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September 30, 1994

U.S. Nuclear Regulatory Commission
Washington, D.C. 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 94-006, Supplement 1
Unit Trip Due to Inadvertent Closure of Main Turbine Stop Valves

The attached Supplement/Licensee Event Report is being sent to you to fulfill our commitment in the original LER for a Supplemental Report. Should you have any questions regarding this report, we will be pleased to discuss them with you.

Very truly yours,

R Wardell
for CHC

CHC/CDS/dlm

Attachment

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
M. K. Boyle, NRC
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NRC FORM 366 (5-92)

U. S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Calvert Cliffs, Unit 1	05000 317	1 OF 06

TITLE (4)
Unit Trip Due to Inadvertent Closure of Main Turbine Stop Valves

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)
06	16	94	94	-- 006 --	01	09	30	94		05000
										05000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR : (Check one or more) (11)					
POWER LEVEL (10)	100		20.402(b)		20.405(c)	X	50.73(a)(2)(iv)		73.71(b)
			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 (include Area Code)
Craig D. Sly, Compliance Engineer	410-260-4858

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-space typewritten lines) (16)

On June 16, 1994, Calvert Cliffs Unit 1 tripped from 100 percent power due to an automatic actuation of the Reactor Protection System (RPS). The RPS signal was the result of low steam generator water levels due to feedwater shrink after all four main turbine stop valves (MTSVs) unexpectedly closed during performance of a weekly MTSV test. After the trip, steam generator levels trended downward with Steam Generator 12 level decreasing more rapidly than Steam Generator 11 level. About eight minutes after the trip, the auxiliary feedwater system actuated, restoring positive level trends in both steam generators.

Troubleshooting efforts did not positively identify the specific hardware cause of the MTSVs closing. Subsequent to this event, another trip of the Unit occurred on July 19, 1994, due to MTSV closure with no testing in progress. The root cause analysis of these two events have been combined. The results will be provided in the supplement to LER 317-94-007 concerning the July 19 event.

I. DESCRIPTION OF EVENT

On June 16, 1994 the Calvert Cliffs Unit 1 reactor tripped due to an automatic actuation of the Reactor Protection System (RPS). The RPS signal was the result of low steam generator water levels due to level shrink after all four main turbine stop valves (MTSVs) closed during performance of a weekly stop valve test. At the time of the trip, the unit was at 100 percent rated thermal power (MODE 1).

Early on June 16, 1994, operations personnel were performing weekly Performance Evaluation (PE) 1-93-1-0-W, "Main Stop Valve Test." This PE successively exercises each stop valve to the closed position. The procedure requires the user to depress and hold the test button in the Control Room for each individual MTSV being tested. Operators are then instructed to observe locally, and on the Control Room control panel, the movement of the MTSV being tested including:

- That the normal operating device closes the MTSV at a moderate rate until it is approximately 12 percent open.

- The fast acting solenoid then closes the MTSV rapidly for the remainder of the stroke.

When the MTSV being tested is fully shut, the operator in the Control Room is instructed to release the test button and observe on the Control Room panel that the MTSV indicates opens. The operator stationed at the MTSV is instructed to observe that the MTSV fully reopens. This process is then repeated for each of the other remaining MTSVs in succession.

At 0135 hours, PE 1-93-1-0-W was completed satisfactorily for Unit 1 MTSV-1 and MTSV-2. The Control Room Operator commenced the test of MTSV-3 by depressing its' test button. MTSV-3 was observed locally and in the Control Room to go shut. When the Operator released the test pushbutton, he observed MTSV-1, 2, and 4 go shut and 3 remained shut. The operator stationed at the MTSVs observed that MTSV-3 remained shut and the other three MTSVs drifted closed. The rate of the closure was faster than the routine MTSV test closure times, but not as fast as a normal turbine trip sequence. A short time later the reactor tripped due to an RPS signal generated by a low water level condition in the steam generators.

