NRC FORM 366 (04-2017) U.S. NUCLEAR REGULATORY COMMISSION

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LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

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1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Callaway Plant Unit 1	05000483	1 of 4

4. TITLE

Inoperability of SSCs Due to Improper Environmental Qualification Classification

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
11	28	2018	2018	- 006	- 000	01	28	2019	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☒ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
100%	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☒ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
T.B. Elwood, Supervising Engineer, Regulatory Affairs and Licensing	314-225-1905

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On November 28, 2018, during an engineering review of design documentation related to the Environmental Qualification (EQ) classification of SSCs located in the Callaway main steam tunnel (MST), it was determined that the EQ requirements imposed on subcomponents related to the atmospheric steam dumps (ASDs) had been improperly downgraded based on an evaluation that was performed in 1986. Upon discovery of this condition, a conclusion was reached that the ASDs would be incapable of performing their specified safety functions to mitigate a main steam line break outside containment (MSLBOC).

Per the plant's safety analysis, the MSLBOC sequence would result in elevated temperatures in the MST. The ASD subcomponents are not qualified for the calculated post-accident conditions. Engineering past operability evaluations identified that ASD subcomponent failure modes exist that could potentially result in the loss of the common safety-grade accumulator nitrogen inventory that supports the ASD and TDAFP flow control valve operators, thus rendering the ASDs and the TDAFP flow control valves inoperable dating back to initial plant startup. Operability was restored by a temporary plant modification installed to insulate affected components. A permanent plant modification is being developed to restore full qualification.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Callaway Plant Unit 1	05000-483	2019	- 001	- 000

NARRATIVE

1. DESCRIPTION OF STRUCTURE(S), SYSTEM(S) AND COMPONENT(S):

Callaway Plant has four atmospheric steam dump valves (ASDs) (EIIS: RV), ABPV0001/2/3/4, which are used to remove heat from the reactor coolant system (RCS) when the plant is being started up or shut down with the main condenser not available. There is one ASD in each main steam (EIIS: SB) line outside of containment and upstream of the associated main steam safety valves and main steam isolation valve. Thus, there is one ASD for each steam generator at Callaway.

The turbine-driven auxiliary feedwater pump (TDAFP) (EIIS system BA, component P) supplies feedwater to the steam generators to remove decay heat from the reactor coolant system when the normal feedwater system is not available. The TDAFP provides a safety-grade source of feedwater to all four steam generators. TDAFP flow to each steam generator is controlled by an air-operated flow control valve.

The event reported in this LER involves the environmental qualification (EQ) requirements imposed on the ASDs and the associated subcomponents at the Callaway Plant. The valve operators for the ASDs and TDAFP flow control valves share common safety-grade sources (accumulators) that utilize pressurized nitrogen. During normal plant operations, the instrument air system, which is supplied by the plant air compressors, provides the source of pressurized air to operate the air-operated valves. The nitrogen accumulators provide the safety-grade source of compressed gas to support valve operation. Per the plant's safety analysis, a postulated main steam line break outside containment (MSLBOC) would result in elevated temperatures in the main steam tunnel (MST). The environmental conditions in the MST could render the ASDs incapable of performing their specified safety functions, and also result in a loss of accumulator nitrogen inventory such that the TDAFP flow control valves would similarly be incapable of performing their specified safety function of cooling the plant to residual heat removal (RHR) system entry conditions following a postulated MSLBOC with a coincident loss of offsite power.

2. INITIAL PLANT CONDITIONS:

Callaway was at 100% Power/Mode 1 at the time of discovery of this event.

3. EVENT DESCRIPTION:

On November 28, 2018, during an engineering review of EQ requirements specified for components located in the Callaway MST, it was determined that the EQ requirements imposed on the ASDs and associated subcomponents had been downgraded per an evaluation documented in SLNRC 86-06, "Main Steam Line Break Superheat Effects on Equipment Qualification," and that the basis for the downgrade was insufficient.

The original plant design for Callaway imposed EQ requirements on the ASDs and associated subcomponents. The post-accident environmental conditions in areas affected by accident-initiated release of mass and energy were determined by pressure-temperature analyses performed by Bechtel using mass and energy release input data calculated by Westinghouse. In June 1984, Westinghouse Electric Company informed the SNUPPS Utilities of a potential safety concern related to their mass and energy analysis for the MSLBOC accident sequence. Specifically, it was determined that as the secondary-side water inventory was depleted in the faulted steam generator for the MSLBOC, the steam release would become superheated. The superheated mass release would adversely affect the previously performed MST pressure-temperature response calculations for the MSLBOC accident sequence.

