AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

10CFR50.73

April 16, 2007

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

ULNRC05398

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2007-001-00
Single Train Inoperability in the Essential Service Water System due to Inadequate Valve Closure Setup

The enclosed Licensee Event Report, 2007-001-00, is prepared and submitted in accordance with 10CFR50.73 to report an event involving a single train of the Essential Service Water System being Inoperabe due to inadequate valve closure setup.

This letter does not contain new commitments.

Sincerely,

Fadi M. Diya
Director, Plant Operations

FMD/EWH/tdp

Enclosure

IE22

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NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

Single Train Inoperability in the Essential Service Water System due to Inadequate Valve Closure Setup

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
									None	
02	28	2007	2007	- 001 -	00	04	12	2007	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

MODE 1

10. POWER LEVEL

100 %

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☒ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☐ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
K. A. Mills, Supervising Engr Regional Regulatory Affairs/Safety Analysis	(573) 676-4317

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
D	BI	ISV	A391	N					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On February 7, 2007, during a preventive maintenance activity excessive valve seat leakage was identified on one of two isolation valves between the Service Water system and the 'A' train of the Essential Service Water system. The affected valve was a 30 inch butterfly valve without a hard seat. Troubleshooting activities determined there was no evidence of degradation, correction of the leakage required only an adjustment of the valve operator closure limits to ensure the valve disk and valve seat were properly mated when the valve operator reached the closed position. A review of work history on the valve revealed that work performed in July, 2006, could have impacted the valve closure limits. Post Maintenance Testing included Motor Operated Valve diagnostics testing to verify the closure limits instead of a more definitive leakage test. Since the diagnostics may not have established the proper closure limits, the leakage was assumed to have existed since restoration of the valve to service on July 28, 2006. Based on the technical specification surveillance requirements for the valve, the excessive leakage rendered the 'A' Essential Service Water train inoperable during the period of excessive leakage. The specified safety functions of the train, however, would have been completed by the redundant isolation valve. A root cause analysis team identified root causes predominantly related to inadequate written instructions for post maintenance testing of this type of valve.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

I. DESCRIPTION OF THE REPORTABLE EVENT

A. REPORTABLE EVENT CLASSIFICATION

50.73(a)(2)(i)(B) - Operation or Condition Prohibited by Technical Specifications

B. PLANT OPERATING CONDITIONS PRIOR TO THE EVENT

Mode 1, 100 Percent Reactor Power

C. STATUS OF STRUCTURES, SYSTEMS OR COMPONENTS THAT WERE INOPERABLE AT THE START OF THE EVENT AND THAT CONTRIBUTED TO THE EVENT

This event was a Technical Specification (T/S) violation resulting from inoperability of isolation valve EFHV0025, 'A' Train Service Water to Essential Service Water (ESW) Downstream Valve, no other structures, systems or components were inoperable at the start of the event which contributed to the event.

D. NARRATIVE SUMMARY OF THE EVENT, INCLUDING DATES AND APPROXIMATE TIMES

During a preventive maintenance (PM) task on February 7, 2007, excessive leakby was identified on one of four isolation valves between the non-safety related Service Water (SW) System and the 'A' train safety related Essential Service Water (ESW) system. The scope of the PM includes testing the 'A' train SW to ESW supply cross-connection isolation valves EFHV0023 and EFHV0025; and return isolation valves EFHV0039 and EFHV0041. All four valves are Anchor-Darling Model 2498-30-100, 30 inch butterfly valves [BI - ISV]. During the restoration portion of the PM, any leakage is quantified and compared to calculation M-EF-37, Revision 0, Addendum 3, External Leakage Allowance for ESW Pressure Boundary Leakage, to determine if the leak rate is acceptable.

