Memorandum from the Office of the Inspector General

June 21, 2019

D. L. Hughes, NAB 2A-BFN

REQUEST FOR FINAL ACTION – EVALUATION 2018-15596 – NUCLEAR FATIGUE RULE – BROWNS FERRY NUCLEAR PLANT

Attached is the subject final report for your review and final action. Your written comments, which addressed your management decision and actions planned or taken, have been included in the report. Please notify us when final action is complete. In accordance with the Inspector General Act of 1978, as amended, the Office of the Inspector General is required to report to Congress semiannually regarding evaluations that remain unresolved after 6 months from the date of report issuance.

If you have any questions or wish to discuss our findings, please contact Lindsay J. Denny, Manager, Evaluations, at (865) 633-7349 or E. David Willis, Director, Evaluations, at (865) 633-7376. We appreciate the courtesy and cooperation received from your staff during the evaluation.

David P. Wheeler
Assistant Inspector General
(Audits and Evaluations)
WT 2C-K

LJD:FAJ
Attachment
cc (Attachment):

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OIG File No. 2018-15596

Office of the Inspector General

Evaluation Report

To the Vice President,
Browns Ferry Nuclear Plant

NUCLEAR FATIGUE RULE - BROWNS FERRY NUCLEAR PLANT

Evaluation Auditor
Lindsay J. Denny

Evaluation 2018-15596
June 21, 2019

ABBREVIATIONS

CFR	Code of Federal Regulations
CR	Condition Report
D&Z	Day & Zimmermann
FY	Fiscal Year
NFR	Nuclear Fatigue Rule
NPG	Nuclear Power Group
SPP	Standard Programs and Processes
SSC	Systems, Structures, and Components
TVA	Tennessee Valley Authority

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APPENDIX

Evaluation 2018-15596 – Nuclear Fatigue Rule – Browns Ferry Nuclear Plant

EXECUTIVE SUMMARY

Why the OIG Did This Evaluation

According to the Occupational Safety and Health Administration, worker fatigue increases the risk for illness and injuries and has been a contributing factor in several industrial disasters. The Tennessee Valley Authority's Nuclear Fatigue Rule (NFR) establishes requirements for managing fatigue and controlling work hours in accordance with Title 10 Code of Federal Regulations Part 26, Subpart I, *Managing Fatigue*. According to the regulation, there are required minimum days off for covered individuals[i] based on the department in which the individual works and the length of the shift. These minimum days off differ based on whether the unit is online or in an outage.

Due to the importance of employees being able to safely and competently perform their duties, we performed an evaluation of the NFR at Browns Ferry Nuclear Plant. Our objective was to determine if the Tennessee Valley Authority is in compliance with the NFR at Browns Ferry.

What the OIG Found

Nuclear Power Group Standard Programs and Processes 03.21, *Fatigue Rule and Work Hour Limits,* includes rules regarding required average minimum days off for covered individuals, as well as overtime rules for how many hours can be worked in specific time periods. Our review of sampled employee and contract employee work hours and badging records for fiscal years 2017 and 2018 identified no violations of NFR minimum days off or overtime rules. However, we identified areas of deficiencies with Browns Ferry's performance of (1) fatigue assessments and (2) NFR compliance reviews. Additionally, we identified areas for improvement related to NFR work-schedule tracking.

What the OIG Recommends

We recommend the Vice President, Nuclear Operations, address issues related to (1) fatigue assessments, (2) work-hour-control reviews, and (3) work-hour tracking. Our detailed recommendations are listed in the body of this report.

[i] Any individual who is granted unescorted access to a nuclear power plant protected area to perform certain risk significant tasks.

EXECUTIVE SUMMARY

TVA Management's Comments

TVA management agreed with the recommendations in this report and provided actions to address the recommendations. See the Appendix for TVA's complete response.

Auditor's Response

We concur with TVA management's planned actions.

