GE Nuclear Energy

Engineering & Technology: Engineering Quality and Safety Evaluations
175 Curtner Avenue, M/C 772, San Jose, CA 95125-1088

Proj 710

June 29, 2001

Facsimile Transmittal to NRC Operations Center
Fax: 301-816-5151

Transmittal of GE Nuclear Energy 10 CFR Part 21 notification, MFN 025-01, "Stability Reload Licensing Calculations Using Generic DIVOM Curve," June 29, 2001.

Sincerely,

Jason Post, Manager
Engineering Quality and Safety Evaluations
(408) 925-5362
jason.post@gene.GE.com

D065 &
IE19

GE Nuclear Energy

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

June 29, 2001
01-01NRC.DOC
MFN 025-01

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

Subject: Stability Reload Licensing Calculations Using Generic DIVOM Curve

This letter provides information concerning the potential for non-conservative reload licensing calculations for plants which have implemented stability detect and suppress trip systems. The non-conservatism could result in (1) Option III stability trip system setpoints which do not provide Minimum Critical Power Ration (MCPR) Safety Limit protection, and (2) inadequate MCPR safety limit protection from the flow-biased Average Power Range Monitor (APRM) flux trip for plants which have implemented Option I-D or Option II. This notification is provided under 10 CFR Part 21.21(d) as a reportable condition for Hatch Units 1 and 2, and as an interim report per §21.21(a)(2) for the other plants listed in Attachment 1: the full impact of this deviation cannot be completed within 60 days from the date of discovery. Therefore, this notification describes the deviation that is being evaluated by GE Nuclear Energy (GE-NE) for associated safety related reload licensing calculations supplied to licensees by GE-NE and states when the evaluation will be completed.

In addition, GE-NE does not have the capability to perform the evaluation to determine if a defect exists for plants at which GE-NE is not responsible for stability reload licensing evaluations. GE-NE has transferred information pursuant to §21.21(b) to those licensees which are known to be potentially affected.

GE-NE has informed all BWR utilities of this issue through the BWROG Potential Issues Response Team (PIRT). All potentially affected utilities have been notified. Compensatory action has been taken at the plants which have been determined to be reportable. Additional information is included in this notification and has been provided to the potentially affected licensees so that they can determine if the concern impacts their stability detect and suppress reload licensing calculations.

Technical Information

Stability solutions, which require detect & suppress reload licensing calculations are stability solutions Options I-D, II, and III. The corresponding reload licensing

methodology is defined in NEDO-32465-A, "Reactor Stability Detect & Suppress Solutions Licensing Basis Methodology for Reload Applications," August 1996. The report specifies generic DIVOM curves (Delta CPR/Initial CPR Vs. Oscillation Magnitude), which are normalized curves of CPR performance vs. hot bundle oscillation magnitude. Two generic curves are specified: one for core wide mode oscillations and one for regional mode oscillations. The regional mode curve is used for Option III to determine the Option III trip system setpoint. The core wide mode curve is used for Option I-D to confirm that the flow-biased APRM flux trip provides adequate MCPR safety limit protection for a core wide mode oscillation initiating on the rated flow control line. The Option II system is not specifically addressed in NEDO-32465-A, but the regional mode curve has been used to confirm that the flow-biased APRM flux trip provides adequate MCPR safety limit protection for a regional mode oscillation initiating on the rated flow control line (GENE-A13-00360-02, "Application of Stability Long-Term Solution Option II to Nine Mile Point Nuclear Station Unit 1," November 18, 1998).

Recent evaluations by GE-NE have shown that the generic DIVOM curves specified in NEDO-32465-A, may not be conservative for current plant operating conditions for plants which have implemented one of the affected stability solutions. Specifically, a non-conservative deficiency has been identified for high peak bundle power-to-flow ratios in the generic regional mode DIVOM curve and for high core average power-to-flow ratios in the generic core wide mode DIVOM curve. The deficiency results in a non-conservative slope of the associated DIVOM curve so that the Option III trip setpoint and MCPR Safety Limit protection provided by the flow-biased APRM flux trip are over predicted.

A figure of merit is defined for each generic DIVOM curve, which may be used to determine applicability of the existing generic DIVOM curves to the potentially affected plants.

Operability Considerations

If the regional mode DIVOM curve used in licensing basis stability reload licensing analysis is found to not be applicable, it is assumed that the Option III trip system setpoint is non-conservative. It is recommended that the automatic trip system be declared inoperable and plant Technical Specification requirements be invoked. The trip system should not be disabled, as it will still provide a measure of automatic protection even if it does not meet the licensing criteria for MCPR Safety Limit protection. When an applicable regional mode DIVOM curve is defined, the revised setpoint should be calculated and implemented. The Option III trip system should then be declared operable.

