



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**

**REGION IV  
1600 EAST LAMAR BOULEVARD  
ARLINGTON, TEXAS 76011-4511**

May 10, 2019

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

**SUBJECT: CALLAWAY PLANT – NRC INTEGRATED INSPECTION  
REPORT 05000483/2019001**

Dear Mr. Diya:

On March 31, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Callaway Plant. On March 27, 2019, the NRC inspectors discussed the results of this inspection with Mr. T. Herrmann, Site Vice President, and other members of your staff. The results of this inspection are documented in the enclosed report.

NRC inspectors documented one finding of very low safety significance (Green) in this report. This finding involved a violation of NRC requirements. The inspectors also documented licensee-identified violations which were determined to be of very low safety significance in this report. The NRC is treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2.a of the Enforcement Policy.

If you contest the violations or 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 the 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 the 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 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

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Nicholas H. Taylor, Branch Chief  
Projects Branch B  
Division of Reactor Projects

Docket No. 50-483  
License No. NPF-30

Enclosure:  
Inspection Report 05000483/2019001

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

Docket Number: 05000483

License Number: NPF-30

Report Number: 05000483/2019001

Enterprise Identifier: I-2019-001-0006

Licensee: Union Electric Company

Facility: Callaway Plant

Location: Steedman, MO 65077

Inspection Dates: January 1 to March 31, 2019

Inspectors: D. Bradley, Senior Resident Inspector  
W. Cullum, Reactor Inspector  
S. Janicki, Resident Inspector  
C. Stott, Reactor Inspector

Approved By: Nicholas H. Taylor  
Chief, Projects Branch B  
Division of Reactor Projects

Enclosure

## SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a Quarterly inspection at the 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. NRC and self-revealed findings, violations, and additional items are summarized in the table below. Licensee-identified non-cited violations are documented in report sections: 71111.04 and 71111.12.

### List of Findings and Violations

Failure to Identify a Condition Adverse to Quality When Performing Essential Service Water System Flow Balance Tests			
Cornerstone	Significance	Cross-cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000483/2019001-01 Open/Closed	[H.12] - Avoid Complacency	71111.07T - Fire Protection (Triennial)
The inspectors identified two examples of a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," for failure to identify a condition adverse to quality during past essential service water system flow balance tests.			

### Additional Tracking Items

Type	Issue number	Title	Report Section	Status
LER	05000483/2018-006-00	Inoperability of SSCs Due to Improper Environmental Qualification Classification	71111.04 - Partial Walkdown	Closed

## PLANT STATUS

Callaway began the inspection period at full power. On February 23, 2019, the licensee reduced power to 73 percent for a dropped control rod. On February 25, 2019, the licensee returned to full power after recovering the dropped control rod. On March 31, 2019, the licensee reduced power for the planned refueling outage. The licensee ended the inspection period at approximately 20 percent power.

## 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 performed plant status activities described in IMC 2515 Appendix D, "Plant Status," and conducted routine reviews using IP 71152, "Problem Identification and Resolution." 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.

## REACTOR SAFETY

### 71111.01 - Adverse Weather Protection

#### Impending Severe Weather Sample (IP Section 03.03) (1 Sample)

The inspectors evaluated readiness for impending adverse weather conditions for winter storms on January 11, 2019.

### 71111.04 - Equipment Alignment

#### Partial Walkdown (IP Section 02.01) (3 Samples)

The inspectors evaluated system configurations during partial walkdowns of the following systems/trains:

- (1) Atmospheric steam dump valves and environmental qualification on January 2, 2019
- (2) Centrifugal charging pump train A during the train B equipment outage on February 26, 2019
- (3) Safety injection pump train B during train A equipment outage on March 12, 2019

### 71111.04S - Equipment Alignment

#### Complete Walkdown (IP Section 02.02) (1 Sample)

The inspectors performed a complete walkdown of centrifugal charging pump train A, including boration sources and injection pathways, on January 24, 2019.

## 71111.05Q - Fire Protection

### Quarterly Inspection (IP Section 03.01) (4 Samples)

The inspectors evaluated fire protection program implementation in the following selected areas:

- (1) Auxiliary building 2000' elevation general area, fire area A-8 on February 4, 2019
- (2) North area of auxiliary building 1974' elevation including boric acid tank room train B, boron injection room, and normal charging pump, fire areas A-1, A-3, and A-7 on February 5, 2019
- (3) Essential service water train A pump house and ultimate heat sink cooling tower, 2000' elevation, fire areas UNPH and UNCT on February 13, 2019
- (4) South and east areas of auxiliary building 1974' elevation including boric acid tank room train A, chiller surge tank area, storeroom number 3, and auxiliary condenser recovery and storage tank room, fire areas A-1 and A-3 on February 18, 2019

## 71111.06 - Flood Protection Measures

### Inspection Activities - Internal Flooding (IP Section 02.02a.) (1 Sample)

The inspectors evaluated internal flooding mitigation protections in the ultimate heat sink cooling tower including return to the pond basin on January 14, 2019.

