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10 CFR 50.73

March 21, 2016

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555

Calvert Cliffs Nuclear Power Plant, Unit No. 1  
Renewed Facility Operating License No. DPR-53  
NRC Docket No. 50-317

Subject: Licensee Event Report 2016-001, Revision 00  
Manual Reactor Trip Due to High Secondary Side Sodium Levels Due to a  
Condenser Tube Leak

The attached report is being sent to you as required by 10 CFR 50.73.

There are no regulatory commitments contained in this correspondence.

Should you have questions regarding this report, please contact Mr. Larry D. Smith at  
(410) 495-5219.

Respectfully,

Mark D. Flaherty  
Plant Manager

MDF/KLG/bjm

Attachment: As stated

cc: NRC Project Manager, Calvert Cliffs  
NRC Regional Administrator, Region I

NRC Resident Inspector, Calvert Cliffs  
S. Gray, MD-DNR

IEZZ  
NRR

**LICENSEE EVENT REPORT (LER)**

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

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@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.

<b>1. FACILITY NAME</b> Calvert Cliffs Nuclear Power Plant, Unit 1	<b>2. DOCKET NUMBER</b> 05000317	<b>3. PAGE</b> 1 OF 5
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**4. TITLE**  
Manual Reactor Trip Due to High Secondary Side Sodium Levels Due to a Condenser Tube Leak

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	
01	25	2016	2016	- 001	00	03	21	2016	FACILITY NAME	

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

**12. LICENSEE CONTACT FOR THIS LER**

LICENSEE CONTACT Kenneth L. Greene, Regulatory Engineer	TELEPHONE NUMBER (Include Area Code) 410 495-4385
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	SG	COND		Y					

<b>14. SUPPLEMENTAL REPORT EXPECTED</b>	<b>15. EXPECTED SUBMISSION DATE</b>	MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO			

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

At 0313 on January 25, 2016, Operators initiated a manual reactor trip on Unit 1 due to high levels of sodium in the Feedwater and Condensate systems that exceeded the threshold levels in Abnormal Operating Procedure 10, Abnormal Secondary Chemistry Conditions. Subsequent investigation determined the high sodium levels were due to a condenser tube leak located in 13A Condenser. The failed condenser tube and several adjacent tubes were plugged and Unit 1 was returned to power operation at 2220 on January 25, 2016. During the 2016 Unit 1 refueling outage eddy current testing confirmed a circumferential crack on the failed condenser tube. The apparent cause is that the condenser tube failure was vibration induced. Radial stakes were installed to help limit future vibration. A causal analysis will be completed following the Unit 1 refueling outage.

NRC FORM 366A (11-2015)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB: NO. 3150-0104		EXPIRES: 10/31/2018	
<b>LICENSEE EVENT REPORT (LER) CONTINUATION SHEET</b>				Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@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.			
				YEAR		SEQUENTIAL NUMBER	
Calvert Cliffs Nuclear Power Plant, Unit 1		05000 317		2016		-- 001 -- 00	
NARRATIVE							

## I. DESCRIPTION OF EVENT:

Energy Industry Identification System (EII) codes are identified in the text as [XX].

## A. INITIAL CONDITIONS:

Unit 1 was operating in Mode 1 at 10 percent power with the Main Turbine [TA] offline on January 25, 2016 prior to the event.

## B. EVENT:

At 0235 on January 25, 2016 Operators received a Condensate [SD] Conductivity high level alarm. Chemistry was notified and began to investigate the cause of the alarm. The Chemistry Technician reported that the Condensate Conductivity levels were rising. Concurrently Operators placed the condensate demineralizers [FDM] in service in attempt to reduce conductivity. Operators entered Abnormal Operating Procedure (AOP)-10, Abnormal Secondary Chemistry Conditions. Operators secured the circulating water pump in the indicated condenser waterbox. At 0313 on January 25, 2016, Operators manually tripped Unit 1 when Feedwater [FJ] and Condensate sodium sample levels exceeded AOP-10 threshold limits that required a reactor trip. Following verification that Emergency Operating Procedure (EOP)-0, Post Trip Immediate Actions, safety functions were met, EOP-1, Reactor Trip, was entered for an uncomplicated reactor trip.

Subsequent investigation determined there was a condenser tube leak on one of the condenser tubes in 13A Condenser [COND] Waterbox. The cracked condenser tube and several surrounding condenser tubes were plugged and the site began preparations to start-up the unit. Unit 1 was returned to Mode 1 at 2220 on January 25, 2016 and the unit returned to full power at 2310 on January 26, 2016.

During the 2016 Unit 1 refueling outage, eddy current testing confirmed a circumferential crack on the affected tube. The apparent cause was that the crack was vibration induced.

