NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Calvert Cliffs, Unit 2	0 5 0 0 0 3 1 8	1 OF 0 5

TITLE (4)

Manual Trip Caused by Degradation of 21A Reactor Coolant Pump Shaft Seal

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 4	2 5	8 5	8 5	– 0 0 1 –	0 0	0 5	2 3	8 5		0 5 0 0 0
										0 5 0 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

OPERATING MODE (9): 1	[ ] 20.402(b)	[ ] 20.405(c)	[X] 50.73(a)(2)(iv)	[ ] 73.71(b)
POWER LEVEL (10): 1 0 0	[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[ ] 50.73(a)(2)(v)	[ ] 73.71(c)
	[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[ ] 50.73(a)(2)(vii)	[ ] OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	[ ] 20.405(a)(1)(iii)	[ ] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	
	[ ] 20.405(a)(1)(iv)	[ ] 50.73(a)(2)(ii)	[ ] 50.73(a)(2)(viii)(B)	
	[ ] 20.405(a)(1)(v)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER: AREA CODE	
D. S.Elkins, Senior Engineer	3 0 1	2 6 0 - 4 9 7 1

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
X	A B	S E A L	B 5 8 0	Y					
X	S B	Z C	M 4 3 0	N					

SUPPLEMENTAL REPORT EXPECTED (14)

[ ] YES (If yes, complete EXPECTED SUBMISSION DATE) [X] NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

At 0933 on April 25,1985, Unit 2 was manually tripped while operating in MODE 1 at 100% power. This trip was caused by a rapid degradation of the 21A Reactor Coolant Pump shaft seal. This was evidenced by an increase in controlled bleedoff flow, degradation of seal pressure staging and a resultant shutting of the controlled bleedoff excess flow check valve just prior to the trip. 21 Atmospheric Dump Valve stuck open contributing to a Reactor Coolant System cooldown to 517°F. By 1000 the reactor plant was stable and boration to shutdown had commenced. Subsequently, the plant was cooled down to affect seal replacement. The seal was replaced and Unit 2 was restored to operation on May 6, 1985.

Two days prior to the trip, temperature fluctuations (over a 5 hour period) in the component cooling water system caused large pressure oscillations between the stages of 21A seal that continued until it degraded requiring a manual trip. 21A seal had exhibited some pressure oscillations in the past.

An investigation has been initiated to determine the effect of service water and component cooling water system transients on reactor coolant pump operation. 21 Atmospheric Dump Valve was repaired and an inspection program was begun which should prevent similar failures in the future.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

On the morning of April 23, 1985, 21A Service Water (SRW) heat exchanger was removed from service, the saltwater side tube inlet cleaned, and restored to service causing flow variations in the saltwater system. Since the SRW system is cooled by the saltwater (SW) system, when a SRW heat exchanger is removed from service, temperatures and flows change in the SW cooling system. The component cooling water (CCW) system is also cooled by the SW system and is in parallel with the SRW system. So when a change in the SRW lineup affects the SW flow, a related affect is experienced in the SW cooling to the CCW heat exchangers, causing CCW temperatures to change.

As the SRW lineup was altered on April 23rd to remove 21 SRW heat exchanger from service, a temperature transient was imposed on 21 CCW heat exchanger of about 20 degrees F peak to peak. The Control Room Operator (CRO) monitored 21A seal performance during this time and regulated SW flow in an attempt to stabilize the transient on 21 CCW heat exchanger. This temperature transient appears to have caused large pressure oscillations to develop between the stages of 21A Reactor Coolant Pump (RCP) shaft seal. Also 21A lower seal temperature began to slowly rise at a rate of about 3 degrees/hour from a value of about 125 degrees F. Pressure oscillations varied from 300-500 psi on both the upper and middle seal cavity pressure indications.

The remaining three RCP shaft seals were not adversely affected by the transient. Pressures and temperatures on these seals were closely monitored and they responded as expected during the transient with no noted degradation resulting.

21A lower seal temperature continued to rise until it leveled off at about 155 degrees F by early morning of April 24th. Pressure oscillations between the seal stages continued. No notable changes were observed on 21A seal until early in the morning on April 25th, when CCW flow was increased to 21A RCP. Then 21A lower seal temperature began to slowly drop (as expected) at a rate of about 3 degrees/hour. The CROs continued to closely monitor 21A seal performance.

At 0925 on April 25, 1985, Controlled Bleedoff (CBO) Hi/Lo flow alarms began to alarm repeatedly on 22B RCP shaft seal, alerting the operator to abnormal CBO flow. 21A RCP seal cavity pressure began to fluctuate by about 600 psi. CBO flow alarms began to occur for 21A, 21B, and 22A RCP seals along with the already alarming 22B CBO flow. These alarms lasted for several minutes. It was evident to the CROs that 21A CBO flow had began to increase markedly indicating a further degradation of the seal staging.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

At this point 21A RCP middle and upper seal cavity pressures increased to 2200 psi, pressure oscillations in the RCP CBO header stabilized and settled out at about 60 psi, and lower seal temperature began to drop quickly. Based on these observations, the CRO correctly deduced that the excess flow check valve on the CBO line from 21A RCP seal had shut due to increased CBO flow through the seal. 22B CBO flow alarms stopped at this point.