In 1986, SNUPPS submitted letter SLNRC 86-06 on Callaway's behalf to transmit a report that evaluated the superheat effects on the environmental qualification of equipment for Callaway. The report concluded that the equipment which must function to mitigate a postulated MSLBOC with superheat effects and to bring the SNUPPS plants to a safe shutdown

condition would perform its safety functions following such a postulated event. The report transmitted by SLNRC 86-006 determined that the ASD valve operators did not require environmental qualification. The basis for this determination was that personnel could be dispatched to perform local manual operation of the ASDs or the main steam safety valves (MSSVs) to facilitate a controlled cooldown of the plant to RHR entry conditions. It has now been determined that it was erroneous to credit local manual operation of the ASDs or MSSVs for the performance of a controlled plant cooldown. The operators for these valves are not equipped with handwheels, levers or any other device that would enable local manual valve operation.

On November 28, 2018, Callaway personnel determined that the lack of qualification of the ASDs and related subcomponents, in conjunction with the lack of capability to perform local valve manipulations, adversely affected the capability of the ASDs to perform their specified safety functions. All four ASDs were declared inoperable, and the plant entered Technical Specification Conditions A, B, and C of Technical Specification 3.7.4, "Atmospheric Steam Dump Valves (ASDs)." To restore operability, a temporary plant modification was installed as a compensatory action. The temporary modification installed insulation that would mitigate the postulated post-MSLBOC environmental conditions. This modification allowed Callaway to declare the ASDs as Operable but non-conforming (EQ).

In addition, subsequent past operability determination reviews performed by engineering determined that the post-MSLBOC harsh environment in the MST could result in failure modes that would result in a loss of inventory from the nitrogen accumulators that support the valve operators for the ASDs as well as the TDAFP flow control valves. Therefore, the TDAFP was also past-inoperable due to the improper qualification of the ASD subcomponents.

4. ASSESSMENT OF SAFETY CONSEQUENCES:

The improper EQ classification of the ASDs and related subcomponents described in this LER represent an adverse condition of low nuclear safety significance. Of the design-basis accidents (DBAs) postulated and analyzed for Callaway, only the MSLBOC is affected by the condition described in this LER. Following a postulated MSLBOC, the ASDs are credited to provide a safety-grade means of heat removal to perform a controlled cooldown to RHR entry conditions. The TDAFP is one of three safety-grade auxiliary feedwater pumps that would provide secondary-side inventory to remove decay heat. The auxiliary feedwater reliability analysis recognized in the Safety Evaluation for License Amendment No. 168 to the Callaway Operating License demonstrates that one auxiliary feedwater pump provides adequate flow to remove decay heat. Should the ASDs and the TDAFP be rendered unavailable to support a controlled cooldown following a MSLBOC, the duration of the event would be extended relative to the sequence of events described in the Callaway FSAR.

The licensing basis MSLB event described in Section 15.1 of the Callaway FSAR does not result in damage to the nuclear fuel cladding. Radiological consequences are driven by assumed pre-existing fuel defects and iodine spiking associated with plant maneuvers. Specifically, the initial conditions used in the licensing basis MSLB analysis assume that pre-existing fuel defects have driven reactor coolant system concentrations of radio-iodines to the maximum levels permitted by Technical Specifications prior to initiation of the accident sequence. It should be noted that Callaway has not had any fuel defects during the last three years. Another item of significance to note is that the most limiting Departure from Nucleate Boiling Ratio (DNBR) values calculated for the licensing basis MSLB occur early in the accident sequence. Therefore, the long-term implications of the prolonged cooldown duration would not adversely impact the limiting MSLB DNBR values.

During the initial stages of a MSLBOC, the plant would undergo a significant cooldown. If the elevated temperatures in the MST would render the ASDs incapable of operation, the ASDs would fail closed, and the plant would heat back up to the saturation conditions associated with the lift setpoint for the main steam safety valves (MSSVs). Plant operation in this condition would not result in damage to the fuel cladding. The plant would remain in this condition until reasonable recovery actions not typically credited in licensing basis safety analysis could be taken. Following a MSLB event, radiological conditions would not restrict movement about the plant site. Reasonable recovery actions that would be taken to resolve the condition would include replenishing the Condensate Storage Tank (CST) and/or Hardened Condensate Storage Tank (HCST) inventories, as well as use of the plant air compressors.

