



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, ILLINOIS 60532-4352

March 9, 2018

EA-18-008

Mr. Mark Bezilla
Site Vice President
FirstEnergy Nuclear Operating Company
Davis-Besse Nuclear Power Station
5501 North State Route 2
Oak Harbor, OH 43449-9760

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION—NRC INSPECTION REPORT
05000346/2018010 AND PRELIMINARY WHITE FINDING

Dear Mr. Bezilla:

On January 31, 2018, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Davis-Besse Nuclear Power Station and the NRC inspectors discussed the results of this inspection with you and other members of your staff. The results of this inspection are documented in the enclosed report.

Section 40A2 of the enclosed report documents a finding with an associated violation that the NRC has preliminarily determined to be White with low-to-moderate safety significance. This finding involved a performance deficiency and the apparent failure of the licensee to provide appropriate instructions to maintain an adequate amount of oil in an auxiliary feedwater turbine bearing oil sumps, resulting in the failure of the auxiliary feedwater pump. We assessed the significance of the finding using the significance determination process (SDP) and readily available information. The evaluation included reviewing and assessing the ability of installed FLEX equipment to mitigate the potential impact on secondary heat removal due to the finding. This apparent violation and its associated cross-cutting aspect association was originally discussed with you and your staff and presented in NRC's Davis-Besse Inspection Report 05000346/2017004 dated February 14, 2018 (ADAMS Accession Number ML18045A076).

We are considering escalated enforcement for the apparent violation consistent with our Enforcement Policy, which can be found at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. Because we have not made a final determination, no notice of violation is being issued at this time. Please be aware that further NRC review may prompt us to modify the characterization of the apparent violation.

We intend to issue our final significance determination and enforcement decision, in writing, within 90 days from the date of this letter. The NRC's significance determination process (SDP) is designed to encourage an open dialogue between your staff and the NRC; however, neither the dialogue nor the written information you provide should affect the timeliness of our final determination.

Before we make a final decision, you may choose to communicate your position on the facts and assumptions used to arrive at the finding and assess its significance by either (1) attending and presenting at a regulatory conference or (2) submitting your position in writing. The focus of

a regulatory conference is to discuss the significance of the finding. Written responses should reference the inspection report number and enforcement action number associated with this letter in the subject line.

If you request a regulatory conference, it should be held within 40 days of your receipt of this letter. Please provide information you would like us to consider or discuss with you at least 10 days prior to any scheduled conference. If you choose to attend a regulatory conference, it will be open for public observation. If you decide to submit only a written response, it should be sent to the NRC within 40 days of your receipt of this letter. If you choose not to request a regulatory conference or to submit a written response, you will not be allowed to appeal the NRC's final significance determination.

Please contact Jamnes Cameron at 630-829-9833, and in writing, within 10 days from the issue date of this letter to notify the NRC of your intentions. If we have not heard from you within 10 days, we will continue with our significance determination and enforcement decision.

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 Julio Lara Acting for/

Patrick L. Loudon, Director
Division of Reactor Projects

Docket No. 50-346
License No. NPF-3

Enclosure:
Inspection Report 05000346/2018010

cc: Distribution via LISTSERV®

Letter to Mark Bezilla from Patrick Loudon dated March 9, 2018

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION—NRC INSPECTION REPORT
05000346/2018010 AND PRELIMINARY WHITE FINDING

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U.S. NUCLEAR REGULATORY COMMISSION
REGION III

Docket No: 50-346

License No: NPF-3

Report No: 05000346/2018010

Enterprise Identifier: I-2018-010-0061

Licensee: FirstEnergy Nuclear Operating Company (FENOC)

Facility: Davis-Besse Nuclear Power Station

Location: Oak Harbor, OH

Dates: January 1 through January 31, 2018

Inspectors: D. Mills, Senior Resident Inspector
J. Hanna, Senior Reactor Analyst
J. Wojewoda, Reactor Engineer

Approved by: J. Cameron, Chief
Branch 4
Division of Reactor Projects

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring licensee’s performance by conducting an assessment of the significance of a previously identified apparent violation at Davis-Besse Nuclear Power Station 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. The NRC’s preliminary significance determination for the self-revealed finding is summarized in the table below.

