspectors determined the evaluation in its final revision was generally commensurate with the safety significance and complexity of the White performance issue and was of sufficient detail to identify the root and contributing causes, extent of condition and extent of cause.
- c. Operating Experience. An internal operating experience review showed that no similar prior occurrences of HPCI EGR actuator failures existed at the site. External operating experience was also considered, and TVA concluded that the site had no actionable information prior to the failure that would have prevented the event. After evaluating the failure, TVA identified a contributing cause associated with the lack of a fleet process for reviewing Electric Power Research

Institute (EPRI) publications for site applicability. Specifically, EPRI published a significant change to lube oil moisture content guidance that may have prevented the event from occurring, but site engineers were not made aware of the published guidance.

- d. Extent of Condition and Cause. An extent of condition evaluation considered similar systems that used control oil governors and similar defects that could cause internal component failure. The extent of cause evaluation considered whether the station demonstrated appropriate behaviors in risk recognition for risk significant systems and whether adequate procedural guidance existed for engineering inspection activities on those systems. The inspectors determined that TVA appropriately identified the extent of condition and extent of cause.
- e. Safety Culture. The inspectors determined the safety culture components were appropriately considered during the root cause, extent of condition, and extent of cause evaluations.

NRC Assessment: The inspectors determined that TVA's Level 1 evaluation appropriately identified and documented the root causes, extent of condition, and extent of cause of the White performance issue. However, the inspectors' review identified that a contributing cause was omitted that necessitated a revision to the evaluation. As a result, the inspectors identified the following general weakness:

General Weakness – Level of Detail, Section 2.b: During the inspection preparation week, the inspectors informed TVA of a potential significant weakness, regarding an omitted causal factor associated with the failure of engineering supervision to ensure task assignment and preparation activities were conducted in a manner that resulted in a successful inspection. Specifically, the initial evaluation did not sufficiently explore how an individual, with limited task proficiency, could be dispatched to perform a risk-significant inspection activity without suitable pre-job proficiency checks and/or post-job debriefing. In this case, photographs had been made available to the work group via an engineering electronic outage log, but these were not reviewed by supervisors or individuals within the work group that had greater proficiency. TVA revised the Level 1 evaluation to include a new contributing cause, safety culture component and corrective action to address this causal factor. The inspectors determined the inadequate level of detail documented in the initial evaluation could be characterized as a general weakness since TVA corrected the issue during the inspection period.

This weakness was evaluated in accordance with the guidance in IMC 0612, Appendix B, "Issue Screening," and Appendix E, "Examples of Minor Issues." The inspectors determined that the condition was not a deficiency of greater than minor significance and therefore are not subject to enforcement action in accordance with the NRC's enforcement policy.

3. Corrective Actions.

a. Corrective Actions to Prevent Recurrence (CAPR)

(1) Completed

- (a) TVA identified the following CAPRs for a root cause associated with the procedure guidance in MPI-0-073-TRB001, "HPCI Turbine

Preventive Maintenance,” being less than adequate to ensure the EGR visual inspection task identifies adverse conditions prior to failure:

CAPR-01: Revised MPI-073-TRB001 to include enhanced EGR visual inspection acceptance criteria (wording and images) to remove the task performer from knowledge-based performance and ensure the task will be performed in rule-based performance during future inspections. The revision also required a CR to be initiated with the results of the inspection.

CAPR-05: Revised MPI-073-TRB001 to clearly delineate responsibility between maintenance and engineering for inspection steps applicable to the EGR visual inspection.

(b) TVA identified the following CAPRs for a root cause associated with the maintenance strategy not being aligned with industry best practices and being insufficient for making risk-based decisions related to the reliability of the unit 1 HPCI EGR:

CAPR-02: Revised procedure 0-TI-230L, “Lubrication Oil Analysis & Monitoring Program,” to incorporate an updated moisture content limit, action level, and recovery actions per industry best practices.

CAPR-03: Established a new preventive maintenance activity to place HPCI auxiliary lube oil pump in service on a biweekly basis to recoat the EGR internals and provide real-time validation of anticipated governor valve response.

