GE Nuclear Energy

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

November 22, 2002
02-10NRC.DOC
MFN 02-091

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

Subject: **Reportable Condition Stability Option III: Period Based Algorithm T_{min} Specification**

Reference: NEDO-31960-A, BWR Owners' Group Long-Term Stability Solutions Licensing Methodology (Supplement 1), November 1995

This letter provides notification of a reportable condition with the reference GE Nuclear Energy (GE) Licensing Topical Report (LTR) in accordance with §21.21(d). GE has identified that the stability Option III Period Based Detection Algorithm (PBDA) T_{min} specification is a defect as described below. GE recommends that T_{min} be set to no higher than 1.2 seconds to ensure that oscillations are detected and suppressed as intended for stability solution Option III. GE cannot determine how each licensee with stability Option III has implemented T_{min}. Therefore, this information is provided as a Transfer of Information in accordance with §21.21(b) for each potentially affected licensee to evaluate if this concern applies to their plant.

Background, Stability Option III

Stability solution Option III is implemented in the Oscillation Power Range Monitor (OPRM). Each OPRM channel contains 18 to 33 OPRM cells (depending upon plant size). Each OPRM cell signal is summed from three to four closely spaced Local Power Range Monitor (LPRM) signals. Each OPRM cell signal is processed through the Option III detection algorithms to determine when a trip is required. Trip of one OPRM cell causes its OPRM channel to trip, and when sufficient OPRM channels trip (one-out-of-two taken twice, or two-out-of-four), a reactor scram is initiated to terminate the oscillation.

An OPRM trip is enabled for plant operation within the OPRM Armed Region as defined on the power/flow map. The Armed Region extends from natural circulation to 60% of rated core flow. The licensing basis for the OPRM is to detect all expected oscillations

IE19

within the OPRM Armed Region, and initiate a reactor trip to suppress the oscillation and provide Minimum Critical Power Limit (MCPR) safety limit protection.

GE LTR NEDO-31960-A, Supplement 1, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology (Supplement 1)," November 1995, describes the Option III detection algorithms. The Period Based Detection Algorithm (PBDA) provides licensing basis MCPR safety limit protection. Other algorithms provide defense-in-depth protection. The PBDA includes two parameters called T_{min} and T_{max}. The PBDA will not evaluate oscillations if the period is less than T_{min} or greater than T_{max} because these would not be indicative of an expected coupled neutronic/thermal-hydraulic instability. The LTR specifies that "typical" T_{min} values are in the range of 1.0 to 1.4 seconds and "typical" T_{max} values are in the range of 3.0 to 3.5 seconds.

The expected period of a coupled neutronic/thermal-hydraulic instability depends upon the fluid transit time through the core, and therefore depends upon core flow rate. This has been demonstrated in reactor operation and is predicted by GE computer models. At high core flow, the expected oscillation period is shorter. At low core flow rate, the expected oscillation period is longer. The intent of the OPRM is that T_{min} and T_{max} provide a wide range with adequate margin to the expected oscillation period for operation within the OPRM Armed Region so that all expected coupled neutronic/thermal-hydraulic instabilities will be detected by the PBDA.

Basis for Reportable Condition

GE has performed calculations of oscillation period for different power/flow conditions with the GE frequency domain code ODYSY. Representative results from these calculations are shown in Figure 1 (attached). Calculations with other models and plant experience support these results.

The lowest value specified in the "typical" range for T_{max} is 3.0 seconds. The results in Figure 1 show that all periods are less than 3.0 seconds and that there is a significant margin between the nominal calculated periods to the 3.0 seconds value. Therefore, even if a plant uses the lowest "typical" value for T_{max}, it is expected to be greater than the actual period. Therefore, the "typical" range specified in T_{max} causes no safety concern.

