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United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Perry Nuclear Power Plant
Docket No. 50-440

Ladies and Gentlemen:

Enclosed is Licensee Event Report 2001-002, "Oscillation Power Range Monitors Inoperable Due to Non-Conservative Setpoints."

No regulatory commitments were identified in this report. If you have questions or require additional information, please contact Mr. Gregory A. Dunn, Manager - Regulatory Affairs, at (440) 280-5305.

Very truly yours,

for John K. Wood
Enclosure

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III

IE22

NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 6-30-2001

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

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TITLE (4)
Oscillation Power Range Monitors Inoperable Due to Non-Conservative Setpoints

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
6	27	2001	2001	02	00	8	21	2001	FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)							
POWER LEVEL (10)			20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
			20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
			20.2203(a)(1)		50.36(c)(1)(i)(A)		50.73(a)(2)(iv)(A)		73.71(a)(4)
			20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)	✓	50.73(a)(2)(v)(A)		73.71(a)(5)
			20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)		OTHER Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		
			20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)		
			20.2203(a)(2)(v)		50.73(a)(2)(i)(B)	✓	50.73(a)(2)(vii)		
			20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
			20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Bruce A. Luthanen - Compliance Engineer	440-280-5389

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	JC	OPRM	GE	Y					

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	✓ NO				

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

The Perry Nuclear Power Plant staff was notified by General Electric (GE) via a Boiling Water Reactor Owners Group (BWROG) conference call on June 27, 2001, at approximately 1130 that the Oscillation Power Range Monitor (OPRM) instrumentation SCRAM setpoints are non-conservative due to non-conservative analysis. The OPRM instrumentation is an input to the Reactor Protection System. The OPRM instrumentation provides a safe shutdown safety function when operating during an unstable power to flow condition. The OPRM equipment was therefore considered inoperable since first placed into service following the scheduled refueling outage in March 2001.

The plant is currently operating within its Technical Specifications 3.3.1.3 Required Action using an off-normal instruction as an alternate method to monitor and suppress thermal hydraulic instability oscillations. GE has issued a 10 CFR Part 21 Interim Report and Transfer of Information to formally notify licensees with an evaluation pending. GE will also provide a 10 CFR 21 Report to be submitted to the NRC, as well as re-analysis to provide new setpoints through BWROG involvement.

This event was reported to the NRC (ENF # 38099) in accordance with 10 CFR 50.72(b)(3)(v)(A), as a condition that at the time of discovery could have prevented the fulfillment of the safety function of a system needed to shut down the reactor and maintain it in a safe shutdown condition. This report is submitted in accordance with 10 CFR 50.73 (a)(2)(v)(A) as a loss of safety function, since the trip function was effectively inoperable. It is also being reported as an event in which a single cause or condition caused two independent trains or channels to become inoperable in a single system designed to shut down the reactor and maintain it in a safe shutdown condition (10 CFR50.73 (a)(2)(vii)).

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

I. Introduction

The potential for thermal-hydraulic instability in Boiling Water Reactors (BWRs) was a phenomenon identified by General Electric (GE) in 1984 with the issuance of Service Information Letter (SIL) 380, " BWR Core Thermal Hydraulic Instability." Reactor conditions at high rod-line and low flow (BWR start-ups, shutdowns or recirculation pump trips) could produce reactor power oscillations that could potentially violate fuel Safety Limits (e.g. Minimum Critical Power Ratio (MCPR)). Industry events at LaSalle-2 in 1988 and WNP-2 in 1992 confirmed that additional monitoring for this condition was required. Training and Interim Compensatory Actions (ICAs) for operators were recommended to monitor reactor power-to-flow conditions. Control Room operators were trained to take appropriate actions if any of the instability regions were entered to avoid challenging Safety Limits. Until instrumentation could be developed to fulfill this function, extremely conservative operating limits and monitoring of power-to-flow maps was a routine evolution for operators, and was the accepted method for monitoring core power oscillations.

