General Information or Other (PAR) Event # 40223

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Region: 4		**Docket #:**	
City: San Jose		**Agreement State:** Yes	
County:		**License #:** Various	
State: CA			
NRC Notified by: JASON POST		**Notifications:** EUGENE COBEY	R1
HQ Ops Officer: JEFF ROTTON		MARK LESSER	R2
Emergency Class: NON EMERGENCY		JULIO LARA	R3
10 CFR Section:		CHUCK CAIN	R4
21.21 UNSPECIFIED PARAGRAPH		MICHAEL TSCHILTZ	NRR

DEFECTS AND NONCOMPLIANCE REPORT

GE Nuclear Energy provided information concerning a reportable condition on the stability Option III Period Based Detection Algorithm (PBDA) for the Oscillation Power Range Monitor (OPRM) installed at the affected Licensee plants listed below. The basic component with the defect is specification of the allowable values for the adjustable period confirmation variables in the PBDA used in Stability Option III. The defect is that certain values of period tolerance and conditioning filter cutoff frequency within the previously specified acceptable range could produce sufficient successive confirmation count resets such that Safety Limit Minimum Critical Power Ratio (SLMCPR) protection might not be provided for all anticipated reactor instabilities.

This condition does not produce a substantial safety hazard and there is no threat of fuel failure. However, because the condition could contribute to exceeding the SLMCPR, it is a reportable condition.

List of Affected Plants:

Clinton
Brunswick 1 & 2
Nine Mile Point 2
Fermi 2
Columbia
Dresden 2 & 3
LaSalle 1 & 2
Limerick 1 & 2
Peach Bottom 2 & 3
Quad Cities 1 & 2
Perry 1
Susquehanna 1 & 2
Hope Creek

IE19

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Hatch 1 & 2
Browns Ferry 2 & 3

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EN 40223

GE Nuclear Energy

General Electric Company
175 Curtner Ave., San Jose, CA 95125

October 4, 2003
MFN 03-107

Document Control Desk
United States Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2738

Subject: Part 21 Notification: Stability Option III Period Based Detection Algorithm Allowable Settings

This letter provides information concerning a reportable condition on the stability Option III Period Based Detection Algorithm (PBDA). The technical bases for the PBDA was defined by GE Nuclear Energy (GENE) and supplied to licensees as safety related documentation in licensing topical reports. Specifically, NEDO-32465-A, Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications, August 1996, defines the PBDA period confirmation adjustable variables for the Oscillation Power Range Monitor (OPRM) to be the period tolerance and the conditioning filter cutoff frequency. The period tolerance could be adjusted in the range of 100 to 300 msec, and the conditioning filter cutoff frequency could be adjusted in the range of 1.0 to 2.5 Hz. Subsequent plant-specific submittals may have extended the period tolerance range on the low end to 50 msec and the cutoff frequency on the high end to 3.0 Hz.

On July 24, 2003, a slow growing core wide instability event occurred at NMP-2. The OPRM is installed at NMP-2 with 4 OPRM channels, each with 30 OPRM cells. A plant-specific Critical Power Ratio (CPR) performance curve has been determined for NMP-2 and the OPRM was armed when the event occurred. For the current cycle, the PBDA confirmation count (CC) setpoint is 14 counts, and the normalized amplitude trip setpoint is 1.12. A scram occurs when at least one cell in two or more OPRM channels simultaneously exceeds both the CC and amplitude trip setpoints.

In the NMP-2 event, the OPRM detected the instability and initiated a reactor scram that provided Safety Limit Minimum Critical Power Ratio (SLMCPR) protection. However, post-event analyses indicate that the OPRM did not perform as expected. Out of 120 cells, only one performed correctly in that it reached the CC trip setpoint first, then the amplitude trip setpoint. At the time of the scram, there were >20 cells with amplitude at

or 1 to 2% above the amplitude setpoint, and only 5 cells with CC at or above the CC setpoint. This was attributed to a large number of unexpected CC resets throughout the event.

At NMP-2, the adjustable period confirmation variables were set at 50 msec for the period tolerance and 3.0 Hz for the cutoff frequency. The evaluation by GENE concluded that the 3.0 Hz value does not adequately filter out high frequency noise and produces a signal with false peaks and valleys that causes frequent CC resets. In addition, the 50 msec value produces frequent CC resets due to small variations in the oscillation period. Analysis by GENE has determined that expected CC performance is achieved with a cutoff frequency of 1.0 Hz and a period tolerance of 100 msec or larger. With these settings, the majority of the OPRM cells would have had CC at or above the CC setpoint when the amplitude trip setpoint was reached.