The highest value in the specified allowable range for T_{min} is 1.4 seconds. The results in Figure 1 show that at high core flow, the expected oscillation period is below 1.4 seconds. The margin to T_{min} of 1.4 second is not adequate since the use of this "typical" T_{min} value could lead to failure of the PBDA to detect an expected oscillation. Failure of automatic detection at this condition is not expected to result in fuel failures, but may lead to violation of the Technical Specification MCPR safety limit. This is considered to be a Reportable Condition on NEDO-31960-A, Supplement 1. GE analysis shows that for current licensed operation conditions, a generic T_{min} value of 1.2 seconds provides adequate margin to expected oscillation periods.

GE does not have responsibility for the T_{min} value used by each plant that has selected Option III. Furthermore, GE does not know if any licensee has developed a plant-specific

basis to support the T_{min} value used. Consequently, all Option III plants are potentially affected and this is a Transfer of Information to all Option III plants under 10CFR21.

Corrective Action

1) Absent plant-specific justification of a higher value, the OPRM is not considered to be operable with a T_{min} value greater than 1.2 seconds; T_{min} should be set to 1.2 seconds or lower. With T_{min} set to 1.2 seconds or lower, the OPRM is considered to be operable. However, GE recommends that plants consider using a value of 1.0 second to provide additional margin to the expected period range.
2) The OPRM is considered operable for values of T_{max} set to 3.0 seconds or higher. However, absent plant-specific justification, GE recommends using a T_{max} value of 3.5 seconds or higher to provide additional margin to the expected period range.
3) A tighter T_{min}/T_{max} range may be justified based on plant-specific analysis and/or experience.

