



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION II**

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ATLANTA, GEORGIA 30303-1257

February 7, 2018

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

**SUBJECT:     BROWNS FERRY NUCLEAR PLANT – NRC INTEGRATED INSPECTION  
                 REPORT 05000259/2017004, 05000260/2017004 AND 05000296/2017004**

Dear Mr. Shea:

On December 31, 2017, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Browns Ferry Nuclear Plant, Units 1, 2, and 3. On January 12, 2018, the NRC inspectors discussed the results of this inspection with Mr. S. Bono and other members of your staff. The results of this inspection are documented in the enclosed report.

NRC inspectors documented two findings which were determined to be of very low safety significance (Green) in this report. All of these findings involved violations of NRC requirements. Further, inspectors documented a licensee-identified violation which was determined to be of very low safety significance in this report. Because of their very low safety significance, the NRC is treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2.a of the Enforcement Policy.

If you contest any of the violations or significance of these NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at Browns Ferry Nuclear Plant.

If you disagree with a cross-cutting aspect assignment in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II, and the NRC Resident Inspector at Browns Ferry Nuclear Plant.

J. Shea

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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 Nos.: 50-259, 50-260, 50-296  
License Nos.: DPR-33, DPR-52, DPR-68

Enclosure:  
NRC IIR 05000259/2017004,  
05000260/2017004 and 05000296/2017004  
w/Attachment: Supplemental Information

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SUBJECT: BROWNS FERRY NUCLEAR PLANT – NRC INTEGRATED INSPECTION  
REPORT 05000259/2017004, 05000260/2017004 AND 05000296/2017004  
February 7, 2018

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**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION II**

Docket Nos.: 50-259, 50-260, and 50-296

License Nos.: DPR-33, DPR-52, and DPR-68

Report No.: 05000259/2017004, 05000260/2017004, and 05000296/2017004

Licensee: Tennessee Valley Authority (TVA)

Facility: Browns Ferry Nuclear Plant, Units 1, 2, and 3

Location: Corner of Shaw and Nuclear Plant Road  
Athens, AL 35611

Dates: October 1 through December 31, 2017

Inspectors: D. Dumbacher, Senior Resident Inspector  
M. Kirk, Resident Inspector  
A. Ruh, Resident Inspector  
N. Hobbs, Acting Resident Inspector  
R. Patterson, Reactor Inspector  
M. Riley, Reactor Inspector  
M. Schwieg, Reactor Inspector  
D. Lanyi, Senior Operations Engineer

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

Enclosure

## SUMMARY

05000259/2017004, 05000260/2017004, 05000296/2017004; 10/01/2017- 12/31/2017; Browns Ferry Nuclear Plant, Units 1, 2, and 3; Operability Determinations and Functionality Assessment

The report covered a three-month period of inspection by resident and regional inspectors. Two Green non-cited violations (NCV) findings were identified. The significance of inspection findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP) dated April 29, 2015. Cross-cutting aspects are determined using IMC 0310, "Components Within the Cross-Cutting Areas" dated December 4, 2014. All violations of NRC requirements are dispositioned in accordance with the NRC's Enforcement Policy dated November 1, 2016. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 6. Documents reviewed, which have not been identified in the Report Details, are listed in the Attachment.

### Cornerstone: Mitigating Systems

- Green. Two examples of an NRC-identified NCV of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings" were identified for the licensee's failure to properly implement operability evaluation requirements for degraded High Pressure Coolant Injection (HPCI) components. Specifically, from September 23 to September 28, 2017, the operability evaluations for degraded Unit 2 and 3 HPCI injection valves 2/3- FCV-73-44 did not provide reasonable assurance of operability as per the site's operability review procedures.

The performance deficiency was determined to be more-than-minor because it impacted the Mitigating Systems cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events. As an immediate corrective action, the licensee later performed maintenance to open and inspect these valves. Subsequently the licensee initiated condition reports and a Performance Assessment Worksheet to assess the training for such evaluations. The violation was entered into the licensee's corrective action program (CAP) as CR 1341458. The inspectors determined that the finding had a cross-cutting aspect of Evaluation in the Problem Identification and Resolution area [P.2], because the organization concluded Technical Specification operability prior to thoroughly investigating these issues commensurate with their potential safety significance. (Section 1R15)

- Green. The inspectors identified a NCV of 10 CFR Part 50, Appendix B, Criterion V, Instructions, Procedures and Drawings, for failure to perform an immediate operability determination (IDO) for 3A Emergency Diesel Generator (EDG) upon discovering a degraded condition. Specifically, on December 19, 2017, the licensee failed to perform an IDO after identifying and confirming less than minimum cooling flow, thus leaving the EDG in an indeterminate state of operability.

The performance deficiency is more than minor because it was associated with the equipment performance attribute and affected the associated cornerstone objective to ensure availability, reliability and capability of systems that respond to initiating events to prevent undesirable consequences. As a corrective action, the licensee performed operations to restore flow within the acceptable range and performed an IDO. The violation was entered into the licensee's CAP as CR 1370601. The inspectors

determined that the finding had a cross-cutting aspect in the human performance area of H.13, Consistent Process, because the performance deficiency was caused by not following a consistent, systematic approach to making a decision concerning operability of the affected DG. (Section 1R15)

A violation of very low safety significance that was identified by the licensee has been reviewed by the NRC. Corrective actions taken or planned by the licensee have been entered into the licensee's CAP. One violation and its corrective action tracking number is listed in Section 4OA7 of this report.

## REPORT DETAILS

### Summary of Plant Status:

Unit 1 operated at 100 percent rated thermal power (RTP).

Unit 2 operated at 100 percent RTP except for four planned downpowers for rod sequence exchanges.

