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R. E. DENTON
GENERAL MANAGER
CALVERT CLIFFS

January 7, 1991

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

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 and 2; Docket Nos. 50-317 and 50-318;
License No. DPR 53 and DPR 69
Licensee Event Report 90-027, Revision 00

Gentlemen:

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,

Leon B Russell
for R.E. Denton

RED/CDS/bjd
Attachment

cc: D. A. Brune, Esquire
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NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES 4/30/92
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-630), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Calvert Cliffs, Unit 1	0 5 0 0 0 3 1 7	1 OF 0 7

TITLE (4) Undersized Fuses Could Have Prevented Safety-Related Equipment From Performing Its Intended Safety Function Caused By A Calculational Error

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 NUMBER(S)
1 2	0 6	9 0	9 0	0 2 7	0 0	0 1	0 7	9 1	Calvert Cliffs, Unit 2	0 5 0 0 0 3 1 8
										0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)					
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)		
		20.405(a)(1)(i)	50.36(c)(1)	X 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 AREA CODE
Craig D. Sly, Engineer- Compliance Unit	3 0 1 2 6 0 - 4 8 5 8

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
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On December 6, 1990 a condition was discovered at Calvert Cliffs which could have prevented various safety-related (SR) motors from performing their intended safety functions. If a degraded voltage condition existed at the Motor Control Center power source while an Engineered Safety Feature Actuation Signal (ESFAS) was attempting to start SR loads, fuses for the control circuitry of SR motors supplied by the Motor Control Centers would have blown before the degraded-voltage relays could time out and switch the power source to the Emergency Diesel Generators (EDGs). At the time Unit 1 was in a Cold Shutdown condition and Unit 2 was in a refueling condition.

The cause of the condition was a calculational error in the design package that installed the 4160-volt bus power voltage protection relays in 1977. The calculation error resulted in allowing some undersized fuses in SR motor control circuits to remain installed.

All undersized fuses for both Units have been replaced with properly rated fuses. Fusing sizes for all ESFAS and EDG loads have been verified as correct. The calculation has been revised. Appropriate drawings will be revised. A problem report has been initiated to address one of the underlying causes of the calculational error.

I. DESCRIPTION OF EVENT

On December 6, 1990 during an internal review to evaluate the status of the Electrical Distribution System, Design Engineering Section (DES) personnel at Calvert Cliffs discovered a condition that alone could have prevented various safety-related (SR) motors from performing their intended safety functions. Specifically, if a sustained degraded voltage (</= 84.5 percent) existed at the SR Motor Control Centers (MCCs) while an Engineered Safety Feature Actuation Signal (ESFAS) attempted to start SR loads, fuses for the control circuitry of the SR motors supplied by these MCCs may have blown before the 4160-volt degraded-voltage relays timed out.

The problem was reported to the Control Room at 1750 hours that same day. At that time Unit 1 was in a Cold Shutdown condition with reactor coolant system (RCS) temperature and pressure at 172 degrees Fahrenheit and 185 psig, respectively. Unit 2 was in a Refueling condition with RCS temperature at 105 degrees Fahrenheit and atmospheric pressure.

The Calvert Cliffs electrical power system includes a non-safety-related (NSR) offsite power system connected to SR class IE Busses and a SR emergency onsite power system in the form of three emergency diesel generators (EDGs). The EDGs are designed to supply power to essential auxiliary equipment if offsite power is lost or in a degraded voltage condition that lasts greater than 6 seconds. The EDGs are designed to reach rated speed and voltage and to start accepting load within 10 seconds after the receipt of a starting signal.

The EDGs are connected to the AC emergency busses through the use of two sets of four redundant and independent undervoltage relays for each redundant 4160-volt emergency bus. The first set of four relays is used to provide a two-out-of-four undervoltage signal on a loss of bus voltage. The second set of four relays provides a two-out-of-four undervoltage signal on a sustained bus undervoltage (degraded voltage).

The coincidence of two-out-of-four undervoltage signals from both sets of four undervoltage relays also initiates starting of the EDG which is aligned to the bus with which the undervoltage relays are associated. A Safety Injection Actuation Signal (SIAS) which is an ESFAS will also initiate an EDG start, but the EDGs will not load.

In the event of a sustained degraded voltage condition on an emergency bus the undervoltage relays react, after a 6 second time delay, to cause shedding of the loads on the bus. The EDGs receive a start signal no greater than 2.2 seconds after the initial 6 second time delay. Once the EDGs come up to rated speed they are loaded to the 4160-volt busses. This occurs within 10 seconds of an EDG starting signal.

In the event of a SIAS, many motors in the plant are required to reposition valves or remain in normal operation with their control circuitry energized. A SIAS signal energizes various SIAS relays which close contact(s) in the control circuitry of these motors. This allows energization of the appropriate contactors which allows 480-volt current to flow from the MCC to the motors so that the valves and equipment perform their post-SIAS required functions of Figure 1.

