Entergy

10 CFR 50.73

Entergy Nuclear Generation Company
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360

August 13, 1999
ENGC Ltr. 2.99.080

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Docket No. 50-293
License No. DPR-35

The enclosed Licensee Event Report (LER) 99-007-00, "Bus B6 Voltage Restoration Not Consistent with Safety Analysis Assumptions," is submitted in accordance with 10 CFR 50.73.

This letter contains no commitments.

Please do not hesitate to contact me if there are any questions regarding this report.

J.F. Alexander, Director
Nuclear Assement

JLR/sc
Enclosure

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NRC Form 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/20

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE(3)
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TITLE (4)

Bus B6 Voltage Restoration Not Consistent with Safety Analysis Assumptions

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
									N/A	05000
07	16	1999	1999	007	00	08		99	FACILITY NAME N/A	DOCKET NUMBER 05000

OPERATING MODE (9)	N	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)
			22.2203(a)(1)		20.2203(a)(3)(i)	x	50.73(a)(2)(ii) B		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)		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)		or in NRC Form 366A

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Jeffrey L. Rogers - Regulatory Affairs Senior Engineer	(508) 830-8160

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

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)

On July 16, 1999, engineering personnel were reviewing the operating characteristics of a design change and discovered a potential failure mode that could result in 480V swing bus B6 remaining deenergized following a loss of coolant accident coincident with degraded grid voltage. Due to the circuit design change, the B6 supply breaker charging springs may not be fully precharged when signaled to close, thereby leaving bus B6 deenergized. An engineering evaluation determined that the guidance contained in procedures is sufficient to ensure that safety-related components will operate within their design limits during a degraded voltage condition.

The cause was personnel error during the development of the design change. During the design process all possible scenarios were not considered for impact.

Corrective action taken consisted of an extent review which determined that this potential failure mode is limited to only the bus B6 transfer scheme. No other breakers at Pilgrim Station are subject to this potential failure mode. Corrective action planned is to evaluate the need for any modifications to correct the problem.

The condition was discovered on July 16,1999. The reactor mode selector switch was in the RUN position. The reactor vessel pressure was approximately 1034 psig with the reactor water temperature at the saturation temperature for that pressure. The event posed no threat to public health and safety.

BACKGROUND

Emergency AC power is provided to the Pilgrim Station Auxiliary Power Distribution System through the safety-related 4160V buses A5 and A6. The startup transformer (SUT) is designed to supply these buses if offsite power is available. Should offsite power be lost or become seriously degraded, two emergency diesel generators(EDG) are designed to provide onsite power to their respective bus. Buses A5 and A6 supply power to 480V safety related buses B1, B2 and swing bus B6. Bus A5 supplies Core Spray(CS) System pump A and Residual Heat Removal(RHR) System pumps A and C. Bus A6 supplies CS pump B and RHR pumps B and D. The CS train A injection valves are powered from 480V Motor Control Center (MCC) B17 which is fed by bus B1. The CS train B injection valves are powered from 480 V MCC B18 which is fed by bus B2. The RHR/low pressure coolant injection(LPCI) valves are powered from MCC B20 which is fed by bus B6. The CS and RHR systems are part of the Pilgrim Station(PNPS) Core Standby Cooling Systems(CSCS).

Bus B6 is a swing type bus that can be powered by bus B1 or B2. Bus B1 is the normal power source for bus B6 with supply breakers 52-102/52-601 in the CLOSED position and with bus B2 supply breakers 52-202/52-602 in the OPEN position. These sets of breakers are interlocked to prevent B6 from being simultaneously powered by bus B1 and B2. If bus B1 were to experience a loss of voltage, the design provides for an automatic transfer of the power supply of B6 to B2.

The objective of the PNPS LOCA analysis(NEDC-31852P Rev. 1) is to provide assurance that the most limiting break size, break location, and single failure combination has been considered. All combinations also assume a loss of offsite power(LOOP) coincident with the LOCA. The most limiting case for PNPS is the recirculation suction line break with LPCI injection valve failure. For this limiting break, the two core spray trains are credited with providing core cooling.

