ACCESSION #: 9910270216

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Calvert Cliffs Nuclear Power Plant, Unit 1 PAGE: 1 OF 5

DOCKET NUMBER: 05000317

TITLE: Inadequate Electrical Current Determination Leads to
Manual Reactor Trip

EVENT DATE: 09/22/1999 LER #: 1999-006-00 REPORT DATE: 10/22/1999

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: T.W. Grover TELEPHONE: (410) 495-2064

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On September 22 1999, at 9:08 a.m., Calvert Cliffs Unit 1 was manually tripped from 100 percent power in response to loss of main feedwater, which occurred when a circuit breaker supplying two cross-tied non-vital 480 volt motor control centers (MCCs) tripped on overload and de-energized the lube oil pumps for both main feedwater pumps. Water level was maintained in both steam generators by the auxiliary feedwater system. The MCCs had been cross-tied to perform maintenance on one of the MCCs feeder breakers. The electrical loading from both MCCs exceeded the trip rating of one feeder breaker because the evolution was performed at power without first having shed the excess loads. Operators responded appropriately to the loss of feedwater and plant systems functioned as designed after the trip. The root causes of this event include less than adequate trip risk assessment and weaknesses in the electrical maintenance training program. Corrective actions include evaluating the trip risk assessment process for enhancements and assessing the training needs of electricians to improve knowledge levels in the area of electrical theory application.

END OF ABSTRACT

I. DESCRIPTION OF EVENT

On September 22 1999, at 9:08 a.m., Calvert Cliffs Unit 1 was manually tripped from 100 percent power with Reactor Coolant System (RCS) temperature at 547.4 degrees in response to decreasing steam generator water levels. Control Room operators received indications of a loss of 480 volt non-vital MCCs 106 and 116. The Control Room Supervisor ordered a manual reactor trip due to loss of both steam generator feed pumps and rapidly decreasing steam generator water levels. Post-Trip Immediate Actions were performed in accordance with Emergency Operating Procedure (EOP)-O "Post Trip Immediate Actions," and completed satisfactorily at 09:30 a.m. with all safety functions within acceptance criteria. At 09:30 a.m., EOP-1, "Reactor Trip," recovery actions were implemented by Control Room personnel. Emergency Operating Procedure-1 was exited at 10:10 a.m. with the plant in MODE 3, "HOT STANDBY," with steam generator water levels maintained by the auxiliary feedwater (AFW) system. Control Room operators maintained RCS temperature using manual control of the atmospheric dump valves (ADVs). On September 23, 1999, at 04:00 a.m., Control Room operators initiated main feed and secured AFW.

The maintenance plan of the day for September 22, 1999 included a Maintenance Order (MO) to perform an inspection of the normal 480 volt feeder breaker (52-1313) to MCC 116. Breaker 52-1313 must be removed from service to conduct the inspection. Motor Control Centers 106 and 116 must be cross-tied to remove the breaker from service. These MCCs are a part of the 480 volt system, which is designed to function reliably and supply power during normal operation and under accident conditions. The trip risk for Unit 1 on September 22, 1999 was evaluated to be low.

At approximately 06:45 a.m., the two electricians assigned to inspect breaker 52-1313 conducted a pre-job brief. The brief focused on electrical safety and inspection of the breaker.

At approximately 07:00 a.m., the electricians signed the MO in at Operations Work Control (OWC). At that time, the OWC requested that the electricians take clamp-on ammeter readings to measure the current drawn by both MCCs in accordance with Operating Instruction (OI) 27D-1, "Station Power 480 Volt System," the procedure used to cross-tie MCCs. Operating Instruction 27D-1 requires verification that the sum of the currents drawn by both MCCs is less than 500 amps by using a portable clamp-on ammeter before cross tying the MCCs. A junior electrician measured the current at the bottom of the two MCC feeder breaker cubicles, 52-10601 and 52-11601 using a clamp-on ammeter. Each feeder breaker was supplied with three-phase current. Each phase was supplied with two cables. The lead electrician for the job directed the junior electrician to take the current readings on only one of two cables in each of the three phases. The electricians did not realize they were measuring only part of the total current flow for each phase. The lead electrician recorded the current readings and incorrectly calculated the total current flow as the

sum of phases A, B and C for both MCCs on a notepad and gave the information to the OWC. This resulted in a total calculated current of 1009 amps.

The OWC presented the current readings to the Control Room Supervisor CRS). The CRS questioned how the total current was calculated. The CRS called the Electric Shop and questioned the lead electrician involved. He was unable to resolve his concern with the lead electrician and subsequently spoke to the Electrical Supervisor. The Electrical Supervisor confirmed that the readings should not be totaled. The Electrical Supervisor indicated that the readings from phase A should be summed, the readings from phase B should be summed, and the readings from phase C should be summed, and indicated the total current drawn from both MCCs is the highest value of these sums. The CRS calculated the total current drawn by both MCCs using the readings supplied, which resulted in a total calculated current of 345 amps.

Since the CRS now believed that the current was less than the 500 amp limit specified in OI 27D-1, he dispatched the OWC operator and another Reactor Operator to perform the cross-tie of MCCs 106 and 116. The tiebreaker (52-10650) was then closed and the supply breaker to MCC 116 (52-11601) was opened. After completing the tying operation, the OWC operator noted that the ammeter on MCC 106 was reading approximately 710 amps. The Reactor Operator with him pointed out that there was a sign on the meter stating that it was not in service and the indication was discounted.