The above CAPR actions were appropriate for the identified root causes of the violation and were completed in a timely manner. The effectiveness review actions included appropriate quantitative and qualitative criteria for determining success of the CAPRs. Specifically, this review will require monitoring of the Units 1, 2 and 3 HPCI lube oil moisture content as remaining less than 0.025% and that the qualitative criteria from MPI-073-TRB001 be satisfied during future 1R15, 2R23, 3R21 outage inspections to ensure effectiveness. Note: In the final revision of the root cause analysis, there was no CAPR-04.

(2) Planned

(a) No planned CAPR actions existed since all actions were completed before the end of the inspection period.

b. Other Corrective Actions

(1) Completed

(a) For the above root causes, TVA identified the following other corrective actions:

CA-18: Performed an assessment of MPI-0-73-TRB001 to validate that a qualified, least experienced performer could perform the EGR visual inspection activity without error.

CA-20: Revised MPI-073-TRB001 to ensure HPCI EGR visual inspections were photographed and documented with the CR describing the results of the inspection.

(b) TVA identified the following corrective action for the direct cause associated with corrosion internal to the EGR:

CA-02 & 22: Implemented modifications to correct the slope of Units 1 and 2 HPCI gland seal condenser leak-off lines to resolve known deficient conditions that presented a margin reduction to lube oil quality.

(c) TVA identified the following corrective action for a contributing cause associated with insufficient procedural guidance for installing the HPCI turbine insulation in the correct configuration:

CA-01: Revised MPI-073-TRB001 to include an image of correct gland case insulation installation with written guidance.

(d) TVA identified the following corrective action for a contributing cause associated with the TVA nuclear fleet lacking a process to ensure new or revised EPRI publications are reviewed for site applicability:

CA-03: NPG-SPP-09.18.17, "EPRI Program Interface and Management" was created to have "TVA EPRI Advisor" personnel initiate a CR to document the review of all Category 1 and applicable Category 2 EPRI publications to determine site applicability. Guidance was also included to show how to subscribe to automated email updates when EPRI products are issued.

(e) TVA identified the following corrective action for a contributing cause associated with engineering supervision failing to ensure the task assignment and preparation activities were conducted in a manner that resulted in a successful inspection:

CA-23: Incorporated an engineering department memo into the Engineering Outage Control Center logbook establishing expectations of engineering supervisors to evaluate the performer's proficiency and mitigating actions prior to assigning engineering activities. Briefings were also conducted with mid-level managers, front-line supervisors and engineers regarding pre-job brief expectations and use of human performance tools.

(f) TVA identified the following corrective action for the extent of condition review:

CA-03, 21: Revised MPI-071-TRB001, "Reactor Core Isolation Cooling (RCIC) Turbine Preventive Maintenance," to include enhanced EGR visual inspection acceptance criteria (wording and images) to remove the task performer from knowledge-based performance and ensure the

task will be performed in rule-based performance during future inspections. The revised instructions required CR initiation describing the results of the inspection with photographs. Additionally, the revision included an image of correct gland case insulation installation and written guidance.

(g) TVA identified the following corrective actions for the extent of cause review:

CA-05, 06, 07, 08, 09, 10: Required system engineers of certain risk-significant systems to verify or revise maintenance procedures to ensure visual inspections are well defined for the qualified, least experienced performer.

CA-11, 12, 13, 14, 15, 16: Required system engineers of certain risk-significant systems to review EPRI Newsletters, dating back to 2018, and initiate a CR if cornerstone guidance had been missed for implementation.

CA-17: Complete a training activity for engineers to reinforce standards and behaviors focused on documenting deficiencies when performing visual inspections.

(2) Planned

(a) No planned corrective actions existed since all actions were completed before the end of the inspection period.

NRC Assessment: The inspectors determined that TVA implemented appropriate and timely corrective actions to preclude repetition for a significant condition adverse to quality associated with the White performance issue. TVA also identified appropriate effectiveness reviews for these corrective actions.

4. Conclusion.

Overall, the inspectors determined that the licensee's problem identification, causal analyses, and corrective actions sufficiently addressed the notice of violation that led to the White finding. The final revision of the Level 1 evaluation contained sufficient information such that all inspection objectives, as described in the inspection procedure 95001, were met. Therefore, this inspection is closed.

