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March 18, 1996
PY-CEI/NRR-2037L

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

Perry Nuclear Power Plant
Docket No. 50-440
LER 96-002

Gentlemen:

Enclosed is Licensee Event Report 96-002, Inverter Failure Results in Partial High Pressure Core Spray System Initiation.

If you have questions or require additional information, please contact Mr. James D. Kloosterman, Manager - Regulatory Affairs at (216) 280-5833.

Very truly yours,

CRE:sc

Enclosure: LER 96-002

cc: NRC Project Manager
NRC Resident Inspector Office
NRC Region III

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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TITLE (4)

Inverter Failure Results in Partial High Pressure Core Spray System Initiation

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
										05000
02	18	96	96	-- 002 --	00	03	15	96	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9): 5
POWER LEVEL (10): 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
	20.2203(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)	X	50.73(a)(2)(iv)		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)
Keith R. Jury, Supervisor-Compliance	(216) 280-5594

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
B	BG	INVT	G080	No					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION	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 February 18, 1996, at 0230, during refueling outage maintenance activities in Operational Condition 5, with the reactor cavity flooded, a Topaz inverter failure resulted in an unplanned partial automatic actuation of the High Pressure Core Spray (HPCS) system and actuation of the associated Emergency Service Water system. The HPCS Pump and HPCS Diesel generator had been previously taken out of service and no injection into the reactor pressure vessel occurred.

The cause of the event has been determined to be an intermittent failure of the Topaz inverter circuitry (i.e., equipment failure). A capacitor on the inverter control board was identified to be in a degraded condition. Due to the sequence in which instrumentation and analog trip units sensed the power loss, a HPCS reactor low level initiation signal was generated and sealed in.

The Topaz inverter was refurbished with replacement electrolytic capacitors including the degraded capacitor on the control board, was bench tested, and was returned to service. Engineering personnel are evaluating replacement designs for safety related Topaz inverters whose failures can result in safety system initiations. This event is being reported pursuant to 10CFR50.73(a)(2)(iv).

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

I. Introduction

On February 18, 1996, at 0230, a High Pressure Core Spray [BG] (HPCS) system Topaz inverter [INVT] (General Electric Company, Model Number 5252-13) failure resulted in an unplanned partial automatic actuation of the HPCS system and actuation of the associated Emergency Service Water [BI] (ESW) system. At 0451, a four hour non-emergency notification (ENF No. 29991) was made to the NRC as required by 10CFR50.72(b)(2)(ii) for any event or condition that results in a manual or automatic actuation of any Engineered Safety Feature (ESF). This event is being reported pursuant to 10CFR50.73(a)(2)(iv).

At the time of the event, the plant was in Operational Condition 5 with the reactor shut down for Refueling Outage 5 (RF05). The reactor pressure vessel pressure was at atmospheric with reactor coolant temperature at approximately 100 degrees Fahrenheit.

II. Event Description

On February 18, 1996, at 0130, the HPCS system, the HPCS Diesel Generator, and ESW Loop "C" were declared inoperable for maintenance activities associated with RF05. The reactor mode switch was locked in the "Shutdown" position, the head was removed from the reactor pressure vessel, and the upper containment pools were flooded and maintained at levels required by Technical Specifications (TS). Fuel Pool Cooling and Cleanup (FPCC) system Loop "B" was the primary decay heat removal system, with FPCC Loop "A" as the alternate. The Low Pressure Coolant Injection mode of the Residual Heat Removal system Loop "C" was the available Emergency Core Cooling system. No core alterations or operations that had a potential for draining the reactor vessel were in progress.

On February 18, 1996, at 0230, while an operator was pulling a fuse (1E22B-F1) for the HPCS Pump motor control circuitry as part of a tagout evolution for routine maintenance, a HPCS reactor level low initiation signal was received by the HPCS system. Although the HPCS Pump and the HPCS Diesel Generator did not start (due to the tagout that was in progress), the HPCS Injection valve and the HPCS Pump Minimum Flow valve opened. ESW pump "C" also started as a result of the initiation signal.

Control Room Operators immediately recognized the initiation signal due to the receipt of the associated annunciators. At 0250, the HPCS pump breaker was racked out to prevent an inadvertent pump start. While attempting to determine the cause of the ESF actuation, at 0315 plant operators identified that a fuse (1E22A-F9) which supplied power to the 125 VDC to 120 VAC Topaz inverter (1E22-K650) had operated or "blown". At 0330, the HPCS initiation signal seal-in was reset, the HPCS Injection valve was closed and electrically disabled, and the HPCS system was placed in secured status. At 0345, ESW Loop "C" was shut down to standby readiness status, and at 0347, was placed in secured status.

III. Cause of Event

The cause of the event has been determined to be an intermittent failure of the 1E22-K650 inverter circuitry (i.e., equipment failure). A capacitor [CAP] on the inverter control board was found to be in a degraded condition (i.e., open) which could have degraded the inverter's 120 VAC output. This condition apparently caused the inverter to de-energize then re-energize (i.e., cycle) resulting in a Division 3 125 VDC bus transient and subsequent "blowing" of 1E22A-F9 fuse. Fuse 1E22A-F9 provides 125 VDC power to the 1E22-K650 inverter input. The 1E22-K650 inverter output provides 120 VAC power to the 24 VDC power supply (1E22-K651). Power supply 1E22-K651 provides 24 VDC power to the HPCS system instrumentation and analog trip units. Due to the sequence in which the instrumentation and analog trip units sensed the power loss caused by 1E22-K650 inverter cycling and/or 1E22A-F9 fuse operation, a HPCS reactor low level initiation signal was generated and sealed in.