The SW to ESW cross-connect piping has redundant isolation valves in series, which are tested as a set. During testing of the 'A' train supply line isolation valves on February 7, 2007, EFHV0025 exhibited leakage through the valve. Although the leakage could not be quantified, it was assumed to be in excess of the calculated allowable leakage. A job was initiated to correct the leakage, where it was determined that the valve required approximately six hand wheel turns to place the valve disk in the correctly seated position. There was no evidence of degradation, correction of the leakage required only an adjustment of the valve operator closure limits to ensure the valve disk and valve seat were properly mated when the operator reached the closed position. Following motor operator adjustment, the final leak rate was much less than 1 gpm (approximately one quart per minute) and acceptable.

During testing the valves are isolated and do not affect ESW operability. However, a review was performed to assess potential impact of the identified leakage on past operability of the 'A' ESW train. A review of work history on EFHV0025 revealed that work performed in July, 2006, could have impacted the valve closure limits. Post Maintenance Testing (PMT) included Motor Operated Valve (MOV) diagnostics testing to set or verify the closure limits. Because this valve is a large butterfly valve without a hard seat, MOV diagnostics are not the preferred method for establishing closure limits as it is difficult to determine the actual fully-seated position without a hard seat to provide indication. As such, since the work performed could have affected the closure limits and the MOV diagnostics may not have established the proper closure limits, the leakage was assumed to have existed since restoration of the valve to service on July 28, 2006.

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Compliance with Technical Specifications (T/S) was reviewed based on the determination that this work very likely affected the ability of the valve to close to the correct position as required. Under Surveillance Requirements (SR) 3.7.8.1 and 3.7.8.2, EFHV0025 is required to be in the correct position, or have the ability to stroke to the correct position, respectively. The correct position for these valves is a closed position sufficiently leak-tight to ensure that the Limiting Conditions for Operation (LCO) 3.7.8, "Essential Service Water System (ESW)", and 3.7.9, "Ultimate Heat Sink (UHS)" are met. The leakage was determined to be excessive such that the redundant isolation valve, EFHV00023, would be required to perform the isolation necessary to ensure the ability to meet LCO 3.7.9 and the supported portion of LCO 3.7.8. The surveillance requirement was not met while the excessive leakage condition existed on EFHV00025, LCO 3.7.8 was also not met based on the requirements of SR 3.0.1, which specifies that failure to meet a SR, whether such failure is experienced during the performance of the surveillance or between performances of the surveillance, shall be failure to meet the LCO. In addition, although there is no specific SR for leakage, the excessive leakage condition challenged LCO 3.7.9, which requires the ability to provide a 30 day water supply in support of ESW operability. LCO 3.7.9 is challenged if the redundant cross-connect valves fail to fully isolate, because leakage through this flowpath is lost from the ESW system to the SW system and can no longer be credited as ESW inventory. A past operability determination found that LCO 3.7.9 was met during this event because EFHV00023 would have closed and isolated sufficiently to support operability of the UHS. However, while the specified safety function of the 'A' ESW train would have been performed due to the redundant design; past operability was not maintained under LCO 3.7.8 due to the inability of each valve, independently, to meet the associated SR during the period of excessive leakage from July 28, 2006 to February 7, 2007.

A root cause investigation was performed to determine causes and corrective actions for the resulting condition prohibited by T/S. The investigation reviewed the history of EFHV0025 to develop an understanding of past performance and testing requirements.

On October 13, 1993, EFHV0025 was replaced with a like-kind valve. The valve closure limits were set up and MOV diagnostics were performed. Surveillance procedure OSP-EF-V001A, "ESW Train A Valve Operability", was performed as a PMT on November 12, 1993. Following these activities, routine PM tasks to evaluate leakage on SW to ESW isolation valves were established as work documents PM0823501 and PM0823502. These PMs were first performed on December 16, 1994, with EFHV0025 exhibiting satisfactory results. At the time, leakage was evaluated using acoustic emissions tests.