## 71111.07T - Heat Sink Performance

### Triennial Review (IP Section 02.02) (4 Samples)

The inspectors evaluated heat exchanger/sink performance on the following components March 4 through March 7, 2019:

- (1) Component cooling water heat exchanger EEG01B, cooled by essential service water, Section 02.02b
- (2) Component cooling water pump room cooler SGL11A, cooled by essential service water, Section 02.02b
- (3) Residual heat removal heat exchanger EEJ01B, cooled by component cooling water, Section 02.02c
- (4) Containment cooler SGN01A, cooled by essential service water, Section 02.02b

## 71111.11Q - Licensed Operator Regualification Program and Licensed Operator Performance

### Licensed Operator Performance in the Actual Plant/Main Control Room (IP Section 03.01) (1 Sample)

The inspectors observed and evaluated licensed operator performance in the Control Room during:

- (1) Planned work activities including switchyard circuit breakers, air compressors, and surveillance testing on January 28, 2019
- (2) Planned work activities including diesel generator train B surveillance testing on February 6, 2019

### Licensed Operator Regualification Training/Examinations (IP Section 03.02) (1 Sample)

The inspectors observed and evaluated operator performance in the simulator during emergency drills and Mode 2 training on February 21, 2019.

## 71111.12 - Maintenance Effectiveness

### Routine Maintenance Effectiveness Inspection (IP Section 02.01) (2 Samples)

The inspectors evaluated the effectiveness of routine maintenance activities associated with the following equipment and/or safety significant functions:

- (1) Component cooling water heat exchangers on January 2, 2019
- (2) Chemical and volume control system on January 28, 2019

## 71111.13 - Maintenance Risk Assessments and Emergent Work Control

### Risk Assessment and Management Sample (IP Section 03.01) (4 Samples)

The inspectors evaluated the risk assessments for the following planned and emergent work activities:

- (1) Elevated risk actions due to planned safety injection surveillance testing during a switchyard breaker replacement on January 28, 2019
- (2) Elevated risk actions due to unplanned work on the motor-driven auxiliary feedwater pump suction check valve, train A, on January 22, 2019
- (3) Elevated risk actions due to planned work on a component cooling water valve, train A, on February 12, 2019
- (4) Emergent risk actions due to a dropped control rod on February 23, 2019

### 71111.15 - Operability Determinations and Functionality Assessments

#### Sample Selection (IP Section 02.01) (4 Samples)

The inspectors evaluated the following operability determinations and functionality assessments:

- (1) Essential service water and ultimate heat sink pipe supports, Condition Reports 201806277 and 201806521, on January 2, 2019
- (2) P-9 permissive indication light, Condition Report 201900105, on January 14, 2019
- (3) Reactor temperature indication accuracy and setpoints, Condition Reports 201900651 and 201900646, on February 1, 2019
- (4) Essential service water to component cooling water makeup valves, Condition Report 201801880, on March 18, 2019

### 71111.18 - Plant Modifications

#### Temporary Modifications and/or Permanent Modifications (IP Section 03.01 and/or 03.02) (1 Sample)

The inspectors evaluated modification MP 08-016, emergency core cooling system and containment spray vent valves, on March 25, 2019.

### 71111.19 - Post Maintenance Testing

#### Post Maintenance Test Sample (IP Section 03.01) (4 Samples)

The inspectors evaluated the following post maintenance tests:

- (1) Motor-driven auxiliary feedwater pump train B after equipment outage on January 10, 2019
- (2) Component cooling water train A valve EGHV053 after equipment outage on January 15, 2019
- (3) Air compressor train C after equipment outage on February 11, 2019
- (4) Centrifugal charging pump train B after equipment outage on February 26, 2019

### 71111.22 - Surveillance Testing

The inspectors evaluated the following surveillance tests:

#### Containment Isolation Valve (IP Section 03.01) (1 Sample)

Boration isolation valves EM8815 and BGHV8160 on January 14, 2019



In Service Testing (IP Section 03.01) (3 Samples)

- (1) Residual heat removal check valve testing on January 28, 2019
- (2) Containment spray pump B testing on January 29, 2019
- (3) Pressurizer pressure operated relief valve block valve testing on February 14, 2019

Surveillance Testing (IP Section 03.01) (1 Sample)

Instrument air surveillance test on January 7, 2019

71114.06 - Drill Evaluation

Drill and/or Simulator-Based Licensed Operator Requalification Training (IP Section 02.01) (1 Sample)

The inspectors evaluated emergency response training, Team 5, on February 28, 2019.

**OTHER ACTIVITIES – BASELINE**

71151 - Performance Indicator Verification

The inspectors verified licensee performance indicator submittals listed below:

BI01: Reactor Coolant System Specific Activity Sample (IP Section 02.10) (1 Sample)

Reactor coolant system specific activity sample (01/01/2018 - 12/31/2018)

MS06: Emergency AC Power Systems (IP Section 02.05) (1 Sample)

Emergency AC Power systems (01/01/2018 - 12/31/2018)

MS10: Cooling Water Support Systems (IP Section 02.09) (1 Sample)

Cooling water support systems (01/01/2018 - 12/31/2018)

71152 - Problem Identification and Resolution

Annual Follow-up of Selected Issues (IP Section 02.03) (2 Samples)

The inspectors reviewed the licensee's implementation of its corrective action program related to the following issues:

- (1) Shutdown cooling suction valve and power supply, Condition Report 201806045, on January 9, 2019
- (2) Auxiliary feedwater suction check valve ALV0002 and torque, Condition Report 201900366, on February 4, 2019

## 71153 – Follow-up of Events and Notices of Enforcement Discretion

### Event Report (IP Section 03.02) (1 Sample)

The inspectors evaluated the following licensee event reports which can be accessed at <https://lersearch.inl.gov/LERSearchCriteria.aspx>:

LER 05000483/2018-006-00, "Inoperability of SSCs Due to Improper Environmental Qualification Classification," (ADAMS Accession ML19028A293). The circumstances surrounding this licensee event report are documented in the results section. This licensee event report is closed.

