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BGE

March 28, 1996

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 96-001
Automatic Plant Trip Due to Partial Loss of Offsite Power

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,

Peter E. Katz

PEK/RCG/bjd

Attachment

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
L. B. Marsh, NRC
D. G. McDonald, Jr., NRC
T. T. Martin, NRC
Resident Inspector, NRC
R. I. McLean, DNR
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IE22

NRC FORM 366 (4-95) U. S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES: 04/30/98
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENISNG PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), 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 08

TITLE (4)

Automatic Plant Trip Due to Partial Loss of Offsite Power

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 NAME	DOCKET NUMBER
										05000
02	27	96	96	-- 001	-- 00	03	28	96	FACILITY NAME	DOCKET NUMBER
										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	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)	X 50.73(a)(2)(iv)	OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Specify in Abstract below
		20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (include Area Code)
R. C. Gradle, Compliance Engineer	410-495-3738

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)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X	YES (If yes, complete EXPECTED SUBMISSION DATE).	NO		05	17	96

ABSTRACT (Limit to 1400 spaces, i.e., approximately15 single-space typewritten lines) (16)

On Tuesday, February 27, 1996, at 5:08 p.m., 500 kV Breakers 552-41, 552-21, and 552-61 tripped open in the Calvert Cliffs switchyard, causing the loss of the 500 kV Red Bus. Unit 2 automatically tripped on a low reactor coolant flow signal when power was lost to its' reactor coolant pumps. The 500 kV Black Bus feeding Unit 1 was unaffected. At the time of the event, Unit 1 and Unit 2 were at 100 percent power.

The most probable cause of the Unit 2 trip was the failure of an auxiliary relay card in Breaker 552-41 in conjunction with less than adequate switchyard control. Previous corrective actions for a similar event did not prevent recurrence.

The failed relay card was replaced, the circuit tested satisfactory and the Red Bus was restored to service. Interim controls for work in the switchyard are in place. Long-term expectations and procedural controls will be developed to prevent recurrence.

I. DESCRIPTION OF EVENT

On Tuesday, February 27, 1996, at 5:08 p.m., 500 kV Breakers 552-41, 552-21, and 552-61 tripped open in the Calvert Cliffs switchyard, causing the loss of the 500 kV Red Bus. Unit 2 automatically tripped on a low reactor coolant flow signal when power was lost to its' reactor coolant pumps. The 500 kV Black Bus feeding Unit 1 was unaffected. At the time of the event, Unit 1 and Unit 2 were at 100 percent power.

At the time of the event, 500 kV transmission line No. 5052 was removed from service for troubleshooting to isolate a control system failure on 500 kV Breakers 552-41 and 552-43. The other two 500 kV transmission lines, Nos. 5051 and 5072 were in their normal line ups. See Figure 1 for a schematic drawing of the Calvert Cliffs 500 kV switchyard ring bus. The 500 kV Red and Black Busses serve as common connection points between the 500 kV transmission system (offsite power) and the other 500 kV switchyard components. These busses also connect the 500 kV switchyard and the 13.8 kV system through the plant service transformers (Red Bus to P-13000-2 primarily for Unit 2, and Black Bus to P-13000-1 primarily for Unit 1). The plant service transformers supply power to reactor coolant pump 13.8 kV busses and to the plant's 4 kV transformers. The loss of the Red Bus caused a loss of power to the Unit 2 reactor coolant pumps, a loss of power to 4 kV vital Bus No. 24 (Unit 2), and a loss of power to 4 kV vital Bus No. 14 (Unit 1).