## C. INOPERABLE STRUCTURES, COMPONENTS, OR SYSTEMS THAT CONTRIBUTED TO THE EVENT:

There were no structures, systems or components inoperable at the start of the event that contributed to the event.

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## NARRATIVE

## D. DATES AND APPROXIMATE TIMES OF MAJOR OCCURRENCES:

January 25, 2016

- 0235 Received alarm in Control Room for high level of Condensate Conductivity.
- 0240 Chemistry Technician reported Condensate Conductivity level rising.
- 0255 Entered AOP-10.
- 0312 Chemistry Technician reported Condensate sodium of 432 ppb; Feedwater sodium of 232 ppb.
- 0313 Unit 1 Manual reactor trip due to exceeding AOP-10 trip criteria.
- 0318 EOP-0 safety functions verified met.
- 0331 Implemented EOP-1 for uncomplicated reactor trip.
- 0429 Exited EOP-1 and implemented Operating Procedure OP-4, Plant Shutdown from Power Operation to Hot Standby.
- 2220 Unit 1 entered Mode 1.

January 26, 2016

- 2310 Unit 1 returned to full power.

## E. FAILURE MODES:

The failed 13A Condenser tube is a titanium tube that was installed during the 2012 refueling outage. During initial installation of the titanium condenser tubes, vertical stakes were installed to reduce vibration of the condenser tubes however the vertical stakes do not prevent vibration in the vertical direction.

Eddy current testing during the 2016 refueling outage identified that the affected condenser tube experienced a circumferential crack around approximately 180 degrees. The apparent cause for the tube leak is that the failure was vibration induced in the unrestrained direction.

## F. METHOD OF DISCOVERY:

The condenser tube leak in 13A Condenser Hotwell was self-revealing. This event is documented in the site's Corrective Action Program under IR02616491.

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## II. CAUSE OF EVENT

## A. SAFETY CONSEQUENCES:

The Reactor Protection System [JD] was manually initiated in response to the condenser tube leak in 13A Condenser Hotwell in accordance with AOP-10. During performance of AOP-10, Operators started 13 Auxiliary Feedwater [BA] Pump [P] and secured both Steam Generator Feed Pumps. Although both Steam Generator [SG] Feed Pumps were secured to reduce sodium buildup in the steam generators, the Main Feedwater system remained functional. Additionally, Operators shut the Main Steam [SB] Isolation Valves [ISV] to protect the condenser from overpressure. This step, although listed in the abnormal operating procedure, was not required as sufficient condenser vacuum was still being maintained by the remaining Circulating Water [KE] Pumps. The Main Steam Isolation Valves were subsequently re-opened.

The safety consequence of this event was the introduction of sodium into the Condensate and Feedwater systems and ultimately into the Steam Generator. If left uncorrected, the high sodium conditions would have a detrimental effect on steam generator tube integrity. The condenser tube leak resulted in a manual reactor trip to be initiated once sodium levels exceeded AOP-10 allowed levels. Operators continued actions to restore steam generator secondary side water chemistry to acceptable levels.

This event satisfies the criteria in NUREG-1022, Revision 3, for system actuations of the Reactor Protection system and the Auxiliary Feedwater system. Therefore, this event is reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A). An immediate event notification report (51683) was also made pursuant to 10 CFR 50.72(b)(2)(iv)(B) for reactor protection system actuation while critical and 10 CFR 50.72(b)(3)(iv)(A) for the manual actuation of the auxiliary feedwater system.

## B. CORRECTIVE ACTIONS:

The failed condenser tube and several adjacent tubes were plugged prior to returning the unit to power operations.

During Unit 1's 2016 refueling outage eddy current testing confirmed a through-wall circumferential crack of around 180 degrees on the affected condenser tube. The apparent cause is that the condenser tube failure was vibration induced. As part of the extent of condition investigation the normal number of condenser tubes that were eddy current tested in 13A Condenser during a refueling outage was expanded. As a result four other condenser tubes in 13A Condenser were found to have indications of wear at tube stake locations and were subsequently plugged. Radial stakes were then installed during the refueling outage to

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**NARRATIVE**

reduce movement in the x and y direction. The site conducted the normal amount of eddy current testing on the remaining Unit 1 condensers with no similar issues detected.

Following the refueling outage, a causal analysis will be performed to determine the cause of the tube leak. If additional information is subsequently developed that would significantly affect the understanding of this event, a supplemental licensee event report will be submitted.

**III. PREVIOUS SIMILAR EVENTS:**

A review of Calvert Cliffs' events over the past several years was performed and no similar instance was found.

**A. COMPONENT INFORMATION:**

COMPONENT	IEEE 803 FUNCTION ID	IEEE 805 SYSTEM ID
13A Condenser Tube	COND	SG

The 13A Condenser tubes were fabricated by Valtimet.