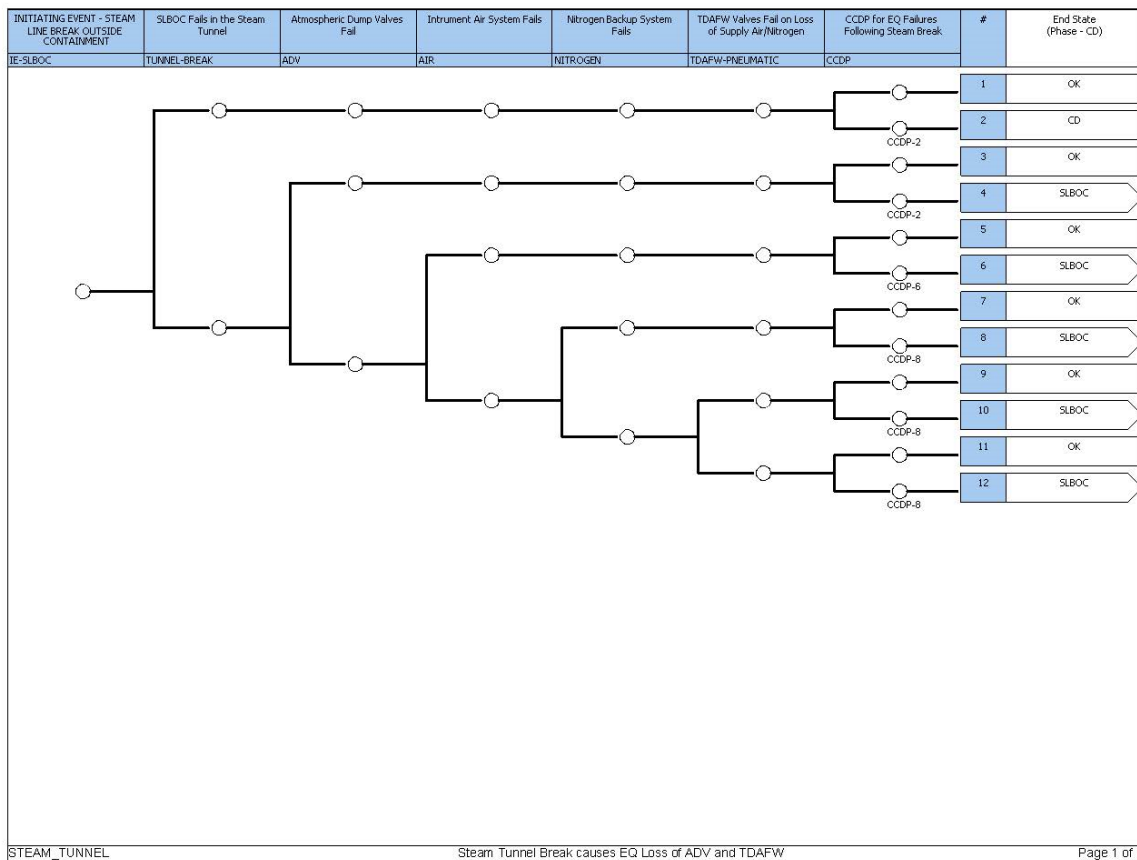
### **INSPECTION RESULTS**

Licensee-Identified Non-Cited Violation	71111.04 - Partial Walkdown
This violation of very low safety significance was identified by the licensee and has been entered into the licensee's corrective action program and is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.	
Violation: Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis are correctly translated into specifications, drawings, procedures, and instructions. The licensee established environmental qualification change notice EQCN 88-15, in part, to meet this requirement.	
<p>Contrary to the above, from October 1988 to November 2018, the licensee failed to assure that the design basis was properly translated into plant procedures and instructions. Specifically, the environmental qualification of the atmospheric steam dumps was improperly downgraded by taking credit for local manual operation; however, the atmospheric steam dumps lack any design features or capabilities that would allow local operation. The failure modes of environmentally unqualified atmospheric steam dumps include rendering the turbine-driven auxiliary feedwater flow control valves inoperable due to a loss of their common safety-related nitrogen supply through leaks. These failures could result in the specified systems being incapable of performing their required safety function of cooling the plant to residual heat removal system entry conditions for certain accident sequences. The licensee identified this issue during an environmental qualification evaluation, informed the control room staff, and initiated a condition report. This issue is associated with Licensee Event Report 05000483/2018-006-00, "Inoperability of SSCs Due to Improper Environmental Qualification Classification," (ADAMS Accession ML19028A293).</p>	
Significance: Green.	
This performance deficiency was more than minor, and therefore a finding, because it adversely affected the design control attribute of the Mitigating Systems Cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences (i.e. core damage). Specifically, the environmental qualification of the atmospheric steam dumps was improperly downgraded by taking credit for local manual operation; however, the atmospheric steam dumps lack any design features or capabilities that would allow local operation. The failure modes of environmentally unqualified atmospheric steam dumps include rendering the turbine-driven auxiliary feedwater flow control valves inoperable due to a loss of their common safety-related	