BACKGROUND

According to the Occupational Safety and Health Administration, worker fatigue increases the risk for illness and injuries and has been a contributing factor in several industrial disasters. Nuclear Power Group (NPG) Standard Programs and Processes (SPP) 03.21, *Fatigue Rule and Work Hour Limits,*[1] implements requirements for managing fatigue and controlling work hours in accordance with Title 10 Code of Federal Regulations [CFR], Part 26, Subpart I, *Managing Fatigue*. This subpart includes requirements related to general provisions, work hours, waivers and exceptions, self-declarations of fatigue, and fatigue assessments.[2]

While fatigue management applies to all individuals who have unescorted access to protected areas[3] at a nuclear plant, work-hour controls apply only to covered individuals[4] who perform or direct covered work. Covered work includes:

- Operating or on-site directing of the operation of systems, structures, and components (SSC) that a risk-informed evaluation process has shown to be significant to public health and safety.
- Performing maintenance or on-site directing of the maintenance of SSCs that a risk-informed evaluation process has shown to be significant to public health and safety.
- Performing radiation protection or chemistry duties required as a member of the on-site emergency response organization's minimum shift complement.
- Performing duties of a fire brigade member who is responsible for understanding the effects of fire and fire suppressants on safe shutdown capability.
- Performing activities that change the condition or state of risk significant SSCs.
- Performing security duties as an armed security-force officer, alarm-station operator, response team leader, or watchperson.

According to 10 CFR Part 26, there are required average minimum days off for covered individuals based on the department in which the individual works and the length of their shifts. These minimum days off differ based on whether the unit is online or in an outage. However, the following work-hour limits apply to covered individuals regardless of whether the unit is online or in an outage:

- No more than 16 work hours in any 24-hour period.

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1 The SPP is commonly referred to as the Nuclear Fatigue Rule (NFR).

2 Fatigue assessments are face-to-face evaluations of an individual whose alertness may be impaired.

3 An area encompassed by physical barriers and to which access is controlled.

4 Any individual who is granted unescorted access to a nuclear power plant protected area and performs covered work is a covered individual.

- No more than 26 work hours in any 48-hour period.
- No more than 72 work hours in any 7-day period (168 hours).
- At least a 10-hour break between successive work periods.
- A continuous break of at least 34 hours in any 9-day period (216 hours).

To ensure employees are not fatigued, fatigue assessments are required for four conditions: (1) for cause - in response to an observed condition of impaired individual alertness creating a reasonable suspicion that an individual is not fit for duty, (2) self-declaration - in response to an individual's self-declaration to their supervisor that they are not fit to safely and competently perform their duties or any part of a work shift due to fatigue, (3) post-event - in response to events requiring post-event drug and alcohol testing, or (4) follow-up - to follow after a "for cause" fatigue assessment or a self-declaration and the individual is returning to duty following a break of less than 10 hours.

According to NPG-SPP-14.1, *Fitness-For-Duty and Fatigue Management*, fatigue assessments address (1) acute and cumulative fatigue, (2) potential degradations in alertness and performance due to circadian variations,[5] (3) potential degradations in alertness and performance to affect risk significant functions, and (4) whether any controls and conditions must be established under which the individual will be permitted to perform work.

Additionally, NPG-SPP-03.21 requires quarterly and annual reviews be performed by each department to determine NFR compliance. Documents to be reviewed include condition reports (CR),[6] fatigue assessments, and waivers. In conjunction with the quarterly reviews, the annual review shall evaluate the effectiveness of the control of work hours for covered individuals.

Due to the importance of employees being able to safely and competently perform their duties, we performed an evaluation of the NFR at Browns Ferry Nuclear Plant.

OBJECTIVE, SCOPE, AND METHODOLOGY

The objective of our evaluation was to determine if the Tennessee Valley Authority (TVA) is in compliance with the NFR at Browns Ferry. Our scope included employee and contract employee[7] work hours in fiscal years (FY) 2017 and 2018. In order to fulfill our objective, we:

5 The increases and decreases in alertness and cognitive/motor functioning caused by human physiological processes (e.g., body temperature, release of hormones) that vary on an approximate 24-hour cycle.

6 A CR is a mechanism used to document an issue (undesired condition, problem, or concern raised by personnel).

7 Day & Zimmerman (D&Z) employee work hours were limited to the 2018 fall outage because they were not included in the TVA work-hour system.

