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 LICENSING 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)

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Clinton Power Station	05000461	1 OF 5

TITLE (4)
Incorrect Calculation in Diesel Generator Control Circuitry Results in Insufficient Voltage and Inoperability of the Division I Diesel Generator

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
									None	05000
01	31	93	98	006	00	03	02	98	FACILITY NAME: None	DOCKET NUMBER: 05000

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
	4	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
POWER LEVEL (10)		20.2203(a)(1)	20.2203(a)(3)(i)	X 50.73(a)(2)(ii)	50.73(a)(2)(x)
	000	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)	50.73(a)(2)(iv)	X OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
		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)
M. G. McMenamin, Design Engineer	(217) 935-8881, Extension 3469

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 15 single-spaced typewritten lines) (16)

With the plant in Mode 4 (COLD SHUTDOWN) and the sixth refueling outage in progress, a discrepancy in a Direct Current voltage calculation for the Division I Diesel Generator control circuitry was discovered. The calculation did not include the existence of two cables that are run to the Remote Shutdown Panel and their effect on the voltage drop to the Diesel Generator control panel. Preliminary evaluation of the impact of this error indicated that there has not been sufficient voltage to the control panel for all of its connected equipment. The cause for this event was due to an erroneous calculation provided by Sargent and Lundy design engineers. The engineer failed to include the cable lengths from and to the Remote Shutdown Panel in the voltage drop calculation for the Diesel Generator Control Panel. This error was overlooked in several subsequent revisions. The corrective actions for this event are to restore the Diesel Generator control panel voltage to an acceptable level, to review other voltage calculations to ensure no other circuits omitted cabling, to review the control circuits that pass through the Remote Shutdown Panel and to brief engineering personnel on lessons learned from this event. This issue is also reportable under 10CFR21.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

DESCRIPTION OF EVENT

On January 31, 1998, the plant was in Mode 4 (COLD SHUTDOWN) for the sixth refueling outage (RF-6), and reactor [RCT] coolant temperature was being maintained within a band of 95 to 115 degrees Fahrenheit (F) and pressure was zero pounds per square inch. A review was being performed by Nuclear Station Engineering Department personnel of the Emergency Diesel Generator (EDG)[EK] control circuitry due to a supplier deficiency noted with the air start solenoids [SOL]. During this review, a discrepancy was identified with a calculation for the Direct Current (DC) feed to the Division I DG control panel (1PL12JA)[PL]. The identified error was that certain cables [CBL3], which comprise part of the normal DC feed to the Division I DG control panel, had not been included in the voltage drop calculation to the panel. An informal calculation of the resistances and voltage drop, with the additional cable lengths included, indicated that the acceptance criteria of the original calculation had not been met. Condition Report (CR) 1-98-01-452 was written to address this issue.

The control power feed to 1PL12JA has an alternate feed through the Remote Shutdown Panel (RSP). This alternate feed is routed through a transfer switch located on the RSP. On February 4, 1998, during the review of the voltage requirements for 1PL12JA, it was noted that the amperage specifications for the transfer switch on the RSP were not adequate for the revised calculation. CR 1-98-02-060 was written to address this inadequacy.

The normal 125 volts (V) DC power is supplied to panel 1PL12JA through a feed cable (1DG01N) from the DC Motor Control Center (MCC). This cable is a three conductor, 1/0 gauge utilizing two of the conductors to carry the current to the panel. This cable choice appears to have treated the voltage drop issue as the limiting factor for this circuit and, at the time of installation, provided some margin in the design.

In order to provide the capability to transfer to an alternate source of DC power, the normal feed circuit passes through the remote shutdown panel. This was accomplished by the addition of cables to and from the RSP, connecting through the transfer switch. This cabling (1DG01M and 1DG01P) consists of #6 American Wire Gauge (AWG) size conductors. This part of the design failed to adequately evaluate the loads that existed at the diesel panel versus the rating of the transfer switch contacts (20 Amps (A) continuous, 6.5A inductive interrupting). At the time of the initial design, the maximum continuous load of the panel would have been approximately 14A but the inductive load represented by two DG lube oil motors [MO] would have been approximately 12.8A. The cable selection was acceptable from an ampacity viewpoint but the voltage drop was not considered. The original design current of 14A results in a voltage drop that does not meet the criteria of Sargent and Lundy standards with respect to motor feeds.