Unit 3 operated at 100 percent RTP except for six planned downpowers for rod sequence exchanges and water box cleanings.

### 1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

#### 1R01 Adverse Weather Protection (71111.01)

##### Readiness for Seasonal Extreme Weather Conditions, (71111.01)

##### a. Inspection Scope

After the licensee completed preparations for seasonal low temperature, the inspectors walked down the Intake Structure, covering the Service Water Pump Rooms and reviewed the temperature controls and history associated with the Unit 1 Reactor building including the refueling floor. These systems and areas were selected because their safety-related functions could be affected by adverse weather and internal heating system reliability. The inspectors observed plant conditions, and evaluated those conditions using criteria documented in the Inspection Procedure. This activity constituted one Readiness for Seasonal Extreme Weather conditions inspection sample as defined in IP 71111.01.

##### b. Findings

No findings were identified.

#### 1R04 Equipment Alignment (71111.04)

##### Partial Walkdown

##### a. Inspection Scope

The inspectors performed partial walkdowns of the following systems to verify the operability of redundant or diverse trains and components when safety equipment was inoperable. The inspectors focused on identification of discrepancies that could impact the function of the system and, therefore, potentially increase risk. The inspectors reviewed applicable operating procedures, walked down control system components, and determined whether selected breakers, valves, and support equipment were in the correct position to support system operation. The inspectors also verified that the licensee had properly identified and resolved equipment alignment problems that could cause initiating events or impact the capability of mitigating systems or barriers and

entered them into the CAP. The inspectors completed four Equipment Alignment Partial Walkdown samples.

- Unit 2, Traversing Incore Probe (TIP) system due to emergent maintenance on the drive proximity switches
- Unit 2, Residual Heat Removal Service Water (RHRSW) system division II, up to RHR heat exchanger inlet
- Unit 1, Residual Heat Removal system Loop I while maintenance was being performed on Loop II
- Unit common Reactor building crane due to discovery of degraded single failure proof capabilities

b. Findings

One licensee-identified finding is documented in Section 4OA7 (Degraded Reactor Building crane).

1R05 Fire Protection (71111.05)

Fire Protection Tours

a. Inspection Scope

The inspectors reviewed licensee procedures for transient combustibles and fire protection impairments, and conducted a walkdown of fire areas (FA) or selected compartments of larger fire areas as listed below. These FAs, or compartments, were examined in order to verify licensee control of transient combustibles and ignition sources; the material condition of fire protection equipment and fire barriers; and operational lineup and condition of fire protection features or measures. The inspectors verified that selected fire protection impairments were identified and controlled in accordance with procedures. The inspectors reviewed applicable portions of the Fire Protection Requirements Manual (FPRM) to verify that the necessary firefighting equipment, such as fire extinguishers, hose stations, ladders, and communications equipment, was in place. This activity constituted seven Fire Protection Walkdown inspection samples, as defined in inspection Procedure 71111.05.

- Compartment 03-03, Unit 3 Reactor Building 593' and Residual Heat Removal Heat Exchanger Rooms 565'-593'
- Fire Area 05, Unit 1 Electrical Board Room 1A and 250V Battery Rooms 621'
- Fire Area 19, Unit 3 Battery and Battery Board Room, Control Building 593'
- Fire Area 16K, Unit 1 Auxiliary Instrument Room
- Fire Area 16A, Unit 3 Control Bay Chiller Room
- Fire Area 09, Unit 2 Electrical Board Room 2A and 250V Battery Rooms 621'
- Fire Area 13, Unit 3 Electrical Board Room 3B

b. Findings

No findings were identified.



## 1R11 Licensed Operator Regualification and Performance (71111.11)

### .1 Licensed Operator Regualification (71111.11A)

#### a. Inspection Scope

Annual Review of Licensee Regualification Examination Results: On December 5, 2017, the licensee completed the comprehensive biennial requalification written examinations and the annual requalification operating examinations required to be administered to all licensed operators in accordance with Title 10 of the *Code of Federal Regulations* 55.59(a)(2), "Requalification Requirements," of the NRC's "Operator's Licenses." The inspectors performed an in-office review of the overall pass/fail results of the individual operating examinations, written examinations, and the crew simulator operating examinations in accordance with Inspection Procedure (IP) 71111.11, "Licensed Operator Regualification Program." These results were compared to the thresholds established in Section 3.02, "Requalification Examination Results," of IP 71111.11.

#### b. Findings

No findings were identified.

### .2 Quarterly Review by Resident Inspectors

#### a. Inspection Scope

On November 2, 2017, the inspectors observed a licensed operator training session for an operating crew on the Unit 2 Simulator. The scenario evaluated was control room abandonment due to a fire in the cable spreading room.

The inspectors specifically evaluated the following attributes related to the operating crew's performance:

- Clarity and formality of communication
- Ability to take timely action to safely control the unit
- Prioritization, interpretation, and verification of alarms
- Correct use and implementation of procedures including Abnormal Operating Instructions (AOIs), Emergency Operating Instructions (EOIs) and Safe Shutdown Instructions (SSI)
- Timely control board operation and manipulation, including high-risk operator actions
- Timely oversight and direction provided by the shift supervisor, including ability to identify and implement appropriate technical specification actions such as reporting and emergency plan actions and notifications
- Group dynamics involved in crew performance

The inspectors assessed the licensee's ability to assess the performance of their licensed operators. The inspectors reviewed the post-examination critique performed by the licensee evaluators and verified that licensee-identified issues were comparable to issues identified by the inspector. The inspectors reviewed simulator physical fidelity (i.e., the degree of similarity between the simulator and the reference plant control room,

such as physical location of panels, equipment, instruments, controls, labels, and related form and function). This activity constituted one Observation of Requalification Activity inspection sample.

b. Findings

No findings were identified.