As a result of the loss of 4 kV Bus Nos. 14 and 24, all normal Control Room lighting went out. Emergency lighting came on as designed. Licensed plant operators are trained to recognize that one of the symptoms of a loss of offsite power is the loss of Control Room normal lighting. Plant operators recognized the Unit 2 trip (due to low reactor coolant system flow) and immediately implemented Emergency Operating Procedure (EOP)-0, "Post-Trip Immediate Actions," for Unit 2, and Abnormal Operating Procedure (AOP)-7I, "Loss of 4 kV, 480 Volt or 208/120 Volt Instrument Bus Power," for Unit 1, for loss of 4 kV Bus No. 14. Emergency Diesel Generator (EDG) Nos. 12 and 21 started upon the loss of power to 4 kV Bus Nos. 14 and 24, respectively. Emergency Diesel Generator No. 21 automatically closed in on 4 kV Bus No. 24 and EDG No. 12 output breaker was manually closed onto 4 kV Bus No. 14 at 5:13 p.m.

At 5:30 p.m., Unit 2 exited EOP-0 and entered EOP-2, "Loss of Offsite Power." An Unusual Event was declared on Unit 2 at 5:42 p.m. because of the partial loss of offsite power.

At 6:35 p.m., 4 kV Bus No. 14 was powered from Unit 1 transformer U-4000-11 via its alternate feeder breaker (152-1401) and EDG No. 12 was secured. At 6:50 p.m., the 500 kV Red Bus was restored by closing 500 kV Breakers 552-21, 552-61, and 552-63.

4 kV Bus No. 14 was then restored to its normal feeder breaker (152-1414) powered from Unit 2 transformer U-4000-21 and at 8:15 p.m., the plant exited the Unusual Event.

The following event narrative describes the circumstances leading up to the Unit 2 automatic trip.

On Tuesday, February 27, 1996, at approximately 11:36 a.m., 500 kV Breakers 552-41 and 552-43 in the Calvert Cliffs switchyard tripped open, re-closed as per design, and then tripped again. Control Room operators placed the handswitches for these breakers in pull-to-lock, sent a plant operator to the switchyard to investigate (no dropped targets were found), and documented the event on an Issue Report. Various plant and Baltimore Gas and Electric Company (BGE) offsite System Operation and Maintenance Department (SOMD) personnel responded to the problem. The group included a System Manager, two Design Engineering Section Engineers, an Electrical Maintenance Supervisor, and an SOMD Senior Technician who was onsite for EDG testing. The SOMD Senior Technician took the lead in investigating and troubleshooting the problem.

At 1:20 p.m., BGE Bulk Power directed that the automatic reclosure feature on Breakers 41 and 43 be disabled and the A and B disconnects be opened to isolate each breaker from the respective bus. The troubleshooting group collected data and determined the status of the equipment in the switchyard. At 1:58 p.m., Bulk Power and the Calvert Cliffs Control Room made a joint decision to attempt to close Breaker 41. The result was a trip-free condition and no targets indicated. An SOMD Substation Technician then inspected Breakers 41 and 43, finding them to be in normal condition. At 3:30 p.m., the System Protection Unit Supervisor phoned to report no abnormalities from a review of fault recorders.

The Electrical Maintenance Supervisor on the troubleshooting team returned to the plant to assemble a set of controlled prints to be used in the troubleshooting, and to have a "Troubleshooting and Procedure Controlled Activities," MN-1-110, Troubleshooting Form prepared and approved by Operations Work Control. The Electrical Maintenance Supervisor's primary reason for preparing the MN-1-110 was to ensure that controlled prints were used for the troubleshooting and that the actions taken were documented. The troubleshooting steps were vague in nature, authorizing the group to coordinate with Operations while isolating the problem. The risk level was listed as "3," defined as, "Equipment is not removed from service. Could have an affect on plant equipment, but should not present a risk of causing an undesirable plant transient or reportable event. No unusual personnel safety risk." The Electrical Maintenance Supervisor chose risk level 3 because the breakers' disconnects were open, he believed the troubleshooting was planned as non-intrusive, and Breaker 41 had already been shut (and tripped free) with no adverse impact.

When the Control Room approved the MN-1-110 Troubleshooting Form, they added a note to keep the Control Room updated. The Electrical Maintenance Supervisor

returned to the switchyard and briefed the group on the plant's troubleshooting process. The SOMD Senior Technician later stated that he had seen the Troubleshooting Form at the briefing, but did not know what became of it.