The resultant configuration should have been included as part of calculation 19-D-28, "Review of Division I DC System 1A," (Revision 0 dated June 6, 1985). This calculation recognized that the DC lube oil motors at the diesel would be running. In the "voltage drop in DC feeder circuits" portion of calculation 19-D-28, the feeder circuit breaker to 1PL12JA was evaluated, but only with the three conductor 1/0 cable (1DG01N) included and not the alternate feed through 1DG01M and 1DG01P. Based on the calculation layout, the preparer of calculation 19-D-28 was most likely working from the MCC key diagram and wiring

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diagram as well as the cable database. These documents show 1DG01N feeding 1PL12JA and terminating there. In order to identify the additional cables involved, it would be necessary to go to the wiring diagrams for the DG panel and the RSP, but there was nothing to specifically lead the preparer to look at these documents.

After issuance of the initial calculation, it was unlikely that the error would be subsequently identified since changes would tend to be loads and this would only lead to revision of the numerical values and not re-verification of the base data. This proved to be the case when the diesel pre-lubrication modification (DG-08, Engineering Change Notice 6644, dated November 19, 1985) was issued. In revision three of the calculation (issued February 18, 1987), the battery loading was revised to reflect the two new DC motors at the diesel. However, the "voltage drop in DC feeder circuits" was not revised. When this modification was issued, the transfer switch at the RSP was not re-examined for the additional load of two DC motors which took the continuous load to 26A, which is greater than the switch rating of 20A.

In revision eight to calculation 19-D-28 (issued June 15, 1991), the voltage drop portion was redone. This revision reformatted the calculation and examined not only the voltage drop to 1PL12JA, but also examined the addition of the two DC motors for pre-lubrication. However, the revision failed to identify the cabling through the RSP and so the acceptance values achieved were in fact not present at the motor terminals. As a result of this error, the Division I DG control panel would not have had sufficient voltage to operate all connected equipment in the event of an actual loss of Alternating Current(AC) power start.

No automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. This event was not effected by other inoperable equipment or components.

CAUSE OF EVENT

There was an initial error in the preparation of calculation 19-D-28 provided by Sargent and Lundy, which was not detected in the initial review nor subsequent revisions to the calculation. This error was further aggravated by the improper selection of a transfer switch that was marginal for its purpose and not further evaluated during later design changes.

CORRECTIVE ACTION

The corrective actions for this event includes a resolution to the voltage level required at the DG control panel. DC calculations for the safety-related batteries will be reviewed to ensure no other circuits omitted cabling. The control circuitry that runs through the RSP will also be analyzed for other components to ensure proper voltage/amperage is adequate for their operation. Engineering personnel will be briefed on the lessons learned from this event.

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ANALYSIS OF EVENT

This event is reportable under the provisions of 10CFR50.73(a)(2)(ii)(B) due to the plant being in a condition outside of its design basis in that there could have been insufficient voltage to the DG equipment fed by the control panel such that they would not have performed their design function.

An assessment of the safety consequences and implications of this event concluded that this event was safety significant. In the event of a true Loss of Alternating Current (AC) Power situation, the lack of sufficient voltage could have had significant adverse effects to the operation of the Division I DG up to and including failure of the diesel to start within the required time period. This condition has existed since initial plant licensing. This cabling configuration only effects the Division I Diesel Generator. The DC feed to the Division II and III Diesel Generators do not have the extra cabling that runs through the RSP.

ADDITIONAL INFORMATION

No equipment or components failed during this event. Illinois Power has not reported any events of insufficient DC voltage or underrated control switches in the past two years.

For further information regarding this event, contact M. G. McMenamin, Nuclear Station Engineering, at (217) 935-8881, extension 3469

10CFR, PART 21 REPORT 21-98-014

On January 31, 1998, a review of the DC power to the control circuitry of the DG control panel revealed that there was an error in the base calculation for the required voltage to DC equipment associated with the Division I DG. This error in preparing the calculation should be reported under the provisions of 10CFR21. The basis for the reportable conclusion is that the lack of sufficient voltage to the DG equipment could have adverse effects to its operation when required.

(i) Walter G. MacFarland, IV, Chief Nuclear Officer of IP, Clinton Power Station, Highway 54, 6 miles East, Clinton, Illinois, 61727, is informing the Nuclear Regulatory Commission of a condition reportable under the provisions of 10CFR, Part 21.

