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U-602729  
2C.220

WC-175-97  
April 22, 1997

Docket No. 50-461

10CFR50.73

Document Control Desk  
Nuclear Regulatory Commission  
Washington, D.C. 20555

Subject: Clinton Power Station - Unit 1  
Licensee Event Report No. 97-008-00

Dear Madam or Sir:

Enclosed is Licensee Event Report (LER) No. 97-008-00: Diesel Generator Undervoltage Relays Inoperable. This report is being submitted in accordance with the requirements of 10CFR50.73.

Sincerely yours,

Wilfred Connell  
Vice President

BGS/lrh

Enclosure

cc: NRC Clinton Licensing Project Manager  
NRC Resident Office, V-690  
Regional Administrator, Region III, USNRC  
Illinois Department of Nuclear Safety  
INPO Records Center

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## LICENSEE EVENT REPORT (LER)

(See reverse for required number of  
digits/characters for each block)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.

FACILITY NAME (1)

Clinton Power Station

DOCKET NUMBER (2)

05000461

PAGE (3)

1 OF 5

TITLE (4)

Diesel Generator Undervoltage Relays Inoperable

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
04	08	92	97	008	00	04	22	97	None	05000
									FACILITY NAME	DOCKET NUMBER
									None	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)		75.71
		20.2203(a)(2)(ii)			20.2203(a)(4)			50.73(a)(2)(iv)		OTHER
		20.2203(a)(2)(iii)			50.36(c)(1)			X 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

M. G. McMenamin

TELEPHONE NUMBER (Include Area Code)

(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

X

NO

(If yes, complete EXPECTED SUBMISSION DATE).

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

In 1992, Illinois Power electrical design engineers raised a concern that the setpoints for second-level undervoltage relays in the Auxiliary Power system may not be correctly set to provide adequate voltage for proper equipment operation. In 1994, an extensive study of the AP system response under Loss of Coolant Accident (LOCA) conditions identified the minimum voltage required at all levels from the 4160-volt to the 120-volt levels and concluded that the second-level undervoltage relay minimum reset point of 3799 volts would not ensure sufficient voltages for all equipment fed from the 120-volt motor control center distribution panels following a postulated LOCA scenario. This condition was identified on Licensee Event Report (LER) 94-005. However, it was not recognized at that time that the relays must be considered inoperable. Corrective actions for LER 94-005 included a Main Control Room alarm, revising the annunciator procedure for operator guidance, training of operators to respond to an undervoltage condition, and modifications of the plant design to replace the existing plant equipment with more accurate undervoltage relays and regulating transformers. In March of 1997, the Improved Technical Specification requirements for power sources and instrumentation were reviewed to submit an amendment to the Facility Operating License No NPF-62. Based on that review, the operability requirements of the undervoltage relays were not being met, so the relays and the associated Emergency Diesel Generators were declared inoperable.

LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Clinton Power Station	05000461	97	008	00	2 OF 5

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

## DESCRIPTION OF EVENT

On March 26, 1997, after an investigation into the operability requirements of Technical Specification 3.3.8.1-1, for submitting an amendment to the Facility Operating License No. NPF-62, the condition described in this LER was determined to be reportable under the provisions of 10CFR50.73. The plant was in Mode 4 (SHUTDOWN), reactor [RCT] temperature was about 110 degrees Fahrenheit, reactor pressure was atmospheric and the sixth refueling outage (RF-6) was in progress.

On April 8, 1992, electrical engineers were reviewing calculations developed in response to Electrical Distribution System Functional Inspection (EDSFI) degraded voltage issues identified at other nuclear power plants. The calculation being reviewed was recently enhanced to evaluate the voltages at various levels following automatic initiation of safety systems during a postulated Loss of Coolant Accident (LOCA) scenario. While reviewing the calculations, an engineer raised a concern that the setpoints for the second-level undervoltage relay [27] in the auxiliary power (A) [EC] system may not be correctly set to provide adequate voltage for proper operation of all required equipment. The second-level undervoltage relay is designed to transfer safety-related electrical loads to the associated emergency diesel generator [EK][DG] in the event of a sustained degraded voltage condition of the normal off site electrical sources. Adequate voltage might not be assured if the installed circuits were in the worst case configuration allowed by the bounding design specifications. The engineer initiated Condition Report (CR) 1-92-04-031 to track the continuing investigation and resolution of this concern.