The installation of Oscillating Power Range Monitor (OPRM) [JC] instrumentation was intended to reduce operational burdens on the control room personnel by requiring less immediate operator responses to plant transients, and to provide flexibility during start-ups and shutdowns. Administrative controls had been used successfully for many years. OPRMs could provide instrumentation for monitoring power-to-flow instabilities, and allow greater flexibility in plant start-ups rather than simply following a power-to-flow graph. The actual instrumentation would not be developed until the mid-1990's, so ICAs were the only oversight.

The OPRM satisfies General Design Criteria 10 and 12 by ensuring that power oscillations that could result in challenges to fuel design limits are readily detected and suppressed. The system uses inputs from Local Power Range Monitors (LPRMs) to generate alarms and trips through the Reactor Protection System (RPS) when appropriate trip logics are satisfied. The arrangement of the LPRMs gives sufficient axial and radial coverage within the reactor vessel (detailed in the Updated Final Safety Analysis Report section 7.6.1.4) to ensure that core power distribution is monitored adequately. Of several OPRM formats available, Perry Nuclear Power Plant (PNPP) selected the detect-and-suppress option for the OPRM to enable a reactor trip function if a region of unstable power-to-flow is entered. The OPRM uses three separate algorithms for detecting stability-related oscillations. The fuel power curves used to develop the setpoints for the OPRM were based on the nominal fuel design from the early 1990's, before extended fuel cycles were common (which was later determined to be a contributing cause for the 10 CFR 21 issue here.)

The OPRM installed at PNPP was provided by Asea-Brown-Boveri-Combustion Engineering (ABB-CE; hardware) and GE (software.) It was installed in several phases, with the initial installation beginning during Operating Cycle 7 (1998) under Design Change Package 89-0205, and completing during Refueling Outage 7 in 1999.

GE recommended that operational experience of at least 6 months be accumulated prior to arming the system (i.e. tying it to the reactor protection system trip function.) PNPP staff committed to run the entirety of Operating Cycle 8 with the OPRM unarmed but operational, in order to tune the modules and gather operating experience from it. However, on June 29,1999, ABB-CE submitted correspondence to the NRC under 10 CFR 21 identifying potential problems with the OPRM system. This addressed the OPRM slave module randomly resetting, which potentially could cause the OPRM trip channel to be out of service for a short period, under a minute. This was not resolved until ten months later, in early 2000.

The final portion of the installation was the connection of the OPRM to the RPS, which was completed during Refueling Outage 8 in March 2001. Amendment 118 to the PNPP Technical Specifications implemented the required changes to incorporate the OPRM system.

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

OPRM instrumentation is required to be OPERABLE to detect neutron flux oscillations in the event of thermal-hydraulic instability at greater than or equal to 23.8 percent rated thermal power. At lower rated thermal power, instabilities would not be expected to grow large enough to challenge the MCPR Safety Limit.

This event is being reported in accordance with 10 CFR 50.73 (a)(2)(v)(A) as a loss of safety function, since the RPS trip was determined to be INOPERABLE. It is also reported under 10CFR 50.73(a)(2)(vii) as an event in which a single cause or condition caused two independent trains or channels to become INOPERABLE in a single system designed to shut down the reactor and maintain it in a safe shutdown condition.

At the time of the notification, PNPP was in Mode 1 at approximately 100 percent rated thermal power. The reactor vessel was at approximately 1024 pounds per square inch gauge, with the reactor coolant at saturated conditions. There were no other inoperable systems, structures or components that contributed to this condition.

II. Event Description

Late in March 2001, PNPP was re-starting after a routine refueling outage. The threshold for required OPRM operability (23.8 percent rated thermal power) was reached on March 25, 2001, at 0645 hours for the first time since activation of the RPS portion of the instrumentation. The plant has experienced four different forced outages of minor length due to plant equipment issues not related to the OPRM's since that time. The last time that the 23.8 percent rated thermal power threshold was crossed in the process of power ascension was on July 31, 2001 at 0608 hours. A 100 percent rated thermal power condition was achieved on August 3, 2001 at 1457 hours. With the exception of the forced outages, routine testing and rod sequence exchanges, PNPP has remained at 100 percent power since that date, a total of 84 days at full power since re-starting from the outage (as of August 21).