The Valve Retest Manual (VRM) is a document which specifies PMT requirements under the Inservice Testing (IST) program for maintenance potentially impacting the operability of safety related valves. On March 23, 1998, Revision 30 of the VRM was issued. Note 21 of the VRM added an acoustic emissions test to the PMT requirements for the eight SW to ESW cross-connect isolation valves. The note also stated to perform the test in conjunction with surveillance procedure OSP-EF-P001A, "ESW Train A Inservice Test - Group A" or OSP-EF-P001B, "ESW Train B Inservice Test - Group A".

On June 3, 2002, MOV diagnostics and OSP-EF-V001A were performed as a PMT on EFHV0041 following maintenance. A corrective action document was written when the Shift Manager questioned PMT requirements for EFHV0041, believing that an acoustic emissions test for leakage should have been performed as a PMT instead of MOV diagnostics. The issue was reviewed by plant staff and it was concluded that an acoustic emissions test using the PM methodology was not necessary to establish operability. Following this determination, on September 24, 2002, the VRM was revised to state that "acoustic emission leakage test is not required for operability and is trend information only."

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The ESW system engineer initiated a corrective action document, "External leakage and UHS Operability", on October 16, 2002. Several actions were requested in an effort to establish a comprehensive leak monitoring program, including the addition of leakage test points and an associated change from acoustic emission tests to leak rate testing. On June 11, 2003, an action was added to the corrective action document specifying that Modification Package MP 03-1001A should have sufficient scope defined to allow closure of the corrective action document. The scope included test connections for leak testing SW to ESW cross-connect isolation and the revision or creation of test procedures to implement a testing methodology. This action was closed on the same day specifying that MP 03-1001A was associated with a refueling milestone adequately tracked under the refueling outage procedure APA-ZZ-00150, Outage Preparation and Execution, to assure the modification would be developed in time to meet plant priorities. On May 2, 2004, during refueling outage 13, drains and vents were installed between EFHV0023 and EFHV0025 per MP 03-1001A to allow the routine PMs that had been established, PM0823501 and PM0823502, to be performed using direct leakage measurement verses the acoustic emission testing previously used. The remaining requests made by the ESW system engineer were not fully implemented.

The PM documents were revised in August, 2005, changing the acoustic emissions test to a timed leakage test: PM0823501 for 'A' Train ESW valves (EFHV0023, 25, 39 and 41), and PM0823502 for 'B' Train ESW valves (EFHV0024, 26, 40, and 42). On August 25, 2005, the routine PM for EFHV0023 and EFHV0025 was completed satisfactorily with a measured leakage of less than 0.1 gpm. However, the VRM was not revised to reflect the change in PM testing methodology so as to ensure that the same methodology would be used for post maintenance testing.

During the process of establishing the ESW leak monitoring program in 2005, there was an effort to close corrective action documents to reduce the corrective action program backlog. As a result of this effort, the corrective action document related to the monitoring program was inappropriately closed on September 6, 2005, following receipt of a calculation which alleviated some of the concerns being addressed by development of the program.

On May 29, 2006, a job to perform a grease change out on EFHV0025 was planned. In order to reduce out of service time, the job was changed from a grease change out to a change out of the valve operator. The valve closure setup instructions and the leakage test PMT were not specified in the job package. Note 21 of the VRM stated that "acoustic emission leakage test is not required for operability and is trend information only." Based on the completed modification allowing for leakage testing, the job planner recognized the acoustic emissions test as unnecessary and not required for operability based on the guidance in the VRM. The planner did not specify the acoustic emissions test as a PMT in the Job package.

A configuration control tag was placed on EFHV0025 on July 26, 2006, with the valve in the closed position and the valve operator was replaced. The work instruction stated, "Ensure valve is in closed position" for the purpose of setting the limit stops. There were no instructions for verifying the closed position by performance of a valve leakage test. The procedure based work instructions assumed the tagged position of the valve was the position necessary to perform its safety related isolation function. The closed position can not be accurately determined by the valve stem indication for large butterfly valves without a hard seat; closure can only be definitely determined using a leakage test. In accordance with the guidance in the VRM, the valve closure limits for EFHV0025 were set up using the valve stem indication and MOV diagnostics on July 27, 2006. Then on July 28, 2006, EFHV0025 was stroked and its position indication verified using surveillance procedure OSP-EF-V001A, which only tests that EFHV0025 traveled to its indicated closed limit when stroked closed.