The 120-volt control circuitry of each motor is powered from the 480-volt power supply to that motor via a 480 to 120-volt step-down transformer. Thus, an undervoltage condition on the offsite power supply will be seen at the 480-volt MCC bus and in the 120-volt control circuitry of the motor.

If a SIAS signal is received at the same time as a degraded voltage condition, the SIAS contacts in the motor control circuit will close causing the motor contactor to energize. If the voltage at the motor contactor coils is too low to allow the contactor contacts to pick-up, a high in-rush current will result from low open-gap coil impedance. The high current will continue until the degraded voltage relays time-out (approximately 6-seconds) and the 4160-volt busses are disconnected from the offsite power supply.

Review of the calculations to determine the appropriate fuse rating for the motor control circuits discovered that a calculational error resulted in many of the fuses being undersized. In this condition the fuse would blow due to the high in-rush current during degraded voltage conditions prior to the disconnect of the offsite power supply (degraded voltage relays timing out). Blown fuses in the motor control circuitry would prevent the motors from performing their post-SIAS safety-related functions. Most of the motors with undersized fuses operate valves (35 of 38 for Unit 1 and 35 of 37 for Unit 2). Two of the motors operate the SR Air Compressors for each Unit and one of the motors for Unit 1 operates a boric acid pump.

This condition is a postulated scenario and does not describe an actual event and has not contributed to any actual component or system failures.

II. CAUSE OF EVENT

The cause of the event was a calculational error in the design package used to install the 4160-volt bus power voltage protection relays. These relays were installed in response to Nuclear Regulatory Commission (NRC) letter dated June 3, 1977. This letter provided a Safety Evaluation and Staff Positions relative to onsite emergency power systems and required that all plants protect their safety systems and components from degraded voltage conditions on the offsite power source.

Facility Change Request 76-1059 was issued to install the appropriate degraded voltage relays. The effects of sustained degraded voltage conditions on the fuses of the motor control circuits were analyzed at that time and some fuses were replaced as a result of the analysis. However, due to a calculational error in the analysis, some motor control circuit fuses were not properly rated to ensure they would last in a sustained degraded voltage condition until the undervoltage relays operate to disconnect the offsite power supply.

The calculational error was contributed to by two factors. First, the analysis neglected some small loads in the control circuits that were thought to be insignificant. However, the fuse melting time is very sensitive to small changes in current in the range that would be seen. Second, the calculation was never revised to incorporate new contactor pickup data received from the vendor and from BG&E tests.

III. ANALYSIS OF EVENT

The effect of the undersized fuses would only be significant if a sustained undervoltage condition and a SIAS were to occur simultaneously. This condition is conservatively postulated in the Updated Final Safety Analysis Report (UFSAR). UFSAR Section 14.17 "Loss of Coolant Accident" (LOCA) postulates that a LOCA occurs simultaneously with a Loss of Offsite Power (LOOP). The primary purpose of this assumption is based on adding conservatism to the safety analysis of the very unlikely event of a LOCA. There is no common failure mechanism between a LOOP and a LOCA. Thus, the event scenario (LOOP and LOCA) described in this event is even more unlikely than just a LOCA alone. The initiating scenario of a LOCA and a concurrent LOOP caused by a sustained degraded voltage condition is even more unlikely.

If the initiating event did actually occur and the control circuit fuses blew, many of the safety-related MOVs in the plant would not operate automatically or be manually operable from the Control Room. The valves could be operated by hand or after replacing the fuses. However, it is not considered credible to assume that operators could manually control all of the valves that would have been affected in the plant nor recognize that the control circuitry fuses had blown and replace them in time to assure effective mitigation of a LOCA/LOOP event scenario. Based on this, the event did have a potentially high safety significance.

Based on the fact that the scenario of concern was highly unlikely to occur and the fact that it never did actually occur, it is concluded that this condition actually had minor operational safety significance and had no affect on the health and safety of the public or plant personnel.

This condition is considered reportable per 10 CFR 50.73(a)(2)(v), "Any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to: (a) shutdown the reactor and maintain it in a safe shutdown condition; (b) remove residual heat; (c) control the release of radioactive material; or (d) mitigate the consequences of an accident."

IV. CORRECTIVE ACTIONS

Upon discovery of the condition, DES personnel reported the problem to the Control Room. A temporary modification was immediately initiated to identify and change-out the undersized fuses. At the same time DES completed a new calculation to determine the correct rating for the replacement fuses.

The following corrective actions are underway or completed:

- All of the undersized fuses for both Units have been replaced with correctly rated fuses.

- Drawings are being updated to ensure that correct fuses will be used as replacements.

- DES has verified that fusing for all Unit 1 ESFAS and all EDG loads are now correct.

