Entergy

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Pilgrim Nuclear Power Station
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J. F. Alexander
Director
Nuclear Assessment

10 CFR 50.73

May 25, 2000
ENGC Ltr. 2.00.046

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

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

Dear Sir:

The enclosed Licensee Event Report (LER) 2000-002-00, "High Pressure Coolant Injection System Inoperable due to Power Inverter Failure," is submitted in accordance with 10 CFR 50.73.

Except for the submittal of a supplemental report, no commitments are made in this letter.

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

Sincerely,

J. F. Alexander

DWE/
Enclosure: LER 2000-002-00

cc: Mr. Hubert J. Miller
Regional Administrator, Region 1
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

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RGN-021

NRC Form 366 (6-1998) | U.S. NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB NO. 3150-0104 | EXPIRES 06/30/200

LICENSEE EVENT REPORT (LER)

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

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TITLE (4)

High Pressure Coolant Injection System Inoperable due to Power Inverter Failure

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
04	25	2000	2000	002	00	5	25	2000	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)	50.73(a)(2)(ii)	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)	x 50.73(a)(2)(v)(D)	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)
Douglas W. Ellis - 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
X	BJ	INVT	A631	Y						

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE(15)	MONTH	DAY	YEAR
X	YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		07	31	2000

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

On April 25, 2000, at 1545 hours, the High Pressure Coolant Injection (HPCI) system became inoperable when the inverter, which supplies power to the system's flow control circuitry, tripped but did not automatically reset as designed. The HPCI system was declared inoperable and a 14-day limiting condition for operation was entered.

The inverter was replaced and the HPCI system was tested with satisfactory results and declared operable later on April 25, 2000. The results of the root cause analysis will be reported in a supplement to this report. The replaced inverter was sent to the designer (General Electric) for evaluation.

This event occurred at 100 percent reactor power with the reactor mode selector switch in the RUN position. The reactor vessel pressure was about 1030 psig with the water temperature at the saturation temperature for that pressure. This event posed no threat to public health and safety.

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

BACKGROUND

The High Pressure Coolant Injection (HPCI) system is designed to provide high pressure reactor core cooling in the event of a small break loss of cooling accident. This system functions to ensure the reactor core is adequately cooled to limit fuel clad temperature in the event of a small break in the nuclear system pressure boundary that does not result in rapid depressurization of the reactor vessel.

The previous HPCI system and Reactor Core Isolation Cooling (RCIC) system inverters in the control room were a Topaz Electronics design and were installed during original plant construction (c. 1972). The inverters were replaced with inverters having a newer design in the 1992 refueling outage (RFO-9) via an engineering design modification (PDC 91-63). The new HPCI and RCIC inverters were manufactured by Abacus Controls Incorporated (ACI) with an ACI design.

During the 1995 refueling outage (RFO-10), the design of the HPCI and RCIC inverters in the control room was modified as a result of separate failures of the HPCI and RCIC inverters on different dates in February 1995 (LER 95-002-01). The RCIC inverter power supply was modified via a design modification (FRN 95-04-30) that was implemented during RFO-10, on April 28, 1995 (MR 19500782). In essence, the RCIC inverter power supply power resistor was elevated above the circuit board to improve heat dissipation. The modification (FRN 95-04-30) also provided for the modification of the HPCI inverter power supply. The modified HPCI inverter power supply, however, was kept as a spare for the RCIC inverter. Concurrently, the HPCI inverter design was changed from the ACI design to a General Electric design via a separate design modification (FRN 95-04-32 and related substitution equivalency evaluation 722) that was implemented during RFO-10, on May 3, 1995 (MR 19500781). The HPCI inverter (General Electric design) was manufactured by ACI.

In December 1998, the HPCI system became inoperable when the inverter (INV-2340-13) in the control room tripped and failed to reset (LER 98-026-00). The event occurred while a HPCI turbine drain pot valve (CV-9068B) was being surveillance tested. The event was most likely caused by stored electromagnetic field energy in the valve's 125 vdc coil that caused contact arcing in the valve's control switch (PR 98.9604.02). Corrective action taken included the installation of filter rectifiers on valves CV-9068A/B. This action was taken via a design modification (PDC 99-06) that was implemented via a maintenance work document (MR E9900002).

The HPCI inverter is safety-related, operates continuously to convert 125 vdc power to 120 vac power to the HPCI turbine-pump flow control circuitry. The electrical load on the HPCI (and RCIC) inverter in the control room is essentially constant and very light regardless of system operating state.

Technical Specification 3.5.C. (HPCI System) requires the HPCI system be operable when irradiated fuel is in the reactor vessel, reactor pressure is greater than 150 psig, and reactor coolant is greater than 365 degrees F.

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

EVENT DESCRIPTION

On April 25, 2000, at 1545 hours, control room Panel C903 (A-4) alarm, "HPCI Inverter Failure," annunciated. The alarm occurred when the HPCI system was operable and in normal standby status.

Initial investigation was performed in accordance with the alarm response procedure ARP-C903C (window A4). The investigation indicated the inverter had tripped but had not reset automatically as designed. There were no HPCI system maintenance or surveillance tests in progress at the time of the event. The circuit breakers that provide 125 vdc power to the inverter were checked with satisfactory results. The HPCI system was declared inoperable and a 14-day limiting condition for operation (LCO A00-278) was entered, effective at the time of the event. The inverter automatically reset at 1551 hours. As a result of the automatic reset, the HPCI system was available (capable of starting in the event of an initiating signal). The HPCI system, however, was not declared operable pending the results of continued investigation.