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

Sincerely,

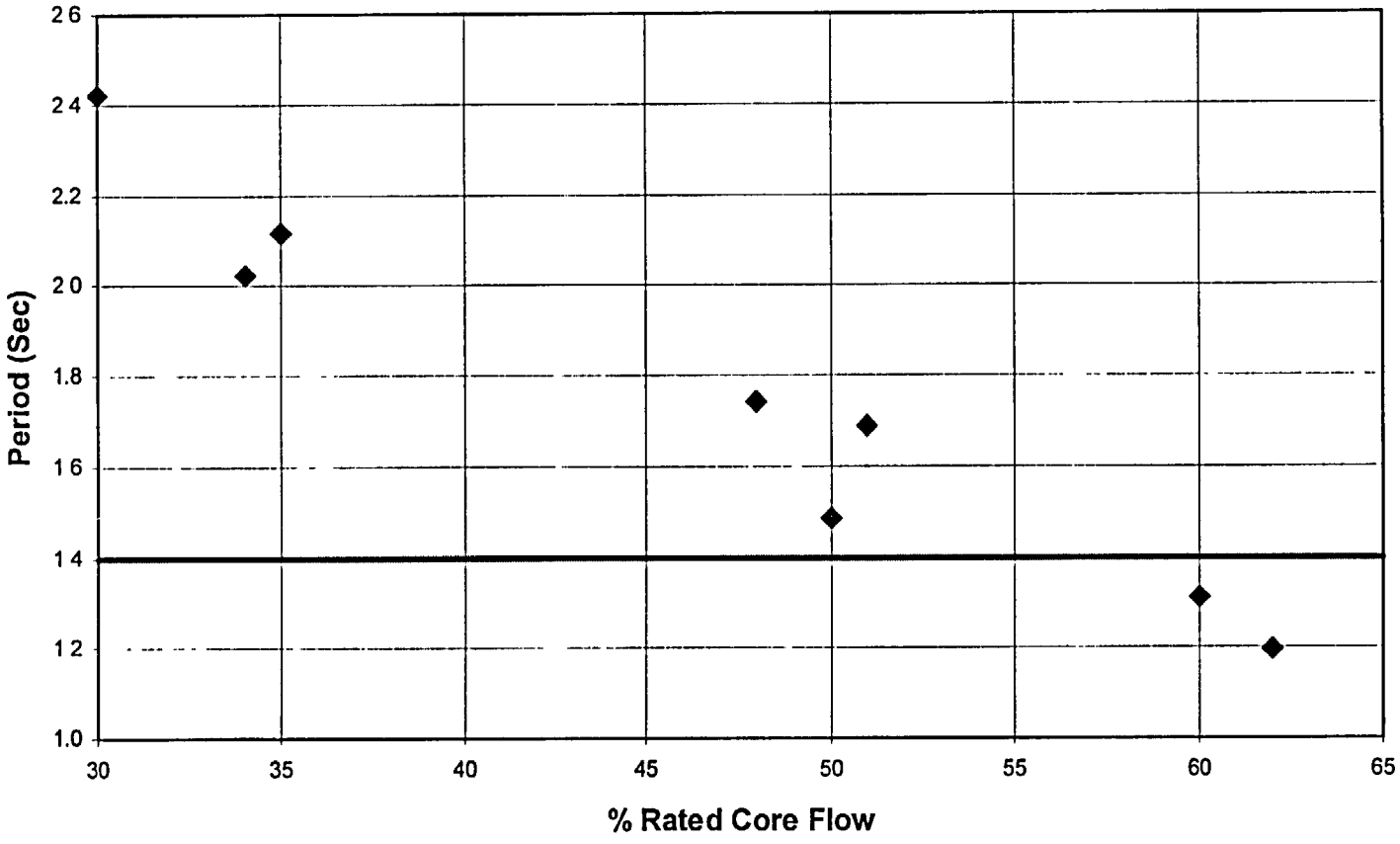
Jason Post

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

cc: S. D. Alexander (NRC-NRR/DISP/PSIB) Mail Stop 6 F2
J. W. Foster (NRC-NRR/DISP/PSIB) Mail Stop 12 H2
J. F. Klapproth (GE-NE)
H. J. Neems (GE-NE)
PRC File

Attachments:
1. Figure 1. Expected Oscillation Period vs. Core Flow
2. Information per §21.21(d)(4)
3. Potentially Affected Plants

Attachment 1 - Figure 1. Expected Oscillation Period vs. Core Flow



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 3.

(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:

The specification of the T_{min} parameter in licensing topical report NEDO-31960-A, BWR Owners' Group Long-Term Stability Solutions Licensing Methodology (Supplement 1), November 1995 is defective. This report provides a "typical" range of values for T_{min} as 1.0 to 1.4 seconds. However, plants may have been using this as a generically approved range. GE has determined that expected oscillation period may be less than 1.4 seconds for a portion of the power/flow operating domain where the Option III system is to be armed. If a plant used a T_{min} value of 1.4 seconds and the actual oscillation period was less than 1.4 seconds, the oscillation would not be detected. Thus, automatic protection for the Minimum Critical Power Ratio (MCPR) Technical Specification safety limit would not be provided by the Option III system as intended. Fuel failures are not expected as many minutes are available for the operator to take action to mitigate this event.

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

September 23, 2002

(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 2.

(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 Transfer of Information per §21.21(b) on this date.
- Each potentially affected licensee must initiate action to determine if they are affected by this concern within their Part 21 program.
    - If a licensee is using $T_{min} = 1.4$ seconds and does not have a plant-specific justification for use of this value, the OPRM should be declared inoperable until the value is changed to $T_{min} \leq 1.2$ seconds, or a plant-specific justification for continued use of $T_{min} = 1.4$ seconds is completed.
    - If a licensee is using $T_{min} \leq 1.2$ seconds, it is not necessary to declare the OPRM inoperable. However, it is recommended that the licensee consider reducing the value to 1.0 seconds
- GE will modify the user's manual for plants which use the GE supplied Power Range Neutron Monitor to limit the T_{min} setting, with allowance to use a higher value if applicable, based on a plant-specific 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. Absent plant-specific justification of a higher value, T_{min} should be set to 1.2 seconds or lower. GE recommends that plants consider using a value of 1.0 second to provide additional margin to the expected period range.

2. The T_{max} value specified in the reference licensing topical report is not identified as being reportable because values over the entire "typical" range of 3.0 to 3.5 seconds will not prevent detection of expected oscillations. However, GE recommends using a value of 3.5 seconds or higher to provide additional margin to the expected period range.

3. A tighter range of values for T_{min} and T_{max} may be justified based on plant-specific analysis and/or experience.

Attachment 3 – 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