.3 Control Room Observations

a. Inspection Scope

Inspectors observed and assessed licensed operator performance in the plant and main control room, particularly during periods of heightened activity or risk and where the activities could affect plant safety. Inspectors reviewed various licensee policies and procedures covering Conduct of Operations, Plant Operations and Power Maneuvering.

Inspectors utilized activities such as post maintenance testing, surveillance testing and other activities to focus on the following conduct of operations as appropriate:

- Operator compliance and use of procedures.
- Control board manipulations.
- Communication between crew members.
- Use and interpretation of plant instruments, indications and alarms.
- Use of human error prevention techniques.
- Documentation of activities, including initials and sign-offs in procedures.
- Supervision of activities, including risk and reactivity management.
- Pre-job briefs.

This activity constituted one Control Room Observation inspection sample as defined in Inspection Procedure 71111.11.

b. Findings

No findings were identified.

1R12 Maintenance Effectiveness (71111.12)

a. Inspection Scope

The inspectors reviewed the specific structures, systems and components (SSC) within the scope of the Maintenance Rule (MR) (10CFR50.65) with regard to some or all of the following attributes, as applicable:

- (1) Appropriate work practices;
- (2) Identifying and addressing common cause failures;
- (3) Scoping;
- (4) Characterizing reliability issues;
- (5) Tracking unavailability;
- (6) Balancing reliability and unavailability;
- (7) Trending key parameters for condition monitoring;

- (8) System classification and reclassification;
- (9) Appropriateness of performance criteria;
- (10) Appropriateness and adequacy of 50.65 (a) (1) goals, monitoring and corrective actions; and
- (11) Quality control aspects

The inspectors compared the licensee's performance against site procedures. The inspectors reviewed, as applicable, work orders, surveillance records, CRs, system health reports, engineering evaluations, and MR expert panel minutes; and attended MR expert panel meetings to verify that regulatory and procedural requirements were met. This activity constituted one Maintenance Effectiveness inspection sample as defined in Inspection Procedure 71111.12

- Scoping aspects associated with degraded EDG corridor sump pumps

b. Findings

No findings were identified.

1R13 Maintenance Risk Assessments and Emergent Work Evaluation (71111.13)

a. Inspection Scope

For planned online work and/or emergent work that affected the combinations of risk significant systems listed below, the inspectors examined on-line maintenance risk assessments, and actions taken to plan and/or control work activities to effectively manage and minimize risk. The inspectors verified that risk assessments and applicable risk management actions (RMA) were conducted as required by 10 CFR 50.65(a)(4) applicable plant procedures. As applicable, the inspectors verified the actual in-plant configurations to ensure accuracy of the licensee's risk assessments and adequacy of RMA implementations. This activity constituted five Maintenance Risk Assessment inspection samples as defined in Inspection Procedure 71111.13.

- Planned risk on October 30, 2017, associated with the Unit 2 RCIC turbine, Athens 161 kv line and A3 EECW strainer valve out of services. The Equipment out of Service (EOOS) multiplier was 4.81.
- Unit 1 and Unit 2 risk associated with breaching secondary containment in "B" shutdown board room for planned maintenance.
- Emergent risk on November 7, 2017, associated with inadvertent loss of 500kV Bus 1 while performing planned maintenance.
- Unit 1 risk associated with EECW north header out of service and planned maintenance occurring at the intake structure.
- Unit 1/2 risk associated with D EDG, D3 EECW and 2D RHR pumps out of service on December 4, 2017.

b. Findings

No findings were identified.

## 1R15 Operability Determinations and Functionality Assessment (71111.15)

### a. Inspection Scope

The inspectors reviewed the operability/functional evaluations listed below to verify technical adequacy and ensure that the licensee had adequately assessed TS operability. The inspectors reviewed applicable sections of the UFSAR to verify that the system or component remained available to perform its intended function. In addition, where appropriate, the inspectors reviewed licensee procedures to ensure that the licensee's evaluation met procedure requirements. The inspectors reviewed CRs on a daily basis to verify that the licensee was identifying and correcting any deficiencies associated with operability evaluations. This activity constituted nine Operability Evaluation inspection samples as defined in Inspection Procedure 71111.15.

- Unit 3, PAM Instrumentation inoperable due to missed surveillance prior to restoration (CR 1339723)
- Unit 3, HPCI valve 73-44, not fully closed due to broken yoke nut (CR 1341468)
- Unit 3, 3B EDG heat exchanger eddy current testing resulted in tube plugging and shortened heat exchanger projected lifetime (CR 1342473)
- Unit 2, RCIC valve 71-17, as found test data acceptance criteria exceeded (CR 1353717)
- Unit 3, 3D EDG EECW South supply line in contact with scaffolding (CR 1351592)
- Units 1/2, A EDG high vibrations on generator outboard bearing (CR 1350596)
- Unit 3, 3A RHR pump inoperable longer than TS allowance due to breaker failing to close on demand (CR 1334534)
- Unit 3, HPCI check valve 73-45 leakage during HPCI surveillance allowed feedwater to enter HPCI discharge (CR 1356507)
- 3A EDG EECW flow low at 350 gpm (CR 1369859)

### b. Findings

- .1 Introduction: Two examples of an NRC-identified NCV of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings" related to degraded HPCI system components were identified for the licensee's failure to properly implement Immediate Determination of Operability (IDO) requirements in accordance with OPDP-8, "Operability Determination Process and Limiting Conditions for Operation Tracking" (LCO) and the Prompt Determination of Operability (PDO) requirements per NEDP-22, "Operability Determinations and Functional Evaluations."