On June 27, 2001, PNPP staff received telephone notification from GE stating that potential non-conservatism in the OPRM setpoints had been discovered. GE stated that they were submitting notification in accordance with 10 CFR Part 21.21(d), which requires NRC notification when information is obtained which reasonably indicates a defect affecting a basic component supplied for a licensed facility. In GE correspondence (SC01-01, issued June 29, 2001), GE states that PNPP uses Option III of generic DIVOM (Delta Core Power Ratio (CPR)) / Initial CPR Vs. Oscillation Magnitude) graphs for determining the Option III RPS trip system setpoints. The document further states that, " If the regional DIVOM curve used in licensing basis stability studies is found to be not applicable, it is assumed that the Option III trip system setpoint is non-conservative." The PNPP Technical Specification 3.3.1.3 Action B.1 requires that with OPRM trip capability not maintained, alternate methods to detect and suppress thermal hydraulic instability oscillations must be initiated within 12 hours of discovery. Based on this, all OPRM channels were declared INOPERABLE and alternate methods for monitoring were implemented.

III. Cause of Event

The event was caused by calculational assumptions used in OPRM setpoints. GE discovered these through review of their documentation, and notified all parties through the Boiling Water Reactors Owner Group (BWROG) prior to submitting interim licensee notification in accordance with 10 CFR Part 21(d).

The root cause analysis published by GE (OG01-0240-001, dated July 27, 2001) stated that inadequate modeling was the major causal factor. The transient analysis code used for the modeling analysis is named "TRACG"; it generates correlation for CPR as a function of peak [fuel] bundle oscillation magnitude (NEDO-31960-A.) The TRACG code "produced non-symmetrical oscillations [that] were discounted as not representative of anticipated reactor instability." This produced the non-conservatisms in the setpoints.

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

IV. Safety Analysis

Operations personnel are trained to monitor a number of reactor parameters that could indicate potential power oscillations: variability in flow, generator output, reactor period, etc. Prior to the implementation of the OPRM's, conservative operating limits and operator oversight were the means of identifying the phenomena of power oscillations. Based on over 10 years of successful operating experience since the LaSalle-2 event, the approved Technical Specification change for OPRM implementation provided for an indefinite completion time for inoperable OPRMs. Restoration of OPRM OPERABILITY was credited to 10 CFR 50 Appendix B criteria for timeliness of corrective actions. Since power-to-flow monitoring was retained as a Technical Specification Action, re-instatement of monitoring did not require any additional training for Operations personnel, and monitoring capability was never lost.

Administrative controls for the loss of required OPRM channels were already proceduralized for Operations personnel when the OPRM's were declared INOPERABLE. Approved plant procedures were implemented, ensuring that there was no subsequent loss of monitoring for power oscillations. Although the existing OPRM setpoints are not conservative, the instruments still provide useful information to the plant operators for defense-in-depth.

Based on this information, this event would have no safety significance.

V. Corrective Actions

All OPRM channels were declared INOPERABLE and administrative procedural controls were implemented to monitor potential oscillations in reactor power.

GE addressed long-term corrective actions in their correspondence referenced previously. When revised setpoints have been calculated and implemented, then the Option III trip system OPERABILITY can be restored. Questions concerning the OPRM methodology are still unresolved at this time. These are being resolved through a BWROG sub-committee coordinating with GE.

PNPP staff anticipates receipt of the new OPRM setpoints by late 2002. Emergent issues or expansion of the scope of the BWROG sub-committee work could potentially delay receipt of these figures.

VI. Previous Similar Events

The ABB-CE submittal under 10 CFR 21 in 1999 discussed previously was a similar event related to the OPRM system. There have been no other similar events at Perry related to the OPRM system. A review of Licensee Event Reports from the past five years at PNPP did not discover any similar events at the site.

No regulatory commitments were identified in this report.

Energy Industry Identification System (EIIS) Codes are identified in the text by square brackets [XX].