CHARLES H. CRUSE
Plant General Manager
Calvert Cliffs Nuclear Power Plant

Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, Maryland 20657
410 586-2200 Ext. 4101 Local
410 260-4101 Baltimore

BGE

May 31, 1995

U.S. Nuclear Regulatory Commission
Washington, DC 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 95-002, Revision 1
Unit 2 Trip Due to Steam Generator Low Levels After SGIS Actuation

The attached report is being sent to you as required under 10 CFR 50.73 guidelines. Should you have 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
L. B. Marsh, NRC
D. G. McDonald, Jr., NRC
T. T. Martin, NRC
P. R. Wilson, NRC
R. I. McLean, DNR
J. H. Walter, PSC

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NRC FORM 366 (5-92) U. S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES: 5/31/952

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 (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.

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 2	05000 318	1 OF 07

TITLE (4)
Unit 2 Trip Due to Steam Generator Low Levels After SGIS Actuation

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)
01	13	95	95	-- 002 --	01	05	31	95		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)		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)	X	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)
M. D. Milbradt, Compliance Engineer	410-260-4352

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 January 13, 1995, at approximately 1047, Calvert Cliffs Unit 2 tripped from 100 percent power due to low levels in the Steam Generators (SGs). The Reactor Protective System low level trip occurred after an Engineered Safety Feature Actuation System Steam Generator Isolation Signal (SGIS) was generated.

At around 1020 on Friday, January 13, 1995, Instrument Maintenance (IM) technicians tripped SGIS Channel ZG as part of surveillance testing. At around the same time an IM safety tagger, walking down a tagging request, twisted an instrumentation cable for SG pressure transmitter 2PT1013A to read the cable scheme number. A wire in the cable was broken and SGIS Channel ZD tripped, resulting in the SGIS actuation.

Corrective actions include placing restrictions on electrical walkdowns; retermination of the transmitter wires, and changes to surveillance procedures.

I. DESCRIPTION OF EVENT

On January 13, 1995, at approximately 1047, Calvert Cliffs Unit 2 tripped from 100 percent power due to low levels in the Steam Generators (SGs). The Reactor Protective System (RPS) low level trip occurred after an Engineered Safety Feature Actuation System (ESFAS) Steam Generator Isolation Signal (SGIS) was generated. The SGIS signal caused the Main Steam Isolation Valves (MSIVs) and Main Feedwater Isolation Valves to close, as well as the tripping of the Steam Generator Feed Pumps, Heater Drain Pumps, and Condensate Booster Pumps, resulting in SG levels shrinking to the low level setpoint. At the time of the event, Unit 2 was operating at 100 percent power and normal operating temperature and pressure.

At around 1020 on Friday, January 13, 1995, Instrument Maintenance technicians began a pre-planned calibration of Channel D pressure sensor loop for 21 SG, in accordance with Surveillance Test Procedure (STP) M-510D-2 (RPS SG Pressure Calibration Checks). Part of this procedure verifies the setpoint for ESFAS SGIS Channel ZG. The SGIS instrumentation is comprised of four channels per SG that receive SG pressure input. A SGIS signal is generated when two of the four channels sense pressure less than 703 psia in a SG. As part of the STP, the technicians tripped Channel ZG to check the setpoint, thus changing the logic for a SGIS actuation to one out of three.

At around the same time on January 13, an IM Safety Tagger began to walkdown a tagging request for the scheduled replacement of transmitters during an upcoming Unit 2 refueling outage. The tagger wanted to verify the proper location for safety tags by comparing the actual wiring configuration associated with the transmitters to a schematic drawing he was using. One of the transmitters scheduled to be replaced was 21 SG pressure transmitter 2PT1013A, located in Panel 2C43A. This transmitter provides SG pressure input to various RPS, ESFAS, and Auxiliary Feedwater (AFW) functions including Channel ZD SGIS in 21 SG.

The tagger opened Panel 2C43A to identify termination points for the instrumentation cable to 2PT1013A. A group of cables were bundled together in the cabinet and the scheme number on the cable for 2PT1013A was not readily visible. To verify the scheme number the tagger reached in and rotated the cable towards him. The cable consists of two wires, one colored white and one black. After rotating the cable the tagger noticed the black wire was no longer connected to its terminal lug. The tagger then proceeded to the Control Room to inform Operations of the broken wire.

At approximately 1047, with 21 SG sensor Channel ZG already in the tripped condition for SGIS, due to testing, the wire for 2PT1013A was broken. This resulted in a loss of sensed pressure for Channel ZD SGIS. With two out of

four SGIS channels tripped on 21 SG the MSIVs and Main Feedwater Isolation valves were automatically shut and the Steam Generator Feed Pumps, Heater Drain Pumps, and Condensate Booster Pumps were automatically tripped. The resulting shrink in SG levels resulted in the reactor trip.