nitrogen supply through leaks. These failures could result in the specified systems being incapable of performing their required safety function of cooling the plant to residual heat removal system entry conditions for certain accident sequences. The inspectors screened this finding utilizing Inspection Manual Chapter 0609, Attachment 4, "Initial Characterization of Findings," and Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 2, "Mitigating Systems Screening Questions," dated June 19, 2012. The inspectors determined that the finding required a detailed risk evaluation because the finding represented loss of systems and/or functions. Specifically, the atmospheric steam dumps and turbine-driven auxiliary feedwater system would not have been capable of cooling the plant to residual heat removal entry conditions for a main steam line break outside containment that affected the main steam tunnel.

A Region IV senior reactor analyst performed the detailed risk evaluation.

The analyst evaluated the risk of the subject performance deficiency by using the Callaway Plant Standardized Plant Analysis Risk (SPAR) model, Versions 8.50 and 8.54. Additionally, the analyst developed the following event tree to quantify the potential effects of the degraded equipment.



The analyst quantified each of the top events in the event tree as follows:

IE-SLBOC	Using the SPAR model, the analyst determined that the initiating event frequency for a main steam line break outside containment was $6.32 \times 10^{-3}$ /year.
TUNNEL-BREAK	Using pipe length information provided by the licensee, the analyst determined that 19.9 percent of the main steam piping outside containment was inside Area 5, the main steam tunnel, and had the potential to affect the atmospheric dump valve actuators. This represented a failure probability of $1.99 \times 10^{-1}$ .
ADV	As a bounding assumption, the analyst assumed that the atmospheric dump valves would always fail upon a steam line break in Area 5. This represented a failure probability of 1.0
AIR	Using the SPAR model, the analyst determined that the failure probability of the instrument air system failing following a steam line break outside containment was $5.20 \times 10^{-2}$ . The analyst noted that neither the SPAR nor the licensee's PRA provided credit for restoring instrument air compressors that are stripped following a safety injection signal.
NITROGEN	As a bounding assumption, the analyst assumed that the backup nitrogen supply to the turbine-driven auxiliary feedwater train would fail 50 percent of the time from loss, given a failure of the atmospheric dump valve elastomers. This represented a failure probability of $5.0 \times 10^{-1}$ .
TDAFW-PNEUMATIC	Because the auxiliary feedwater valves fail in their current position on loss of air/nitrogen, the analyst assumed that in most scenarios these valves would be in their risk significant position when the nitrogen system depleted. Therefore, the analyst used a screening failure probability of $1.0 \times 10^{-1}$ for the failure of the system caused by the depletion of the backup nitrogen system.

The analyst noted that core-damage Sequences 2 and 4 would not be directly affected by the performance deficiency. Therefore, these sequences were baseline risk and did not need to be quantified. The analyst used the SPAR model Events and Conditions Assessment Workspace to quantify the conditional core damage probability (CCDP) for each of Sequences 6, 8, 10 and 12.

The analyst noted that the SPAR was undeveloped for a steam line break with induced steam generator tube rupture without the capability to cooldown. As a result, the analyst added credit for the licensee refilling the refueling water storage tank in accordance with their procedure Emergency Coordinator Supplemental Guideline, Attachment C, "Filling RWST From Firewater – High Flow." Using the SPAR-H method defined in NUREG/CR-6883, "The SPAR-H Human Reliability Analysis Method," the analyst estimated the probability of operators failing to refill the refueling water storage tank as  $4.0 \times 10^{-2}$ . This value was added to Fault Tree RFL 1, "Operator Fails to Refill the RWST."

Using this revised SPAR model and an initiating event frequency of  $1.26 \times 10^{-3}$  /year for a steam line break in Area 5, the following were the results of the analysis:

Sequence	Component Failure Probabilities	CCDP	Sequence Frequency (per year)
6	1.0	$1.15 \times 10^{-4}$	$1.44 \times 10^{-7}$
8	$5.2 \times 10^{-2}$	$4.26 \times 10^{-4}$	$2.78 \times 10^{-8}$
10	$2.6 \times 10^{-2}$	$4.26 \times 10^{-4}$	$1.39 \times 10^{-8}$
12	$2.6 \times 10^{-3}$	$7.14 \times 10^{-5}$	$2.33 \times 10^{-10}$

This resulted in a total incremental CCDP of  $1.86 \times 10^{-7}$  over a 1-year exposure period. The dominant sequence involved the postulated steam line break; an induced steam generator tube rupture; a failure to cooldown and depletion of the refueling water storage tank.

The analyst noted that there were several bounding assumptions used in the analysis:

1. That all four atmospheric dump valves would fail following every steam line break in Area 5;
2. That the backup nitrogen system would deplete 50 percent of the time following failure of the atmospheric dump valve elastomers;
3. That the safety-related instrument air compressors would not be realigned following a safety-injection signal; and
4. That the turbine-driven auxiliary feedwater train valves would not be open 10 percent of the time when the motive force air/nitrogen failed.