The Control Room Supervisor, Shift Supervisor, and General Supervisor Operations (acting) were informed of the situation. The Shift Supervisor and the General Supervisor Operations (acting) determined that Unit 2 should be manually tripped.

At 0933 with Unit 2 at 100% power in **MODE** 1, the CRO tripped the Unit 2 reactor and turbine. The steps of Emergency Operating Procedure-1 were commenced. 23 Auxiliary Feedwater Pump automatically started immediately after the trip with the actuation of the Auxiliary Feedwater Actuation Signal (AFAS).

Since both Main Feedwater (MFW) pumps were being operated in manual mode of operation, the CRO tripped 22 MFW pump manually as 21 MFW pump tripped on a high discharge pressure signal.

Approximately 60 seconds after the manual reactor trip, the CRO secured 21A RCP. Main steam was manually initiated to the steam driven AFW pumps (21 and 22) to assist in restoring steam generator level control.

After the trip, 21 Atmospheric Dump Valve opened and failed to shut as expected. This complicated control of the Reactor Coolant System (RCS) cooldown. RCS temperature decreased to 517 degrees F before it was stabilized. RCS pressure decreased to about 1900 psi and pressurizer level dropped to about 70 inches. 21 Atmospheric Dump Valve and steam generator blowdown were isolated.

AFW flow was increased to restore steam generator level and steam generator blowdown was placed back in service. MFW was restored and AFW was secured. By 1000 the reactor plant was well stabilized and the CRO commenced borating to a shutdown concentration.

The reactor plant was cooled down and preparations were made to replace 21A RCP seal. The seal was replaced, 21 Atmospheric Dump Valve was repaired, and Unit 2 was brought to criticality at 1905 on May 5, 1985. At 0252 on May 6, 1985, Unit 2 was paralleled to the grid.

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Throughout the event, the actions of the CROs were proper and based on a correct assessment of plant conditions.

21 Atmospheric Dump Valve malfunctioned due to a fault in its Moore Products Valve Positioner (Model 72G315). The positioners have a potential for their internal levers to interfere with one another causing the levers to disengage resulting in the dump valve failing to close. Interference can be detected if an inspection and stroke test are performed. Alterations can be made to the positioner to prevent the interference from occurring. Adjustments will be made to these valve positioners if required as each will be inspected during valve stroking and prior to subsequent positioner installations.

The specific mechanism of failure for 21A RCP seal has not been determined. It exhibited symptoms of increased degradation several months before the trip, and had been closely watched by trending performance indicators on a daily basis. These symptoms (larger than normal pressure oscillations) lessened to more normal values which had remained relatively consistent until the CCW transient on April 23, 1985. The CCW temperature transient was enough to cause the suspect seal to degrade further. The shaft seal is manufactured by the Byron Jackson Pump Division of Borg-Warner Corporation. It is a four-stage seal (including the vapor seal) used on a type DFSS reactor coolant pump, size 35 x 35 x 43. The seal had been in operation for 18 months in 21A RCP at the time of degradation. An additional investigation of the precursors to this event has been initiated. This investigation will examine what affect CCW and SRW transients have on RCP shaft seal temperatures, and hence operation and reliability.

ASSESSMENT OF SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT

This event occurred with Unit 2 at 100% power in **MODE** 1. All leakage past the lower, middle and upper stages of 21A RCP shaft seal went into the CBO line or out the vapor seal drain line. Once the excess flow check valve shut at 10 gpm flow, RCS pressure was held entirely by the vapor seal. No resultant leakage to the containment occurred since the vapor seal functioned as designed. 21A vapor seal was subject to full RCS pressure, with the RCP operating, for just a few minutes. Manually tripping the reactor plant and securing 21A RCP within one minute of the trip minimized any potential for subsequent shaft seal degradation.

Because of the prompt and correct actions of the CROs, no significant safety consequences resulted from this event.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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Since the reactor was at 100% power, this event would not have been more severe under other reasonable and credible alternative conditions. There was no other equipment inoperable which contributed to the event.

An examination of previous LERs dealing with manually tripping because of RCP seal degradation revealed no similar events.

The contact person for this event is D. S. Elkins, 301-260-4971.

BALTIMORE GAS AND ELECTRIC COMPANY

P.O. BOX 1475

BALTIMORE, MARYLAND 21203

NUCLEAR POWER DEPARTMENT
CALVERT CLIFFS NUCLEAR POWER PLANT
LUSBY, MARYLAND 20657

May 23, 1985

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Docket No. 50-318
License No. DPR 69

Dear Sirs:

The attached LER 85-01, Unit 2 is being sent to you as required by 10 CFR 50.73.

Should you have any questions regarding this report, we would be pleased to discuss them with you.

Very truly yours,

L B Russell
L. B. Russell
Plant Superintendent

LBR/~~DBE~~ /pah

cc: Dr. Thomas E. Murley
Director, Office of Management Information and Program Control
Messrs: A. E. Lundvall
J. A. Tiernan

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