#### Description:

On September 23, 2017, HPCI pump injection valve 3-FCV-73-44 stroke time surveillance result was in the Alert range at 24 seconds. Normal time for the valve stroke was a very consistent 19 seconds. Five years of stroke data showed approximately ½ second as the standard deviation between the 20 surveillances. Operators performed an IDO and determined, without reviewing the historical data or requesting engineering assistance, that the valve remained fully operable since subsequent, additional stroking of the valve was within the acceptance criteria.

On September 24, performance of the quarterly HPCI pump test resulted in an unintentional injection of colder condensate water into the reactor vessel causing reactor power to be at 104 percent power for about 5 minutes. The injection was caused by a sheared actuator yoke nut condition that had developed during the June 2017 stroke test of 3-FCV-73-44. The limit switches for valve position indication are triggered on actuator travel and not true stem/wedge position. With this relationship unsynchronized due to the sheared yoke nut, operators were unaware the valve was left partially open on September 23. Subsequent PDO conclusion of operable for the similar Unit 2- FCV-73-44 was supported by five assumptions that were not supportable due to inaccuracies and, for some, lack of relevance. Below are examples of the operations staff failing to confirm the HPCI injection valves on Unit 3 and 2 remained operable as required by technical specifications.

**Example 1: Understanding the limitations of a surveillance**

Valve 3-FCV-73-44 was evaluated as operable after the September 23, 2017, stroke test was significantly longer (24 seconds) for this MOV than historically documented (19 seconds).

OPDP-8, Section 3.3.3.C, cautioned operators that a surveillance may not by itself be sufficient to determine operability due to a narrower perspective or focus. Section 3.3.3.D stated that indications of imminent failure may also be a case where meeting the surveillance acceptance criteria would not support a conclusion of operability. The IDO (CR 1341315) stated that meeting the In-service Test stroke time was sufficient to declare the valve operable. If the operators had reviewed the last five years of stroke times or the pressures at the HPCI pump following the opening of the 3-FCV-73-44 valve it would have been clear that the valve was not operating correctly. The acceptance criteria in the surveillance was suitable for IST trending but, not by itself, suitable for concluding operability.

**Example 2: Conclusions of Operable require a reasonable, supportable basis.**

For extent of condition purposes valve 2-FCV-73-44 was evaluated as operable in CR 1344119 after the September 24, 2017, discovery that the 3-FCV-73-44 actuator yoke nut and yoke nut bearings were significantly degraded. Five reasons (bolded) were stated as a basis to assume the Unit 2 valve was not likely to fail in a fashion similar to 3-FCV-73-44. These were:

1. **The Unit 3 valve lasted 5 years prior to failure.** *The cause of the Unit 3 valve failure was related to a modification to increase the actuator thrust. The Unit 2 valve had operated for six years since the same modification was applied.*
2. **Unit 2 valve had a 1 ¼ inch yoke nut flange.** *After the failure, the licensee staff discovered that the Unit 3 valve yoke nut flange had been modified as part of the 2011 - 2012 design changes to have a weaker, 1 inch yoke nut flange. The drawing for the Unit 3 valve did not reflect the smaller dimension. The TVA engineering staff assumed that there could not be a similar configuration deviation on the Unit 2 valve despite both having had the same design change. No inspection had been performed previously for the purpose of confirming this assumption. When the Unit 2 valve was opened up later it was found to have bearing configurations that were different from the drawings.*
3. **After the design change the Unit 2 valve had less initial thrust than Unit 3.** *The TVA engineers did not know what the actuator weak link was and did not know at what thrust value the yoke nut or the bearings would fail. Condition Report 1349343 later identified that the initial PDO assessment had not used the design*

*opening thrust values but rather less conservative test based values that will increase over time with improved valve stem factors. The design opening thrust and as-found thrust values exceeded the vendor documented rated thrusts for both the yoke nut and its bearings*

4. **The stroke time data for the Unit 2 valve showed consistent acceptable results**  
*Prior to the failure in June 2017 all the Unit 3 valve stroke time results were acceptable. This assumption lacks relevance because the Unit 3 failure occurred before the September stroke time surveillance revealed the failure.*
5. **Unit 2 Flowrate surveillance has indicated no inadvertent injection**  
*The Unit 3 June 2017 failure occurred prior to an actual inadvertent injection. Using Unit 3 history does not make this a reasonable assumption.*

Analysis: The inspectors determined that the failure to properly evaluate the two operability examples in accordance with the IDO and PDO guidance was a performance deficiency. The performance deficiency was determined to be more-than-minor because it impacted the Mitigating Systems cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events. This finding was evaluated in accordance with NRC IMC 0609, Appendix A, Exhibit 2 "Mitigating Systems Screening Questions." The inspectors determined the finding was Green because TVA later performed maintenance to restore the system to full qualification within the Technical Specification LCO 3.5.1 allowed outage time. TVA did verify proper yoke nut thicknesses and corrected the bearing deficiencies. The inspectors determined that the finding had a cross-cutting aspect of Evaluation in the Problem Identification and Resolution area [P.2], because the organization concluded Technical Specification operability prior to thoroughly investigating these issues commensurate with their potential safety significance.

Enforcement: 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings" states, in part, "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." TVA procedures OPDP-8, Section 3.3.3.D and NEDP-22, Section 3.2.1.B.f, established requirements concerning the use of assumptions, and inputs that form the basis of operability. Contrary to the above, from September 23 to September 28, 2017, the IDO and PDO for CRs 1341315 and 1344119 were not accomplished in accordance with the requirements of OPDP-8, Section 3.3.3.D and NEDP-22 Section 3.2.1.B.f, in that these evaluations were based on unrealistic assumptions that did not address inputs affecting margin to potential imminent failure, i.e., the bases for operability. As an immediate corrective action, the licensee replaced damaged components, obtained third party engineering reviews to support a root cause determination, established the valve weak link analyses for the yoke nut assembly, and inspected similar valves to determine the extent of condition. The licensee entered the violation into the CAP as CR 1341458. This violation is being treated as an NCV consistent with Section 2.3.2 of the Enforcement Policy. (NCV 05000260/296/2017004-01, Inadequate Determination of Operability for the HPCI System.