The NRC Operations Center was notified of the event in accordance with 10 CFR 50.72(b)(2)(iii) at 1621 hours on April 25, 2000 (event notification #36929). A corrective action program document (PR 00.9165) was written to document the HPCI inverter failure. A priority maintenance request (MR 10000993) was written to investigate the problem.

At 1930 hours, the HPCI system was removed from service to replace the inverter. The inverter was replaced because the investigation could not determine the cause of the problem. After the inverter was replaced with the spare HPCI inverter (same G.E. design), the system was returned to standby service (available) at 1947 hours. The HPCI system was post work tested with satisfactory results and the system was declared operable. The 14-day LCO (A00-278) was terminated at 2215 hours on April 25, 2000.

The event occurred while at 100 percent reactor power with the reactor mode selector switch in the RUN position. The reactor vessel pressure was approximately 1030 psig with the reactor water temperature at the saturation temperature for the reactor pressure.

CAUSE

The direct cause of the HPCI inverter alarm was no output power from the inverter. At the time of the alarm, the control room operators observed the HPCI inverter power light extinguished, indicating a loss of power to the HPCI flow control circuitry.

The cause of the HPCI inverter failure alarm was investigated at Pilgrim Station but the results of the investigation were inconclusive. No system testing or maintenance was being performed at the time of the event that had the potential to directly or indirectly affect the inverter's performance. The 125 vdc input voltage to the inverter was in its normal range at the time of the event. The

inverter was bench tested after it was replaced, and the tests revealed the inverter was functioning properly. The tests included maintaining a nominal input voltage (125 vdc) while monitoring the inverter's output voltage. The tests also included the application of heated air to the inverter to simulate possible heating in the control panel.

EXTENT OF THE PROBLEM

The HPCI inverter that was replaced was manufactured by Abacus Controls Incorporated but with a General Electric design. Nameplate data of the replaced inverter includes the following: model number 452B-4-125-GE, serial number #559-00020 (G.E.). The serial number of the spare HPCI system inverter is #559-00010 (G.E.).

The HPCI system inverter in the control room is a diverse design with respect to the ACI designed RCIC system inverter in the control room. The HPCI inverter (G.E. design) uses an output driver that utilizes an insulated gate bipolar transistor technology. The design provides a more efficient, heavier duty, optically isolated inverter. The HPCI (and RCIC) inverters in the main control room are separately monitored and are equipped with separate alarms in the main control room. The HPCI inverter is powered by the 125 vdc system Bus 'B'. The RCIC system inverter in the control room is powered by the 125 vdc system Bus 'A'.

CORRECTIVE ACTION

Corrective action taken includes the following:

The HPCI inverter was replaced with the spare HPCI inverter (same G.E. design) via a maintenance request (MR 10000993). The replacement inverter was calibrated in accordance with procedure 8.E.23 (rev. 36), "HPCI System Instrumentation Calibration," with satisfactory results. The HPCI system was post-work tested in accordance with procedure 8.5.4.1 (rev. 58), "HPCI System Pump and Valve Quarterly Operability," with satisfactory results and the system was returned to standby (available) status at 1947 hours. The 14-day HPCI system LCO (A00-278) was terminated at 2215 hours on April 25, 2000.

Corrective action planned includes the following:

The inverter was sent to General Electric for further evaluation. The evaluation includes testing by Abacus Controls Inc (ACI). The testing by ACI revealed normal setpoints and operating parameters. The evaluation is being tracked under the corrective action program (PR 00.9165).

Maintenance personnel were in the process of conducting a root cause analysis when this report was prepared. Corrective actions that are required as a result of this analysis will be tracked in accordance with the corrective action program (PR 00.9516). A supplemental report will be submitted after the root

cause analysis is completed and approved. The root cause analysis is expected to be completed, reviewed and approved in June 2000. Therefore, the submittal of the supplemental report is expected by the end of July 2000.

SAFETY CONSEQUENCES

The event posed no threat to public health and safety.

The core standby cooling system (CSCS) consists of the HPCI system, Automatic Depressurization system (ADS), Core Spray system, and the Residual Heat Removal (RHR) system in the low pressure coolant injection (LPCI) mode. Although not part of the CSCS, the RCIC system is capable of providing water to the reactor vessel for high pressure core cooling, similar to the HPCI system. During the time period the HPCI system was inoperable, the ADS, RHR/LPCI mode, Core Spray, and RCIC systems were operable. In the unlikely event the RCIC system was to become inoperable while the HPCI system was inoperable and high pressure core cooling was necessary, an actuation (automatic or manual) of the ADS would function to reduce reactor vessel pressure for low pressure core cooling provided independently by RHR system (LPCI mode) and/or the Core Spray system.

This report was submitted in accordance with 10 CFR 50.73(a)(2)(v)(D) because the HPCI system was inoperable in that the inverter tripped but did not reset automatically as designed.

SIMILARITY TO PREVIOUS EVENTS

A review was conducted of Pilgrim Station Licensee Event Reports (LERs) issued since 1995. The review focused on LERs involving RCIC or HPCI system inverter problems due to similar causes. The review identified LER 95-002-01 (HPCI system and RCIC system separately inoperable on different dates due to failed power inverters), LER 95-011-00 (RCIC system made inoperable due to unplanned maintenance to replace the power inverter), and LER 98-026-00 (HPCI declared inoperable due to failed power inverter).

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

The EIIS codes for this report are as follows:

COMPONENTS	CODES
Inverter (INV-2340-13)	INVT
SYSTEMS	
High Pressure Coolant Injection (HPCI) system	BJ