List of Findings and Violations

Failure to Prescribe Appropriate Work Instructions for an Activity Affecting Quality			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Preliminary White Apparent Violation 05000346/2017004-03 Open EA-18-008	H-11 – Challenge the Unknown	4OA2
A self-revealed finding with an Apparent Violation (AV) of Title 10 of the <i>Code of Federal Regulations</i> (CFR) Part 50, Appendix B, Criterion V, “Instructions, Procedures, and Drawings,” and an associated AV of TS 3.7.5, “Emergency Feedwater (EFW),” was identified on September 13, 2017, due to the licensee’s apparent failure to prescribe appropriate work instructions for an activity affecting quality of the safety-related auxiliary feedwater (AFW) system. Specifically, the licensee did not provide detailed instructions to maintain an adequate amount of oil in the auxiliary feed pump turbine (AFPT) 1 inboard bearing oil reservoir, which resulted in a low oil level condition and the failure of AFW 1 on September 13, 2017.			

REPORT DETAILS

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 – BASELINE

71152—Problem Identification and Resolution

Annual Follow-Up of Selected Issues (No sample)

Inspection report 05000346/2017004 (ADAMS Accession Number ML18045A076) documents an apparent violation with significance to be determined. During this inspection period, a Region III Senior Reactor Analyst, in conjunction with other NRC personnel developed analyses for the significance the apparent violation. This inspection report provides only a brief synopsis of the information presented in inspection report 2017004; this report contains the results of Senior Reactor Analyst's analyses for preliminary significance. The activity below does not constitute an additional inspection sample.

INSPECTION RESULTS

71152—Problem Identification and Resolution

<u>Failure to Provide Detailed Work Instructions for an Activity Affecting Quality</u>			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Preliminary White Apparent Violation 05000346/2017004-03 Open EA-18-008	H-11 – Challenge The Unknown	71152
<u>Introduction:</u> A self-revealed finding with an Apparent Violation (AV) of Title 10 of the <i>Code of Federal Regulations</i> (CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," and an associated AV of TS 3.7.5, "Emergency Feedwater (EFW)," was identified on September 13, 2017, due to the licensee's apparent failure to prescribe appropriate work instructions for an activity affecting quality of the safety-related auxiliary feedwater (AFW) system. Specifically, the licensee did not provide detailed instructions to maintain an adequate amount of oil in the auxiliary feed pump turbine (AFPT) 1 inboard bearing oil reservoir, which resulted in a low oil level condition and the failure of AFW 1 on September 13, 2017.			
<u>Description:</u> On September 13, 2017, the licensee began performance of DB-SP-03151, "AFP 1 Quarterly Test." Several minutes after full flow conditions were established, the licensee received a high temperature alarm (>220 degree Fahrenheit) associated with the			

AFPT 1 inboard bearing. The licensee secured the system. The initial oil sample taken from the turbine inboard bearing was black, indicating potential bearing failure.

The inspectors reviewed the licensee's root cause evaluation (RCE), procedures, maintenance packages and previous condition reports. The RCE determined the failure mechanism to be inadequate lubrication due to an incorrectly marked sight glass, and the root cause to be that preventive maintenance (PM) instructions for replacing the sight glass did not include guidance to calibrate or set the required operational bands. Specifically, the licensee found the oil level allowable band on the AFPT 1 inboard bearing sight glass was approximately 15/16 inches, as opposed to the vendor recommended 3/8 inches. A consequence of the incorrect larger allowable operating band was that a portion of the band was lower than the level need to ensure the minimum required quantity of oil in the associated sump. Inspectors also found that the deficient PM instructions were the same for all of the AFPT bearings on both trains 1 and 2 of AFW.

Oil was last removed from the AFPT 1 sight glass sump during the sampling on June 21, 2017, after the last quarterly surveillance. Therefore, the inspectors determined AFW train 1 had been unavailable since that surveillance.

The corrective actions by the licensee are described in IR 05000346/2017004.

Performance Assessment:

Performance Deficiency: The inspectors determined that the licensee's failure to prescribe appropriate work instructions for an activity affecting quality was a performance deficiency. Specifically, the licensee apparently did not provide appropriate instructions to maintain an adequate amount of oil in the AFW turbines bearing oil sumps resulting in the failure of AFW 1 on September 13, 2017.

Screening: The inspectors determined the performance deficiency was more than minor because it adversely affected the Mitigating Systems cornerstone attribute of equipment performance and adversely affected the cornerstone objective of ensuring the availability, capability and reliability of equipment that respond to initiating events. Specifically, the performance deficiency resulted in the failure of the AFW 1 system.

Significance: The inspectors assessed the significance of the finding using SDP Appendix A. The inspectors determined the finding represented an actual loss of function of at least a single train for greater than its Technical Specification allowed outage time. Therefore, a detailed risk evaluation was performed by a regional Senior Reactor Analyst (SRA).