As a result of these bounding assumptions and their potential impact on the results of the analysis, the analyst determined qualitatively that the incremental CCDP was likely less than  $1 \times 10^{-7}$ . Therefore, this finding is of very low safety significance (Green).

Corrective Action Reference: Condition Report 201804562

**Failure to Identify a Condition Adverse to Quality When Performing Essential Service Water System Flow Balance Tests**

Cornerstone	Significance	Cross-cutting Aspect	Report Section
Mitigating Systems	Green NCV 0000483/2019001-01 Closed	[H.12] - Avoid Complacency	71111.07T – Fire Protection (Triennial)

The inspectors identified two examples of a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," for failure to identify a condition adverse to quality during past essential service water system flow balance tests.

Description:

The licensee performed an essential service water flow balance test during previous outages to ensure every safety-related heat exchanger that uses essential service water as its cooling

source has sufficient flow per design calculations. During a refueling outage in November 2014, the licensee performed a flow balance test and recorded the as-found essential service water flow rate through the component cooling water (CCW) heat exchanger B of 7,476 gallons per minute. The licensee's design calculation EF-45, "Acceptance Criteria Used in Essential Service Water Flow Balance Procedures," Revision 8, lists the required flow rate for CCW heat exchanger B as 7,559 gallons per minute.

Likewise during another refueling outage in November 2017, the licensee performed another essential service water flow balance test and recorded the as-found essential service water flow rate through the diesel generator cooler A was 1250 gallons per minute. The licensee's design calculation KJ-20, "Evaluate Tube Plugging Limits for EDG Intercooler Heat Exchangers, EKJ03A/B, EDG Jacket Water Heat Exchangers EKJ06A/B, and EDG Lube Oil Coolers, EKJ04A/B," Revision 0, lists the required flow rate for the diesel generator cooler A as 1300 gallons per minute.

The licensee learned of this issue on March 7, 2019, when the inspectors asked to see the past operability determinations for these examples. In each instance, the licensee failed to identify these conditions adverse to quality.

Corrective Action: The licensee performed past operability determinations for CCW heat exchanger B for the as found flow rate in November 2014 and the diesel generator cooler A for the as found flow rate in November 2017.

In the CCW heat exchanger B design calculation EF-45, "Acceptance Criteria Used in Essential Service Water Flow Balance Procedures," Revision 8, the licensee had a seven percent margin built into the calculation for essential service water pump degradation. After the issue was identified, the licensee performed a calculation which showed that essential service water pump B provided sufficient flow to CCW heat exchanger B even after accounting for the degradation of the pump since installation.

In the diesel generator heat exchanger A design calculation KJ-20, "Evaluate Tube Plugging Limits for EDG Intercooler Heat Exchangers, EKJ03A/B, EDG Jacket Water Heat Exchangers EKJ06A/B, and EDG Lube Oil Coolers, EKJ04A/B," Revision 0, the licensee has a 100 gallon per minute margin, which the licensee did not exceed.

In both cases, the licensee adjusted the throttle valves before performing an "as-left" test to ensure that each heat exchanger had the proper flow rate before being returned to service.

Corrective Action Reference: Condition Report 201901330

Performance Assessment:

Performance Deficiency: The inspectors determined that the licensee's failure to identify two examples of conditions adverse to quality was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because it adversely affected the equipment performance attribute of the mitigating systems cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Because the licensee failed to identify conditions that called into question whether safety-related heat exchangers could perform their safety-related function, the capability of the associated mitigating systems was affected.

Significance: The inspectors assessed the significance of the finding using Appendix A, "Significance Determination of Reactor Inspection Findings for At - Power Situations". Using Exhibit 2, "Mitigating Systems Screening Questions," the issue screened as having very low safety significance (Green) because the findings were a design or qualification deficiency that did not represent a loss of operability or functionality.

Cross-cutting Aspect: H.12 - Avoid Complacency: Individuals recognize and plan for the possibility of mistakes, latent issues, and inherent risk, even while expecting successful outcomes. Individuals implement appropriate error reduction tools. The licensee failed to recognize and plan for the possibility of latent issues even while expecting successful outcomes.

Enforcement:

Violation: Title 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Actions," which states, in part, that measures shall be established to assure that conditions adverse to quality, such as deficiencies, are promptly identified.

Contrary to the above, on November 6, 2014, and on November 10, 2017, the licensee failed to assure that conditions adverse to quality, such as deficiencies, were promptly identified. Specifically on two occasions, the licensee recorded essential service water flow through safety-related heat exchangers at flow rates below the required minimum per design calculations, but failed to identify the deficiencies as conditions adverse to quality.

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

Licensee-Identified Non-Cited Violation	71111.12 - Maintenance Effectiveness
<p>This violation of very low safety significance was identified by the licensee and has been entered into the licensee corrective action program and is being treated as a Non-Cited Violation, consistent with Section 2.3.2 of the Enforcement Policy.</p>	
<p>Violation: Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled.</p> <p>Contrary to the above, prior to September 10, 2018, for the quality-related components associated with the component cooling water system, to which 10 CFR Part 50, Appendix B applies, the licensee failed to assure that measures include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled. Specifically, the design of a protective coating applied to the inside of the train B component cooling water heat exchanger did not appropriately specify and control the physical tolerances within the heat exchanger. An area of this internal coating cracked, when the heat exchanger manway cover was shut, due to inadequate clearances. As a result, localized corrosion from essential service water degraded the heat exchanger along this crack. This degradation lead to an essential service water leak of less than 0.1 gallons per minute from through-wall corrosion of the heat exchanger. The licensee identified this leak during a plant tour, informed the control room staff, and initiated a condition report.</p>	

Significance: Green.

