**UNITED STATES**
**NUCLEAR REGULATORY COMMISSION**
**REGION IV**
**1600 EAST LAMAR BOULEVARD**
**ARLINGTON, TEXAS 76011-4511**

April 15, 2020

Mr. Fadi Diya
Senior Vice President and Chief Nuclear Officer
Ameren Missouri
8315 County Road 459
Steedman, MO 65077

SUBJECT: CALLAWAY PLANT – DESIGN BASIS ASSURANCE INSPECTION (TEAMS)
INSPECTION REPORT 05000483/2020011

Dear Mr. Diya:

On March 31, 2020, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Callaway Plant. On March 31, 2020, 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.

Two findings of very low safety significance (Green) are documented in this report. Two of these findings involved violations of NRC requirements. We are treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2 of the Enforcement Policy.

If you contest the violations or the significance or severity of the violations documented in this inspection report, 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 IV; the Director, Office of Enforcement; and the NRC Resident Inspector at Callaway 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 IV; and the NRC Resident Inspector at Callaway Plant.

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

Sincerely,

Vincent G. Gaddy

Digitally signed by Vincent G. Gaddy
Date: 2020.04.15 15:35:46 -05'00'

Vincent G. Gaddy, Chief
Engineering Branch 1
Division of Reactor Safety

Docket No. 05000483
License No. NPF-30

Enclosure:
As stated

cc w/ encl: Distribution via LISTSERV®

CALLAWAY PLANT – DESIGN BASIS ASSURANCE INSPECTION (TEAMS) INSPECTION REPORT 05000483/2020011 – April 15, 2020

DISTRIBUTION:
SMorris, RA
MShaffer, DRA
AVegel, DRP
MHay, DRP
RLantz, DRS
GMiller, DRS
DCylkowski, RC
OLópez-Santiago, RIV/OEDO
VDricks, ORA
LWilkins, OCA
JKlos, NRR
AMoreno, RIV/OCA
BMaier, RSLO
AAgrawal, IPAT
NO'Keefe, DRP
DProulx, DRP
JMelfi, DRP
NBrown, DRP
DBradley, DRP
SJanicki, DRP
DYancey, DRP
PJayroe, IPAT
BCorrell, IPAT
MHerrera, DRMA
R4Enforcement

ADAMS ACCESSION NUMBER: ML20106F187

| ☒ SUNSI Review By: GAG | ADAMS: ☒Yes ☐ No | ☐ Non-Publicly Available ☒ Publicly Available | ☒ Non-Sensitive ☐ Sensitive | Keyword: NRC-002 |
|---|---|---|---|---|

| OFFICE | DRS/EB1/SRI | DRS/EB1/RI | DRS/EB2/RI | OCHCO/SRTI | DRP/PBB/C | DRS/EB1/C |
|---|---|---|---|---|---|---|
| NAME | GGeorge | JBraisted | SMakor | GCallaway | COKeefe | VGaddy |
| SIGNATURE | */RA/* | */RA/* | */RA/* | */RA/* | */RA/* | Vgg |
| DATE | 04/09/2020 | 04/10/2020 | 04/10/2020 | 04/09/2020 | 04/13/2020 | 4/15/2020 |

**OFFICIAL RECORD COPY**

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

| | |
|---|---|
| Docket Number: | 05000483 |
| License Number: | NPF-30 |
| Report Number: | 05000483/2020011 |
| Enterprise Identifier: | I-2020-011-0012 |
| Licensee: | Ameren Missouri |
| Facility: | Callaway Plant |
| Location: | Steedman, MO |
| Inspection Dates: | March 2, 2020 to March 20, 2020 |
| Inspectors: | J. Braisted, Reactor Inspector<br>G. Callaway, Senior Reactor Technology Instructor<br>S. Gardner, Contractor<br>G. George, Senior Reactor Inspector, Team Lead<br>S. Makor, Reactor Inspector<br>M. Yeminy, Contractor |
| Approved By: | Vincent G. Gaddy, Chief<br>Engineering Branch 1<br>Division of Reactor Safety |

Enclosure

## SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a design basis assurance inspection (teams) inspection at Callaway Plant, in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to https://www.nrc.gov/reactors/operating/oversight.html for more information.

### List of Findings and Violations

| Failure to evaluate Class 1E 4160 VAC (NB) System Train A for (a)(1) Status in Maintenance Rule | | | |
|---|---|---|---|
| Cornerstone | Significance | Cross-Cutting Aspect | Report Section |
| Mitigating Systems | Green<br>NCV 05000483/2020011-01<br>Open/Closed | [H.8] - Procedure Adherence | 71111.21M |
| The inspectors identified a Green non-cited violation of 10 CFR 50.65 (a)(1), for failure to evaluate a maintenance preventable functional failure of Class 1E 4160 Vac system for 10 CFR 50.65 (a)(1) status following the failure of breaker NB0101. | | | |

| Failure to Use Appropriate Design Pressure Inputs for Diesel Generator Room and Essential Service Water Pumphouse HVAC System | | | |
|---|---|---|---|
| Cornerstone | Significance | Cross-Cutting Aspect | Report Section |
| Mitigating Systems | Green<br>NCV 05000483/2020011-02<br>Open/Closed | None (NPP) | 71111.21M |
| The inspectors identified a Green non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," for the failure of the licensee to specify design inputs for design pressures of the emergency diesel generator and essential service water pumphouse ventilation ducts that are required to withstand the negative pressure caused by the fan when its suction path is blocked by a tornado damper. | | | |

### Additional Tracking Items

None.

## 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. Starting on March 20, 2020, in response to the National Emergency declared by the President of the United States on the public health risks of the coronavirus (COVID-19), regional inspectors were directed to begin teleworking. The inspection documented below was determined that the objectives and requirements stated in the IP could be completed remotely.