If the DIVOM curve used in Option II or Option I-D stability reload licensing calculations is found to not be applicable, then it is assumed that the existing

June 29, 2001
01-01NRC.DOC
MFN 025-01

confirmation that the flow-biased APRM flux trip provides sufficient MCPR safety limit protection is not adequate. However, there is typically substantial MCPR margin in this calculation, such that using a more limiting DIVOM curve might still show that the flow-biased APRM flux trip provides adequate MCPR Safety Limit Protection. Operability issues are not addressed for Option II plants since it is expected that they will demonstrate compliance with the regional mode DIVOM curve figure of merit (i.e., that the existing DIVOM curve is applicable).

Option I-D combines both instability detect & suppress and instability prevention features. Prevention features include the exclusion region, which requires immediate exit, and the buffer zone, which includes required operation of the stability margin predictor system, SOLOMON. The prevention features are not affected by the potentially non-conservative DIVOM curve. Effective instability prevention avoids exercising the automatic trip system. Therefore, it is recommended that if the existing DIVOM curve is not applicable, the flow-biased APRM flux trip should remain operable, considering the guidance in Generic Letter 91-18, while a preliminary bounding DIVOM curve is used to determine if the existing flow-biased APRM flux trip continues to provide adequate MCPR Safety Limit protection. The preliminary bounding DIVOM curve can be specified by GE-NE if this situation occurs. If adequate margin does not exist, the MCPR Safety Limit protection evaluation could be used to develop a delta-CPR adjustment to limit full power operating conditions, or other potential corrective actions developed and implemented. Long-term resolution could include definition of a more limiting flow-biased APRM flux trip.

Figure of Merit

A figure of merit has been provided in the GE-NE Part 21 notification to potentially affected licensees. A separate figure of merit is provided for the core wide and regional mode DIVOM curves. The figure of merit is applied consistent with the stability reload licensing application basis for each stability solution. For Option III, the figure of merit is applied on the highest licensed rod line, consistent with the Option III trip setpoint reload licensing calculation. For Options II and I-D, the figure of merit is applied on the rated rod line, consistent with the flow-biased APRM flux trip safety limit protection calculation.

Reportable Condition Potential Applicability

Attachment 1 lists those plants which are known to be affected per §21.21(d). The plants which are potentially affected per §21.21(a)(2), and for which a transfer of information is needed per §21.21(b), are also listed in Attachment 1 and are identified to be in one of 4 categories:

1. Option III installed and operational – these plants will need to determine if the Option III trip system setpoints are adequate.

June 29, 2001
01-01NRC.DOC
MFN 025-01

Attachment 1 – Potentially Affected Plants

Affected	Potentially Affected				Utility	Plant
	1	2	3	4		
		X			AmerGen Energy Co.	Clinton
				X	AmerGen Energy Co.	Oyster Creek
					Carolina Power & Light Co.	Brunswick 1
					Carolina Power & Light Co.	Brunswick 2
	X				Detroit Edison Co.	Fermi 2
	X				Energy Northwest	Columbia
			X		Entergy Nuclear Northeast	FitzPatrick
					Entergy Nuclear Northeast	Pilgrim
					Entergy Operations, Inc.	Grand Gulf
					Entergy Operations, Inc.	River Bend
					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
			X		Nebraska Public Power District	Cooper
				X	Niagara Mohawk Power Corp.	Nine Mile Point 1
	X				Niagara Mohawk Power Corp.	Nine Mile Point 2
			X		Nuclear Management Co.	Duane Arnold
			X		Nuclear Management Co.	Monticello
					Pooled Equipment Inventory Co.	PIM
		X			PPL Inc.	Susquehanna 1
		X			PPL Inc.	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
			X		Vermont Yankee Nuclear Power Corp.	Vermont Yankee

Potentially Affected Categories:

1. Option III installed and operational
2. Option III selected, trip not enabled
3. Option I-D
4. Option II

June 29, 2001
01-01NRC.DOC
MFN 025-01

Attachment 2 - Reportable Condition per §21.21(d)

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

J. S. Post, Manager, Engineering Quality & Safety Evaluations, 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:

The reload licensing analysis for Hatch Unit 1 Cycle 20 and Hatch Unit 2 Cycle 16 have been found to have a non-conservative stability Option III trip system setpoint.

(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 Safety Limit MCPR is a specified acceptable fuel design limit as defined by General Design Criteria 10 of 10CFR50 Appendix A. The Safety Limit MCPR is applied to ensure fuel cladding integrity is not lost as a result of over–heating. The Safety Limit MCPR defines the minimum allowable critical power ratio (CPR) at which 99.9 percent of the rods in the core are expected to avoid boiling transition during the most limiting anticipated operational occurrence (AOO).

Stability solution Options III, II, and I-D are defined to provide Safety Limit MCPR protection via automatic instability detection and suppression. The licensing basis for stability detect & suppress reload calculations is defined in NEDO-32465-A, "Reactor Stability Detect & Suppress Solutions Licensing Basis Methodology for Reload Applications," August 1996. The report specifies generic DIVOM curves (Delta CPR/Initial CPR Vs. Oscillation Magnitude), which are normalized curves of CPR performance vs. hot bundle oscillation magnitude. The specified Hatch reload licensing calculations use a generic regional mode DIVOM curve which has been found to be non-conservative for the current Hatch core and fuel design. If a reactor instability were to occur, this could lead to violation of the MCPR Safety Limit.