Since the investigation was expected to be lengthy due to the need to evaluate individual circuits and components, a plant modification (Engineering Change Notice 27965) was implemented on May 15, 1992, to ensure sufficient bus [BU] voltage for equipment operability during the investigation. The modification added an alarm [ALM] on the 4160 volt buses of electrical divisions 1, 2, and 3 for low bus voltage. The alarm is designed to actuate in the MCR when bus voltage decreases to 3940 volts alternating current (VAC), thereby alerting operators to a potential degraded/degrading voltage condition. The 3940 VAC value was selected because it is about one percent above the minimum voltage that would be expected at the engineered safety feature 4 kilovolt (KV) buses under LOCA loading. Operators were briefed on the second-level undervoltage scheme and the symptoms they could expect to see during a degraded voltage condition. In addition, the operators were trained on the new undervoltage alarm, possible causes for the alarm, the automatic actions and operator actions in response to the alarm.

On May 6, 1994, the Nuclear Station Engineering Department (NSED) completed an extensive voltage study of the AP system under LOCA conditions. The study identified the minimum voltage required by engineered safety feature equipment at all levels from the 4.16 KV to the 120-VAC levels. The results of the study concluded that the present second-level undervoltage relay minimum reset point of 3799 volts would not ensure sufficient operating voltages for some equipment powered from the 120-VAC motor control center distribution panels following a LOCA start. This condition is contrary to the design criteria of the plant and alone could have prevented fulfillment of the safety function of at least four 120-VAC instrumentation and control circuits.

LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Clinton Power Station	05000461	97	008	00	3 OF 5

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

However, the investigation stated that the interim actions implemented by the ECN 27965 and subsequent operator actions, continue to provide adequate voltage to all required equipment.

On February 22, 1996, Illinois Power (IP) proposed an amendment to the CPS Technical Specifications, in part, to revise the setpoints for the degraded voltage (second-level undervoltage) protection instrumentation. That amendment request was provided in support of the longer term corrective actions of LER 94-005. As identified in that request and subsequent responses to the Nuclear Regulatory Commission (NRC) Requests for Additional Information, the longer term corrective actions involve installation of more accurate undervoltage relays on the 4.16 KV buses and installation of voltage regulating transformers to provide adequate voltage for several 120-VAC distribution panels. Calculations provided to the NRC staff in support of IP's amendment request were based on final configuration, i.e., with the new undervoltage relays and regulating transformers installed. IP's request also noted that the modifications were scheduled to be installed one division at a time during separate refueling outages, beginning in the sixth refueling outage (RF-6). IP's amendment request was approved via Amendment 110 dated December 4, 1996.

Upon installation of the modification for Division 2 (modification AP-028) during the current refueling outage (RF-6), problems were experienced with the new regulating transformers. The transformers were experiencing spurious trips due to the sensitivity of the internal protective circuits to Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI). After an extended and unsuccessful attempt to resolve the tripping problems, a decision was reached to reinstall the original non-regulating transformers for the 120-VAC distribution panels. From a safety point of view, it was recognized that utilization of the new, more accurate relays calibrated to the setpoints approved in Amendment No. 110 would be the most appropriate configuration. They will provide better automatic protection for the Class 1E loads. With the new relays and settings, the range over which the degraded voltage protection is inadequate is on the order of one percent below the rated minimum for 120-VAC equipment.