This performance deficiency was more than minor, and therefore a finding, because it adversely affected the equipment performance attribute of the Mitigating Systems Cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the leak required an unplanned equipment outage, local weld repairs, and rendered train B of component cooling water inoperable for 66 hours. Further, the licensee required engineering analysis of as-found conditions to confirm the degraded area would not have significantly grown in a postulated event. Using Inspection Manual Chapter 0609, Attachment 4, "Initial Characterization of Findings," and Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 2, "Mitigating Systems Screening Questions," dated June 19, 2012, the inspectors determined that the finding was of very low safety significance (Green) because the finding was a deficiency affecting the design or qualification of a mitigating system but the system, structure, and component maintained its operability or functionality. Specifically, the leak rate was very small and the engineering analysis did not indicate significant crack growth would have occurred. As a result, the leakage was well within the margin of essential service water calculations.

Corrective Action Reference: Condition Report 201804562

## **EXIT MEETINGS AND DEBRIEFS**

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

- On March 7, 2019, the inspectors presented the triennial heat sink performance inspection to Ms. Stephanie Banker, Vice President of Engineering and other members of the licensee staff.
- On March 27, 2019, the inspectors presented the quarterly resident inspection results to Mr. T. Herrmann, Site Vice President, and other members of the licensee staff.



## DOCUMENTS REVIEWED

### Inspection Procedure 71111.01: Adverse Weather Protection

#### Condition Reports

201800054      201806273      201900415      201901008

#### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EIP-ZZ-00212	Protective Action Recommendations	30
OTN-QJ-00003	Plant Freeze Protection Heat Tracing Procedure	3
OTO-ZZ-00012	Severe Weather	41
OTS-ZZ-00007	Plant Cold Weather	35

#### Miscellaneous Documents

<u>Number</u>	<u>Title</u>
AP179	Condensate Storage Tank Freeze Protection Control Panel
O130.00001 CL 8	Essential Service Water System Heat Tracing Lineup for Train A
O130.00001 CL 9	Essential Service Water System Heat Tracing Lineup for Train B

### Inspection Procedure 71111.04: Equipment Alignment

#### Condition Reports

200908193      200908388      201202947      201800747      201802042  
201806235      201806334      201806533      201900085

#### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
OSP-BG-00001	Boron Injection Flow Paths – Modes 1, 2 and 3	24
OSP-BG-V001A	Chemical and Volume Control Train B Valve Inservice Test	42
OSP-EM-P001B	Safety Injection Train B Inservice Test – Group B	51

#### Drawings

<u>Number</u>	<u>Title</u>	<u>Revision</u>
M-22BG01	Piping and Instrumentation Diagram Chemical and Volume Control System FSAR Figure 9.3-8, Sheet 1	33

Drawings

<u>Number</u>	<u>Title</u>	<u>Revision</u>
M-22BG02	Piping and Instrumentation Diagram Chemical and Volume Control System FSAR Figure 9.3-8, Sheet 1	30

Miscellaneous Documents

<u>Number</u>	<u>Title</u>	<u>Revision</u>
FSAR 16.1.2.2	Flow Paths – Operating Limiting Conditions for Operation	OL-23
EM-19	Calculate the NPSH for the Intermediate Head Safety Injection Pumps During the Injection and Recirculation Mode of Operation	0
RFR 018471	Boron Injection Flowpaths	B
ZZ-537	Gas Void Allowable Volumes for Centrifugal Charging Pump and Safety Injection Pump Suction Headers	0

**Inspection Procedure 71111.05AQ: Fire Protection Annual/Quarterly**

Condition Reports

2018016183	201900333	201901053	201901529	201109140
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Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
	Fire Preplan Manual	38
APA-ZZ-00701	Control of Fire Protection Impairments	24
APA-ZZ-00703	Fire Protection Operability Criteria and Surveillance Requirements	30

Miscellaneous Documents

<u>Number</u>	<u>Title</u>	<u>Revision</u>
RIS 2005-07	Compensatory Measures to Satisfy the Fire Protection Program Requirements	0

**Inspection Procedure 71111.06: Flood Protection Measures**

Condition Reports

201508454	201703981	201705513	201806168
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Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
APA-ZZ-00395	Significant Operator Response Timing	30
APA-ZZ-00750	Hazzard Barrier Program	43

Miscellaneous Documents

<u>Number</u>	<u>Title</u>	<u>Revision</u>
ME-016	Pipe Break Analysis and Hazzard Barrier Design	1
Desktop Instruction	Operator Rounds Specific Inspection Guide	

**Inspection Procedure 71111.07: Heat Sink Performance**

Condition Reports

201301108	201407777	201604280	201608561	201901330
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Work Orders

10508093.500	13508356.500	13507905.455	13509040.361	14512059.500
14512769.500	14512926.500	16505163.410	16506167.455	16506167.500
16506264.500				