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The routine leakage PM was performed on EFHV0023 and EFHV0025 on February 7, 2007. The PM identified what was determined to be "excessive leakage" past valve EFHV0025. A corrective action document was initiated and it was determined on February 15, 2007, that the excessive leakage identified on EFHV0025 very likely existed since the July 2006 work and was reportable as a condition prohibited by T/S.

Based on the information developed through the root cause evaluation, an extent of condition review was performed. The review focused on MOVs listed in test procedure MTE-ZZ-QA015, Attachment 1, "Valve List", that are annotated as requiring leak testing following adjustments to the close limit or the close stop nut. The condition was determined to extend to the following 'A' train SW to ESW cross-connect isolation valves: EFHV0023, EFHV0025, EFHV0039 and EFHV0041; 'B' train SW to ESW cross-connect isolation valves EFHV0024, EFHV0026, EFHV0040 and EFHV0042; as well as ESW to auxiliary feedwater supply valves ALHV0030, ALHV0031, ALHV0032 and ALHV0033.

A review of work histories indicates that ALHV0030 through ALHV0033 have been adequately tested utilizing a leakage test following maintenance activities which could have affected valve seating characteristics.

The work history review also indicated that EFHV0040 was not leak tested following replacement of the Limitorque operator on July 17, 2006, instead, MOV diagnostics were performed and the valve was stroke tested in accordance with the guidance in the VRM. The subsequent January 27, 2007, PM leakage test for EFHV0040 found leakage to be more than desired, but acceptable at between four and six gpm. A job was initiated and successfully reduced leakage to less than one gpm.

During the same course of PM testing, EFHV0024 was discovered to have excessive leakage on January 25, 2007. Indications were that valve EFHV0024 was traveling past the ideal closure point because leakage slowed and then increased. The cause investigation determined that no maintenance having the potential to affect the closure position had been performed on EFHV0024 since the last successful leak rate test. The investigation could not determine a specific cause or timeframe associated with the leakage so the failure was determined to have occurred at the time of discovery. In addition, the redundant isolation valve, EFHV0026, was operable and able to perform the required isolation function.

As discussed above, EFHV0025 was not leak tested following replacement of the Limitorque operator on July 26, 2006. MOV diagnostics were performed and the valve was stroke tested; however, subsequent leak testing in February 2007 determined leakage to be unacceptable. Again, the redundant isolation valve, EFHV0023, was operable and able to perform the required isolation function.

The remaining valves either did not have maintenance performed which would affect closure settings or had acoustic emissions tests performed following maintenance.

A review of the event using a seven-step root cause analysis process was conducted. The analysis identified three causal factors with associated root causes predominantly related to inadequate written instructions.

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E. METHOD OF DISCOVERY OF EACH COMPONENT, SYSTEM FAILURE, OR PROCEDURAL ERROR

As described above, excessive leakage through EFHV0025 was identified through local observations during periodic PM task activities. Discovery of the root and contributing causes occurred through the performance of a root cause analysis in accordance with station guidance.

II. EVENT DRIVEN INFORMATION

A. SAFETY SYSTEMS THAT RESPONDED

No automatic actuations occurred and no safety systems were required to respond to this event.

B. DURATION OF SAFETY SYSTEM INOPERABILITY

On May 29, 2006, a job was planned to change out the valve operator for EFHV0025. Following the operator change out, the valve closure limits for EFHV0025 were set up using the valve stem indication and MOV diagnostics on July 27, 2006. There were no instructions for verifying the closed position by performance of a valve leakage test. EFHV0025 was restored to service at 0305 on July 28, 2006.

A routine leakage PM was performed on February 7, 2007. The PM identified "excessive leakage" past valve EFHV0025. A job was initiated to adjust operator limit settings for EFHV0025 and the valve was restored to service at 0800 on February 8, 2007.