## REACTOR SAFETY

71111.21M - Design Bases Assurance Inspection (Teams)

The inspectors evaluated the following components and listed applicable attributes, permanent modifications, and operating experience:

Design Review - Risk-Significant/Low Design Margin Components (IP Section 02.02) (6 Samples 1 Partial)

From March 2, 2020, to March 20, 2020, the team inspected the following components and listed applicable attributes.

(1) 480 V Bus NG02

- Component walkdown and visual inspection was performed to assess the material condition and configuration
- Maintenance and testing procedures and performance history was reviewed to assure consistency with vendor and industry recommendations
- Design bases documents, updated safety analysis report, technical specifications and bases to assure licensing bases match component capabilities
- Component maintenance history and corrective action program reports to verify the monitoring of potential degradation
- Calculations for electrical distribution, system load flow, voltage drop, short-circuit, and electrical protection to verify that bus capacity and voltages remained within minimum acceptable limits

(2) 4.16 KV Bus NB02

- Component maintenance history and corrective action program reports to verify the monitoring for potential degradation
- Short circuit calculation to determine adequacy of design
- Procedures for circuit breaker inspection and testing to compare maintenance practices against industry and vendor guidance

- Calculations for DC control voltage to meet acceptance criteria for new Square D breakers
- Breaker tracking for maintenance history by serial number

(3) 480 V Motor Control Center, NG03C

- Component walkdown and vendor document review to verify installed configuration, specifications and acceptance criteria and design bases functions
- Procedures for circuit breaker inspection and testing to compare maintenance practices against industry standards and vendor guidance
- Maintenance and testing procedures and performance history was reviewed to assure consistency with vendor and industry recommendations
- Design bases documents, updated safety analysis report, technical specifications and bases to assure licensing bases match component capabilities

(4) Motor Driven Auxiliary Feedwater Pump A, PAL01A

- Pump inservice testing plan which established the test intervals and parameters to be measured to meet ASME Code requirements
- Results of comprehensive and quarterly motor driven auxiliary feedwater pump testing
- Calculations for auxiliary feedwater pump available net positive suction head and suction pressure setpoints for suction source swapover
- Flow models of the auxiliary feedwater system during normal operating conditions or postulated scenarios
- Design bases document and piping and instrumentation diagram for the auxiliary feedwater system.
- Vendor manuals for the motor driven auxiliary feedwater pump
- Corrective action documents to verify the monitoring of potential degradation

(5) Diesel Generator Supply Fan, CGM01A

- Component walkdown and vendor document review to verify installed configuration, specifications and acceptance criteria, and design bases functions
- Fan and duct design drawing, vendor specifications, pressure curves, flow calculations and structural integrity calculations
- Emergency room heating and ventilation calculations
- Protection against external events (seismic and tornado)
- Setpoints and instrument uncertainty of recirculation damper system operating instrumentation and controls
- Normal and emergency operating procedures
- Maintenance effectiveness

(6) Load Shed and Sequencing Train B, NF039B

- Validate qualification and seismic requirements
- Control logic for capacitor bank permissives
- Procedures for response time testing to determine consistency between design bases, calculations, and testing acceptance criteria
- Effect of charging times of new Square D breakers on sequencing interval

(7) Evaluation of Operator Procedures and Actions Related to Components

1. Control room operator actions resulting from a simulated steam generator tube rupture (SGTR) with a stuck open atmospheric steam dump (ASD). Verify the following actions are performed within the required completion times in accordance with the FSAR:
    a. Close block valve to failed open ASD 20 minutes after the ASD opens
    b. Isolate the failed train to the control room HVAC filtration system in 30 minutes from event initiation
    c. Initiate a reactor coolant system (RCS) cooldown in 40 minutes from event initiation
    d. Complete the RCS cooldown in 56 minutes from event initiation
    e. Complete the RCS depressurization in 60 minutes from event initiation
    f. Terminate safety injection (SI) in 5 minutes after the depressurization is completed
    g. Equalize RCS and ruptured steam generator pressures in 15 minutes after SI termination
2. Control room operator actions resulting from a simulated feedwater line break to the steam generators between the feedwater isolation valve and the check valve. Verify the resulting internal flooding is isolated in 30 minutes from event initiation.
3. Control room operator actions resulting from a simulated loss of secondary heat sink. Verify that the crew re-establishes main feedwater flow prior to the need to initiate bleed and feed cooling of the reactor coolant system.
4. Auxiliary operator actions to locally line up the hardened condensate storage tank (HCST) to the non-safety auxiliary feedwater pump within 20 minutes of task assignment.

Design Review - Large Early Release Frequency (LERFs) (IP Section 02.02) (1 Sample)

From March 2, 2020, to March 20, 2020, the team inspected the following large-early-release-frequency component.

(1) Residual Heat Removal Pumps to Reactor Coolant System Cold Leg Loops Check Valves, EP8818 A, B, C, D

- Valve inservice testing plan which established the test intervals and parameters to be measured to meet ASME Code requirements
- Results of inservice testing of full stroke open capability and seat leakage rate (valve closure)
- Results of instrument calibrations for seat leakage rate testing.
- Design bases document and piping and instrumentation diagram for the emergency core cooling system
- Vendor manuals for the residual heat removal pumps to reactor coolant system cold leg loops check valves
- Corrective action documents to verify the monitoring of potential degradation

Modification Review - Permanent Mods (IP Section 02.03) (4 Samples)

From March 2, 2020, to March 20, 2020, the team inspected the following permanent modifications.