- .2 Introduction: The inspectors identified a finding and an associated NCV of 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures and Drawings, for failure to perform an IDO for 3A EDG upon discovering a degraded condition. Specifically, the licensee failed to perform an IDO after identifying and confirming less than minimum cooling flow, thus leaving the EDG in an indeterminate state of operability.

Description: During operator rounds on December 19, 2017, at approximately 0030, an operator identified that indicated EECW flow to 3A EDG was approximately 360 gpm. Calculation MDQ0067910008, "Flow Requirements of EECW-Fed Components", which includes the design flow requirements for EDG coolers required 400 gpm. The Unit Supervisor was informed of the expected flow discrepancy and generated CR 1369859 to track the condition. Operations performed a flush of the sensing lines and saw no improvement in flow. Operators did not identify this as a degraded condition. The CR did not identify the condition as an operability issue. The on shift crew was relieved in the morning with 3A DG in an indeterminate state of operability and no IDO performed. Operations subsequently flushed the EECW piping and the 3A heat exchanger to obtain acceptable flows of 490 gpm. The licensee performed additional engineering analysis and concluded that with less than minimum flow rates and much lower river temperatures during this short time period the diesel would have been able to perform its intended design function.

Analysis: Leaving 3A EDG in an indeterminate state of operability due to a delay in performing an IDO for degraded cooling flow conditions was a performance deficiency. The performance deficiency was more than minor because it was associated with the equipment performance attribute and affected the associated cornerstone objective to ensure availability, reliability and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the failure to perform an IDO without delay resulted in a failure to ensure capability of the 3A EDG to perform its intended safety function. Using Chapter 0609, Appendix A, "The Significance Determination Process for Findings At-Power," Exhibit 2, "Mitigating Systems Screening Questions," the issue screened as having very low safety significance (Green) because it was a deficiency that affected the design of the EDG (less than design flow), but it maintained its operability. The inspectors determined that the finding had a cross-cutting aspect in the human performance area of H.13, Consistent Process, because the performance deficiency was caused by not following a consistent, systematic approach to making a decision concerning operability of the affected EDG.

Enforcement: Title 10 CFR Part 50, Appendix B, Criterion V, Instructions, Procedures, and Drawings, requires, in part, that activities affecting quality shall be accomplished in accordance with documented instructions, procedures, or drawings of a type appropriate to the circumstances. Procedure OPDP-8, "Operability Determination Process and Limiting Conditions of Operation Tracking," Revision 24, provides instructions used to assess operability of SSCs for compliance with TS when a degraded or nonconforming condition or an unanalyzed condition is identified. Step 3.3.6.C states, in part, an IDO is to be made without delay with consideration to the best available information. Step 3.3.1.B states, in part, that there is no indeterminate state of operability. A TS SSC is either operable or it is not. Contrary to the above, on December 19, 2017, the licensee failed to perform an IDO for 3A DG upon discovering a degraded condition. Specifically, the licensee allowed 3A DG to be in an indeterminate state of operability by failing to perform an IDO without delay after confirming that EECW cooling flow to the 3A DG was less than the minimum acceptable. Because this finding is of very low safety significance and was entered into the CAP as CR 1370601, this violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the NRC Enforcement Policy: NCV 05000296/2017004-02, "Failure to Perform an IDO for 3A DG after Observing Indications of a Degraded Condition."

1R18 Plant Modifications (71111.18)a. Inspection Scope

The inspectors verified that the plant modifications listed below did not affect the safety functions of important safety systems. The inspectors confirmed the modifications did not degrade the design bases, licensing bases, and performance capability of risk-significant structures, systems, and components (SSCs). The inspectors also verified modifications performed during plant configurations involving increased risk did not place the plant in an unsafe condition. Additionally, the inspectors evaluated whether system operability and availability, configuration control, post-installation test activities, and changes to documents, such as drawings, procedures, and operator training materials, complied with licensee standards and NRC requirements. The inspectors reviewed a sample of related corrective action documents to verify the licensee was identifying and correcting any deficiencies associated with modifications. This activity constituted two Plant Modification samples as defined in Inspection Procedure 71111.18.

- DCN 71355, BFN Reactor Building Control Crane Upgrade
- DCN 71586, Replacement Steam Dryer

b. Findings

No findings were identified.

1R19 Post Maintenance Testing (71111.19)a. Inspection Scope

The inspectors witnessed and reviewed post-maintenance tests (PMT) listed below to verify that procedures and test activities confirmed Structure, System, or Component (SSC) operability and functional capability following the described maintenance. The inspectors reviewed the licensee's completed test procedures to ensure any of the SSC safety function(s) that may have been affected were adequately tested, that the acceptance criteria were consistent with information in the applicable licensing basis and/or design basis documents. The inspectors witnessed and/or reviewed the test data, to verify that test results adequately demonstrated restoration of the affected safety function(s). The inspectors verified that problems associated with PMTs were identified and entered into the CAP. This activity constituted three PMT inspection samples as defined in Inspection Procedure 71111.19.

- Unit 2, HPCI valve 73-44 yoke nut and bearing replacement
- Unit 3, HPCI valve 73-35 yoke nut and bearing replacement
- Unit common "A" EDG PMT following shimming to reduce vibrations

b. Findings

No findings were identified.