EFHV0025 is assumed to have been incapable of meeting associated surveillance requirements under T/S LCO 3.7.8 from 0305 on July 28, 2006, to 0800 on February 8, 2007.

As a result, entry into applicable T/S action statements and compliance with associated completion times were not been met as follows:

3.7.8.A One ESW train inoperable in MODE 1, 2, 3 or 4.
Action A.1 Restore ESW train to OPERABLE status in 72 hours

3.7.8.B Required Action and associated Completion Time of Condition A not met.
Action B.1 Be in MODE 3 in 6 hours, AND
Action B.2 Be in MODE 5 in 36 hours

Under condition 3.7.8.A, required actions under 3.8.1 were also required:

3.8.1.B One DG inoperable in MODE 1, 2, 3 or 4.
Action B.1 Perform SR 3.8.1.1 for the offsite circuit(s) in 1 hour AND once per 8 hours thereafter, AND
Action B.3.1 Determine OPERABLE DG is not inoperable due to common cause failure in 24 hours OR
Action B.3.2 Perform SR 3.8.1.2 for OPERABLE DG in 24 hours, AND
Action B.4 Restore DG to OPERABLE status in 72 hours AND 6 days from discovery of failure to meet LCO

The total elapsed duration of excessive leakage on EFHV0025 and associated 'A' train ESW inoperability is 195 days, 4hours, 55 minutes beginning on July 28, 2006, and ending on February 8, 2007.

C. SAFETY CONSEQUENCES AND IMPLICATIONS OF THE EVENT.

The design basis of the Essential Service Water (ESW) system is for one ESW train, in conjunction with the Component Cooling Water system and a 100 percent capacity containment cooling system, to remove accident generated and reactor core decay heat following a design basis Loss of Coolant Accident (LOCA). The ESW system consists of two separate cooling water trains rated at 100 percent heat removal capacity. The ESW pumps and valves are aligned remotely and manually during normal operations, but can be configured automatically to their post accident positions upon the receipt of a demand signal.

The specified safety function of the SW to ESW cross-connect isolation valves is to close upon the receipt of a Safety Injection Signal, Auxiliary Feedwater System Low Suction Pressure Signal or a Loss of Offsite Power. The cross-connect valves isolate the safety related ESW system from the non-safety related SW piping. Separation of the two systems is necessary to ensure the UHS is protected and capable of supplying cooling and makeup water during post-LOCA conditions. Each cross-connect isolation valve has a companion or backup valve installed in the shared 30 inch piping leg to serve as a redundant isolation valve. Each valve in the pair is powered from a separate class 1E electrical source to provide single-valve isolation in the event one source should fail.

The post accident position for EFHV0025 is 'closed' with a sufficiently leak-tight seal to ensure that the specified safety function of the 'A' ESW train can be accomplished. A sufficiently leak-tight seal in the SW to ESW cross-connect piping is important to prevent loss of UHS inventory over the 30-day mission time during the post-LOCA recovery period (T/S LCO 3.7.9). Excessive seat leakage past EFHV0025 could potentially place LCO 3.7.9 at risk if the most limiting single failure is assumed at the time of the Design Basis Accident (DBA). For this scenario, the most limiting single failure is a loss of the opposite 'B' train Emergency Diesel Generator, which results in a failure of EFHV0023 (redundant isolation valve to EFHV0025) to automatically align to a closed position. Failure of the backup valve to isolate allows the loss of ESW water through the leaking EFHV0025 valve and into the non-safety related SW system. The unchecked loss of ESW into the SW system represents a loss of UHS inventory and reduces the amount of time the stored volume of water can supply cooling and makeup water for post LOCA safety functions.

Callaway's ESW and UHS systems are designed to meet General Design Criterion 44 to provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Based on the following considerations, the potential impact on calculated dose to the Public following a DBA event (10 CFR Part 100 criteria) is considered to be minimal during the timeframe that excessive seat leakage past EFHV0025 existed.