(1) MP 13-0002, "Replace EDG Supply Fans CGM01 A and B"
(2) MP 16-0027, "Approval of Remanufactured ESFAS and LSELS Circuit Boards"
(3) MP 17-0006, "ESW Water Hammer Mitigation Modification"
(4) MP 18-0019, "NG02BER2-Replace SR 480 VAC MCC Buckets"

Review of Operating Experience Issues (IP Section 02.06) (3 Samples)

From March 2, 2020, to March 20, 2020, the team inspected the following operating experience issues.

(1) Callaway OpE 201801880, "OE Received from Comanche Peak Station Electric Station Related to Component Cooling Water System Cross Tie Valves"
(2) Callaway OpE 20190019, "Ametek Solid State Controls Part 21"
(3) NRC Operating Experience Smart Sample (OpESS) 2019/01, "Commercial Grade Dedication, Procurement, and Design Control"

**INSPECTION RESULTS**

<table>
<tr><td colspan="4">Failure to evaluate Class 1E 4160 VAC (NB) System Train A for (a)(1) Status in Maintenance Rule</td></tr>
<tr><td>Cornerstone</td><td>Significance</td><td>Cross-Cutting Aspect</td><td>Report Section</td></tr>
<tr><td>Mitigating Systems</td><td>Green<br>NCV 05000483/2020011-01<br>Open/Closed</td><td>[H.8] - Procedure Adherence</td><td>71111.21M</td></tr>
<tr><td colspan="4">The inspectors identified a Green non-cited violation of 10 CFR 50.65 (a)(1), for failure to evaluate a maintenance preventable functional failure of Class 1E 4160 Vac system for 10 CFR 50.65 (a)(1) status following the failure of breaker NB0101.</td></tr>
<tr><td colspan="4">Description: The functions of the breakers of the Class 1E 4160 Vac system, in addition to providing circuit protection, are to shed load by demand from the control room or engineered safety features actuation system and load shedder and emergency load sequencer (LSELS).<br><br>The Ameren maintenance rule program procedures outline the requirements and responsibilities for compliance with Paragraphs (a)(1), (a)(2), and (a)(3) of 10 CFR 50.65, Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. These maintenance rule procedures consist of EDP-ZZ-001128, Revision 28, “Maintenance Rule Program”; EDP-ZZ-001128 Appendix 2, Revision 36, “Summary of SSC Performance Criteria”; EDP-ZZ-001128 Appendix 4, Revision 22, “Maintenance Rule System Functions”; and APA-ZZ-0500, Appendix 5, Revision 30, “Maintenance Rule.” These procedures identify the applicable structures, systems, and components to which 10 CFR 50.65 applies, their performance criteria, the thresholds for meeting their performance criteria, and requirements in the event the criteria are not met.</td></tr>
</table>

On March 21, 2019, a control room hand switch malfunction created an electrical short around the trip coil circuit of Class 1E 4160 Vac breaker NB0101, which resulted in the unavailability of the load shed function for the residual heat removal pump motor. On August 26, 2019, the maintenance rule expert panel determined that the failure of breaker NB0101 was a maintenance preventable functional failure. It was considered to be a maintenance preventable functional failure of the residual heat removal system, load shedder, and emergency load shed sequencer system, the 13.8 kV system, and the Class 1E 4160 Vac system. In accordance with EDP-ZZ-01128 Appendix 4, Revision 22, "Maintenance Rule System Functions", the maintenance rule expert panel determined that maintenance rule criteria, NB-03, *Provides protective features for Class 1E busses, which includes the isolation of certain Non-Safety Related loads from the Safety Related bus in the event of an SIS,* was not met. According to EDP-ZZ-001128, Appendix 2, Revision 36, the 4160 Vac system A train performance criteria NB-03 has a threshold of "0" maintenance preventable functional failures per rolling 18 months.

Procedure EDP-ZZ-001128, Revision 28, "Maintenance Rule Program", step 4.5.3(b) requires, when a structure, system, or component's performance criterion has not been met or repetitive maintenance preventable function failures are identified, initiate a condition report in accordance with APA-ZZ-00500, "Corrective Action Program**."** Procedure APA-ZZ-00500, Appendix 5, Revision 30, step 4.1.2, requires that a 10 CFR 50.65 (a)(1) evaluation be completed within 60 days of the initiation of this condition report. Contrary to this, on August 26, 2019, no condition report was initiated following the expert panel determination of the maintenance preventable functional failure on the Class 1E 4160 Vac system A train. Consequently, no 10 CFR 50.65 (a)(1) evaluation was initiated or completed within 60 days.

Corrective Actions: On March 19, 2020, a 10 CFR 50.65 (a)(1) evaluation was completed under CR 202001216. It was determined that the Class 1E 4160 Vac system was to be moved to 10 CFR 50.65 (a)(1) status and performance goals and monitoring criteria were identified.

Corrective Action References: Condition Report 202001216-001

Performance Assessment:

Performance Deficiency: The failure to initiate a condition report and complete a 10 CFR 50.65(a)(1) evaluation in accordance with EDP-ZZ-001128, "Maintenance Rule Program," was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the equipment performance attribute of the Mitigating Systems Cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, similar to Example 8.g of Manual Chapter 0612 Appendix E, "Examples of Minor Issues," the inspectors determined that the significance was more than minor because the Mitigating Systems Cornerstone objectives were adversely affected because, when the Maintenance Rule functional failure was considered, performance indicates that the SSC was not being effectively controlled through appropriate preventive maintenance and that the SSC was not moved to 10 CFR 50.65(a)(1).

Significance: The inspectors assessed the significance of the finding using Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." Using Exhibit 2, "Mitigating

Systems Screening Questions," the inspectors determined the finding to be of very low safety significance (Green) because the finding affected the qualification of a mitigating SSC and did not affect its operability or PRA functionality.