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
APA-ZZ-00100	Written Instructions Use and Adherence	39
CDP-ZZ-00200, Appendix D	Closed Cooling Systems Tables	20
CDP-ZZ-00940	Auxiliary Water Systems Chemistry Optimization Plan	13
EDP-ZZ-01112	Heat Exchanger Predictive Performance Manual	23
ETP-ZZ-03001	GL89-13 Heat Exchanger Inspection	12
OSP-EF-0002A	Essential Service Water Train A Flow Verification	11
OSP-EF-0002B	Essential Service Water Train B Flow Verification	10
OTN-GL-00001	Auxiliary Building HVAC System	21
OTN-GN-00001	Containment Cooling and CRDM Cooling	30

### Drawings

<u>Number</u>	<u>Title</u>	<u>Revision</u>
M-1055-00234	Heat Exchanger Tube Tracking Drawing – Auxiliary Building Component Cooling Water Pump Room Cooler A, SGL11A	1
M-1055-00242	Heat Exchanger Tube Tracking Drawing Containment Cooler A, SGN01A	5
M-1089-00097	31 Tube Face Coil Assembly Drawing	4
M-1179-00001	Type RC Coil 17 Tube Face, 8'-6" NTL 12 Row, 6 Pass	3

### Miscellaneous

<u>Number</u>	<u>Title</u>	<u>Revision</u>
ASC-23 11504347-500	Final Eddy Current Inspection Report Component Cooling Water Heat Exchanger B	4/2016 RF21
M-612	Centrifugal Fan Data Sheet	5
PD041150.02	Record of Eddy Current Inspection of Component Cooling Water Heat Exchanger B	4/2010 RF17
PD04749.03	Record of Eddy Current Inspection of Component Cooling Water Heat Exchanger B	10/2005

### Calculations

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EF-45	Acceptance Criteria Used in Essential Service Water Flow Balance Procedures	8
EG-42	Component Cooling Water Heat Exchanger Tube Plugging Calculation	0
KJ-20	Evaluate Tube Plugging Limits for Emergency Diesel Generator Intercooler Heat Exchangers, EKJ03A/B, Emergency Diesel Generator Jacket Water Heat Exchangers EKJ06A/B, and Emergency Diesel Generator Lube Oil Coolers, EKJ04A/B	0
06-097	Containment Cooler Proto-HX Model Development and Design Limiting Condition Analysis	0
10-042	Callaway Nuclear Plant Containment Fan Coil Unit, SGN01D, Thermal Performance Test Report	A
11-171	October 2011 Thermal Performance Test Data Evaluation and Uncertainty Analysis for CCW Heat Exchanger EEG01B	0
13-274	April 2013 Thermal Performance Test Data Evaluation and Uncertainty Analysis for CCW Heat Exchanger EEG01B	0

Calculations

<u>Number</u>	<u>Title</u>	<u>Revision</u>
14-103	Callaway Nuclear Plant Containment Fan Coil Unit SGN01D June 2014 Thermal Performance Test Report	0
16-062	April 2016 Thermal Performance Test Data Evaluation and Uncertainty Analysis for CCW Heat Exchanger EEG01B	0

**Inspection Procedure 71111.11: Licensed Operator Requalification Program and Licensed Operator Performance**

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
ODP-ZZ-00001	Operations Department – Conduct	104
ODP-ZZ-00003	Shift Relief and Turnover	37
OSP-NE-0001B	Standby Diesel Generator B Periodic Tests	66
OTO-NB-0004	Loop to NB01/NB02 With EDG Paralleled	6

Miscellaneous Documents

<u>Number</u>	<u>Title</u>	<u>Revision or Date</u>
	Operations Night Orders	

**Inspection Procedure 71111.12: Maintenance Effectiveness**

Condition Reports

200508185	200900221	201703962	201804562	201804603
201804677	201804678	201804717	201804807	

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
APA-ZZ-00500	Corrective Action Program	71
EDP-ZZ-01128	Maintenance Rule Program	26
FDP-ZZ-00006	Safety Monitor Configuration Control	6
FDP-ZZ-01129	Callaway Energy Center Risk Assessment	48

Drawings

<u>Number</u>	<u>Title</u>	<u>Revision</u>
M-22BG01	Chemical and Volume Control System Final Safety Analysis Report Figure 9.3-8, Sheet 1	33

Miscellaneous Documents

<u>Number</u>	<u>Title</u>	<u>Revision</u>
	Safe Work Practices Manual	21
BG-01	Chemical and Volume Control System Maintenance Rule Scope Evaluation	
BKRLV-1.PMB	Low Voltage Switchgear	35
FSAR 9.3.4	Chemical and Volume Control System	OL-23

**Inspection Procedure 71111.13: Maintenance Risk Assessments and Emergent Work Control**

Condition Reports

200502303	201805256	201900542	201900557
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Work Orders

18501221

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
APA-ZZ-00322	Integrated Work Management Process	20

Miscellaneous Documents

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CEC BG	BG Assessment of Risk Hazards by PRA and Other Methods	
CEC CCW	Component Cooling Water Shutdown Risk Assessment	
EG-19	Loss of all CCW Support System Initiating Event Fault Tree	1B
M-236-00180	Butterfly Control Valves	