A Problem Report (PR 8388) has been initiated to address the issue of reviewing and revising design calculations to incorporate new information from vendors and BG&E tests. This PR will flow through the administrative process delineated in Calvert Cliff Instruction CCI-116, "Identification and Control of Non-conforming Conditions." The root cause analysis, and required long and near term corrective actions will be dispositioned for this problem via this internal administrative process.

V. ADDITIONAL INFORMATION

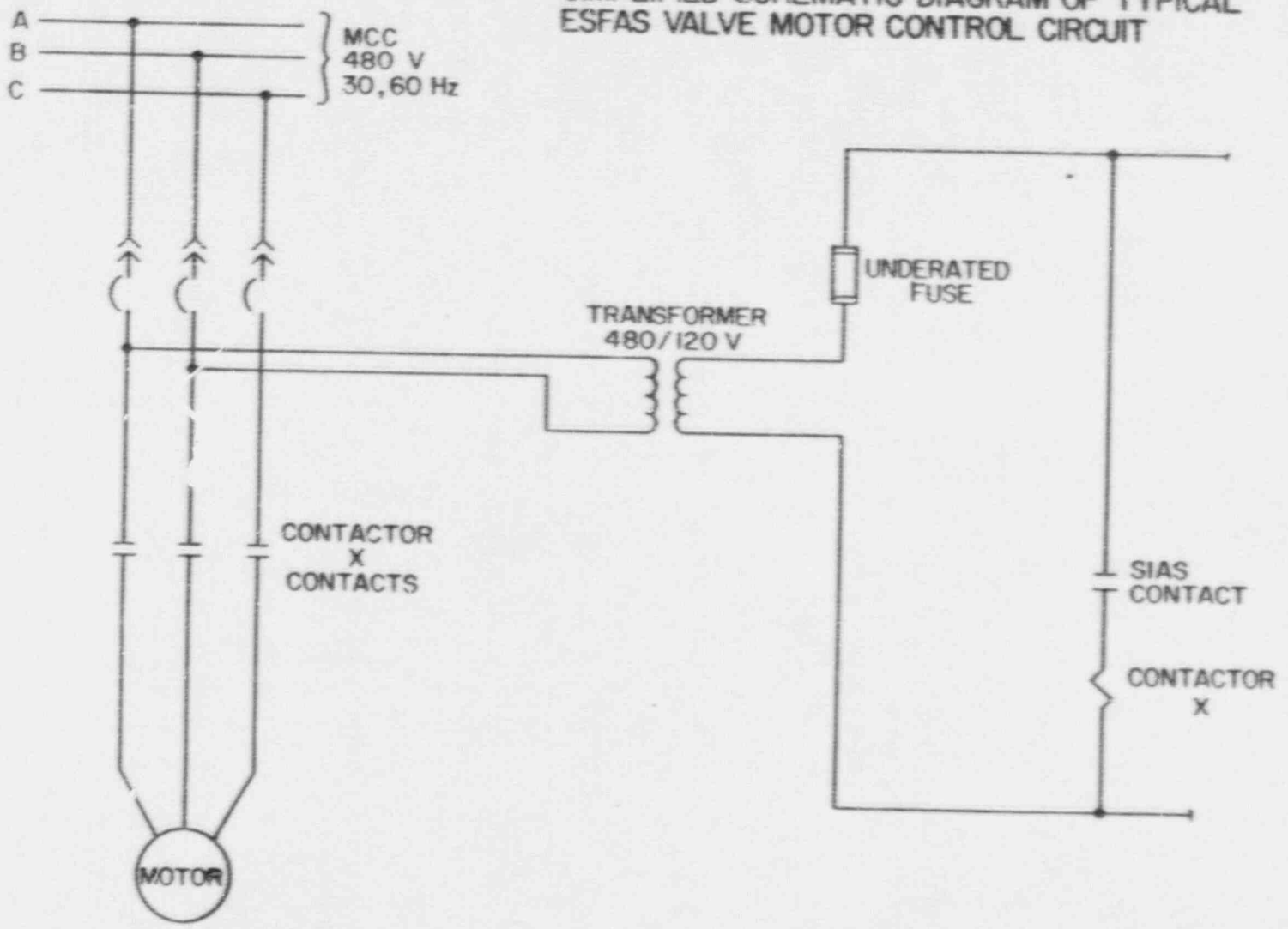
There have been no previous similar events involving undersized fuses due to calculation errors at Calvert Cliffs.

A. Identification of Components Referred to in this LER.

Component	IEEE 803 EIIS Funct	IEEE 805 System ID
Valve	V	Various B
Motor	NO	Various B
Fuse	FU	EB
Salt Water Air Compressors	CMP	LE
Boric Acid Pump	P	CB
EDG's	DG	EK
Motor Control Center	MCC	EB
Contactor	CNTR	EB
Undervoltage Relay	27	EB

FIGURE 1

SIMPLIFIED SCHEMATIC DIAGRAM OF TYPICAL ESFAS VALVE MOTOR CONTROL CIRCUIT



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