Level in 21 SG continued to decrease and an Auxiliary Feedwater Actuation Signal (AFAS) was generated when the level in 21 SG reached -170 inches approximately six and one half minutes after the trip. Both the motor driven AFW Pump (23) and one of the turbine driven pumps (21) were automatically started in response to the AFAS signal (the second turbine driven AFW pump is normally secured). Only one of the AFW turbine driven pump's redundant main steam supply valves opened (2-MS-4071) and provided steam to 21 AFW pump after receiving the AFAS signal. Troubleshooting later determined 2-MS-4070 failed to open due to a degraded handswitch contact.

Approximately 40 seconds after the trip the technicians removed their test equipment for STP M-510D-2. The removal of their equipment caused a momentary loss of SG pressure as sensed by Channel ZG of the AFAS BLOCK circuitry. Auxiliary Feedwater Actuation Signal BLOCK uses input from the four channels of SG pressure on each SG to isolate AFW if a rupture occurs in a SG. When two of four channels on one SG sense a differential pressure of 115 psia or more as compared to the same two channels on the second SG an AFAS BLOCK signal is generated, resulting in an isolation of AFW to the SGs. When the wire for 2PT1013A was broken an AFAS BLOCK signal was created for Channel ZD on 21 SG. As mentioned above, ZG AFAS BLOCK was generated when the technicians removed their equipment. Although there were two out of four channels satisfying the BLOCK logic, the signal on Channel ZG was only momentary (1 second) and did not seal in, thus AFW was not isolated to the SGs. After the reactor trip, operators initiated Emergency Operating Procedure (EOP)-0, "Post Trip Immediate Actions" and proceeded to recover the plant in a normal fashion.

II. CAUSE OF EVENT

The cause of the reactor trip was an RPS signal generated as a result of low SG water levels (-50 inches) after an SGIS signal was generated. The SGIS signal resulted from satisfying the two out of four logic for low SG pressure on 21 SG. The closure of the MSIVs caused SG pressure to increase resulting in a shrink in levels. This shrink combined with the isolation of feedwater resulted in the low level trip.

A Significant Incident Finding Team (SIFT) was appointed by the Plant General Manager to investigate the event. The SIFT determined the cause associated with both SGIS channels being tripped at the same time is that both activities, the performance of the STP and the verification of wires, were

allowed to occur at the same time. Approval to start the STP was approved by the Control Room staff. The staff was not aware of the tagging walkdown, including entrance into panel 2C43A. The walkdown was considered a non-intrusive activity and there was no formal requirement or expectation for prior notification even though panel 2C43A contained field wiring for trip sensitive RPS, ESFAS, and AFAS instrumentation.

Awareness Recommendation No. 1, from a 1986 Reactor Trip Reduction Task Force, recommended that "(t)rip initiator sors should be specifically designated by painting the sensor and/or square ound the sensor with a high visibility color and labeled: *Trip Sensitive.*" The justification for labeling trip sensitive equipment stated "(t)he use of color and labeling provides an easy, highly visible way of distinguishing trip initiators similar to the way red designates fire equipment." There was no action taken to label trip sensitive equipment and in October of 1994, a recommendation was made by the Electrical and Controls Maintenance Section to not label based on a lack of inadvertent actuations/trips associated with the trip sensitive equipment. This issue was unresolved at the time of the trip.

The cause for the broken black wire has been identified as faulty installation. Panel 2C43A was initially installed in 1982. A preliminary materials evaluation discovered evidence of stripping damage on the black wire. Four of the seven strands in the wire were broken for some period of time. Movement of the wire since 1982 resulted in low cycle fatigue on the remaining three strands causing them to eventually break. The Quality Control program in place at the time also failed to identify the stripping damage in 1982. Additionally, an opportunity to fix the black wire was missed in 1986 when the white wire was found to be degraded with only one strand still connected. The white wire was reterminated but apparently due to a less than adequate questioning attitude, the black wire was not inspected or repaired.

The cause of sensor channel ZG trip was the performance of STP M-510D-2. The STP was being performed to satisfy Surveillance Requirement 4.3.1.1 channel calibration for SG pressure low. Plant staff personnel had interpreted the surveillance requirement to include, in the channel calibration check, the requirement to trip the actuation logic to achieve proper test results.

Facility Change Request (FCR) 87-87 was generated in response to 1986 Reactor Trip Reduction task force hardware recommendation No. 10 (Provide a bypass capability for Engineered Safety Features Actuation System). The justification for the recommendation was: "(c)urrently the ESFAS does not have channel bypass capability. Monthly ESFAS Surveillance Test Procedures insert signals that cause sensor channel trips. If a second channel trip is simultaneously generated, a logic channel actuation will occur, possibly resulting in a plant trip. Bypass capability, similar to the Reactor

resulting in a plant trip. Bypass capability, similar to the Reactor Protective System design, is needed for UV, SGIS, and CSAS to avoid the condition and thus minimize the trip potential."