Even with the 50 msec and 3.0 Hz settings, the OPRM provided SLMCPR protection for the NMP-2 event. Due to the robust OPRM design, it is possible that the settings currently in use and allowed by licensing documentation could provide SLMCPR protection for other instability events. Additional justification may show that other values for the PBDA adjustable period confirmation variables provide acceptable performance. However, GENE cannot currently confirm that performance of the OPRM with settings other than period tolerance of 100 msec or higher and cutoff frequency of 1.0 Hz will not contribute to exceeding the SLMCPR for all anticipated instability events.

The recommended changes to the PBDA period confirmation adjustable variables does not produce a significant increase in the probability of a spurious scram since both counts above the CC setpoint and amplitude above the amplitude trip setpoint are required for an OPRM cell to trip, and cells in multiple OPRM channels must trip before a scram is initiated (in accordance with the reactor protection system logic). It is highly unlikely that the CC and amplitude trip setpoints would be reached simultaneously in multiple OPRM cells in multiple OPRM channels except during an actual instability event.

The recommended changes to the PBDA period confirmation adjustable variables are expected to increase the occurrence of OPRM alarms based on high CC. The OPRM alarm is not a licensing basis function of the OPRM. An alarm based on high CC in a single OPRM cell may result in ambiguous indication since it could be attributed either to an actual reduction in stability margin or could have been generated as a result of the random nature of the OPRM signal. Due to the large number of opportunities associated with continuous monitoring of ~120 OPRM cell signals, operating experience is that occasional alarms are not associated with an actual reduction in stability margin. Therefore, it may be appropriate to increase the alarm CC setpoint, or disable the alarm if it continues to provide ambiguous indication.

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This condition does not produce a substantial safety hazard and there is no threat of fuel failure. However, because the condition could contribute to exceeding the SLMCPR, it is a reportable condition.

If you have any questions, please call me at (408) 925-5362.

Sincerely,

Jason Post

Jason. S. Post, Manager
Engineering Quality and Safety Evaluations

cc: S. D. Alexander (NRC-NRR/DISP/PSIB) Mail Stop 6 F2
J. F. Foster (NRC-NRR/DRIP/RORP) Mail Stop 12 H2
A. B. Wang (NRC-NRR/DLPM/LPD4) Mail Stop 7 E1
J. F. Klapproth (GENE)
H. J. Neems (GENE)
G. B. Stramback (GENE)
I. Nir (GENE)
PRC File

Attachments

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Attachment 1 – Potentially Affected Plants

	Utility	Plant
X	AmerGen Energy Co.	Clinton
	AmerGen Energy Co.	Oyster Creek
X	Carolina Power & Light Co.	Brunswick 1
X	Carolina Power & Light Co.	Brunswick 2
	Constellation Nuclear	Nine Mile Point 1
X	Constellation Nuclear	Nine Mile Point 2
X	Detroit Edison Co.	Fermi 2
	Dominion Generation	Millstone 1
X	Energy Northwest	Columbia
	Entergy Nuclear Northeast	FitzPatrick
	Entergy Nuclear Northeast	Pilgrim
	Entergy Operations, Inc.	Grand Gulf
	Entergy Operations, Inc.	River Bend
	Entergy Nuclear Northeast	Vermont Yankee
	Exelon Generation Co.	CRIT Facility
X	Exelon Generation Co.	Dresden 2
X	Exelon Generation Co.	Dresden 3
X	Exelon Generation Co.	LaSalle 1
X	Exelon Generation Co.	LaSalle 2
X	Exelon Generation Co.	Limerick 1
X	Exelon Generation Co.	Limerick 2
X	Exelon Generation Co.	Peach Bottom 2
X	Exelon Generation Co.	Peach Bottom 3
X	Exelon Generation Co.	Quad Cities 1
X	Exelon Generation Co.	Quad Cities 2
X	FirstEnergy Nuclear Operating Co.	Perry 1
	Nebraska Public Power District	Cooper
	Nuclear Management Co.	Duane Arnold
	Nuclear Management Co.	Monticello
	Pooled Equipment Inventory Co.	PIM
X	PPL Susquehanna LLC.	Susquehanna 1
X	PPL Susquehanna LLC	Susquehanna 2
X	Public Service Electric & Gas Co.	Hope Creek
X	Southern Nuclear Operating Co.	Hatch 1
X	Southern Nuclear Operating Co.	Hatch 2
	Tennessee Valley Authority	Browns Ferry 1
X	Tennessee Valley Authority	Browns Ferry 2
X	Tennessee Valley Authority	Browns Ferry 3