- Interviewed the Browns Ferry Site NFR Coordinator, each department's NFR coordinator, and other relevant employees to gain an understanding of the NFR process.
- Compared the general requirements in 10 CFR Part 26, Subpart I, *Managing Fatigue*, to TVA policies, procedures, training and examinations content, reports, and audits to determine TVA's compliance with the regulation.
- Compared departmental lists of covered employees being tracked for NFR purposes to employees listed in TVA's human resource system in departments that perform covered work to determine if all appropriate employees were being included in the NFR program.
- Requested all fatigue assessments and waivers[8] from FYs 2017 and 2018 to determine if they were performed in accordance with 10 CFR Part 26 and NFR procedures.
- Reviewed documentation for a statistically selected random sample of 96 of 22,126 pay periods with overtime for covered employees in FYs 2017 and 2018. We selected our sample using rate of occurrence sampling with a 95-percent confidence level to perform the following steps:
  - Compared work hours from payroll records, work-hour tracking, and badging records to determine if records were consistent.
  - Reviewed time records to identify any NFR violations.

  Since this was a statistical sample, we can project the results of our sample testing.
- Reviewed documentation for a statistically selected random sample of 78 of 407 D&Z contract employees working the 2018 fall outage using rate of occurrence sampling with 95-percent confidence level to perform the following steps:
  - Compared work hours and badging records for those individuals whose time records indicated potential violations to determine if violations were committed.
  - Reviewed time records to identify any NFR violations.

  Since this was a statistical sample, we can project the results of our sample testing.
- Reviewed documentation related to the 24 (non-D&Z) contract employees performing covered work during FYs 2017 and 2018 to perform the following steps:
  - Compared work hours and badging records to determine if records were consistent.
  - Reviewed time records to identify any NFR violations.

[8] No waivers were issued during the scope of our project.

This evaluation was performed in accordance with the Council of the Inspectors General on Integrity and Efficiency's *Quality Standards for Inspection and Evaluation*.

FINDINGS

As stated above, NPG-SPP-03.21, *Fatigue Rule and Work Hour Limits,* includes rules regarding required average minimum days off for covered individuals, as well as overtime rules for how many hours can be worked in specific time periods. Our review of sampled employee and contract employee work hours and badging records for FYs 2017 and 2018 identified no violations of NFR minimum days off or overtime rules. However, as discussed below, we identified areas of deficiencies with Browns Ferry's performance of (1) fatigue assessments and (2) NFR compliance reviews. Additionally, we identified areas for improvement related to NFR work-schedule tracking.

FATIGUE ASSESSMENTS WERE DEFICIENT

Our review of the 11 fatigue assessments[9] performed in FYs 2017 and 2018 identified several deficiencies. Specifically, we identified fatigue assessments that were (1) performed by incorrect personnel, (2) not performed timely, (3) performed without a CR initiated, and (4) without comments to describe the circumstances resulting in the fatigue assessment.

- Performed by Incorrect Personnel – According to 10 CFR Part 26, for a post-event fatigue assessment, the individual who conducts the fatigue assessment may not have performed or directed the work activities during which the event occurred. However, one post-event fatigue assessment was performed by the person who directed the work which resulted in the event.
- Not Performed Timely – According to 10 CFR § 26.31, tests should be administered as soon as practical after an event involving human error. However, 3 post-event fatigue assessments were performed more than 24 hours after the event took place, including 1 performed 8 days after the event requiring a fatigue assessment.
- Without CR as Required – According to NPG-SPP-14.1, *Fitness-For-Duty and Fatigue Management*, supervisors must initiate a CR on each fatigue assessment performed. However, of the 11 fatigue assessments reviewed, a CR was not initiated for 5.
- Without Comments – According to NPG-SPP-14.1, comments are required when a post-event or for-cause assessment is performed. However, 7 of the 11 assessments reviewed did not include any comments to describe the circumstances resulting in the fatigue assessment.

[9] The 11 fatigue assessments reviewed were all post-event or for-cause assessments.

A Quality Assurance assessment[10] performed in September 2017 identified several deficiencies related to fatigue assessments and recommended a process be put in place for review of compliance with procedural guidance. A CR was created to address this recommendation with a completed action dated December 2017. The CR stated that the fatigue assessment instructions and fatigue assessment form had been revised to further clarify the requisite information in accordance with procedural guidance to ensure completeness and accuracy of the records. However, our review identified issues with 4 of the 5 fatigue assessments performed in FY2018, after the CR was closed. Therefore, it does not appear that the CR actions were effective at addressing the deficiencies identified in fatigue assessments.

