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October 20, 1994

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 2; Docket No. 50-318; License No. DPR 69
Licensee Event Report 94-005
Unit 2 Trip Due to Main Turbine Governor Valve Opening

The attached report is being sent to you as required under 10 CFR 50.73 guidelines. Should you have any questions regarding this report, we will be pleased to discuss them with you.

Very truly yours,

CHC/MDM/bjd

Attachment

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
M. J. Case, NRC
D. G. McDonald, Jr., NRC
T. T. Martin, NRC
P. R. Wilson, NRC
R. I. McLean, DNR
J. H. Walter, PSC
Director, Office of Management Information
and Program Control

cert # 2899 387 306

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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNEB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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

FACILITY NAME (1) Calvert Cliffs, Unit 2	DOCKET NUMBER (2) 05000 318	PAGE (3) 1 OF 05
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TITLE (4)
Unit 2 Trip Due to Main Turbine Governor Valve Opening

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 NUMBERS(S)
09	24	94	94	-- 005 --	00	10	20	94		05000
										05000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (Check one or more) (11)							
		20.402(b)	20.405(c)	X	50.73(a)(2)(iv)	73.71(b)			
POWER LEVEL (10)	16	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)				
		20.405(a)(1)(iii)	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)	OTHER			
		20.405(a)(1)(iv)	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)	(Specify in Abstract below and in Text, NRC Form 366A)			
		20.405(a)(1)(v)	50.73(a)(2)(iii)		50.73(a)(2)(x)				

LICENSEE CONTACT FOR THIS LER (12)

NAME M. D. Milbradt, Compliance Engineer	TELEPHONE NUMBER (include Area Code) 410-260-4352
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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

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-space typewritten lines) (16)

On September 24, 1994, at 2016, Calvert Cliffs Unit 2 experienced a reactor trip at 16 percent power due to low Steam Generator (SG) pressure. The low pressure was sensed after a rapid increase in steam demand was experienced due to an unexpected opening of No. 21 main turbine governor valve.

Troubleshooting after this event identified a loose wire on No. 21 governor valve's Linear Voltage Differential Transformer (LVDT). This loose wire essentially removed the LVDT feedback from the valve's positioning circuit. Thus, No. 21 governor valve started to open and continued to open due to the lack of feedback from the LVDT. The sudden increase in steam flow that occurred after No. 21 governor valve ramped open caused SG pressure to drop low enough to cause the reactor trip.

In response to this event the wire on No. 21 governor valve LVDT was tightened and the wiring on all of the other Unit 2 main turbine throttle and governor valves was checked as well. Additional system monitoring and evaluation is being performed as well.

NRC FORM 388A (5-92)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95	
LICENSEE EVENT REPORT (LER) TEXT CONTINUATION				ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNSB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503	
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TEXT (If more space is required, use additional copies of NRC Form 388A) (17)

I. DESCRIPTION OF EVENT

On September 24, 1994, at 2016, Calvert Cliffs Unit 2 experienced a reactor trip due to low Steam Generator (SG) pressure. The low pressure was sensed after a rapid increase in steam demand was experienced due to an unexpected response from a main turbine governor valve. Plant response to the event was in accordance with design. At the time of the event, Unit 2 was operating at 16 percent power with normal operating temperature and pressure.

The main turbine is a Westinghouse 1800 RPM tandem turbine consisting of one double-flow high pressure section and three double-flow low pressure sections. Located on either side of the high pressure turbine casing are throttle valve-steam chest assemblies. Each assembly consists of two horizontally mounted throttle valves and two plug type governing valves. Each of these valves are controlled by the turbine Electro-Hydraulic Governing System through individually operated valve actuators.

At approximately 2006 on September 24, 1994, Calvert Cliffs Unit 2 main generator was paralleled to the electrical grid. The turbine was being operated at the time in the OPERATOR AUTOMATIC mode and 40 MWe was initially established on the machine. In OPERATOR AUTOMATIC, if the operator desires to change turbine speed or load, a desired setpoint is entered, a start signal is initiated by the operator and the automatic control circuits bring the turbine to the desired speed or load. The SETTER indication will display the desired setpoint and the REFERENCE indication will display the final referenced output.

After the unit was paralleled, the mode of control was transferred to TURBINE MANUAL. In this mode, the operator applies a signal directly to the throttle or governor valves by using the TURBINE MANUAL pushbuttons. In TURBINE MANUAL control, the SETTER indication displays the desired governor valve demand voltage (0-10 volts) and the REFERENCE indication displays the same demand, generated by the OPERATOR AUTOMATIC system. The two modes of control track each other to facilitate a "bump-less" transfer if the operator changes from TURBINE MANUAL to OPERATOR AUTOMATIC.