**Inspection Procedure 71111.15: Operability Determinations and Functionality Assessments**

Condition Reports

201801880	201806272	201806277	201806521	201900105
201900646	201900651	201900831		

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
APA-ZZ-00001	Operator Burdens and Workarounds	9
APA-ZZ-00500, Appendix 1	Operability and Functionality Determinations	32
OSP-EG-V001A	Component Cooling Water Train A Valve Inservice Test	44

Miscellaneous Documents

<u>Number</u>	<u>Title</u>	<u>Revision</u>
	Night Order – EFHV0065/66 Position Verification When Starting and Stopping Essential Service Water Flow to the Ultimate Heat Sink	0
MP 18-0068	RFR 180240 – Perform Necessary Repairs of Spalled Concrete Around Piping Support Plate in the A Ultimate Heat Sink Cooling Tower	0
MP 18-0069	Perform Repairs of Sheared Bolting on Header Piping Support in the A Ultimate Heat Sink Cooling Tower	0

**Inspection Procedure 71111.18: Plant Modifications**

Condition Reports

200501092	200803543	200803669	200809898	200810010
201304033				

Drawings

<u>Number</u>	<u>Title</u>	<u>Revision</u>
M-22EN01	Piping and Instrumentation Diagram – Containment Spray	16
MS-05	Line Vents and Drains	6

Miscellaneous Documents

	ECCS Inspection Acceptance Criteria	0
	Vent Valve Installation for EM, BG, and Other systems	0
MP 08-016	ECCS and Containment Spray Vents	1
P-075	Pipe Support Loads	8

### **Inspection Procedure 71111.19: Post Maintenance Testing**

#### Condition Reports

201900360      201900406      201900474      201901731

#### Work Orders

10502264      18500165      18500182      18510371

#### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
OSP-AL-P001B	Motor Driven Aux Feedwater Pump B Inservice Test	24
OSP-BG-P005B	Centrifugal Charging Pump B Inservice Test	54
OSP-EG-V001A	Component Cooling Water Train A Valve Inservice Test	44
OTN-KA-00001	Compressed Air System	27

### **Inspection Procedure 71111.22: Surveillance Testing**

#### Condition Reports

201900377      201900717      201900788      201901011      201901410

#### Work Orders

13004049      16505864

#### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
OSP-BB-VL005	BBV0001, BBV0022, BBV0040, BBV0059 and EM8815 Inservice Test – IPTE	23
OSP-EM-V001B	Safety Injection System Train B Valve Inservice Test	35
OSP-EM-V0003	Emergency Core Cooling System Check Valve Inservice Test	34
OSP-SA-0013A	Train A Safety Injection System Slave Relay Test	23

### **Inspection Procedure 71114.06 - Drill Evaluation**

#### Condition Reports

201900613      201900777      201900954      201901500



Procedures

<u>Number</u>	<u>Title</u>	<u>Date</u>
E-0	Reactor Trip or Safety Injection	22
EIP-ZZ-A0001	Emergency Response Organization	20
EIP-ZZ-00101	Classification of Emergencies	55
OTO-ZZ-00012	Severe Weather	41

**Inspection Procedure 71151: Performance Indicator Verification**

Condition Reports

201900488	201900490	201900492	201900493	201900610
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Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
KDP-ZZ-02000	NRC Performance Indicator Data Collection	19
Various	Mitigating Systems Performance Index Basis Document	18

**Inspection Procedure 71152: Problem Identification and Resolution**

Condition Reports

201806045	201900366
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Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
OTS-ZZ-00004	Plant Cooldown With Loss of Instrument Bus	14

Miscellaneous Documents

<u>Number</u>	<u>Title</u>	<u>Revision</u>
AMN-010-CALC-002	Flood Levels in Control Building Rooms Due to Pipe Break or Crack	0
RFR 06571A	Cable Storage in Room 1408	1

**Inspection Procedure 71153: Follow-up of Events and Notices of Enforcement Discretion**

Condition Reports

201806334	201806533	201900085
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Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
E-2	Faulted Steam Generator Isolation	11
ES-1.1	Safety Injection Termination	17
OTG-ZZ-00005	Plant Shutdown 20% Power to Hot Standby	50

Miscellaneous Documents

<u>Number</u>	<u>Title</u>	<u>Revision</u>
LER 2018-006-00	Inoperability of SSCs Due to Improper Environmental Qualification Classification	0

CALLAWAY UNIT 1 – NRC INTEGRATED INSPECTION REPORT 05000483/2019001 –  
 May 10, 2019

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<input checked="" type="checkbox"/> SUNSI Review Complete By: NHT		ADAMS <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Publicly Available <input type="checkbox"/> Non-Publicly Available	<input checked="" type="checkbox"/> Non-Sensitive <input type="checkbox"/> Sensitive	Keyword: NRC-002
OFFICE	SRI/DRP/B	RI/DRP/B	C:DRS/EB1	C:DRS/OB	TL:DRS/IPAT
NAME	DBradley	SJanicki	VGaddy	GWerner	RKellar
SIGNATURE	DSB	SMJ	vgg	CCO	RLK
DATE	5/6/19	05/06/19	5/2/19	5/3/19	5/6/19
OFFICE	AC:DRS/RCB	C:DNMS/RIB	AC:DRS/EB2	C:DRP/B	
NAME	NMakris	GWarnick	JDrake	NTaylor	
SIGNATURE	NJM	ggw	JFD	NHT	
DATE	5/1/19	5/2/19	5/1/19	5/10/19	

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