Calvert Cliffs Nuclear Power Plant
Constellation Generation Group, LLC

1650 Calvert Cliffs Parkway
Lusby, Maryland 20657

Constellation Energy

March 19, 2007

U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1; Docket No. 50-317; License No. DPR 53
Licensee Event Report 2007-001
Reactor Coolant System Pressure Boundary Leakage in Pump Cover Heat Exchanger

The attached report is being sent to you as required by 10 CFR 50.73. Should you have questions regarding this report, please contact Mr. Jay S. Gaines at (410) 495-5219.

Very truly yours,

Joseph E. Pollock
Plant General Manager

JEP/ALS/bjd

Attachment: As stated

cc: D. V. Pickett, NRC
S. J. Collins, NRC
Resident Inspector, NRC
R. I. McLean, DNR

ML070810509

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)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Calvert Cliffs Nuclear Power Plant, Unit 1	05000 317	1 OF 004

4. TITLE
Reactor Coolant System Pressure Boundary Leakage in Pump Cover Heat Exchanger

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
01	17	2007	2007	- 001 -	00	03	19	2007	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING 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)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☒ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
A. L. Simpson, Principal Engineer	410-495-6913

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
B	AB	HX	B580	Y					

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)*

Results from the hydrostatic pressure test performed in January 2007 on the Pump Cover Heat Exchanger (HX) previously installed on 11B Reactor Coolant Pump (RCP), indicates that a Reactor Coolant System (RCS) pressure boundary leak existed when the component was installed in Unit 1. The HX was removed during the 2006 Unit 1 refueling outage as a corrective action to address failures of the lower seal stage and RCS detected in the Component Cooling Water (CCW) system. The RCS leakage was documented in September 2004. The RCS leak rate was so small (approximately 0.016 gallons per day) that the exact location could not be identified by sampling. The leakage was considered unidentified RCS operational leakage, and was less than the one gallon per minute Technical Specification allowable. The Technical Specifications limit RCS pressure boundary leakage to zero. Chemistry tests performed on the CCW system subsequent to startup from the 2006 refueling outage indicated that the active RCS leak was no longer present. The hydrostatic pressure test results, and the fact that the RCS leakage stopped after the 11B RCP HX was replaced, confirm that an RCS pressure boundary leak existed.

I. DESCRIPTION OF EVENT

Results from a hydrostatic pressure test performed in January 2007 on the Pump Cover Heat Exchanger (HX), previously installed on the 11B Reactor Coolant Pump (RCP), indicates that a Reactor Coolant System (RCS) pressure boundary leak existed when the component was installed in Unit 1. The HX was removed during the 2006 Unit 1 refueling outage (RFO) as a corrective action to address failures of the lower seal stage and the low level of radioactivity detected in the Unit 1 Component Cooling Water (CCW) system. The low level of radioactivity (indicative of RCS leakage) was documented in September 2004. The RCS leak rate was so small (approximately 0.016 gallons per day) that the exact location could not be identified. The leakage was considered unidentified RCS operational leakage, and was less than the one gallon per minute Technical Specification allowable. The Technical Specifications limit RCS pressure boundary leakage to zero. The RCP pump cover HX was identified as one of the potential sources of the leak. Component cooling water flows through several HXs in and on the pump cover to provide cooling to the mechanical seal. Chemistry tests performed on the CCW system subsequent to startup from the 2006 RFO indicated that the active RCS leak was no longer present. The hydrostatic pressure test results, and the fact that the RCS leakage stopped after the 11B RCP HX was replaced, confirm that an RCS pressure boundary leak existed.

II. CAUSE OF EVENT

Low levels of radioactivity detected in the Unit 1 CCW system slightly increased between June and September 2004. Plant Chemistry tracked the increasing trend and initiated Condition Report Number IR4-025-347 on September 10, 2004. At that point, the activity level was below the target level, but still indicated an increasing trend. A feed and bleed of the CCW system had been initiated on September 3, 2004 to reduce the activity level; however, the level continued to increase and eventually exceeded the station's self-imposed administrative target value on September 22, 2004. Activity levels in the CCW system returned to near target value with additional feeding and bleeding of the system. A complex troubleshooting plan was developed to establish non-routine sampling and testing of the possible leaking systems containing components that interface between the CCW system and radioactive fluids. Assuming a continuous leak, the leak rate was calculated to be approximately 0.016 gallons per day (approximately 0.04 ml/min). This very small leak rate made identification of the exact leak location extremely difficult using traditional sampling methods.