The plant air compressors are non-Technical Specification, non-safety related components located in the Turbine Building. Therefore, credit is not taken for the air compressors in the licensing basis safety analysis. However, an air compressor is provided with electrical power from a safety-grade supply and cooling from the essential service water system. Further, the Emergency Operating Procedure network includes guidance that directs the operators to start an instrument air compressor following entry into the Emergency Operating Procedures. Therefore, it is probable that a plant compressor would be available following a Design Bases Accident. Use of the plant compressors would mitigate the adverse impact of the condition described in this LER on the TDAFP flow control valves.

The MSLBOC pressure/temperature analysis of record for the MST demonstrates that following completion of the blowdown of the faulted steam generator, buoyancy-driven natural circulation airflow through the MST blowout panels would restore the MST to habitable conditions within a reasonable timeframe. This would allow plant personnel to replace ASD subcomponents and enable the plant to perform a controlled cooldown to RHR entry conditions.

Based on these considerations, it is concluded that the downgraded EQ requirements imposed on the ASDs and their subcomponents described in this LER do not represent a condition that significantly degraded nuclear safety.

5. REPORTING REQUIREMENTS:

This LER is submitted pursuant to 50.73(a)(2)(i)(B), 50.73(a)(2)(v)(B), and 50.73(a)(2)(v)(D).

The inadequate environmental qualification of the ASDs and their subcomponents rendered the ASDs and the TDAFP flow control valves incapable of performing their specified safety functions. Specifically, the ASDs and TDAFP would not have been capable of cooling the plant to RHR entry conditions following a main steam line break outside containment. The period of inoperability for the ASDs and TDAFP exceeded the allowances of Technical Specifications 3.7.4, "Atmospheric Steam Dump Valves (ASDs)," and 3.7.5, "Auxiliary Feedwater (AFW) System." Thus, this event is being reported as an operation or condition prohibited by Technical Specifications in accordance with 50.73(a)(2)(i)(B).

As explained above, the inadequate environmental qualification of the ASDs would potentially have resulted in the ASDs and TDAFP being incapable of performing a specified safety function following a postulated main steam line break outside containment. Specifically, the ASDs and TDAFP would not have been capable of cooling the plant to RHR entry conditions following a main steam line break outside containment. Thus, this event is being reported as a condition that could have prevented fulfillment of a safety function in accordance with 50.73(a)(2)(v)(B) and 50.73(a)(2)(v)(D).

The condition described in this LER was also reported as ENS # 53759 on November 28, 2018, as required by 10 CFR 50.72(b)(3)(v) for any event or condition that at the time of discovery could have prevented the fulfillment of the safety function of structures or systems that are needed to (B) Remove residual heat, or (D) mitigate the consequences of an accident.

The condition described in this LER was determined to not represent an unanalyzed condition that significantly degraded nuclear safety. The basis for this determination is presented in Section 4 "Assessment of Safety Consequences" of this LER.

6. CAUSE OF THE EVENT:

An error was made in 1986 in the Callaway evaluation to the Main Steam Line Break Superheat Effects on Equipment Qualification issue provided in SLNRC 86-06. This error credited the use of local manual Operator actions for operating the ASDs. This error subsequently led to Callaway down grading the EQ classification of the ASD sub-components.

7. CORRECTIVE ACTIONS:

Since the submittal of SLNRC 86-06, Callaway has developed administrative programs for the control of Emergency Operating Procedures to ensure that operator actions credited in the plant's design and licensing bases are supported by the Emergency Operating Procedures. The current EOP control process provides a formalized multi-disciplinary review of new operator actions and requires validation that would demonstrate that proposed new operator actions are practicable.

Additionally, subsequent to the submittal of SLNRC 86-06, Callaway has revised its 10CFR50.59 review process to include a detailed set of review criteria to consider should a proposed change involve a new or modified operator action. Application of the review criteria would have identified that the credit taken for local manual operator action in SLNRC 86-06 was not adequately supported.

Operability was restored by a temporary plant modification installed to insulate affected components. A permanent plant modification is being developed to restore full qualification.

8. PREVIOUS SIMILAR EVENTS:

A review of LERs from the past three years found no other events in which credit was taken for inadequately supported local operator actions that resulted in the improper downgrade of EQ requirements imposed on plant SSCs.