REQUIRED REVIEWS NOT PERFORMED

Our review of the FYs 2017 and 2018 quarterly and annual NFR compliance reviews for the nine departments with covered workers at Browns Ferry found a department that did not perform one required quarterly review and one annual review. 10 CFR Part 26, Subpart I, requires licensees to evaluate the effectiveness of their control of work hours for individuals subject to work-hour controls, including documentation of the methods used to conduct the review and the results of the review. Although the regulation requires this review to be conducted once each calendar year, NPG-SPP-03.21 requires a quarterly and annual review of each department's NFR compliance.

ADDITIONAL INFORMATION

During our comparison of work hours in the payroll software and the work-hour software, we identified issues related to (1) hours not worked included in the schedule and (2) hours worked missing from the work-hour-schedule software.

Employee work hours are tracked through NFR work-hour-schedule software that indicates when an employee is eligible for overtime or when an overtime shift would create an NFR violation. When an employee takes leave or does not work on a holiday, the employee's schedule should be manually adjusted to create an accurate reflection of the employee's time worked for future overtime purposes. However, we identified hours not worked that were still included in the software for 19 of the 96 employees in our sample testing. Without an accurate reflection of the actual time worked, the site may not be able to adequately and efficiently staff overtime shifts.

We also identified 1 employee and 2 contract employees whose payroll and badging records indicated they worked a shift that was not included in the schedule software. According to TVA personnel responsible for the employee's schedule, the employee's time had been entered during the initial load of the schedule, but was later removed and replaced with "LEAVE." This error was

[10] Corporate Quality Assurance performs an audit focusing on the effectiveness of fatigue management at least once every 2 years.

attributed to a known software issue. Additionally, according to TVA personnel responsible for the contractor's schedule, the time had been entered into the schedule and at some time after had been removed. Although these errors did not result in NFR violations, a violation could have occurred if the individuals had been scheduled for overtime based on the inaccurate schedule in the system.

RECOMMENDATIONS

We recommend the Vice President, Nuclear Operations:

- Reinforce the importance of completing fatigue assessments as required.

  TVA Management's Comments – TVA management stated they will reinforce procedural guidance and management expectations related to fatigue assessments by conducting a briefing with first line supervision and site leadership. See the Appendix for TVA's complete response.

  Auditor's Response – We concur with management's planned actions.

- Establish a review of completed fatigue assessments to ensure they contain required information.

  TVA Management's Comments – TVA management stated they will conduct a review to ensure current procedure requires a review of completed fatigue assessment documents. This review will also determine if reviews are being conducted as required. See the Appendix for TVA's complete response.

  Auditor's Response – We concur with management's planned actions.

- Reinforce the expectation for work-hour-control reviews to be performed quarterly and annually as required.

  TVA Management's Comments – TVA management stated they will reinforce procedural guidance and management expectation related to NFR reviews by conducting a briefing with Browns Ferry department NFR coordinators and department Performance Improvement coordinators. See the Appendix for TVA's complete response.

  Auditor's Response – We concur with management's planned actions.

- Reinforce the expectation for hours not worked to be removed from the schedule software.

  TVA Management's Comments – TVA management stated they will reinforce management expectation to continuously monitor and update the NFR schedule by conducting a briefing with department NFR coordinators and administrative personnel. See the Appendix for TVA's complete response.

  Auditor's Response – We concur with management's planned actions.

- Identify and correct the issue causing time entered into the schedule software to be subsequently removed.

TVA Management's Comments – TVA management stated that the work-hour software database administrator will conduct a review of the NFR component to identify and correct issues that result in time entered to be removed without cause. This action may require vendor support or the reconfiguration of software. See the Appendix for TVA's complete response.

Auditor's Response – We concur with management's planned actions.

In addition, TVA management stated they will conduct a benchmarking activity to determine if the TVA Fitness-For-Duty and/or NFR procedure and processes are outliers within the industry.