Hatch has taken action to declare the Option III trip system inoperable and invoke the required plant Technical Specification actions. GE has initiated action to evaluate the adequacy of the generic DIVOM curves for all plants and provided a figure of merit which may be used by potentially affected licensees to perform an evaluation. GE is also working to establish a basis for revised DIVOM curves which are applicable to more limiting core and fuel design conditions than the original scope covered by NEDO-32465-A.

June 29, 2001
01-01NRC.DOC
MFN 025-01

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

May 3, 2001.

(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:

A defect has been confirmed to exist at Hatch Units 1 and 2. This Reportable Condition is an attachment to an Interim Report Notification per §21.21(a)(2), which documents the other potentially impacted facilities.

(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):

Determine the application limits for the core wide and regional mode DIVOM curves documented in NEDO-32465-A and define a corresponding figure of merit which may be used by licensees to assess applicability of stability reload licensing calculations	GE Nuclear Energy	Action complete
Use the figure of merit to determine applicability of the Hatch stability reload licensing calculations.	GE Nuclear Energy	Action complete
Declare the Option III trip system inoperable and invoke required plant Technical Specification actions	So. Nuclear Operating Co.	Action complete
Develop a preliminary bounding DIVOM curves	GE Nuclear Energy	July 3, 2001
Calculate revised stability Option III trip system setpoints for Hatch Units 1 and 2 based on a preliminary bounding regional mode DIVOM curve	GE Nuclear Energy	July 3, 2001
Develop updated DIVOM curves to supplement those previously defined in NEDO-32465-A and provide a corresponding figure of merit which may be used to determine DIVOM curve applicability to individual licensees	GE Nuclear Energy	August 17, 2001

June 29, 2001
01-01NRC.DOC
MFN 025-01

Obtain NRC concurrence for use of the new DIVOM curves (this is expected to include submittal of appropriate licensing report information, which may include a supplement to NEDO-32465-A).	GE Nuclear Energy	To be determined in consultation with NRC staff
Complete revised stability reload licensing calculations for Hatch Units 1 and 2 and issue revised Supplemental Reload Licensing Reports to reflect revised Safety Limit MCPR calculation and corresponding revised Operating Limit MCPR.	GE Nuclear Energy	Two weeks following NRC concurrence for use of the new DIVOM curves
Amend the stability reload licensing technical design procedure to include determination of the appropriate DIVOM curve for the associated calculations.	GE Nuclear Energy	Six weeks following NRC concurrence for use of the new DIVOM curves

(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. GE informed all BWR licensees in writing via a BWROG Potential Issues Response Team (PIRT) conference call notification on June 26, 2001. A Part 21 notification was issued to all BWR licensees on June 29, 2001.
2. Conference calls were held with representatives of the BWROG on April 27, 2001 to (1) describe the issue, (2) discuss the technical bases for a figure of merit which may be used to determine applicability of the existing generic DIVOM curves, (3) inform licensees of GE-NRC discussions on this issue and GE Part 21 reporting plans, (4) inform BWR licensees of the compensatory actions taken by Hatch as a result of this Reportable Condition, and (5) outline plans for how the BWROG and GE can work together to develop revised DIVOM curves.
3. The GE-NE Part 21 notification to BWR licensees includes a figure of merit, which may be used to determine applicability of existing generic DIVOM curves, and a discussion of operability considerations.
4. GE is providing correspondence to Hatch with verified changes needed in the stability Option III trip system setpoints based on a bounding regional mode DIVOM curve.

June 29, 2001
01-01NRC.DOC
MFN 025-01

2. Option III installed, trip not enabled – these plants may have calculated Option III trip system setpoints, but they are not enabled. Implementation of the trip should be delayed if it was planned to enable the trip prior to resolution of this issue.
3. Option I-D – these plants will need to confirm applicability of the existing core wide mode DIVOM curve for their reload licensing stability protection calculation.
4. Option II - these plants will need to confirm applicability of the existing regional mode DIVOM curve for their reload licensing stability protection calculation.

Evaluation Completion Date

The evaluation will be completed by August 31, 2001. Individual plant corrective actions may be completed prior to this date, in which case the Option III trip system may be declared operable after appropriate setpoints have been implemented.

If you have any questions, please call me.

Sincerely,

Jason Post

Jason S. Post, Manager
Engineering Quality & Safety Evaluations
(408) 925-5362

cc: S. D. Alexander (NRC-NRR/DISP/PSIB)
G. C. Cwalina (NRC-NRR/DISP/PSIB)
J. F. Klapproth (GE-NE)
H. J. Neems (GE-NE)
PRC File

Attachments:
1. Potentially Affected Plants
2. Reportable Condition Evaluation per §21.21(d)