A detailed assessment identified the Unit 1 RCS sample cooler, the Chemical and Volume Control System letdown HX and the RCP HXs, as the most likely sources of in-leakage into the CCW system. The Unit 1 RCS sample cooler was replaced on line in March 2005 with no resulting change in leak rate. The remaining components could not be isolated at power. The 11B RCP Pump Cover HX was removed during the 2006 RFO and shipped offsite for testing. Following startup from the 2006 RFO, Chemistry testing confirmed that the short-lived fission products were no longer present in the CCW system. This indicates that an active leak of RCS into the CCW

system was no longer present. The 11B RCP Pump Cover HX removed during the 2006 RFO failed its as-found hydrostatic pressure test during overhaul activities performed at an offsite facility (Reference Condition Report Number IRE-019-549). During the test, hydrostatic pressure was applied to the CCW side of the HX at 44 psig. After 30 minutes, pressure had dropped to 42 psig. The vendor's specification for a successful test is a pressure drop of less than 0.5 psig over 30 minutes. The failure mechanism of the HX is unknown. The exact location of the leak was not determined. The leak could be in the tube-in-tube HX or in the drilled port HX. Either location would constitute an RCS pressure boundary failure. The hydrostatic pressure test results, and the fact that the RCS leakage stopped after the 11B RCP HX was replaced, confirm that an RCS pressure boundary leak existed.

III. ANALYSIS OF EVENT

The Technical Specification for RCS operational leakage (Technical Specification 3.4.13.a) limits pressure boundary leakage to zero. If any RCS operational pressure boundary leakage exists, the Technical Specifications require the operating Unit to be in Mode 3 within six hours and to be in Mode 5 within 36 hours. The results from the hydrostatic pressure test confirm that the activity detected in the CCW system in 2004 was due to a pressure boundary leak in the RCS. Specifically, the leakage was determined to be in the 11B RCP Pump Cover HX. The condition existed from June 2004 until the RCP was removed during the spring 2006 RFO. The RCS pressure boundary leakage condition existed for a time longer than allowed by the Technical Specification. Therefore, this condition is reportable pursuant to 10 CFR 50.73 (a)(2)(i)(B).

An examination of the failed component to determine the exact location of the leak was not performed. Therefore, the actual failure mechanism of the pump cover heat exchanger is unknown. However, the design of Calvert Cliffs' RCP pump covers is such that thermal cracking can occur which may propagate to the drilled port heat exchanger in the thermal barrier region. Since the failure may have occurred due to a material problem that resulted in abnormal degradation of a principal safety barrier (i.e., it was necessary to take corrective actions to restore the barrier's capability), this event is also reportable pursuant to 10 CFR 50.73(a)(2)(ii)(A).

This event did not result in any actual nuclear safety consequences. The monitored CCW system radioactivity level was maintained near the threshold value for the duration that the condition existed. The CCW system activity level and leak rate were monitored on a weekly basis. The licensee performed an interim corrective action to "feed and bleed" inventory to and from the system, thus the monitored activity level in the CCW system was maintained at approximately 1.2 E-5 micro Curies per milliliter. At that level, the system did not present a safety hazard to plant personnel or to the environment. The monitored leak rate remained relatively constant at approximately 0.016 gallons per day for the known duration of the condition.

From a qualitative perspective, there was no significant increase in core damage frequency or large early release frequency due to the small thermal barrier leak. The leak was extremely small

(0.016 gallons per day) for the duration that the condition existed. As such, there is no indication that the rupture likelihood of the leak should be increased. If the leakage rate had increased, then it is likely that a plant shutdown would ensue prior to the leakage reaching the level where the event would be considered an initiating event.

IV. CORRECTIVE ACTIONS

A. A complex troubleshooting plan was developed and implemented to identify possible sources of the activity detected in the CCW system.

B. A feed and bleed of the CCW system was performed to minimize CCW system contamination levels and to maintain the activity level near the target value.

C. The 11B RCP Pump Cover HX was removed and replaced during the 2006 RFO.

D. Chemistry samples performed subsequent to removal of the 11B RCP Pump Cover HX verified that an active leak of RCS into the Unit 1 CCW system no longer exists.

V. ADDITIONAL INFORMATION

A. Component Identification

Component	IEEE 803 EIIS Function	IEEE 805 System ID
11B RCP Pump Cover HX	HX	AB

B. Previous Occurrences

No previous Calvert Cliffs occurrences were identified involving an RCS pressure boundary leak due to failure of an RCP pump cover heat exchanger.