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

June 18, 2019

David P. Wheeler, WT 2C-K

RESPONSE TO REQUEST FOR COMMENTS ON DRAFT EVALUATION 2018-15596 NUCLEAR FATIGUE RULE – BROWNS FERRY NUCLEAR PLANT

In accordance with your request, I have reviewed the Office of the Inspector General (OIG) draft evaluation focused on Browns Ferry Nuclear Plant Nuclear Fatigue Rule. Thank you for your review and feedback; we appreciate the OIG's insights.

In the report, the OIG made five recommendations to the Senior Vice President, Nuclear Operations. We agree with the recommendations and have actions in progress or previously completed actions to improve Browns Ferry's Nuclear Fatigue Rule.

Below are some of the actions related to each recommendation:

1. Reinforce the importance of completing fatigue assessments as required.

   - Action
     Reinforce procedural guidance and management expectations related to fatigue assessments.
     The Office of Inspector General Evaluation 2018-15596 Nuclear Fatigue Rule BFN identified a deficiency related to the conduct and completion of fatigue assessments at BFN. Based on the recommendation of actions by the Office of Inspector General, the BFN NFR SME (or designee) will conduct a briefing to reinforce the conduct of fatigue assessments as stipulated in NPG-SPP-14.1 Fitness-For-Duty and Fatigue Management and NPG-SPP-03.21 Fatigue Rule and Work Hour Limits. The target population for this briefing will be First Line Supervision and Site Leadership. The briefing will be documented and 80 percent or greater of the current First Line Supervision and Site Leadership will be required to participate.

2. Establish a review of completed fatigue assessments to ensure they contain required information.

   - Action
     Conduct review to ensure that current procedure requires a review of completed fatigue assessment documents.
     Based on the recommendations of the Office of Inspector General Evaluation 2018-15596 Nuclear Fatigue Rule BFN, the BFN NFR SME will conduct a review to ensure that SPP-14.1 Fitness-For-Duty and Fatigue Management and/or NPG-SPP-03.21 Fatigue Rule and Work Hour Limits requires an oversight review of completed fatigue

assessments. Review will also determine if reviews of fatigue assessment are being conducted as required.

3. Reinforce the expectation for work-hour-control reviews to be performed quarterly and annually as required.

   - Action
     Reinforce procedural guidance and management expectation related to NFR reviews. The Office of Inspector General Evaluation 2018-15596 Nuclear Fatigue Rule BFN identified a deficiency related to the conduct and completion of nuclear fatigue rule quarterly and annual reviews at BFN. Based on the recommendation of actions by the Office of Inspector General, the BFN NFR SME (or designee) will conduct a briefing to reinforce requirements for conduct of NFR reviews as stipulated in NPG-SPP-03.21 Fatigue Rule and Work Hour Limits. The target population for this briefing will be BFN department NFR coordinators and department Performance Improvement Coordinators. Briefing will be documented.

4. Reinforce the expectation for hours not worked to be removed from the schedule software.

   - Action
     Reinforce management expectation to continuously monitor and update NFR schedule. The Office of Inspector General Evaluation 2018-15596 Nuclear Fatigue Rule BFN identified a best practice related to the monitor and update of the NFR work hour tracking schedule. This best practice recommendation would provide an improvement to the efficiency of work hour availability. Based on the recommendation of actions by the Office of Inspector General, the BFN NFR SME (or designee) will conduct a briefing to reinforce management expectations related to the monitor of work hour tracking schedule and the removal of leave when required to provide increased efficiency and flexibility related to the schedule of workers. The target population for this briefing will be department NFR coordinators and administrative personnel.

5. Identify and correct the issue causing time entered into the schedule software to be subsequently removed.

   - Action
     eSOMS database administrator to conduct review of NFR component.
     The eSOMS database administrator will conduct a review to identify and correct any issues that result in time entered into the eSOMS system for the purpose of NFR work hour tracking to be removed without cause. This action may require vendor support or the reconfiguration of software.

- Additional Action
  Conduct benchmark activity to determine if the TVA FFD and/or NFR process is an industry outlier.
  The BFN NFR SME (or designee) will conduct a benchmark with multiple industry peer facilities to determine if current TVA/BFN FFD and/or NFR procedure and processes are outliers within the industry. This benchmark will not require travel to industry locations and may be in an informal format.

Please contact me if you have any questions.

D. L. Hughes
Site Vice President, Browns Ferry Nuclear
NAB 2A-BFN