EXIT MEETINGS AND DEBRIEFS

The inspectors verified no proprietary information was retained or documented in this report.

- On September 21, 2023, the inspectors presented the 95001 supplemental inspection results to Mr. Daniel Komm, Plant Manager, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
95001	Corrective Action Documents	1872447, 1870753, 1870751, 1870742, 1870544, 1867808, 1860558, 1860444, 1849572, 1856181, 1840636, 1851017, 1843963, 1840358, 1839520, 1839485, 1828728, 1827759, 1814923, 1811874, 1809947, 1808791, 1802513, 1800532, 1789217, 1244115, 1234141, 146171, 382507		
95001	Corrective Action Documents Resulting from Inspection	1881243	95001 Preparation Learnings	
95001	Corrective Action Documents Resulting from Inspection	1881254	Broken Conduit	
95001	Corrective Action Documents Resulting from Inspection	1881310	Insulation	
95001	Engineering Evaluations	SVR-BFN-073-08262016	System Vulnerability Review: System 073, High Pressure Coolant Injection	08/12/2016
95001	Miscellaneous	EPRI Technical Report 3002001669	Nuclear Maintenance Applications Center: Terry Turbine Maintenance Guide, High-Pressure Coolant Injection (HPCI) Application	September 2013
95001	Miscellaneous	Interview Questions & Summary	Previous NSSS System Engineer who performed 1R12 HPCI EGR Inspection	
95001	Miscellaneous	Level 1 Evaluation (RCA) Report 1828873	Internal Corrosion of U1 HCPI EGR Actuator was not Identified, Corrected, or Prevented Leading to Inoperability of the HPCI System	3

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
95001	Miscellaneous	Level 1 Evaluation (RCA) Report 1828873	Internal Corrosion of U1 HPCI EGR Actuator was not Identified, Corrected, or Prevented Leading to Inoperability of the HPCI System	4
95001	Miscellaneous	Photographs: HPCI EGR Visual Inspection		U2R19
95001	Miscellaneous	Photographs: HPCI EGR Visual Inspection		U3R18
95001	Miscellaneous	Photographs: HPCI EGR Visual Inspection		U1R10
95001	Miscellaneous	Photographs: HPCI EGR Visual Inspection		U1R11
95001	Miscellaneous	Photographs: HPCI Oil Sump Visual Inspection		U1R12
95001	Miscellaneous	Photographs: HPCI Tappet Visual Inspection		U1R12
95001	Miscellaneous	Photographs: RCIC EGR Visual Inspection		U1R14
95001	Miscellaneous	Photographs: RCIC EGR Visual Inspection		U2R22
95001	Miscellaneous	U1R12 NSSS Engineering Logs	Day Shift	11/05/2018
95001	Miscellaneous	U1R12 NSSS Engineering Logs	Day Shift	11/06/2018
95001	Miscellaneous	U1R12 NSSS Engineering Logs	Night Shift	10/27/2018
95001	Miscellaneous	VTD-T147-0530	U-1 Terry Steam Turbine Co. Lubrication System	0
95001	Miscellaneous	VTD-W290-0100	Product Specification for Woodward EG-3C and EG-R Actuators	0
95001	Miscellaneous	VTD-W290-0480	U-1 Woodward Governor Co. Installation and Operation of EG-3C and EG-R Actuators Terry Model CS HPCI Turbine Operation (Unit 1)	0
95001	Procedures	MCI-0-073-TRB001	HPCI Turbine-Terry Turbine CCS-Disassembly, Inspection, Rework and Reassembly	38
95001	Procedures	MPI-0-071-TRB001	Reactor Core Isolation Cooling (RCIC) Turbine	43

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
			Preventive Maintenance	
95001	Procedures	MPI-0-073-TRB001	High Pressure Coolant Injection (HPCI) Turbine Preventive Maintenance	63
95001	Procedures	NPG-SPP-09.18.17	Electric Power Research Institute (EPRI) Program Interface and Management	0
95001	Procedures	NPG-SPP-22.300	Corrective Action Program	24
95001	Self-Assessments	1868710	HPCI EGR Failure 95001 Inspection Readiness	0
95001	Work Orders	117686278, 122542828, 119022899, 112965141, 115116033, 117195311, 123038729		