Also during RF-6, CPS established a new operability determination program. That program, which is based on the guidance contained in NRC Generic Letter 91-18, "Information to Licensees Regarding Two NRC Inspection Manual Sections of Resolution of Degraded and Non-Conforming Conditions and on Operability," requires completion of a safety evaluation when manual actions are being credited to support operability of structures, systems, or components with automatically initiated actions. Review of the previously established interim corrective actions (i.e., the MCR alarm and contingent operator actions) concluded that use of these administrative controls constitutes an unreviewed safety question. IP has concluded that, given the new relay settings and the manual operator response time, there is an increased potential for 120-VAC Class 1E equipment to be damaged by a degraded voltage condition. The failure mode was not previously evaluated in the CPS Updated Safety Analysis Report (USAR), nor was the reduction in the margin of safety as defined in the CPS Technical Specifications (TS). Further, IP has concluded that the automatic degraded voltage relays do not meet their Technical Specification bases. Thus, the degraded voltage



LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Clinton Power Station	05000461	97	008	00	4 OF 5

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

(second-level undervoltage) relays in all three divisions are currently considered inoperable. As a result of this declaration, all three emergency diesel generators have also been declared inoperable.

## CAUSE OF EVENT

The root cause of the declaration of the emergency diesel generators being inoperative (CR 1-97-03-187) was an inadequate process to review operability requirements of plant equipment as defined in the Technical Specifications (TS) Table 3.3.8.1-1. This inadequate operability assessment process has been identified on condition report CR 1-96-10-045. An additional area of concern is the safety screening program. When it was determined that the relay setpoints were inadequate for automatic degraded voltage protection and the condition reported in LER 94-005 was identified, operability and the safety evaluations performed for the addition of a MCR alarm and for the changes to the annunciator procedures were not reassessed. The failure to perform adequate safety screenings and/or evaluations have been identified on condition report CR 1-96-12-045.

## ANALYSIS OF EVENT

This event is reportable under the provisions of 10CFR50.73(a)(2)(ii)(B) and 10CFR50.73(a)(2)(v) because the current second-level undervoltage setpoint (and reset point) is not in accordance with the plants design basis and is a condition that alone could have prevented the fulfillment of the safety functions of at least four 120-VAC instrumentation and control circuits.

Assessment of the safety consequences and implications of this event identified that it has potential nuclear safety significance. Since initial plant startup on September 29, 1986, to the present time, if a LOCA had occurred while grid voltage was low, sufficient voltage may not have been available for proper safety system equipment operation. Although the emergency diesel generators automatically start in response to a LOCA signal, they do not automatically pick up loads unless a degraded voltage condition exists. For a degraded bus voltage condition, and for each affected bus, the undervoltage relay will trip at the associated setpoint and cause a timer circuit to initiate. Bus transfer to pick up the loads occurs automatically only if voltage fails to recover above the degraded voltage reset point prior to timer time-out or if a total loss of voltage occurs. However the condition described in this LER would have allowed the degraded undervoltage relay to reset at a voltage too low to ensure proper operation of all required equipment. Manual transfer of affected Class 1E loads can be performed if the operators take immediate action in response to the MCR alarm of an undervoltage condition. This administrative control is in place until all three divisions can have the undervoltage protection circuits upgraded to provide sufficient automatic action on an undervoltage event.

LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Clinton Power Station	05000461	97	008	00	5 OF 5

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

## CORRECTIVE ACTION

Resolution of this condition is addressed by the Licensee's letter (LS-97-001) to the Nuclear Regulatory Commission (NRC) which proposes an amendment of Facility Operating License No. NPD-62. This request consists of a proposed change to the Technical Specification (TS) Table 3.3.8.1-1, "Loss of Power Instrumentation." The proposed TS change requires that the interim administrative controls, consisting of the MCR annunciator and operator actions, to be maintained until the planned modifications can be completed and operator actions, be maintained until the planned modifications can be completed on all three divisions of safety related AC power.

Because the proposed configuration (i.e., use of the new relays at their setpoints, with the original, non-regulating transformers in place) is different than what was reviewed by the NRC in support of Amendment No. 110, the NRC staff requested that IP include in the TS a commitment to maintain the administrative controls in effect until the degraded voltage protection instrumentation and distribution system have been upgraded for all three divisions of safety-related AC power. Because there are not qualified replacement regulating transformers readily available, these modifications are currently planned to be completed prior to restart from the seventh refueling outage (RF-7).

## ADDITIONAL INFORMATION

LER 94-005 has additional information on previous actions taken to resolve this event.

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