The UHS inventory design provides an additional margin of 12.43 acre-feet of stored water (in excess of the 30-day mission volume) to supply the ESW system. This stored excess water inventory is not credited for accident mitigation in the current licensing bases for Callaway, but would have been available during the period of excessive seat leakage and a postulated DBA.

UHS margin volume allows time for proceduralized operator actions under Emergency Operating Procedure E-0, Attachment A, Automatic Action Verification, which requires operators to verify proper valve alignment following automatic actuation. This verification includes all eight SW to ESW cross-connect valves. For the case of EFHV0025 seat leakage in the 'A' ESW train, the procedure requires

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operators to verify that the 'B' ESW train backup valves are correctly aligned following automatic actuation. If not, operators are dispatched to close the valves locally. Assuming the single most limiting failure and a conservative leak rate, it is unlikely that manual alignment of EFHV0023 and the other 'B' train ESW valves to their safety related positions would have taken long enough to deplete the available margin of UHS inventory.

In addition, a review of 'B' train availability was conducted following discovery of the event. During the period of time excessive seat leakage existed on EFHV0025, the required isolation function would have been performed by the redundant 'B' valve consistent with the Callaway Plant licensing bases.

The conditions described in this LER were also evaluated with the Callaway PRA model. The evaluation determined that the incremental conditional core damage probability (ICCDP) attributable to this issue was less than 1E-6; therefore, this event was of very low risk significance. Use of the PRA model to evaluate the event provides for a comprehensive, quantitative assessment of the potential safety consequences and implications of the event, including the consideration of alternative conditions beyond those analyzed in the FSAR.

III. CAUSE(S) OF THE EVENT AND CORRECTIVE ACTION(S)

Causal Factors (CF), associated Root Causes (RC) and Corrective Actions to Prevent Recurrence (CATPR) were developed for evaluation under the corrective action program (CAP). Additionally, Contributing Causes and associated Corrective Actions (CA) were identified for evaluation.

A seven-step root cause analysis process was used to evaluate this event. A timeline was generated and interviews conducted to gather information and to validate facts. The root cause team developed an Events and Causal Factors Chart and identified three Causal Factors. The TapRoot(R) method was used to determine the Root Cause(s) of each Causal Factor, which lead predominantly to identification of inadequate written instruction.

CAUSAL FACTOR CF-1: Leakage testing as a post maintenance test was not specified in the July 2006 job package for the valve operator change out and limit switch replacement on EFHV2005.

ROOT CAUSE RC-1.1: The Valve Retest Manual was not kept current with changes made to preventive maintenance testing methodology under work documents PM0823501 and PM0823502.

CATPR-1.1.1: The Valve Retest Manual will be revised to reflect the current requirements for performing leak testing under PM0823501 and PM0823502.

ROOT CAUSE RC-1.2: Post Maintenance Testing requirements for valves are contained in several sources requiring job planners to consult numerous sources to identify Post Maintenance Testing requirements.

CATPR-1.2.1: A Post Maintenance Testing matrix which consolidates testing requirements for specific valve types is in development. The Post Maintenance Testing matrix will be validated and issued for use under the work management program.

Contributing Cause CC-1.3: A formal process to train job planners had not previously been developed.

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Corrective Action CA-1.3.1: The Systematic Approach to Training process will be applied to the job planning process. A Performance Analysis Worksheet will be developed for the planning process and resources allocated to implement required training.

CAUSAL FACTOR CF-2: Valve closure setup instructions were not specified in the job package for the valve operator change out on EFHV0025.

ROOT CAUSE RC-2.1: Procedure MTM-ZZ-QA006, Limitorque Actuator Electrical Rework and Adjustment, does not have instructions for valve closure setup on butterfly valves without a hard seat.

CATPR-2.1.1: MTM-ZZ-QA006 will be revised to provide instructions for valve closure setup on EFHV0025 and similarly designed valves.