Cross-Cutting Aspect: H.8 - Procedure Adherence: Individuals follow processes, procedures, and work instructions. This finding had a human performance cross-cutting aspect, associated with procedure adherence, because individuals failed to follow maintenance rule processes and procedures.

Enforcement:

Violation: Title 10 CFR Part 50.65 (a)(1) requires each holder of an operating license for a nuclear power plant shall monitor the performance or condition of structures, systems, or components, against licensee-established goals, in a manner sufficient to provide reasonable assurance that these structures, systems, and components are capable of fulfilling their intended functions. These goals shall be established commensurate with safety and, where practical, take into account industry wide operating experience. When the performance or condition of a structure, system, or component does not meet established goals, appropriate corrective action shall be taken.

Contrary to the above, from August 26, 2019, to March 19, 2020, the licensee failed to monitor the performance or condition of structures, systems, or components, against licensee-established goals, in a manner sufficient to provide reasonable assurance that these structures, systems, and components are capable of fulfilling their intended functions. When the performance did not meet established goals, appropriate action was not taken. Specifically, the licensee failed to evaluate the Class 1E 4160 Vac system for 10 CFR 50.65 (a)(1) status, when the performance criteria of "0" maintenance preventable functional failures per rolling 18-month period was not met. Additionally, the licensee did not take any corrective action to ensure the Class 1E 4160 Vac bus would be capable of meeting their intended functions.

Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

Failure to Use Appropriate Design Pressure Inputs for Diesel Generator Room and Essential Service Water Pumphouse HVAC System

| Cornerstone | Significance | Cross-Cutting Aspect | Report Section |
|---|---|---|---|
| Mitigating Systems | Green<br>NCV 05000483/2020011-02<br>Open/Closed | None (NPP) | 71111.21M |

The inspectors identified a Green non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," for the failure of the licensee to specify design inputs for design pressures of the emergency diesel generator and essential service water pumphouse ventilation ducts that are designed to withstand the negative pressure caused by the fan when its suction path is blocked by a tornado damper.

Description: Each emergency diesel generator room is equipped with an inlet duct, connecting the outside air source for room ventilation and combustion air. The system design incorporates a recirculation damper designed to protect the room temperature from overcooling in case the outside air temperature is very low. The recirculation damper

modulates its opening and closing based on emergency diesel generator room temperature; thus, providing part of the 120,000 CFM flow rate from inside the room, such that the volumetric flow rate from the cold environment is greatly reduced. When the room temperature reaches 101 °F, the inlet duct supply fan operates to provide additional air flow for cooling the emergency diesel generator room. However, when the emergency diesel generator room temperature reaches 103 °F, the recirculation damper closes to maximize the air flow rate from outdoors in order to maximize cooling.

The system is also equipped with a tornado damper designed to shut at the onset of a reverse flow, because of low ambient air pressure caused by a tornado. The tornado damper reopens when the tornado event passes. The tornado damper is designed to seal the air inlet opening, thereby shutting air flow to the supply fan. The closing of the tornado damper is not accompanied with logic to stop operation of the fan. When the tornado damper closes, the fan will continue to operate at full angular speed attempting to provide 120,000 CFM to the room. Therefore, in a design basis tornado event that causes a corresponding loss of offsite power with emergency diesel generators running, there is a potential condition where little to no air will flow to the fan, while operating, when the tornado damper is fully closed coincident with a mostly closed recirculation damper because of elevated room temperature while the diesel generators are running.

The fan's design curve shows that the fan can create a negative pressure of -6.8 inches of water in the duct while operating with no air flow. The inlet duct design documents show that the duct was built to withstand a negative pressure of only -3.75 inches of water. Therefore, during the postulated design basis conditions, the negative pressure created by the fan can exceed the documented duct design pressure, causing the duct to potentially implode. When the tornado damper then opens, the reduced area duct would potentially limit the suction flowrate below the design flowrate necessary to maintain the emergency diesel generator room at operable temperatures. This condition affected both emergency diesel generator rooms.

Following the discovery of emergency diesel generator room issue, the licensee determined that the essential service water pumphouse ventilation system is subjected to the same condition, where the inlet fan suction can draw pressure of -6.4 inches of water, while the ventilation duct is designed to withstand a documented maximum pressure of -3.75 inches of water. Therefore, under postulated design conditions, the duct would potentially implode and limit the flowrate below the required flowrate which provides cooling air to maintain the essential service water pumphouse at operable temperatures.

After discovery of the issues, the licensee performed a prompt operability determination because there was no information or analysis available to ensure that the ventilation ducts would maintain structural integrity to support emergency diesel generator operability. The licensee contracted an engineering firm to analyze the strength of the ventilation ducts and their ability to resist collapse at internal pressures greater than its design value of -3.75 inches of water. The analysis evaluated an internal pressure on the inlet duct of -7 inches of water using the ANSYS Version 19.2 Finite Element Analysis software. The analysis illustrated that minor yielding would occur in localized regions near the bottom of the duct at a ninety-degree bend near the inlet to the fan; however, the yielding was very small at 0.00025 in/in. This is below the 0.19 in/in strain necessary to cause a failure. Therefore, the emergency diesel generators and essential service water system remain operable.

The Callaway Operating Quality Assurance Manual states that Ameren Missouri complies with the recommendations of NRC Regulatory Guide 1.64, Revision 2. NRC Regulatory Guide 1.64 endorses ANSI 45.2.11-1974, “Quality Assurance Requirements for the Design of Nuclear Power Plants,” as acceptable method to comply with the quality assurance requirements of Title 10 CFR Part 50. ANSI 45.2.11-1974, Section 3.1, “Design Requirements,” states, “The design input shall be specified on a timely basis and to the level of detail necessary to permit the design activity to be carried out in a correct manner and to provide a consistent basis for making design decisions, accomplishing design verification measures, and evaluating design changes.” The inspectors determined that Callaway failed to specify design inputs for design pressures of the emergency diesel generator and essential service water pumphouse ventilation ducts to provide a consistent basis for making design decisions, accomplishing design verification measures, and evaluating design changes.