The actual current through the load center feeder breaker to MCCs 106 and 116 (52-1213) was approximately 690 amps. This current was sufficient to actuate breaker 52-1213's long time over-current trip. Eighteen minutes after opening 52-116T01, breaker 52-1213 tripped open, causing a complete loss of electrical power to MCCs 106 and 116.

Due to the loss of power to MCCs 106 and 116, power was lost to both the A and the B lube oil pumps on 11 and 12 Steam Generator Feed Pumps (SGFPs). Loss of the SGFP lube oil pumps caused both SGFP Turbines to trip due to loss of oil pressure. Loss of both SGFPs resulted in a loss of all feedwater flow. Operators initiated a manual reactor trip due to rapidly decreasing steam generator water levels approximately 15 seconds after the loss of power to MCCs 106 and 116.

II. CAUSE OF EVENT

The immediate cause of this event was failure to accurately measure the current being supplied to the MCC load center feeder breakers. Contributing factors that led to the event were as follows:

A. The trip risk assessment process was not sufficiently objective in identification of trip risk. The Quarterly System Schedule Risk Assessment did not designate this preventive maintenance task as trip risk sensitive because the MCCs had been cross-tied successfully in the past.

B. The electrical maintenance qualification training received by these electricians did not include the application of "skill-of-the-craft" electrical theory for measurement of current in a multi-phase, multiple-conductor circuits.

C. Clear peer-checking expectations were not defined. The Electrical Shop does not have clear written expectations for peer checking. Administrative procedure MN-1-314, "Conduct of Electrical Maintenance," and other applicable administrative maintenance procedures do not address peer checks concerning technical issues, only personnel safety issues.

D. Installed ammeters were not available to operations personnel to monitor the loads on MCCs 106 and 116. There is an ammeter installed in each MCC feeder breaker cubicle, but adjacent labels indicate that the meters are not in service and should not be used when tying MCCs together. Operations use of an installed ammeter would decrease the probability of personnel error resulting in a similar event.

III. ANALYSIS OF EVENT

There was no undue risk to the health and safety of any member of the general public, or risk of radiation exposure to any individual from this event. The manual trip of the plant was conducted as prescribed in approved plant procedures. Operations personnel actions were prompt and correct. All safety systems functioned as required with all safety function status checks completed satisfactorily. The event was fully bounded by the Chapter 14 safety analyses in our Updated Final Safety Analysis Report.

This event is reportable in accordance with 10 CFR 50.73(a)(2)(iv), Any event or condition that resulted in a manual or automatic actuation of any engineered safety feature including the Reactor Protective System.

IV. CORRECTIVE ACTIONS

Immediate

A. Operations personnel promptly and appropriately tripped the Unit 1 reactor in accordance with established plant procedures.

B. All breaker preventive maintenance and corrective maintenance activities requiring MCC cross-ties were suspended.

C. On-coming electrical maintenance and operations shifts were briefed on the details of the event.

D. Tailgate training was conducted in the Electrical Maintenance Shop on measuring current in a multi-phase, multi-conductor circuits.

E. Insulation integrity of the MCCs and their loads was verified.

F. A Significant Incident Finding Team (SIFT) was activated to investigate the event, determine the root cause(s) of the event, and recommend corrective actions.

Long-Term

A. The trip risk assessment process, specifically the methods used to identify risk and methods employed to mitigate these risks, will be evaluated for improvements.

B. The training needs of electricians and operations personnel will be assessed to identify where knowledge levels can be improved in the area of application of electrical theory.

C. A consistent approach to peer checking for personnel who perform "hands-on" work on plant equipment will be developed and implemented.

D. Modifications to install permanent MCC ammeters, which would eliminate the need for clamp-on readings, will be evaluated.

V. ADDITIONAL INFORMATION

A. Component Identification

Component	IEEE 803 EIIS Function	IEEE 805 System ID
Breaker	BKR	EC
MCC	NA	EC
SGFP	P	SJ
Condenser	NA	SG
SGFP lube oil pump	P	SL
AFW pump	P	BA

B. Previous Similar Events

On October 25, 1979, Unit 1 tripped from 100 percent power when power was lost to 480 volt MCC 107 while tying MCCs 107 and 207. The loss of MCC 107 caused the loss of excitation to all Circulating Water Pumps on Unit 1. Operating Instruction 27D-1 was changed to add a caution statement regarding the possibility of a unit trip when tying MCCs 107 and 207. A similar caution was not added to OI-27D for cross-tying other trip sensitive MCCs.

On May 24, 1995, Unit 2 tripped when a loose cover plate caused a phase to ground short in MCC 208. One of the root causes for this event was inadequate risk assessment. Corrective action to improve risk assessment was credited to activities already initiated for trip reduction and improved human performance. One of the proceduralized risk assessment barriers that was implemented was a set of questions to analyze the

trip risk associated with a maintenance activity. One of these questions was answered incorrectly in this instance, which led to incorrect risk identification.

Peter E. Katz
Plant General Manager
Calvert Cliffs Nuclear Power Plant

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A Member of the
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October 22, 1999

U.S. Nuclear Regulatory Commission
Washington, DC 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 99-006
Inaccurate Electrical Current Determination Leads to Manual Reactor Trip

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,

for Peter E. Katz
Plant General Manager

PEK/TWG/bjd

Attachment
cc: R. S. Fleishman, Esquire H. J. Miller, NRC

J. E. Silberg, Esquire
A. W. Dromerick, NRC
S. S. Bajwa, NRC
Resident Inspector, NRC
R.I. McLean, DNR
J. H. Walter, PSC

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