The solution to the recommendation was to install a new bypass module and keylock switch panel in each of the four sensor cabinets and to change STPs to reflect their use. Placing the keylock switch in bypass inhibits the selected bistable from passing a trip signal and thus converts the actuation logic from 2/4 to 2/3. The FCR was installed on Unit 2 during the 1993 refueling outage without obtaining full agreement as to how and when the bypass feature should be used. As a result of failing to adequately resolve all concerns and questions during the FCR installation, the use of the bypass feature was not incorporated into STP M-510D-2.

This refueling cycle STP was originally written to be performed with the unit in a cold shutdown condition. In 1993, to support the 24-month fuel cycle, the STP was revised to allow performance of the sensor calibration checks with the unit on-line. The use of the bypass feature was not incorporated into the STP when checking the sensor trip setpoint on-line, because the risk associated with the sensor calibration check portion of STP M-510D-2 was essentially the same as the monthly surveillance test, STP M-212D-2 (Reactor Protection System Functional Test). Electrical and Controls Maintenance personnel felt the administrative controls they had in place to minimize inadvertent ESFAS SGIS actuations were adequate and thus the bypass feature was not needed.

In 1994, a task team reviewing the status of the Reactor Trip Reduction Task Force recommendations, reported to the Plant General Manager that the ESFAS bypass modification was complete. Verification did not include a review to ensure the original intent of the recommendation, ESFAS being bypassed during surveillance testing, was satisfied. There was no process for assessing the effectiveness of recommendations after implementation.

III. ANALYSIS OF EVENT

After the MSIVs shut, pressure in the SGs increased rapidly causing SG levels to shrink. As levels declined, the reactor tripped at the -50 inch level. This is the expected plant response to this event. SG levels continued to decrease to the -170 inch level whereupon an AFAS signal was generated. The AFW pumps started and established a positive level trend in both SGs. The only other notable occurrence was the AFAS BLOCK signal described above. Because of the signal's short duration, this did not isolate AFW. Plant recovery was normal thereafter.

Except for the items noted above, based on the fact that all systems responded as designed and this event is bounded by existing analysis in our Updated Final Safety Analysis Report, 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 features including the RPS.

IV. CORRECTIVE ACTIONS

Short Term

A. Both the black and the white wires associated with 2PT1013A in Panel 2C43A were properly reterminated.

B. In response to the trip, the Superintendent-Nuclear Operations issued guidance for awareness training that was given to site personnel involved in conducting wiring checks or electrical/instrument walkdowns in the field. The precautions stressed included:

- Alerting the Control Room Staff to any walkdowns or wiring checks in Control Room panels, safety related cabinets/panels or other trip sensitive equipment in the plant;

- Where possible, limiting the walkdowns or inspections on energized systems, especially in trip-sensitive cabinets/panels to visual inspections only; and

- Using extreme caution in touching wire harnesses, considering the potential effect on the plant prior to touching, looking carefully for degraded wires or connections, and documenting degraded conditions in an Issue Report.

C. The current wire stripping guidance and QC plan for observing stripping activities were both reviewed and determined to be adequate.

D. Troubleshooting on 2-MS-4070 was performed immediately following the trip. A degraded contact on the valve's handswitch was determined to be the problem and the handswitch was replaced prior to restarting the Unit. This handswitch is tested monthly during normal surveillance testing and had passed its most recent test.

Long Term

A. Revisions to STPs, to eliminate the need to place certain ESFAS equipment in 1 out of 3 trip logic during operational modes by

incorporating the use of the bypass feature are being made and will be completed by September 30, 1995.

B. Management is establishing clear expectations that task forces, self-assessments, and investigation teams utilize a process that will establish a clearly identified sponsor who will monitor the timeliness and completeness of the actions taken to address the deficiency. These expectations will be in place by June 30, 1995.

C. A plan is being developed and implemented to improve the control of activities (maintenance, tests, inspections, modifications, etc.) that can affect trip sensitive equipment. Control will include a process for identifying trip sensitive activities and equipment, establishment of strong barriers to prevent unapproved activities, and a process to minimize risk when work on trip sensitive equipment is required. This plan will be in place by July 1, 1995.

D. A plan is also being developed to inspect other terminations performed during the same project as Panel 2C43A for signs of broken wire strands. The plan will be developed by June 30, 1995.

V. ADDITIONAL INFORMATION

A. Failed Component Identification

Component	EIIS Funct Code	EIIS System Code
SG Pressure Transmitter Instrumentation Cable	CBL1	SJ
Main Steam Control Valve to AFW Pumps	FCV	SJ

B. Previous Similar Events

There have been no previous reportable events in which an inadvertent SGIS caused low levels in the SGs resulting in a reactor trip.