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Attachment 2 – Information per §21.21(d)(4)

(i) Name and address of the individual informing the Commission:

Jason S. Post, Manager, Engineering Quality & Safety Evaluation, GE Nuclear Energy, 175 Curtner Avenue, San Jose, CA 95125

(ii) Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect:

All stability solution Option III plants are potentially affected. These plants are listed in Attachment 1. The basic component with the defect is specification of the allowable values for the adjustable period confirmation variables in the Period Based Detection Algorithm (PBDA) used in Stability Option III.

(iii) Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect:

GE Nuclear Energy, San Jose, California

(iv) Nature of the defect or failure to comply and safety hazard which is created or could be created by such defect or failure to comply:

This condition does not produce a substantial safety hazard. The defect is that certain values of period tolerance and conditioning filter cutoff frequency within the previously specified acceptable range could produce sufficient successive confirmation count resets such that SLMCPR protection might not be provided for all anticipated reactor instabilities. Even with the defect, the system provided SLMCPR protection for the event at NMP-2. Due to the robust OPRM design, it is possible that the settings currently in use and allowed by licensing documentation could provide SLMCPR protection for other instability events. However, at this time GENE cannot confirm that performance of the OPRM with all conditioning filter and period tolerance settings currently in use and allowed by licensing documentation will not lead to a condition where the SLMCPR could be violated for some anticipated instability events. The recommended changes to the PBDA period confirmation adjustable variables do not produce a significant increase in the probability of a spurious scram.

(v) The date on which the information of such defect or failure to comply was obtained:

August 5, 2003

(vi) In the case of a basic component which contains a defect or failure to comply, the number and locations of all such components in use at, supplied for, or being supplied for one or more facilities or activities subject to the regulations in this part:

The potentially affected plants are listed in Attachment 1.

(vii) The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action (note, these are actions specifically associated with the identified Reportable Condition):

- All potentially affected licensees have been notified by a Part 21 Reportable Condition Notification per §21.21(d).
- GE will modify the user's manual for plants which use the GE supplied Power Range Neutron Monitor to set the cutoff frequency to 1 Hz and the period tolerance to 100 msec or greater, with allowance to use a different value if applicable, based on additional justification.

(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees:

1. The instability event at NMP-2 and additional analysis has shown that selection of 1 Hz for the conditioning filter cutoff frequency is effective in filtering the high frequency noise components, which is essential for reducing excessive resets of successive period confirmation counts (CC) during unstable operations. Analysis by GENE does not support use of a conditioning filter cutoff frequency higher than 1 Hz. Absent additional justification of another value, the cutoff frequency should be set to 1 Hz.
2. The instability event at NMP-2 and additional analysis has shown that a period tolerance of less than 100 msec does not provide for an effective trip function by accommodating small oscillation period variations, which is essential for reducing excessive CC resets during unstable operations. Analysis by GENE does not support use of a period tolerance lower than 100 msec. Absent additional justification of another value, the period tolerance should be set to 100 msec or greater.
3. Additional information is being provided to licensee relative to the alarm function of the OPRM and the procedure for tuning the period tolerance and corner frequency values.
   - An alarm based on high CC in a single OPRM cell may result in ambiguous indication since it could be attributed either to an actual reduction in stability margin or it could have been generated as a result of the random nature of the OPRM signal. Therefore, it may be appropriate to increase the alarm CC setpoint or disable the alarm if it continues to provide ambiguous indication.
   - The PBDA period confirmation adjustable variables should not be changed (i.e., "tuned") in such a way as to limit the number of alarms, without adequate consideration of the impact of the change on ability of the PBDA to detect an actual instability event. If only a single value of each adjustable variable is allowed based on available justification, then a tuning procedure for the PBDA period confirmation adjustable variables is not applicable.