(ii) The activity involved in this condition is the calculation 19-D-28, "Review of Division I DC System 1A," (Revision 0 dated June 6, 1985).

(iii) This calculation was prepared and supplied by Sargent & Lundy.

(iv) The error in the calculation was a failure to analyze the cabling run from the DG control panel to the Remote Shutdown Panel for its impact on the minimum required voltage required for operation of the DC loads off of the DG control panel. Insufficient voltage to this equipment could result in failure for the equipment to perform its desired function when required by plant conditions.

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(v) The error in this calculation was discovered on January 31, 1998, and determined to be potentially reportable under the provisions of 10CFR21. The inadequacy of the transfer switch was identified on February 4, 1998, and was determined to be potentially reportable due to the error in the calculation 19-D-28.

(vi) The scope of the generic applicability of this issue at CPS has not been determined. A review of DC calculations will be performed and an analysis of other circuit configurations that pass through the Remote Shutdown Panel will be performed.

(vii) Corrective actions being taken by Illinois Power are discussed in the corrective action section of the LER portion of this report.

(viii) IP has no advice for other purchasers or licensees regarding this issue.

POWER REACTOR

EVENT NUMBER: 33819

FACILITY: CLINTON REGION: 3
UNIT: [1] [ ] [ ] STATE: IL
RX TYPE: [1] GE-6

NRC NOTIFIED BY: BYRON SHERMAN
HQ OPS OFFICER: JOHN MacKINNON

NOTIFICATION DATE: 03/02/98
NOTIFICATION TIME: 14:25 [ET]
EVENT DATE: 03/02/98
EVENT TIME: 14:25[CST]
LAST UPDATE DATE: 03/02/98

EMERGENCY CLASS: NOT APPLICABLE
10 CFR SECTION:
CCCC 21.21 UNSPECIFIED PARAGRAPH

NOTIFICATIONS

VERN HODGE (PCEB) NRR

UNIT	SCRAM CODE	RX CRIT	INIT PWR	INIT RX MODE	CURR PWR	CURR RX MODE
1	N	N	0	COLD SHUTDOWN	0	COLD SHUTDOWN

EVENT TEXT

INCORRECT CALCULATION IN DIESEL GENERATOR CONTROL CIRCUITRY RESULTS IN INSUFFICIENT VOLTAGE AND INOPERABILITY OF THE DIVISION 1 DIESEL GENERATOR.

A DISCREPANCY IN A DIRECT CURRENT VOLTAGE CALCULATION FOR THE DIVISION 1 DIESEL GENERATOR CONTROL CIRCUITRY WAS DISCOVERED. THE CALCULATION DID NOT INCLUDE THE EXISTENCE OF TWO CABLES THAT ARE RUN TO THE REMOTE SHUTDOWN PANEL AND THEIR EFFECT ON THE VOLTAGE DROP TO THE DIESEL GENERATOR CONTROL PANEL. PRELIMINARY EVALUATION OF THE IMPACT OF THIS ERROR INDICATED THAT THERE HAS NOT BEEN SUFFICIENT VOLTAGE TO THE CONTROL PANEL FOR ALL OF ITS CONNECTED EQUIPMENT. THE CAUSE FOR THIS EVENT WAS DUE TO AN ERRONEOUS CALCULATION PROVIDED BY SARGENT AND LUNDY DESIGN ENGINEERS. THE ENGINEER FAILED TO INCLUDE THE CABLE LENGTHS FROM AND TO THE REMOTE SHUTDOWN PANEL IN THE VOLTAGE DROP CALCULATION FOR THE DIESEL GENERATOR CONTROL PANEL. THIS ERROR WAS OVERLOOKED IN SEVERAL SUBSEQUENT REVISIONS. THE CORRECTIVE ACTIONS FOR THIS EVENT ARE TO RESTORE THE DIESEL GENERATOR CONTROL PANEL VOLTAGE TO AN ACCEPTABLE LEVEL, TO REVIEW OTHER VOLTAGE CALCULATIONS TO ENSURE NO OTHER CIRCUITS OMITTED CABLING, TO REVIEW THE CONTROL CIRCUITS THAT PASS THROUGH THE REMOTE SHUTDOWN PANEL AND TO BRIEF ENGINEERING PERSONNEL ON LESSONS LEARNED FROM THIS EVENT. LER WAS SUBMITTED BY THE LICENSEE.