CAUSAL FACTOR CF-3: A quantitative leakage monitoring program for ESW was not fully implemented.

ROOT CAUSE RC-3.1: A leak rate monitoring program was not established for SW to ESW cross-connect isolation valves.

CATPR-3.1.1: A leak rate monitoring program for ESW will be implemented based on the recommendations made by the system engineer in October 2002.

Contributing Cause CC-3.1: In response to a corrective action document, the Valve Retest Manual was revised to state that acoustic emissions testing is not required for operability and is performed for trending information only.

Corrective Action CA-3.1.1: The Valve Retest Manual will be revised to reflect the current requirements for performing leak testing under PM0823501 and PM0823502 (same action as for CATPR 1.1.1).

Contributing Cause CC-3.2: The change in Preventive Maintenance methodology (from acoustic emissions testing to leak rate testing) was not recognized as affecting the Valve Retest Manual. The Preventive Maintenance Change Request process is a knowledge based activity and some processes do not assign responsibility to initiate required changes to the Valve Retest Manual.

Corrective Action CA-3.2.1: Responsibility will be assigned in plant procedures to ensure changes to various processes include a determination of impact on the Valve Retest Manual.

Contributing Cause CC-3.3: Corrective Action needs improvement. During the process of establishing the ESW leak monitoring program in 2005, the associated corrective action document was inappropriately closed without fully implementing requested actions.

Corrective Action CA-3.3.1: Closure of the corrective action document without addressing the request to establish the leak monitoring program is a Latent Organizational Weakness related to the corrective action process. This Latent Organizational Weakness had been separately identified and entered into the corrective action program for evaluation under an independent root cause analysis. Root causes will be developed and corrective actions implemented.

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IV. PREVIOUS SIMILAR EVENTS

Internal and external operating experience (OE) was reviewed for applicability to this event. Thirty potentially applicable events were initially identified based on searches of the Industry operating experience database. The following OE events were determined to be applicable with respect to this event:

Waterford 3 OE19592: In 2004 a safety injection sump outlet 'B' train isolation valve was returned to service following maintenance without being fully seated. The valve operator stop nuts were not set to a known leak tight position as required by procedure.

Byron Unit 2 OE17728: In 2003 a valve was mispositioned during placement of a clearance order. The lesson learned was that valves should be verified closed by use of valve stops, not solely based on the position of the valve handle. In the Callaway event, inaccurate local indication was used to determine valve position instead of using a leakage test to determine the position of minimum leakage.

Fermi Unit 2 LER 99-005-00: In 1999 a 24-inch inboard purge isolation valve failed a local leak rate test due to improper limit switch adjustment. The limit switch was adjusted using a generic method. This is similar to the Callaway event in that the limit switch was setup using a generic maintenance procedure instead of using a leak test to determine the actual, minimum leakage position as the reference point for setting up the close limit switch.

Hope Creek Unit 1 LER 96-005-00: In 1996 there was a failure to account for residual heat removal heat exchanger bypass valve leakage during surveillance testing. The bypass valves were butterfly valves without hard seats. In the Callaway event, a similar butterfly valve was left with excessive leakage following setup without performing a leakage test.

A search of the Callaway Action Request System (CARS) for internal operating experience identified several relevant entries including the following:

CAR 200203522: Valve Retest Manual entries for EFHV0041 need clarification. In the case of EFHV0025, the VRM did not indicate an adequate PMT following MOV limit switch work.

CAR 199903108: Suggestion to perform MOV Diagnostics and Local Leak Rate Testing (LLRT) in close coordination. The resolution was not to coordinate the two tests because it was believed that using MOV Diagnostics test data was sufficient for valve setup.

CAR 200700698: Excess Leakage through SW-ESW Cross-Connect Valve EFHV0024. EFHV0024 is an opposite train sister valve to EFHV0025. This CAR documents that EFHV0024 was found with excessive leakage as discussed above in the Narrative Summary.

V. ADDITIONAL INFORMATION

None.