Corrective Actions: After discovery of the issues, the licensee performed a prompt operability determination because there was no information or analysis available to ensure that the ventilation ducts would maintain structural integrity to support emergency diesel generator operability.

Corrective Action References: Condition Reports 202001566 and 202001602

Performance Assessment:

Performance Deficiency: The inspectors determined that the failure to specify design inputs for design pressures of the emergency diesel generator and essential service water pumphouse ventilation ducts, in accordance with ANSI N45.2.11-1974, was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the design control attribute of the Mitigating Systems Cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, similar to example 3.e in Manual Chapter 0612, Appendix E, "Example of Minor Issues," in order to justify the as-found condition, the licensee had to revise calculations in order to establish operability and functionality of the ventilation ducts as-found conditions.

Significance: The inspectors assessed the significance of the finding using Appendix A, “The Significance Determination Process (SDP) for Findings At-Power.” Using Exhibit 2, “Mitigating Systems Screening Questions,” the inspectors determined the finding to be of very low safety significance (Green) because the finding affected the qualification of a mitigating SSC and did not affect its operability or PRA functionality.

Cross-Cutting Aspect: Not Present Performance. No cross cutting aspect was assigned to this finding because the inspectors determined the finding did not reflect present licensee performance.

Enforcement:

Violation: Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," states, "Measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions."

Contrary to the above, since December 19, 1984, to March 20, 2020, the licensee failed to assure that applicable regulatory requirements and the design basis for emergency diesel generator and essential service water pumphouse ventilation systems were correctly translated into specifications. Specifically, the licensee failed to specify design inputs for design pressures of the emergency diesel generator and essential service water pumphouse ventilation ducts in accordance with ANSI N45.2.11-1974, "Quality Assurance Requirements for the Design of Nuclear Power Plants."

Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

**EXIT MEETINGS AND DEBRIEFS**

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

- On March 20, 2020, the inspectors presented the design bases assurance inspection (teams) inspection results to Mr. F. Diya, Senior Vice President and Chief Nuclear Officer, and other members of the licensee staff.
- On March 31, 2020, the inspectors presented the design bases assurance inspection (teams) inspection results to Mr. B. Cox, Site Vice President, and other members of the licensee staff.

**DOCUMENTS REVIEWED**

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|---|---|---|---|---|
| 71111.21M | Calculations | 13000678.940 | Diesel Generator Ventilation Supply Fan Flow Determined by Velocty Pressure | 0 |
| 71111.21M | Calculations | 7001280 | Pipe Stress Analysis of ESW Supply Piping | 0 |
| 71111.21M | Calculations | 81402-J-001 | HCST Supply Valve ALHV0220 Opening Setpoint | 0 |
| 71111.21M | Calculations | AL-22 | Aux Feedwater Pumps Suction Pressure Setpoints | 3 |
| 71111.21M | Calculations | AL-24 | Determine the Effect of Dissolved Nitrogen on the NPSHa for AL Pumps. Determine the Effect on Available NPSH for the Aux Feedwater Pumps. | 0 |
| 71111.21M | Calculations | AL-29 | Auxiliary Feedwater System Performance During Feedline Break | 3 |
| 71111.21M | Calculations | AL-30 | Auxiliary Feedwater System Performance During a Loss of Normal Feedwater Flow and Loss of Non-Emergency A/C Power | 6 |
| 71111.21M | Calculations | AL-56 | Loop Tolerance Calculation for ALP-0037, 38, & 39 | 0 |
| 71111.21M | Calculations | ARC-1590 | EDG Suction Plenum Analysis | 1 |
| 71111.21M | Calculations | ARC-595 | Aux. Feedwater Flow Model | 0 |
| 71111.21M | Calculations | B-10 | Voltage Drop in MCC Control Circuits | 3 |
| 71111.21M | Calculations | Callaway Human Reliability Analysis Attachment F | HRA Calculator output for Post-Initiator HFES | 4 |
| 71111.21M | Calculations | E-B-09 | DC Control Circuits Voltage Drops | 1 |
| 71111.21M | Calculations | E-B-10 | MCC Control Circuit Voltage Drop Calculation for MP 18-0003 | 3 |
| 71111.21M | Calculations | FAI/18-0349, | Callaway ESW Water Hammer Mitigation Modification Support Analysis | 1 |
| 71111.21M | Calculations | GM-03 | EDG Room Temperature Without HVAC | 3 |
| 71111.21M | Calculations | H-9 | Systems NG/PG Protective Relay Settings | 3 |
| 71111.21M | Calculations | M-EG-24 | CCW Nuclear Aux. Component Train Switchover Single Failure Analysis | 0 |
| 71111.21M | Calculations | M-FL-13 | Auxiliary Building Flooding: Calculate the Maximum Flood Level in Auxiliary Building Rooms 1304, 1305, 1324, 1325, | 1 |