Troubleshooting began around 4:00 p.m., with the Senior Technician in charge of the group. The Senior Technician conducted a pre-job briefing where he reviewed the SOMD Trip Sensitivity sheet and personnel safety sheet, which had been filled out for the work. The group then began the troubleshooting.

There are two parallel protection paths for each breaker: Trip Circuit 1 and Trip Circuit 2. The group found Trip Circuit 1 for Breaker 41 was satisfactory, and a trip signal existed on Trip Circuit 2. Troubleshooting had not revealed the source of the trip signal and was at a hold point. At this point an SOMD operations analyst, not present at the troubleshooting pre-brief, strongly recommended on two occasions that Breaker 41 be shut to verify proper mechanical operation. After some reluctance, the Senior Technician approved the Analyst's suggestion. None of the people present recognized that closing the Breaker 41 invalidated the original premise of their troubleshooting plan, i.e., that no breaker would be operated.

The Analyst removed the control system links for Trip Circuit 2 on Breakers 41 and 43 preventing Trip Circuit 2 from opening Breakers 41 and 43 with a trip signal present. It was not recognized that the "stuck breaker" protection would be enabled if Breaker 41 or 43 was closed. This protection is designed to trip open adjacent Breakers 552-21 and 552-61 in the event Breaker 552-41 is stuck and will not operate when it receives a trip signal. The Calvert Cliffs Control Room was not aware that the links had been removed. At 5:08 p.m., while the Senior Technician and the remainder of the group were in an adjacent relay room studying the prints to determine their next action, and with the Control Room's permission, an SOMD operator shut Breaker 41 under the Analyst's supervision. This effectively created a stuck breaker condition on Breaker 552-41, caused Breakers 21 and 61 to trip as designed, and resulted in a loss of offsite power to Unit 2, and the Unit 2 trip described previously.

II. CAUSE OF EVENT

The Plant General Manager established a Significant Incident Finding Team (SIFT) to assess the event. Preliminary results of the ongoing investigation indicate the following immediate causes of this event are as follows:

A. The troubleshooting plan did not have sufficient controls to ensure success. The risk significance of the troubleshooting was evaluated to be low because the 500 kV Breakers 552-41 and 552-43 were considered isolated.

B. The troubleshooting process being used in the 500 kV switchyard changed from potential breaker control system problems to a focus on possible

mechanical breaker problems, without a commensurate change to the troubleshooting plan.

C. The SOMD Operations Analyst conducted troubleshooting that was not within the scope of the troubleshooting plan. Furthermore, the Operations Analyst did not initiate steps to obtain a troubleshooting plan to conduct the mechanical troubleshooting.

D. The Breaker 552-41 failure auxiliary relay (A-47) card failed for, as yet, unknown reasons. This card failure resulted in the generation of a signal to the Breaker Failure Initiating Trip Bus, and subsequent actuation of the stuck breaker protection relaying for 500 kV Breakers 552-41 and 552-43.

E. Previous corrective actions taken to prevent similar partial loss of offsite power events and subsequent unit trips were less than adequate.

III. ANALYSIS OF EVENT

A loss of non-emergency AC power (LOAC) event is defined in Calvert Cliffs Updated Final Safety Analysis Report (UFSAR) as a loss of the plant's 500 kV/13 kV service transformers in conjunction with the loss of the other unit's turbine-generator. In such an event, the EDGs supply AC emergency power to all of the plant's 4160 volt safety busses after receiving engineering safety features actuation system signals from undervoltage relays on the 480 volt safety busses. A loss of load to the plant's turbine-generator with offsite and plant power (i.e., other Unit's turbine-generator) unavailable would result in an LOAC event. The most limiting LOAC event described in the UFSAR concludes that no significant safety consequences will result from the defined event.