## 1R22 Surveillance Testing (71111.22)

### a. Inspection Scope

The inspectors witnessed portions of, and/or reviewed completed test data for the following surveillance tests of risk-significant and/or safety-related systems to verify that the tests met technical specification surveillance requirements, UFSAR commitments, and in-service testing and licensee procedure requirements. The inspectors' review confirmed whether the testing effectively demonstrated that the SSCs were operationally capable of performing their intended safety functions and fulfilled the intent of the associated surveillance requirement. This activity constituted two Surveillance Testing inspection samples: one routine test, and one in-service test as defined in Inspection Procedure 71111.22.

#### Routine Surveillance Tests:

- 1-SR-3.5.1.6, Unit 1 Quarterly RHR System Rated Flow Test Loop 1

#### In-service Tests:

- 3-SR-3.5.3.3, Unit 3, RCIC System Rated Flow at Normal Operating Pressure

### b. Findings

No findings were identified.

## 4. OTHER ACTIVITIES

### Cornerstones: Initiating Events, Mitigating Systems

## 4OA1 Performance Indicator (PI) Verification (71151)

### a. Inspection Scope

The inspectors reviewed the licensee's procedures and methods for compiling and reporting the following PIs. The inspectors examined the licensee's Initiating Events PIs for the fourth quarter of 2016 through the third quarter of 2017 and Mitigating Systems PI data for the specific PIs listed below for the third quarter of 2016 through the second quarter of 2017. The inspectors reviewed the licensee's data and graphical representations as reported to the NRC to verify that the data was correctly reported. The inspectors validated this data against relevant licensee records (e.g., CRs, Daily Operator Logs, Plan of the Day, Licensee Event Reports (LERs), etc.), and assessed any reported problems regarding implementation of the PI program. The inspectors verified that the PI data was appropriately captured, calculated correctly, and discrepancies resolved. The inspectors used the Nuclear Energy Institute (NEI) 99-02, Regulatory Assessment Performance Indicator Guideline, to ensure that industry reporting guidelines were appropriately applied. This activity constituted fifteen PI inspection samples, as defined in Inspection Procedure 71151.

Initiating Events

- Units 1, 2, and 3 Scrams (MSPI - IE 01)
- Units 1, 2, and 3 Scrams with complications (MSPI – IE 04)
- Units 1, 2, and 3 Unplanned downpowers > 20% (MSPI – IE 03)

Mitigating Systems

- Units 1, 2, and 3 RHR heat removal (MSPI – MS 09)
- Units 1, 2, and 3 RHRSW and EECW cooling systems (MSPI MS-10)

b. Findings

No findings were identified.

4OA2 Problem Identification and Resolution of Problems (71152).1 Review of items entered into the CAP:a. Inspection Scope

As required by Inspection Procedure 71152, “Identification and Resolution of Problems,” and in order to help identify repetitive equipment failures or specific human performance issues for follow-up, the inspectors performed a daily screening of items entered into the licensee’s CAP. This review was accomplished by reviewing daily CR reports, and periodically attending Management Review Committee and Plant Screening Committee meetings.

b. Findings

No findings were identified.

.2 Semi-annual Trend Reviewa. Inspection Scope

As required by Inspection Procedure 71152, the inspectors performed a review to identify trends that could indicate the existence of a more significant safety issue. The inspectors’ review was focused on repetitive equipment issues, but also included licensee trending efforts and licensee human performance results. The inspectors’ review nominally considered the six-month period of July through December 2017. The inspectors reviewed licensee trend reports and other maintenance and health reports, in order to determine the existence of any adverse trends that the licensee may not have previously identified. This inspection constituted one Semi-annual Trend Review inspection sample as defined in IP 71152.

b. Observations and Findings

The licensee had identified trends and appropriately addressed them in their CAP. The inspectors observed that the licensee had performed a detailed review. The licensee routinely reviewed cause codes, involved organizations and established key words and system links to identify potential trends in their data. The inspectors compared the

licensee process results with the results of the inspectors' review. Trends that have been identified by the inspectors and reported to the licensee were appropriately entered into the licensee's trending program.

Noteworthy Licensee-identified trends included:

- An adverse trend in Engineering product quality (CR 1346441)
- Negative trend related to motor operated valves (MOVs) (CR 1354509)
- Second Trimester identified a negative trend in procedure adherence

Noteworthy NRC-identified adverse trends included:

- Operability reviews were not providing sufficient basis to support a conclusion of operable. This was a trend that was also identified in report 2016-004.
- A significant number of scaffolding jobs are not getting closed out and removed. CRs 1363858, 1363858

No additional findings were identified. (See section 1R15)

#### 4OA3 Follow-up of Events and Notices of Enforcement Discretion (71153)

(Closed) Licensee Event Report 05000259, 260, 296/2017-004-00, Safety System Functional Failures Due to the Inoperability of Both Unit 1 and 2 Control Bay Chillers

##### a. Inspection Scope

On September 9, 2017, at 1520 Central Daylight Time (CDT), Operations personnel declared Unit 1/2 Control Bay (CB) Chiller A inoperable after observing that its outlet water temperature exceeded its specified limits. On September 10, 2017, at 1151 CDT, the Unit 1/2 CB Chiller B was declared inoperable after failing to start and providing a flashing error code to an operator in the field. The concurrent inoperability of both Unit 1/2 CB Chillers required Browns Ferry Nuclear Plant to declare the immediate inoperability of the electrical equipment in the affected electric board rooms, including all four Unit 1/2 4160 V Shutdown Boards, resulting in a Safety System Functional Failure, and entry into Technical Specifications (TS) LCO 3.0.3 for BFN, Units 1, 2, and 3. On September 10, 2017, at 2110 CDT, the Unit 1/2 CB Chiller B was restored to operable status following a capacitor replacement, and LCO 3.0.3 was exited. The inspectors reviewed the licensee event report associated with this event and determined that the report adequately documented the summary of the event including the cause of the event and potential safety consequences. This review also closes URI 05000259/260/296/2017-003-03, Notice of Enforcement Discretion 17-2-01 Granted from TS LCO 3.0.3 Related to the Loss of Control Room Chillers.