After a LOCA with LOOP, the time assumed in the LOCA analysis for power to be restored to the CS and LPCI injection valves is approximately 14.7 seconds. This includes the time to detect the LOCA, trip the SUT breakers, start the EDGs and allow EDG supply breaker closure. If bus B1 were to remain deenergized or to lose voltage(e.g., EDG 'A' failure), bus B6 is designed to automatically transfer to bus B2. This transfer time could add an additional 4.9 seconds to the time assumed in the LOCA analysis for power to be restored to the CSCS injection valves. This time to restore power(approximately 19.6 seconds) does not affect the limiting case because the injection valves are designed to open after reactor pressure has decayed to the opening pressure permissive of the injection valves(occurs at approximately 19.7 seconds).

However, as reported in LER 98-014, "Degraded Grid Voltage Restoration Time Is Not Consistent With Safety Analysis Conclusions," it was discovered that the design of PNPS is such that if a LOCA coincident with degraded grid voltage were to occur power would not be restored at the injection valves until approximately 21 seconds. This additional time delay occurs because the relays used to detect

degraded voltage and trip the SUT breakers (maximum setpoint of 10.6 seconds) must time out before the EDG timer is initiated. After the SUT is tripped, the EDG timer times out at approximately 10.2 seconds and closes the EDG supply breakers. This impacted the LOCA analysis limiting case by delaying core spray injection by about one second.

A design modification(PDC 99-05) was implemented to correct this condition in the 1999 Refueling Outage(RFO 12). Essentially the logic was modified to place the degraded voltage timers and EDG timer in parallel. Additional changes were made to delay EDG breaker closure to ensure residual voltage at the CSCS motors is acceptable. The net effect of the modification was to reduce the time to restore power to the CSCS injection valves from 21 seconds to approximately 15.5 seconds. This restored the results of the limiting case to those reported in the LOCA analysis.

On July 16, engineering personnel discovered a potential failure mode introduced by PDC99-05 that could result in bus B6 remaining deenergized following a LOCA coincident with degraded grid voltage. Once the degraded voltage time delay relay times out at approximately 10.6 seconds, the SUT supply breakers would automatically trip(open) and bus A5 and A6 would be deenergized. One second after these breakers trip, breakers 52-102/52-601 from B1 to B6 would be tripped(breakers from B2 to B6 would remain open). After a two second time delay to allow residual voltage to decay, the EDGs would restore power to buses A5 and A6. Voltage to buses B1 and B2 would be restored and a closure signal would be sent to B6 supply breakers 52-102/52-601 after 1.25 seconds. The total time from tripping breakers 52-102/52-601 to the closure signal is approximately 3.25 seconds. However, the closing springs of the bus B6 transfer breakers charge only when the breaker is in the open position and take an additional 5 to 7 seconds to recharge. Therefore, the closing springs may not be fully precharged when the breaker is signaled to close, thereby preventing automatic closure of the bus B6 transfer breakers.

EVENT DESCRIPTION

On July 16, 1999, engineering personnel were reviewing the operating characteristics of a design modification (PDC 99-05) and discovered a potential failure mode that could result in bus B6 remaining deenergized following a LOCA coincident with degraded grid voltage. The Operations Department declared the degraded voltage system operable based on a verbal recommendation from the Engineering Department. A written engineering evaluation(EE99-065) was also provided on July 16, 1999.

Problem Report(PR) 99.9421 was written to document this condition. The NRC Operations Center was notified in accordance with 10CFR50.72(b)(1)(ii) at 1330 hours.

This condition was identified while at 100 percent reactor power with the reactor mode selector switch in the RUN position. The reactor vessel pressure was approximately 1034 psig with the reactor water temperature at the saturation temperature for this pressure.

CAUSE

The cause was electrical engineering design personnel error during development of PDC 99-05. The PDC was developed to correct the condition described in LER 98-014. During the design process all possible scenarios were not considered for impact. The specific design issue not considered was the pre-charge time required for the closing springs in bus B6 transfer breakers 52-102/52-601 and 52-202/52-602.