At the time of the event, Unit 1 was operating at 100 percent power. All three EDGs were OPERABLE and available to provide AC emergency power to safety-related equipment for both units. The partial loss of offsite power (loss of power from 13 kV bus 21, 13 kV bus 11 still supplying power) was fully bounded by the LOAC Safety Analyses in UFSAR Chapter 14. Unit 1 continued to supply Unit 2 4 kV safety bus 21 as designed. Therefore, it is concluded that this event did not result in any significant safety consequences.

This event is considered reportable under the requirement of 10 CFR 50.73(a)(2)(iv); any event that results in a manual or automatic actuation of any engineered safety features, including the reactor protective system.

IV. CORRECTIVE ACTIONS

The overriding issue contributing to this event is the failure to apply the same level of controls over risk significant work in the site's switchyard

that is used during risk significant work within the plant. This condition has been brought on by the fact that switchyard work has been traditionally controlled by company organizations other than Calvert Cliffs. The functional responsibility roles relating to the risk of switchyard work on safe plant operations has not been well defined. Resolution of this issue is the major thrust of the following corrective action program.

Short-Term

A. The Plant General Manager established a SIFT team to assess the event.

B. A new troubleshooting control form with a detailed plan was written in accordance with MN-1-110 to identify the cause of Breakers 552-41 and 552-43 tripping open and to isolate the failure. The risk level assigned to the troubleshooting was Level 1. A senior supervisor assumed control of troubleshooting activities.

C. The breaker failure auxiliary relay A-47 card was identified as the most probable source of the trip signal and was replaced. The circuit was then tested satisfactorily and line 5052 was returned to service. The failed auxiliary relay A-47 card underwent tests in an attempt to determine the cause of its failure. The breaker failure initiating card A-47 was tested extensively in place to attempt to duplicate the failure (this was unsuccessful). This card was also tested in our lab and performed without any abnormalities. We are evaluating recommendations resulting from this testing.

D. The following interim controls for maintenance and troubleshooting in the Calvert Cliffs Nuclear Power Plant (CCNPP) switchyard have been reinforced and/or implemented:

1. The CCNPP switchyard is a trip sensitive area. Prior to entering or exiting the 500 kV switchyard, all personnel must notify the SOMD Bulk Power System Operator and the CCNPP Control Room Supervisor. In cases where work groups enter or exit the switchyard, the job supervisor is responsible for the notification process.

2. Plant Engineering will be contacted during the work planning stage for all CCNPP switchyard maintenance. Plant Engineering will assist with the assessment of trip risk and contingency planning.

3. The CCNPP Control Room will be briefed prior to starting any switchyard maintenance. Work group personnel and Plant Engineering will jointly conduct this meeting.

4. All troubleshooting will be conducted in accordance with Calvert Cliffs Procedure MN-1-110. Plant Engineering will provide assistance with the development of the troubleshooting plan.

5. Troubleshooting plans will be pre-briefed with either the Principal Engineer-E&C Systems Engineering, the General Supervisor-Electrical Maintenance, or the General Supervisor-Plant Engineering, prior to review with the CCNPP Control Room.

E. Identified deficiencies related to this event have been documented on Issue Reports and will be addressed in accordance with our corrective action process.

Long-Term

A. The Plant General Manager has directed actions to address long-term expectations and procedural controls to prevent recurrence of this event.

B. As mentioned above, a SIFT was formed in response to this event. Additional long-term corrective actions may be generated by this investigation. The SIFT is investigating why previous corrective actions for a similar event in 1993 (see LER 50-317/93-003) were less than adequate in preventing recurrence.

C. Appropriate personnel actions, as deemed necessary, will be taken.

V. ADDITIONAL INFORMATION

A. Component Identification

Component	IEEE 803 EIIS Funct	IEEE 805 System ID
Electrical Protective Relay	94	FK
500 kV Switchyard System	N/A	FK
Breaker	BKR	FK
Reactor Coolant Pump	P	AB

B. Previous Similar Events

LER 50-317/93-003 and this event involve inadvertent actuation of breaker protection circuits in the Calvert Cliffs 500 kV switchyard. The SIFT is investigating and evaluating the effectiveness of the prior corrective actions from this LER. See long-term corrective action IV.B.