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|---|---|---|---|---|
| | | | 1326, 1327, 1328, 1329, 1330, and 1331 due to a Pipe Break or Crack | |
| 71111.21M | Calculations | M-GM-320 | Emergency Diesel Generator Building HVAC | 1 |
| 71111.21M | Calculations | NAI-1560-001 | HELB in the Callaway Auxiliary Building with Additional Openings | 3 |
| 71111.21M | Calculations | NG-22 | NG Load Center Overcurrent Setpoint Calculation1 | 1 |
| 71111.21M | Calculations | NG-23 | MCC Set Point Calculation for MP 18-0003 | 0 |
| 71111.21M | Calculations | NK-10 | NK System DC Voltage Drop | 2 |
| 71111.21M | Calculations | ZZ-145 | Short Circuit Calculation | 2 |
| 71111.21M | Calculations | ZZ-561 | Open Phase Fault Study for Callaway Energy Center | 0 |
| 71111.21M | Calculations | ZZ-62 | Plant Load Flow Calculation | 10 |
| 71111.21M | Corrective Action Documents | Condition Report | 201606143, 201703700, 201703962, 201703981, 201703992, 201705506, 201705509, 201705513, 201705514, 201801880, 201805948, 201800047, 201605682, 201703961, 201707011, 201707076. 201806177, 201900377, 201903601, 201701331, 201801897, 201803497, 201803907, 201906494, 200700040, 201901697, 201706449, 200711067, 201702850, 201703342, 201703699, 201802482 | |
| 71111.21M | Corrective Action Documents Resulting from Inspection | Condition Reports | 202001172, 202001211, 202001216, 202001220, 202001256, 202001563, 202001566, 202001602 | |
| 71111.21M | Drawings | E-017-00004 | AKD-6 Powermaster Indoor Unit Substation | 19 |
| 71111.21M | Drawings | E-018-00010 | Motor Control Center Layout | 30 |
| 71111.21M | Drawings | E-018-00011 | Motor Control Center Layout | 29 |
| 71111.21M | Drawings | E-1041A-00714 | Replacement MCC Cubicles | 0 |
| 71111.21M | Drawings | E-1041A-00753 | Replacement MCC Cubicles | 0 |
| 71111.21M | Drawings | E-1044-0014 | XNB02 LTC Wiring Schematic | 4 |
| 71111.21M | Drawings | E-1044-0019 | XNB02 DC Wiring Schematic | 1 |
| 71111.21M | Drawings | E-1044-0029 | XNB01 DC Wiring Schematic | 1 |
| 71111.21M | Drawings | E-1052-0001 | Control Diagram for 5GSB3, 15GSB3 and 15GSB4 Medium Voltage 1200A, 2000A, 3000A Circuit Breakers | 0 |

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|---|---|---|---|---|
| 71111.21M | Drawings | E-21001 | Main Single Line Diagram | 26 |
| 71111.21M | Drawings | E-21NB02 | Lower Medium Voltage System Class 1E 4.16KV Single Line Meter and Relay Diagram | 17 |
| 71111.21M | Drawings | E-21NG01 | Low Voltage System Class 1E 480V. Single Line Meter & Relay Diagram | 28 |
| 71111.21M | Drawings | E-21NG02 | Low Voltage System Class 1E 480V Single Line Meter & Relay Diagram | 35 |
| 71111.21M | Drawings | E-22NF01 | Load Shedding And emergency Load Sequencing Logic | 8 |
| 71111.21M | Drawings | E-23EG01C | Schematic Component Cooling Water Pump B | 7 |
| 71111.21M | Drawings | E-23EG01C | Schematic Component Cooling Water Pump B | 9 |
| 71111.21M | Drawings | E-23EG07 | Schematic Diagram Component Cooling Water Supply to RHR Heat Exchanger | 16 |
| 71111.21M | Drawings | E-23EG07 | Schematic Diagram Component Cooling Water Supply to RHR Heat Exchanger | 15 |
| 71111.21M | Drawings | E-23EG07 | Schematic Diagram Component Cooling Water Supply to RHR Heat Exchanger | 14 |
| 71111.21M | Drawings | E-23EJ01 | Schematic Residual Heat Removal Pumps | 8 |
| 71111.21M | Drawings | E-23EJ04A | Schematic Diagram RHR Pump 1 to Charging Pump Valve | 11 |
| 71111.21M | Drawings | E-23NB16 | ESF Transformers Auxiliary Power and Control Schematic | 11 |
| 71111.21M | Drawings | E-23NB18A | NB04 Capacitor Step 1 Control Schematic | 3 |
| 71111.21M | Drawings | E-23NE13(Q) | Schematic Diesel Generator KKJ01B Exciter/Voltage Control | 014 |
| 71111.21M | Drawings | E-23NG01 | Low Voltage System Class 1E 480 V Three Line Meter and Relay Diagram | 5 |
| 71111.21M | Drawings | J-22GM01B(Q) | Diesel Generator Building HVAC Exhaust Dampers | 0 |
| 71111.21M | Drawings | M-2014-00003 | Size 6 Class 1690 CF8M Swing Check Clear Waterway | 1 |
| 71111.21M | Drawings | M-22AL01(Q) | Auxiliary Feedwater System | 50 |
| 71111.21M | Drawings | M-22AP01 | Condensate Storage and Transfer System | 31 |
| 71111.21M | Drawings | M-22EF02(Q) | Essential Service Water System | 78 |
| 71111.21M | Drawings | M-22EG01(Q), M-22EG02(Q), M-22EG03(Q) | Component Cooling Water System | 11 |
| 71111.21M | Drawings | M-22EJ01(Q) | Residual Heat Removal System | 62 |
| 71111.21M | Drawings | M-22EM01(Q) | High Pressure Coolant Injection System | 39 |