"As found" bench testing of the "failed" inverter under load for approximately 36 hours indicated no degradation or faults. The degraded capacitor on the inverter control board was identified as part of component checks during the troubleshooting/refurbishment of the inverter. Simulations of the removal of fuse 1E22B-F1 were made both on the bench and with the repaired 1E22-K650 inverter partially installed in the circuitry, however, the inverter cycling and 1E22A-F9 fuse operation could not be repeated.

IV. Safety Analysis

The HPCS system consists of a single motor-driven centrifugal pump located outside the containment, a spray sparger in the reactor vessel located above the core, and associated system piping, valves, controls, and instrumentation. The system is designed to operate from normal offsite auxiliary power or from a standby diesel generator supply if offsite power is not available. The HPCS system supplies water through the spray sparger into the reactor vessel. Coolant can be supplied over the entire range of system operation pressures. The primary purpose of the HPCS system is to maintain reactor vessel inventory after small line breaks which do not quickly or significantly depressurize the reactor vessel. The HPCS system also provides spray cooling heat transfer during breaks in which core uncovery is calculated. ESW Loop "C" provides service water to the HPCS Diesel Generator and to the HPCS Room Cooler.

If a Loss of Coolant Accident (LOCA) should occur, a low reactor vessel water level signal or high drywell pressure signal initiates the HPCS system and its support equipment. During the February 18, 1996 event, the inverter failure resulted in the generation of false low reactor vessel water level signals which initiated the portions of HPCS equipment/system and support equipment that were not removed from service. The HPCS equipment/system and support equipment not removed from service responded as designed to the LOCA signal. The HPCS system had been declared inoperable prior to this event and was not required as an

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Emergency Core Cooling System under TS 3.5.2 due to plant configuration. The partial initiation of the HPCS system and the initiation of ESW Loop "C" did not adversely affect the operation of any required systems; therefore, this event is considered to have minimal safety significance.

V. Similar Events

Previous unplanned HPCS initiations were documented by LER 86-041 and LER 93-012. In both of these events, battery charger output voltage fluctuations resulted in trips of the inverter which caused the initiation signals to be generated. As a result of LER 93-012, consideration was given to a design change of the 1E22-K650 inverter due to its low tolerance for overvoltage conditions; however, a decision was made not to implement the design change. Other corrective actions centered around battery charger maintenance and operation. None of the corrective actions for these two LERs would be reasonably expected to have prevented the February 18, 1996, event from occurring.

Inverter failures in the Reactor Core Isolation Cooling (RCIC) system resulting in Reactor Scrams were documented in LER 95-005 and LER 95-008. LER 95-005 detailed an event on August 31, 1995, in which a failed resistor in a 125 VDC to 120 VAC Topaz inverter resulted in the loss of 24 VDC instrument power to reactor pressure vessel instrumentation and a RCIC system initiation. The RCIC system initiation in turn caused a main turbine trip and subsequent reactor scram. LER 95-008 detailed an event on September 11, 1995, in which a failed output (i.e., filter) capacitor in the same inverter produced results similar to the August 31, 1995, event. Programmatic corrective actions associated with these two events include the engineering evaluation of plant modifications which would preclude an immediate reactor scram upon loss of an inverter, and optimization of refurbishment schedules with respect to Topaz inverters, associated power supplies, and battery charger parts. Part of the scheduled maintenance for which the HPCS system was being removed from service on February 18, 1996, included the refurbishment of inverter 1E22-K650; however, earlier completion of the scheduled refurbishment most likely would not have prevented this event from occurring.

VI. Corrective Actions

Inverter 1E22-K650 was refurbished with replacement electrolytic capacitors, including the degraded capacitor on the control board, was bench tested, and was returned to service. Although the inverter was scheduled to be refurbished, the control board capacitor was not among the components listed for inspection/replacement. Repetitive tasks for associated Topaz inverters are being reviewed and revised to ensure inclusion of the inspection/replacement of appropriate components including electrolytic capacitors on control boards. Topaz inverters previously refurbished without consideration for inspection/replacement of such components will be reworked as appropriate. Engineering personnel are evaluating replacement designs for safety related Topaz inverters whose failures can result in safety system initiations. This action (i.e., design change) will

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be implemented, if determined to be appropriate, through the modification/design change process. Additionally, as part of the established requalification training program, plant licensed operators will be instructed on the lessons learned from this event by May 31, 1996.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

The following table identifies those actions committed to by the Perry Nuclear Power Plant in this document. Any other actions discussed in the submittal represent intended or planned actions by the Perry Nuclear Power Plant. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Manager-Regulatory Affairs at the Perry Nuclear Power Plant of any questions regarding this document or any associated regulatory commitments.

Commitment	Committed date or outage
Repetitive tasks for associated Topaz inverters are being reviewed and revised to ensure inclusion of the inspection/replacement of appropriate components including electrolytic capacitors on control boards.	April 30, 1996
Topaz inverters previously refurbished without consideration for inspection/replacement of components developed from the activity above will be reworked as appropriate.	RF06
Engineering personnel are evaluating replacement designs for safety related Topaz inverters whose failures can result in safety system initiations. This action (i.e., design change) will be implemented, if determined to be appropriate, through the modification/design change process.	June 30, 1996