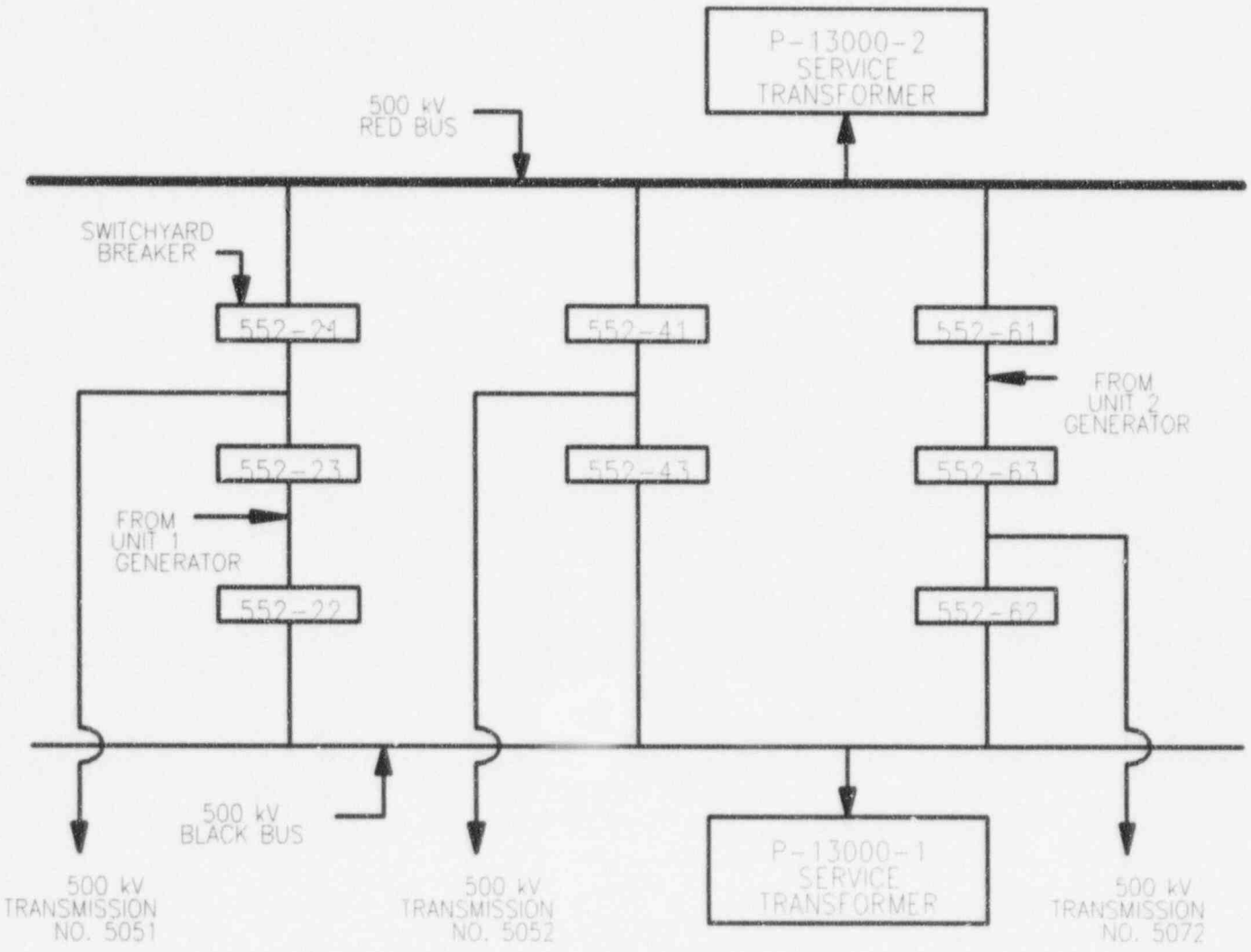

FIGURE 1

500 kV SWITCHYARD RING BUS