The SRA evaluated the finding using the Davis-Besse Standardized Plant Analysis Risk (SPAR) Model, Version 8.50, and Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE), Version 8.1.6. The basic event representing the AFW pump 1 failing to run was set to 1.0 and True. (See discussion below regarding sensitivity analyses that were performed.)

In terms of exposure time, on June 21, 2017, after oil was removed for sampling the pump's oil reservoir was not refilled, and the pump failed on its subsequent quarterly surveillance test on September 13, 2017. The pump was repaired and returned to service on September 15, 2017. The time that the performance deficiency manifested itself was immediately following when the pump oil reservoir was low on June 21, 2017; therefore a "T/2" exposure does not apply. The exposure time (84 days) was adjusted for the repair time (+2 days) for a total of 86 days and it was confirmed that no outages occurred where the pump was not credited.

Common cause failure was assumed to be present because the AFW pumps share a common cause component group, and additionally the performance deficiency (i.e., inadequate work instructions) had the potential to affect the AFW Pump 2 though no actual failures occurred. The SRA assumed that the AFW pump 1 failure could not be repaired or recovered based on the extensive damage observed on the bearing upon disassembly. However the application of common cause to the other pump did not result in a significant change, i.e., crossing an SDP threshold, and was not relevant to this analysis. The delta-CDF for the internal events only, using the Davis-Besse SPAR model and applying a factor for exposure time was $4.0E-6/\text{yr}$.

External Events Risk Contribution:

The Davis-Besse SPAR Model included external risk such as fire and seismic events. External flooding risk contributions were negligible and the external event risk contribution was dominated by fire scenarios. The SRA evaluated fire cutsets specifically where the AFW Pump 1 contributed to the likelihood of core damage to ensure the values used were reasonable. The ΔCDF from the individual fire areas were summed to obtain a total fire risk. The total ΔCDF for fires and for the exposure period using the NRC's SPAR model was determined to be approximately $2E-05/\text{yr}$, however this was prior to any credit was applied for the EFW system, which is part of the licensee's Mitigating Systems FLEX strategy. Additionally, it is worth noting that the First Energy risk model for external events was 1) up-to-date, whereas the NRC SPAR model was based on dated plant specific fire information, 2) the model is Regulatory Guide 1.200 compliant, and 3) is currently being used to support their transition to the fire code/requirements of NFPA-805.

Emergency Feedwater (Portion of the Mitigating Systems FLEX strategy):

Idaho National Labs provided a modified version of the Davis-Besse SPAR model with the licensee's EFW system (part of their FLEX Mitigating Strategies) included. The licensee's PRA notebook for the system was used as a basis for technical details such as fault tree modeling and basic event values. The EFW system was assumed to be used by Davis-Besse operators anytime normal feedwater and/or auxiliary feedwater fail, and the initiating events of concern were not limited to FLEX-type events, i.e., Station Blackout. However no additional credit was applied for other portions of the FLEX strategy, e.g., primary RCS make-up, in part because the timeframe to implement Phase 2 strategies may occur after core damage has already occurred. The delta-CDF for the internal and external events, using the Davis-Besse SPAR model and applying additional credit for FLEX equipment and a factor for exposure time was $7.8E-6/\text{yr}$ (White).

Large Early Release Frequency (LERF):

The Davis-Besse SPAR model has limited capability to calculate LERF whereas First Energy had a fully developed model, and hence the licensee's values were considered the best available information. The licensee's fire Large Early Release calculations have the risk at $7.32E-7$. The dominant sequence is a large fire causing Control Room abandonment and subsequently containment buckles due to Containment Spray creating a large leak path. The performance deficiency is White based on ΔLERF as well.

Licensee's Risk Evaluation:

The licensee provided internal events and external events cutsets (both base and non-conforming results) for discussion at the Significance and Enforcement Review Panel meeting. The licensee's internal events risk was a ΔCDF of $7.9E-7/\text{yr}$ for the exposure time. The external events risk information was a ΔCDF for fires of $5.59E-06/\text{yr}$ for the exposure time. Thus the licensee calculated the total delta-CDF to be $6.4E-6$ (White).