About 8 minutes after the transfer to TURBINE MANUAL, the operator at the turbine controls panel attempted to pick up load by pushing the Governor Valve Up-Arrow (open) pushbutton. He did not see a change in governor valve demand voltage on the SETTER or REFERENCE indications, both remained at .90 volts. He then pushed the button again and saw demand increase from .90 to .92 volts and stabilize. Approximately 1-2 minutes later, operators noticed Reactor Coolant System temperature dropping and the SETTER and REFERENCE indicators displays indicating 1.6 volts. Attempts by the operators to decrease the governor demand voltage and close the governor valves were unsuccessful. Due to the rapid increase in steam flow, resulting from No. 21 governor valve opening, Unit 2 tripped on low SG pressure seconds later.

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TEXT (If more space is required, use additional copies of NRC Form 386A) (17)

II. CAUSE OF EVENT

The cause of the reactor trip was due to low SG pressure, resulting from an increase in steam demand after No. 21 governor valve opened. A demand signal was generated to further open the governor valves when the operator attempted to raise load after paralleling the main generator. The system is designed such that valves No. 22 and No. 23 will open first in response to a lower demand signal, while valves No. 21 and No. 24 will remain closed until a higher demand signal is generated.

Even though No. 21 and No. 24 governor valves require a higher demand voltage to actually open, a common demand signal is sent to all four governor valve's servo cards. Each governor valve has a servo card that receives these demand signals and combines the signal in a summing circuit with a signal from the respective valve's Linear Voltage Differential Transformer (LVDT). The LVDT detects the valve's actual position and acts as feedback circuit to ensure the valve is positioned properly in response to the demand generated.

Troubleshooting after this event identified a loose wire on No. 21 governor valve's LVDT. It is believed the wire became loose due to system vibration. This loose wire essentially removed the LVDT feedback from the valves positioning circuit. Without this feedback, the .92 volts demand signal initiated by the operator was the only signal seen by the servo card for No. 21 governor valve. Thus, No. 21 governor valve started to open and continued to open due to the lack of feedback from the LVDT. The resulting transient from the opening of No. 21 governor valve caused a slight momentary increase in turbine speed. This change in speed was indicated on both the SETTER and REFERENCE displays as the 1.6 volt valve demand voltage seen by the operators. The sudden increase in steam flow that occurred after No. 21 governor valve ramped open caused SG pressure to drop low enough to cause the reactor trip.

III. ANALYSIS OF EVENT

This event is reportable under 10 CFR 50.73(a)(2)(iv), as a condition that resulted in an automatic RPS actuation. The reactor tripped as designed on low SG pressure. This event is bounded by the Excess Load Event in Chapter 14.4 of the Calvert Cliffs Updated Final Safety Analysis Report. The Excess Load Event is analyzed at Hot Zero Power and Hot Full Power to bound the transient at all power levels. The analysis conservatively assumes instant opening of valves which will cause the greatest cooldown of the reactor coolant system. This event does not exceed the specified acceptable fuel design limits. Therefore, there were no safety consequences associated with this event.

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LICENSEE EVENT REPORT (LER)				ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST, 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.	
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IV. CORRECTIVE ACTIONS

In response to this event the following actions were completed or have been initiated:

- A. The wire on No. 21 governor valve 'LVD' was tightened and the wiring on all of the other Unit 2 main turbine throttle and governor valves was checked as well.
- B. A valve position limiter circuit can be used to limit the amount of opening of the governor valves. The circuit compares the selected limit against the governor valve demand signal. If the governor valve demand signal increases enough to reach the setpoint or the limit is lowered below the demand signal, the valves will not open further. To reduce the probability of the governor valves from inadvertently opening, the limiter circuit will now be used when operating the main turbine. A procedure change was processed to establish this requirement.
- C. A briefing on this event was conducted with each Operations crew. Lessons learned will also be included in Licensed Operator training including the changes to the way the system is now to be operated.
- D. Monitoring equipment was installed at key locations in the main turbine control system and important parameters will be monitored through the end of October, 1994, to ensure the system is operating properly.
- E. An ongoing Equipment Performance Task Force will now include as part of their review the turbine control systems and issues involving electrical connections.
- F. A fault tree analysis will be done on the Unit 1 Electro-Hydraulic Governing System to identify single failure modes. The decision to do the same analysis on Unit 2 will be made after the Unit 1 analysis is completed. Maintenance processes will be changed as necessary as a result of the analysis.

V. Additional Information

A. Additional Component Identification

Component	EIIS Funct Code	EIIS System Code
Main Turbine	TRB	TA
Turbine Governor Valves	FCV	TA
Governor Valve Junction Box	JBX	JJ

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B. Previous Similar Events

There have been no previous reportable events at Calvert Cliffs Unit 2 involving a failure of the main turbine control circuit that allowed the governor valves to go open. There were three events, documented in LER 318/83-40, in which the governor valves inadvertently closed due to a failed speed error amplifier 'A' printed circuit card.