After the reactor trip, operators initiated Emergency Operating Procedure (EOP)-0, "Post Trip Immediate Actions." After steam generator levels stabilized at about -111 inches after the trip, operators noted a decreasing trend in steam generator levels with No. 12 Steam Generator level decreasing more rapidly than No. 11 Steam Generator level. Steam generator levels continued to trend downward until, about 8 minutes after the trip, No. 12 Steam Generator level reached -170 inches resulting in an Auxiliary Feedwater Actuation Signal (AFAS). At the time the AFAS occurred, No. 11 Steam Generator level was -140 inches. The Auxiliary Feedwater (AFW) System

actuated and restored a positive level trend in both steam generators. From that point, plant recovery proceeded in a normal fashion.

II. CAUSE OF EVENT

The cause of the reactor trip was an RPS signal generated as a result of low steam generator water levels (~50 inches) after all of the MTSVs closed. The closure of the stop valves caused steam generator pressure to promptly increase. The pressure increase caused level in the steam generators to shrink.

The cause of all four MTSVs closing during PE 1-93-1-0-W has not been identified. A representative of the turbine vendor (General Electric) arrived onsite on June 16, 1994 to assist in investigating the cause of the MTSV closures. Based on his knowledge of the turbine control systems and the observations of the operators who conducted the test, the General Electric representative worked with the system engineers to develop a troubleshooting plan that focused in two specific areas; the MTSV hydraulic system and the valve sequencing circuitry. The troubleshooting plan was implemented on June 16 and 17, 1994.

Hydraulic System Investigation:

As described by the operator, MTSV-3 failed to reopen when its test button was released. At that point in the valve test sequence its disk dump valve is open. Releasing the test button should reset the disk dump valve, and allow the MTSV to reopen. If the disk dump valve failed to reset, the leakage of hydraulic oil directly to drain could have caused a momentary decrease in hydraulic system pressure, and caused the other MTSVs to drift closed.

To simulate the condition described above, the MTSV-3 fast acting valve was held open during a test. In this mode, the MTSV-3 remained closed when the operator released the test button. No decrease in hydraulic pressure was observed, and all other MTSVs remained fully open.

The EHC backup hydraulic pump provides redundancy in maintaining adequate hydraulic oil pressure during normal plant operation. The auto-starting feature of the backup EHC hydraulic pump was tested and no problems were noted. Using the bypass valve on the hydraulic unit, the EHC pressure was slowly allowed to decrease to the turbine trip pressure. All MTSVs remained fully open during the entire test until the turbine trip occurred, and nothing unusual was noted.

In conclusion, while the possibility of MTSV-3 disk dump valve failing to reset could not be fully eliminated, it is unlikely that the resulting hydraulic transient, by itself, would have caused the valves to drift closed as described by the operator. Also, the backup EHC hydraulic pump was operating as required.

Valve Sequencing Investigation:

MTSV-2 is the controlling valve for the other MTSVs. When MTSV-2 reaches 90 percent open, a limit switch is activated to open the other three MTSVs. If MTSV-2 drifted closed, or if the 90 percent switch malfunctioned, the other MTSVs would drift closed. During the valve test sequence the limit switch circuit is disarmed. When the test button is released, the circuit is rearmed. The possibility exists that during the MTSV-3 testing sequence, MTSV-2 may have drifted closed. If this had happened, MTSVs 1 and 4 would have drifted closed as soon as the Control Room operator released the MTSV-3 test switch. The MTSV-3 would also have remained closed. However, this postulated potential event sequence does not explain why MTSV-2 closed as reported by the operator observing the test locally at the MTSVs. Therefore, failure of the 90 percent switch circuit has been eliminated as a potential cause when all the MTSVs closed.

General Electric continues to review this incident in detail to determine if a specific sequence can be identified as the cause of the unexpected MTSV closure. On July 19, 1994, another trip occurred due to a simultaneous closure of the MTSVs. The root cause analyses of these two events has been combined and the results will be described in the supplement to LER 317/94-007 concerning the July 19 reactor trip.

As stated earlier, water level in 12 Steam Generator was noted as decreasing more rapidly than in 11 Steam Generator eventually resulting in an AFAS at -170 inches. An investigation into this discrepancy found that the feedwater regulating bypass valve for 12 Steam Generator did not open to the desired 33 percent open position after the trip. After a reactor trip, the main feed regulating valves close and the feedwater regulating bypass valves receive a constant input signal corresponding to a 33 percent open position for decay heat removal. The feedwater regulating bypass valve (FRBV) for 12 Steam Generator was found to be in a 25 percent open position. The FRBV for 11 Steam Generator was open to the desired 33 percent position. Additional investigation found a partially clogged air relay was the cause of the FRBV for 12 Steam Generator not opening to the desired position.