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|---|---|---|---|---|
| 71111.21M | Drawings | M-22EP01(Q) | Accumulator Safety Injection | 18 |
| 71111.21M | Drawings | M-22GM01(Q) | P&ID Diesel Generator Building | 4 |
| 71111.21M | Drawings | M-2H5211(Q) | HVAC Diesel Generator Building Plan and Sections | 4 |
| 71111.21M | Drawings | M-924-00001 | Drawing for Vaneaxial Fan | 0 |
| 71111.21M | Engineering Changes | MP 07-0070 | Replace Safety-Related and Non-Safety Metal-Clad Breakers | 000.7 |
| 71111.21M | Engineering Changes | MP 13-0002 | Replace EDG Supply Fans CGM01A & B | 3 |
| 71111.21M | Engineering Changes | MP 16-0027 | Approval of Remanufactured ESFAS and LSELS Circuit Boards | 2 |
| 71111.21M | Engineering Changes | MP 17-0006 | ESW Water Hammer Mitigation Modification | 2 |
| 71111.21M | Engineering Changes | MP 18-0003 | Replace Safety Related 480VAC MCC BUckets | 0 |
| 71111.21M | Engineering Changes | MP 18-0019 | NG02BER2 - Replace Safety Related 480 VAC MCC Buckets | 0 |
| 71111.21M | Engineering Changes | MP 19-0113 | ESW Water Hammer Mitigation Phase 2 | 0 |
| 71111.21M | Engineering Evaluations | C-04A05S | Floor Response Spectra for Standardized Nuclear Unit Power Plant System | 1 |
| 71111.21M | Engineering Evaluations | E170.0102 | Approval of ABC Fire Extinguishers on Carts | 07/02/1997 |
| 71111.21M | Engineering Evaluations | RFR 21816 | Determine Impact on M-AL-16 for N2 and Low AL Flow | A |
| 71111.21M | Engineering Evaluations | STRIDE 18-03 | Integrated Engineered Safety Features Actuation System (ESFAS) Testing | 0 |
| 71111.21M | Miscellaneous | | Inservice Testing Program | 33 |
| 71111.21M | Miscellaneous | 10466-M-627A-0149-02 | Test Report For Tornado Dampers | 1 |
| 71111.21M | Miscellaneous | 3857-RPT-003 | Required Response Spectra for Seismic Qualification of Replacement I&C Electronics for Callaway Plant | 0 |
| 71111.21M | Miscellaneous | BLUE 2066 | Category C Justification of Class IE Equipment | 03/05/1986 |
| 71111.21M | Miscellaneous | C-04A05B | Floor Response Spectra for Standardized Nuclear Unit Power Plant System (SNUPPS) | 1 |

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|---|---|---|---|---|
| 71111.21M | Miscellaneous | E-017-00397 | IM Load Center Unit Substations | 28 |
| 71111.21M | Miscellaneous | E-1052-00031 | Instruction Manual for 5GSB3-350-1200/2000 Medium Voltage Circuit Breakers | 000 |
| 71111.21M | Miscellaneous | E-mail | E-mail DRS to Callaway regarding seismic failures | 03/05/2020 |
| 71111.21M | Miscellaneous | J-104-00594 | Seismic Test Report for Callaway and Wolf Creek Modules | B |
| 71111.21M | Miscellaneous | J-104-00602 | Acceptance Test Procedure for Isolation Module 6N234-1 | 0 |
| 71111.21M | Miscellaneous | J-104-0151-03 | Quality Conformance Test Procedure #6N234 | A |
| 71111.21M | Miscellaneous | J-104-271-07 | Environmental Qualification Report for ESFAS and LSELS | F |
| 71111.21M | Miscellaneous | J-104-271-07 | Environmental Qualification Report for ESFAS and LSELS | C |
| 71111.21M | Miscellaneous | Letter | Letter from Archon Engineering PC to AmerenUE, EDG Suction Plenum Preliminary Results | 03/20/2020 |
| 71111.21M | Miscellaneous | M-105A | Design Specification for the Shop Fabricated Tanks (ASME III) for the SNUPPS | 10 |
| 71111.21M | Miscellaneous | M-1205 | Design Specification for ASME Section III Class 3 Stainless Steel Air Accumulators | 0 |
| 71111.21M | Miscellaneous | M-627A | Specification for Dampers | 16 |
| 71111.21M | Miscellaneous | M-924 | Specification for Safety Related Fans | 0 |
| 71111.21M | Miscellaneous | M-924-00025 | Instruction Manual for 150 HP Fan Motor Data Package | 0 |
| 71111.21M | Miscellaneous | M-924-00026 | Instruction Manual for VOLU Probe and Dwyer Gauge | 0 |
| 71111.21M | Miscellaneous | Performance Monitoring | Circuit Breakers | 03/03/2020 |
| 71111.21M | Miscellaneous | SSA-201900029-054 | Design Basis Assurance Self Assessment | 1 |
| 71111.21M | Miscellaneous | System Health Report - NB | Low Med Vlt Sys 1E | 02/24/2020 |
| 71111.21M | Miscellaneous | System Health Report - NF | LSELS | 02/24/2020 |
| 71111.21M | Miscellaneous | TRRQ 201700343 | Lesson Learned for Incorporation into ESP Training Program | 05/03/2018 |
| 71111.21M | Miscellaneous | ULDBD-AL-001 | Auxiliary Feedwater System | 6 |
| 71111.21M | Miscellaneous | ULDBD-Class 1E-001 | Class 1E Design | 0 |
| 71111.21M | Miscellaneous | ULDBD-CLASS 1E-001 | Class 1E Design | 0 |