Sensitivity Studies:

Sensitivity evaluations were performed on a number of factors. Individually they are described below along with their impact on the result:

- Licensee Basic Event Values—the licensee’s values for various basic events were run on the base NRC SPAR model for Davis-Besse; the result was 22 percent higher than the nominal, pooled average values used and would not result in a color change.
- Advanced Mitigation Strategies Credit—the base NRC SPAR model for Davis-Besse was evaluated for the effect of Advanced Mitigation Strategies (commonly known as B.5.b equipment) using the “MTS change set.” This evaluation was done due to the equipment’s potential impact on secondary heat removal; the result was 2 percent lower and would not result in a color change.
- 24 hour Mission Time—When the NRC SPAR model for Davis-Besse was initially solved incorporating external events and the newly installed EFW system, the results were very high. The dominant cutsets were long term sequences where core damage was being assumed at the end of the 24 hour mission time because a “safe and stable” end state had not been achieved. Idaho National Labs created a change set to “turn off” the 24 hour mission time; the result was 4 percent lower and would not result in a color change.
- Basic Event Values Used in Fire PRA—the SRA performed a validation of the basic events used in the licensee’s fire PRA primarily because these were the dominant cutsets. The SRA engaged NRC reviewers in NRR/Division of Reactor Licensing associated with the licensee’s NFWA-805 license submittal and did an independent review of basic events. The results remained below the Yellow/White threshold.

Total Estimated Change in Risk:

The dominant sequence is a reactor trip (TRANS) with subsequent failure of both the secondary heat removal strategy and then primary feed & bleed strategy. Secondary heat removal is failed to the performance deficiency (Train 1), the fire (Train 2) and other random failures, e.g., EFW system in test & maintenance. The total Δ CDF was the sum of the internal and external events Δ CDF risk, or between $6.4E-6$ /yr and $8E-6$ /yr, using the First Energy or the NRC’s SPAR model values respectively. This was a low to moderate safety significance (White) finding. A SERP, held on January 25, 2018, using IMC 0609, Appendix A, “Significance Determination Process For Findings At-Power,” dated June 19, 2012, made a preliminary determination that the finding was of low to moderate safety significance (White) based on the quantitative analysis performed during the detailed risk evaluation.

Cross-cutting Aspect: The inspectors determined this finding affected the cross-cutting aspect of challenge the unknown in the area of Human Performance, where individuals stop when faced with uncertain conditions and risks are evaluated and managed before proceeding. Specifically, the licensee failed to stop when faced with uncertain conditions in the preventive maintenance procedure for replacing the AFPT sight glasses. Although the replacement of the AFPT 1 inboard bearing sight glass occurred in 1997, the licensee had the opportunity to challenge the lack of detail in the work instructions in late 2014 when the AFPT 2 outboard bearing sight glass was replaced. [H.11]

Enforcement:

Violation: Title 10 CFR Part 50, Appendix B, Criterion V, “Instructions, Procedures, and Drawings,” requires, in part, activities affecting quality 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. Instructions,

procedures, or drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

Technical Specification 3.7.5, Emergency Feedwater (EFW), limiting condition for operation states, in part, three EFW trains shall be operable, consisting of: two Auxiliary Feedwater (AFW) trains; and the Motor Driven Feedwater Pump (MDFP) train. Condition B states one EFW train inoperable for reasons other than Condition A in Mode 1, 2, or 3, with an action of restoring the EFW train to operable status within 72 hours.

Since the last known replacement of the sight glass in 1997, the licensee did not prescribe written instructions appropriate to the circumstances for an activity affecting quality of the safety-related auxiliary feedwater system. Specifically, the licensee did not provide appropriate instructions to maintain an adequate amount of oil in the turbine bearing oil sight glasses for the AFW trains.

The failure to properly calibrate sight glasses resulted in a low oil level in the AFP 1 turbine inboard bearing reservoir causing the AFW pump to be inoperable from June 21, 2017, until the bearing was replaced and the system successfully returned to service on September 15, 2017, a period greater than TS 3.7.5.B.1 allowed outage time of 72 hours. The AFW train was inoperable due to reasons not listed in TS 7.3.5.A. Additionally, because the licensee was not aware of the auxiliary feedwater train's inoperability during the June 15 through September 15, operational period, therefore the required actions of TS 3.7.D.1 and 3.7.5.D.2 were not met.

Disposition: This violation is being treated as an apparent violation pending a final significance (enforcement) determination.

EXIT MEETINGS AND DEBRIEFS

The inspectors confirmed that proprietary information was controlled to protect from public disclosure. No proprietary information was documented in this report.

- On January 31, 2018, the inspectors presented the inspection results to Mr. M. Bezilla and other members of the licensee staff.