##### b. Findings

No findings were identified. This LER is closed.

4OA5 Other.1 Power Uprate (IP 71004)

Listed below are samples that can be credited to the performance of IP 71004, Power Uprate for the Browns Ferry Unit 1, Unit 2 and Unit 3 extended power uprates.

## Safety Evaluations (50.59)

- DCN 72342, Modify EHC Software (Browns Ferry Inspection Report 2017007, Section 1R17)
- DCN 67324, Modify FWCS Software (Browns Ferry Inspection Report 2017007, Section 1R17)

## Plant Modifications

- DCN 71586 Replacement Steam Dryer (Section 1R18 of this report)

.2 (Closed) Violation (VIO) 05000260/2016012-01, Failure to Follow Conduct of Operation Procedure and VIO 05000260/2016-02, Failure to Maintain Complete and Accurate Shift Logsa. Inspection Scope

On January 8, 2016, the NRC's Office of Investigations (OI) identified two violations that had occurred at the Browns Ferry Nuclear Plant (BFN). The purpose of the investigation was to determine whether a former Operations Shift Manager (SM) deliberately failed to follow a procedure during the manipulation of an electrical switch, and subsequently deliberately failed to provide complete and accurate information to BFN during its investigation of the incident. The details of the investigation are documented in NRC Inspection Report 05000260/2016012, issued on June 23, 2016 (ADAMS Accession No. ML162175A514). The violations were cited in a Notice of Violation on October 28, 2016 (ADAMS Accession No. ML ML16221A714).

Using Inspection Procedure IP 92702, Followup on Traditional Enforcement Actions Including Violations, Deviations, Confirmatory Action Letters, Confirmatory Orders, and Alternate Dispute Resolution Confirmatory Letters, the inspector conducted an appraisal of licensee responses to ensure that the investigation was conducted appropriately and that generic implications were reviewed. The inspector then reviewed corrective action documentation to ascertain that the stated corrective and preventative actions were timely and appropriate. Specifically the inspector ensured that the licensee institutionalized the expectations that Senior Reactor Operators (SROs) would not operate plant equipment by verifying the following:

- Senior Management personally briefed all SROs on the event and the expectations that on-watch SROs provide supervisory oversight of other licensed and non-licensed operators
- Procedural that guidance was put in place to ensure that SROs were prohibited from manipulating plant equipment unless they were actively holding the position of an on-watch Reactor Operator.

The inspector reviewed the following documentation:

- TVA's OGC Report 2-2015-008, EA-16-009, dated February 3, 2015
- TVA's letter CNL-16-122, Response to Apparent Violations in NRC Inspection Report 05000260/2016012 and Investigation Report No. 2-2015-008, EA-16-009, dated August 8, 2016
- PER 970963, Operation of Incorrect Switch, dated December 24, 2014
- PER 1292544, CA 002 in CR 970963 Not Completed as Written, dated May 5, 2017

b. Findings

No findings were identified. VIO 05000260/2016012-01, Failure to Follow Conduct of Operation Procedure and VIO 05000260/2016012-02, Failure to Maintain Complete and Accurate Shift Logs, are closed.

4OA6 Meetings, Including Exit

Exit Meeting Summary

On January 12, 2018, the resident inspectors presented the quarterly inspection results to Mr. S. Bono, Site Vice President and other members of the licensee's staff, who acknowledged the findings. The inspectors confirmed that proprietary information was controlled to protect it from public disclosure.

4OA7 Licensee-Identified Violations

The following licensee-identified violation of NRC requirements was determined to be of very low safety significance and met the NRC Enforcement Policy criteria for being dispositioned as an NCV.

- 10 CFR 50 Appendix B, Criterion XVI, "Corrective Action," required, in part, that measures shall be established to assure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. Contrary to the above, from May 2011 to September 26, 2017, Browns Ferry staff had not identified that a Reactor Building Crane degraded, adverse condition existed. The crane, which supports the safety-related movement function for irradiated fuel assemblies, had not been meeting the required "Single Failure-Proof" qualification as described in the Final Safety Analysis Report section 12.2.2.5 and licensee commitments to NRC NUREG 0554 since the last wire rope replacement in May 2011. Review for cause by the licensee determined that the Main Hoist Equalizer Arm had been resting on one of its stops, causing a loss of the "shock absorbing" Single Failure function. The finding screens to green per IMC 0609 Appendix A, Exhibit 3 as it was a only a qualification issue that did not cause mechanical damage to fuel, did not result in a loss of spent fuel pool water inventory, and did not affect SFP component placements. The licensee entered this issue into the CAP as CR 1341964. Immediate corrective action was to reestablish the Single Failure qualification per WO 119082082.