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|---|---|---|---|---|
| 71111.21M | Miscellaneous | ULDBD-ECCS-001 | Emergency Core Cooling System | 1 |
| 71111.21M | Miscellaneous | ULDBD-EG-001 | Component Cooling Water | 1 |
| 71111.21M | Miscellaneous | ULDBD-GM-001 | Diesel Generator Building HVAC System | 1 |
| 71111.21M | Miscellaneous | ULDBD-NB-001 | Lower Medium Voltage (Class 1E 4.16 KV) | 1 |
| 71111.21M | Miscellaneous | ULDBD-NF-001 | Load Shedding and Emergency Load Sequencing | 2 |
| 71111.21M | Miscellaneous | ULDBD-NG-001 | Low Voltage (480V) - Class 1E | 2 |
| 71111.21M | Procedures | 1046-M-627A-0081-01 | American Warming and Ventilating Test Procedure for Tornado Dampers | 03/16/1978 |
| 71111.21M | Procedures | 14005614.500 | Determine Leak By of EAV0185 Per Post Change Test Plan | 1 |
| 71111.21M | Procedures | APA-ZZ-00322 Appendix B | Work Week Schedule and Execution | 56 |
| 71111.21M | Procedures | APA-ZZ-00323 | Configuration Management Process | 12 |
| 71111.21M | Procedures | APA-ZZ-00356 | Pump and Valve Inservice Test Program | 25 |
| 71111.21M | Procedures | APA-ZZ-00390 | Environmental and Seismic Qualification of Safety-Related Equipment | 30 |
| 71111.21M | Procedures | APA-ZZ-00395 | Significant Operator Response Timing | 31 |
| 71111.21M | Procedures | APA-ZZ-00500 Appendix 5 | Maintenance Rule | 30 |
| 71111.21M | Procedures | E-0 | Reactor Trip or Safety Injection | 25 |
| 71111.21M | Procedures | E-3 | Steam Generator Tube Rupture | 24 |
| 71111.21M | Procedures | EC Supp Guide | Emergency Coordinator Supplemental Guideline | 24 |
| 71111.21M | Procedures | EDP-ZZ-01122 | Check Valve Predictive Performance Manual | 11 |
| 71111.21M | Procedures | EDP-ZZ-01128 Appendix 1 | SSCS in the Scope of the Maintenance Rule at Callaway | 11 |
| 71111.21M | Procedures | EDP-ZZ-01128 | Maintenance Rule Program | 28 |
| 71111.21M | Procedures | EDP-ZZ-01128 Appendix 2 | Summary of SSC Performance Criteria | 36 |
| 71111.21M | Procedures | EDP-ZZ-01128 Appendix 4 | Maintenance Rule System Functions | 22 |
| 71111.21M | Procedures | EDP-ZZ-04015 | Evaluating and Processing Requests for Resolution | 70 |
| 71111.21M | Procedures | EDP-ZZ-04600 | Engineering Change Control | 3 |

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|---|---|---|---|---|
| 71111.21M | Procedures | Emergency Operating Procedure Addendum 30 | Establishing Main Feedwater Flow | 9 |
| 71111.21M | Procedures | ETP-ZZ-01331 | Crane Nuclear Diagnostic System for Testing Check Valves | 4 |
| 71111.21M | Procedures | FR-H.1 | Response to Loss of Secondary Heat Sink | 18 |
| 71111.21M | Procedures | IP-ENG-001 | Standard Design Process | 1 |
| 71111.21M | Procedures | J-104-00593 | Alternate Parts Equivalency Evaluation for 9N39 and 9N40 Assemblies | 0 |
| 71111.21M | Procedures | J-104-00602 | Acceptance Test Procedure for Isolation Module | 0 |
| 71111.21M | Procedures | J-104-0151-C03 | Quality Conformance Test Procedure for Isolation Module | A |
| 71111.21M | Procedures | M-021-00061 | Installation, Operation, Maintenance, Site Storage and Handling Instructions for 4 HMTA-9 Stage Auxiliary Feed Water Pumps | 53 |
| 71111.21M | Procedures | M-619.2-00136 | Instructions Manual for Safety Related Fans | 9 |
| 71111.21M | Procedures | MDP-ZZ-0STOR | Staging and Storage of Materials, Equipment & Tools | 27 |
| 71111.21M | Procedures | MPE-ZZ-QS014 | General Electric 4.16 KV Switchgear PM | 16 |
| 71111.21M | Procedures | MPE-ZZ-QS015 | Square D Magnum Breaker Preventive Maintenance | 11 |
| 71111.21M | Procedures | MPM-ZZ-QH001 | Inspection and Maintenance of Tornado Damper | 5 |
| 71111.21M | Procedures | OSP-AL-P001A | Motor Driven Aux. Feedwater Pump a Inservice Test - Group A | 68 |
| 71111.21M | Procedures | OSP-AL-PV04A | Train A Motor Driven Auxiliary Feedwater Comprehensive Pump and Check Valve Test | 22 |
| 71111.21M | Procedures | OSP-BB-VL006 | RCS Pressure Isolation Valves Inservice Tests-IPTE | 47 |
| 71111.21M | Procedures | OSP-EJ-PV04A | Train A RHR and RCS Check Valve Inservice Test | 18 |
| 71111.21M | Procedures | OSP-NE-0001B | Standby Diesel Generator B Periodic Tests | 67 |
| 71111.21M | Procedures | OSP-SA-0017B | Train B SIS-CSAS Slave Relay Test | 44 |
| 71111.21M | Procedures | OSP-SA-2413B | Train B Diesel Generator and Sequencer Testing | 33 |
| 71111.21M | Procedures | OSP-ZZ-00001 | Control Room Shift and Daily Log Readings and Channel Checks | 92 |
| 71111.21M | Procedures | OTA-RK-00016 Addendum 22B | Voltage Control Freeze | 0 |
| 71111.21M | Procedures | OTN-EF-00001 | ESW Air Accumulator Operation | 1 |

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|---|---|---|---|---|
| 71111.21M | Procedures | OTO-EG-00001 | CCW System Malfunction | 18 |
| 71111.21M | Procedures | OTO-ZZ-00012 | Severe Weather | 44 |
| 71111.21M | Procedures | ZZ-006 | Engineering Design Guide | 32 |
| 71111.21M | Work Orders | Job | 17502728, 19001424, 20500603, 18504744, 17513089, 19511872, 17508987, 14005288, 16506328, 19502282, 19502288, 05516338, 11504156, 12504716, 12509849, 12511442 | |