Contributing causes include: inadvertent deletion of a portion of the LEGEND on electrical drawing E46(B1 and B2 schematic) that described breaker operation and documented the pre-charging time for the closing springs and lack of a complete design basis document for the 4160V and 480V distribution systems.

CORRECTIVE ACTION

The following corrective actions were taken:

An extent review was performed and it determined that this potential failure mode is limited to only the bus B6 transfer scheme. These breakers are General Electric Type AK-2A-50(Slow Close) breakers and are used only in this transfer scheme. A review of other breaker classes(GE Type AK -25 and GE 4kV Magne-Blast) determined no other breakers are subject to this potential failure mode.

An engineering evaluation(EE99-65) was performed. The evaluation determined that the guidance contained in PNPS Procedures 2.4.144, "Degraded Voltage", and 2.1.15 "Daily Surveillance Log," are sufficient to ensure that safety related components will operate within their design limits during a degraded voltage condition.

The following corrective action is planned and will be tracked as part of the corrective action program (PR99.9421):

An analysis will be conducted of the current design to evaluate the need for any modifications. Drawing E46 (Rev. E8)will be revised to include the partially deleted LEGEND. Design basis documentation will be developed for the 4160V and 480V distribution systems.

SAFETY CONSEQUENCES

The condition posed no threat to public health and safety.

The potential failure mode would exist only during a postulated LOCA coincident with degraded grid voltage. The probability of having a LOCA and a degraded grid voltage condition has been calculated to be approximately 1.694E-9/year.

Also, the bus transfer scheme would operate as designed without a degraded voltage condition. The failure mode does not exist for a loss of voltage scenario nor does it exist if offsite power is maintained after the LOCA.

Finally, if this extremely improbable event were to occur(LOCA coincident with degraded voltage and failure of bus B6 to automatically transfer) there would still be two core spray trains available for CSCS injection. This is a case already evaluated in the LOCA analysis and determined to be acceptable.

Actions to reduce the likelihood of degraded grid voltage from affecting safety-related equipment are contained in plant operating procedures. Procedure 2.1.15, "Daily Surveillance Log," instructs operations personnel to contact ISO New England/REMVEC once per shift to verify switchyard voltage can be maintained above 342kV following a station trip. Switchyard voltages above 342kV ensure that station bus voltages will be maintained above the degraded voltage relay setpoints. If ISO New England/REMVEC can not ensure switchyard voltage of 342kV after a station trip then Procedure 2.4.144, "Degraded Voltage" instructs operations personnel to start the EDGs and load them onto emergency buses A5 and A6. This action ensures bus B6 would remain energized during a postulated LOCA coincident with degraded grid voltage.

There were no system or component failures that occurred as a result of the condition.

REPORTABILITY

This report was submitted in accordance with 10 CFR 50.73(a)(2)(ii)(B) as operation in a condition outside the design basis. Bus B6 is designed to automatically reenergize after a loss of power to bus A5 and A6. This condition could preclude bus B6 from automatically reenergizing which is contrary to the requirement that the emergency service portion of the Auxiliary Power Distribution System be designed to provide power under all accident and transient conditions(UFSAR section 8.4).

SIMILARITY TO PREVIOUS EVENTS

A review of Pilgrim Station Licensee Event Reports (LERs) submitted since 1991 was conducted. The review focused on LERs that involved degraded voltage.

The review identified LER 91-018-00, "Setpoints of Degraded Voltage Relays Too Low During Low Probability Degraded Voltage Conditions," LER 97-015-01, "SSW Pumps Overload Settings Too Low For Single SSW Pump Operation With Degraded Voltage," LER 98-014-00, "Degraded Voltage Restoration Time Is Not Consistent With Safety Analysis Assumptions," and LER 98-015-01, "Non-Conservative Degraded Voltage Trip Setpoint."

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

ENERGY INDUSTRY IDENTIFICATION CODES

The EIIS codes for this report are as follows:

COMPONENTS	CODES
Circuit Breaker, AC	52
Relay, Time Delay Closing	02

SYSTEMS	CODES
Medium-Voltage Power Systems Class-1E	EB
Emergency Onsite Power Supply System	EK