ATTACHMENT: SUPPLEMENTAL INFORMATION

## **SUPPLEMENTAL INFORMATION**

### **KEY POINTS OF CONTACT**

#### **Licensee Personnel:**

S. Bono, Site Vice President  
B. Bruce, Work Management Director  
R. Filipek, Design Engineering Manager  
J. Garner, Licensing  
L. Hughes, General Manager, Site Operations  
J. Kent, Director of Plant Support  
M. McAndrew, Manager of Operations  
C. Mitchell, Design Engineering  
J. Paul, Nuclear Site Licensing Manager  
P. Rescheske, Corporate Licensing

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

#### **Opened and Closed**

NCV 05000260,296/2017004-01	Inadequate Determination of Operability for the HPCI System (1R15.1)
NCV 05000296/2017004-02,	Failure to Perform an IDO without delay for 3A EDG after Observing Indications of a Degraded Condition (1R15.2)

#### **Closed**

VIO 05000260/2016012-01	Failure to Follow Conduct of Operation Procedure (Section 4OA5)
VIO 05000260/2016012-02	Failure to Maintain Complete and Accurate Shift Logs (Section 4OA5)
LER 05000259,260,296/2017-004-00	Safety System Functional Failures Due to the inoperability of Both Unit 1 and 2 Control Bay Chillers (Section 4OA3)
URI 05000259,260,296/2017-003-03	Notice of Enforcement Discretion Granted from TS LCO 3.0.3 Related to Loss of Control Room Chillers (Section 4OA3)

## **LIST OF DOCUMENTS REVIEWED**

### **Section 1R04**

#### **Procedures**

2-SR-3. 6.1.3.5 (94) TIP system PCIV Operability test Rev. 0003

#### **Other Documents**

Condition Report

Work Order 119145090

Work Order 119082082

### **Section 1R05**

#### **Procedures**

FPR-VOLUME 2, Fire Protection Report Volume 2, Rev. 55

### **Section 1R11**

#### **Procedures**

2-FSS-16-2, Unit 2 Abandonment Control Building EL 593', 606', 617', and 635', Rev. 6

### **Section 1R12**

#### **Procedures**

0-TI-346, Maintenance Rule Performance Indicator Monitoring, Trending, and Reporting - 10CFR50.65, Rev. 50

### **Section 1R13**

#### **Procedures:**

NPG-SPP-7.3 Work Activity Risk Management Process, Rev. 22

NPG-SPP-18.4.6 Control of Fire Protection Impairments, Rev. 9

NPG-SPP-18.4.7 Control of Transient Combustibles, Rev. 11

#### **Other Documents:**

CR 1355318

FPIP 17-312

WO 117588590

### **Section 1R15**

#### **Procedures:**

NPG SPP 6.9.2, Surveillance Test Program, Rev. 6

NPG SPP 6.3, Pre-/Post-Maintenance Testing, Rev.1

OPDP-8, Operability Determination Process and Limiting Conditions for Operations Tracking, Rev. 24

2-SR-3.6.1.3.5(RCIC), RCIC System MOV Operability, Rev. 40

2-SR-3.3.3.1.4(F), Verification of Remote Position Indicators for Reactor Core Isolation Cooling System Valves, Rev. 9

3-SR-3.5.1.1

3-SI-3.2.4(DG A), EECW Check Valve Test On Diesel Generator A, Rev. 13

0-GOI-300-1/ATT-9, Unit 3 Reactor Building Operator Round Logs, Rev. 255

0-OI-67, Emergency Equipment Cooling Water System, Rev. 116

Other Documents:

CR 1339723  
 CR 1340850  
 CR 1333308  
 CR 1332383  
 CR 1341468  
 CR 1343560 Analysis on the 3-FCV-73-44 failure  
 CR 1344119 Extent of Condition for 3-FCV-73-44  
 PDO for CR 1343560  
 POE for CR 1341468  
 CR 1353717  
 CR 1354142  
 CR 1354860  
 PDO for CR 1354860  
 WO 119167492  
 WO 119169430  
 WO 118065787  
 WO 119190045  
 CR 1356507  
 CR 1342473  
 PDO for CR 1342473  
 CR 1350596  
 PDO for CR 1350596  
 CR 1334534  
 CR1334534  
 POE for CR 1334534  
 CR 1369859  
 POE for CR 1369859  
 CR 1369996  
 CR 1370601  
 MDQ0067910008, Flow Requirements of EECW-Fed Components, Rev. 18

**Section 1R18**Drawings:

3-730E157-1, Steam Dryer, Rev. 3  
 Slanted Hood Dryer Diagram

Procedures

BFN-27-303, Structural Qualification Appendix C, Rev. 0

Other Documents

DCN 71355  
 WO 118161169  
 003N0524, Support Bracket Certified Stress Report, Rev. 2  
 NEDC-33824P, BF Steam Dryer Replacement Stress Analysis, Rev. 0



**Section 1R19****Procedures**

ECI-0-000-MOV009, Testing of Motor Operated Valves

2-SR-3.6.1.3.5, HPCI System Motor Operated Valve Operability, Rev. 38

3-SR-3.6.1.3.5, HPCI System Motor Operated Valve Operability, Rev. 35

WO 118495668 for PMT following A EDG shimming to correct vibration issues

**Other Documents**

WO 119094678

WO 119094688

WO 119094689

CR 1347395

WO 119123293

WO 119123105

CR 1344633

CR 1357076

CR 1357853

**Section 1R22****Procedures**

3-SR-3.5.3.3, RCIC System Rated Flow at Normal Operating Pressure, Rev. 68

**Other Documents**

0-TI-362, Inservice Testing Program, Rev. 54

0-TI-443, Condition Monitoring of Check Valves, Rev. 20

**Section 4OA2****Other Documents**

CRs 1363858, 1363858, 1354509, 1346441

**Section 4OA3****Procedures**

EPI-0-031-CHR003, Inspection and Maintenance of Trane Air Cooled Chillers, Rev. 3

**Other Documents**

BFN-VTD-N990-0020, Trane Air Cooled Chiller and Gould Pumps, Rev. 3

CR 1336821

CR 1336729

CR 1336830

CR 1340251

WO 119030420

**Section 4OA5****Procedures**

NPG-SPP-22.303, PER Actions, Closures and Approvals, Rev. 5

OPDP-1, Conduct of Operations, Rev. 33

Other Documents

TVA's OGC Report 2-2015-008, EA-16-009

TVA's letter CNL-16-122

PER 970963

PER 1292544

**Section 40A7**

CR 1341964.

WO 119082082