III. ANALYSIS OF EVENT

After the turbine stop valves closed, pressure in both steam generators increased rapidly causing steam generator level to shrink. As steam generator levels declined, the reactor tripped at the -50 inch level. This is the expected plant response to this event. Steam generator levels continued to decrease to about -130 inches about one minute after trip. As steam was dumped through the turbine bypass valves, steam generator pressure dropped and stabilized. Steam generator levels increased to about -111 inches at two minutes after the trip due to feedwater swell resulting from the pressure drop. At that point steam generator levels stabilized and slowly trended downward with No. 12 Steam Generator level trending down faster than No. 11 Steam Generator. About 8 minutes after the trip, level in No. 12 Steam

Generator reached -170 inches, generating an AFAS signal as designed. The AFW system pumps started and established a positive level trend in both steam generators. Plant recovery was normal thereafter.

Except for the items noted above, all systems structures and components responded as designed. This event is bounded by existing analyses in our Updated Final Safety Analysis Report concerning loss of load. The Chapter 14 Analysis for loss of load credits the high pressurizer pressure trip actuation of two primary code safety valves, and opening of two Main Steam Safety Valves to mitigate the transient. All of this equipment was available and would have performed its safety function if challenged. The actual event was mitigated by the fact that a low SG level precluded the high RCS pressure trip. Based on this it is concluded that no significant safety consequences resulted. This event is considered reportable under 10 CFR 50.73(a)(2)(iv), as an event that resulted in the automatic actuation of any engineered safety feature including the RPS.

IV. CORRECTIVE ACTIONS

Post event MTSV testing was completed satisfactorily and the unit was returned to power operation. General Electric is currently reviewing this incident in detail to determine if a specific cause can be identified for the MTSVs suddenly closing. On July 19, 1994, with no testing in progress, another Unit 1 Reactor trip occurred due to simultaneous MTSV closure. This event is discussed in LER 317-94-007. The root cause analyses of these events have been combined and their results will be combined and discussed in the planned Supplement to LER 317-94-007.

An analysis has been completed to determine if an AFAS actuation should be expected after a reactor trip, with main feedwater flow available. A setpoint change to the bypass valve post-trip open position from 33 percent to approximately 58 percent open has been proposed.

The partially clogged air relay for the FRBV to No. 12 Steam Generator was replaced. The valve was tested and found to be operating satisfactorily.

As detailed earlier, extensive troubleshooting was conducted in an effort to identify the cause of the MTSVs closing during the test of MTSV-3. As the test program did not indicate any abnormal conditions, and the hydraulic system was demonstrated to be functioning as designed, it was recommended that the unit be returned to service on June 17, 1994.

The Operations Superintendent authorized Unit 1 restart, but restricted MTSV testing. When the Unit reached 10 percent power the MTSVs were fully tested. All valves tested satisfactorily and no abnormal conditions were noted.

To be consistent with recently issued vendor (General Electric) guidance, for recommended test intervals for steam valves of nuclear steam turbines, we have increased the test interval of this PE and two other similar PEs from weekly

or monthly to quarterly. These changes will reduce the total number of tests that challenge the plant and could potentially result in plant transients.

V. ADDITIONAL INFORMATION

A. Failed Component Identification

Component or System	IEEE 803 EIIS Funct	IEEE 805 System ID
Steam Generator	HX	SJ
Feedwater Regulating Bypass Valve	LCV	SJ
Main Turbine Stop Valve	SHV	TA
Auxiliary Feedwater System	N/A	BA
Turbine Bypass Valves	PCV	TA
Air Relay	PSV	SJ
Main Turbine	TRB	TA
Electrohydraulic System	N/A	TG

B. Previous Similar Events

There have been no previous similar reported occurrences of unexplained MTSV closure during testing of the MTSV at Calvert Cliffs in the past.