GE Nuclear Energy

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Attention: Chief, Information Management Branch
Program Management
Policy Development and Analysis Staff

Subject: Part 21 Transfer of Information: Turbine Control System Impact on Transient Analyses

This letter provides information concerning GE Nuclear Energy (GENE) transient analysis for a load rejection event in generation of the APRM Rod Block Technical Specification (ARTS) improvement program off-rated power dependent operating limits. GENE recently learned that there may be a disconnect between the performance of turbine control systems and the corresponding assumptions in the transient analysis performed by GENE for fuel reload licensing calculations.

GENE has notified all plants that have a reload analysis performed by GENE or Global Nuclear Fuels-America (GNF-A) of this concern. In some cases, GENE was able to determine that this was not a reportable condition either because they have not been supplied ARTS limits for a current fuel cycle, they have confirmed to GENE that the potentially non-conservative ARTS limits have not been implemented, or they have confirmed to GENE that the turbine protection system performance is consistent with the assumptions in the ARTS analysis. However, in other cases GENE did not have sufficient information to determine if the ARTS analysis assumptions were consistent with the turbine control system performance, and GENE has transferred information pursuant to 10 CFR Part 21.21(b) to those licensees potentially affected.

The plants that have been notified by GENE are listed in Attachment 1. The unaffected plants are identified as NR (Not Reportable) and the potentially affected plants are identified as TI (Transfer of Information). We are providing this information to the NRC for appropriate action since other plants that do not have reload analysis performed by GNF-A may have off-rated power dependent limits that depend upon turbine control systems to mitigate a load rejection event.

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Discussion

Turbine control systems are designed to protect the turbine from overspeed conditions from a load rejection event. One such system is the Power Load Unbalance (PLU) system on GE turbines with Electro-Hydraulic Control (EHC) turbine control system. There are also Mechanical-Hydraulic Control (MHC) and Digital Electro-Hydraulic Control (DEHC) systems in operation. The turbine control system initiates Turbine Control Valve (TCV) fast closure and Turbine Bypass Valve (TBV) fast opening to protect the turbine from overspeed from a load rejection at high power, and will initiate a direct reactor scram to provide reactor thermal limit protection. For a load rejection from conditions that do not threaten turbine overspeed (e.g., load rejection from low power), the turbine control system will initiate TCV closure at normal speed, TBV opening at normal speed, and will not generate a direct scram. However, other turbine protection systems may initiate a fast TCV closure and direct scram even if turbine overspeed is not threatened.

The ARTS analysis assumes that for a load rejection event with no turbine bypass available, turbine control valve (TCV) fast closure and direct scram are initiated for power levels above the Technical Specification value at which TCV fast closure scram is enabled (Pbypass). However, enabling the direct scram at Pbypass does not ensure that TCV fast closure (and subsequent direct scram) will actually occur for a load rejection event for all power levels above Pbypass. For EHC plants, the GE Standard Application for Fuel Reload, GESTAR II, NEDE-24011-P-A-14, June 200, Section S.2.2.1.1, Generator Load Rejection Without Bypass, describes how the PLU devices senses a load rejection event and initiates a direct scram upon sensing TCV fast closure. This assumption has produced a Minimum Critical Power Ratio (MCPR) power dependent multiplier, Kp, on the Operating Limit MCPR (OLMCPR) that has a break point in the Kp curve at the value of Pbypass.

Pbypass is a Technical Specification value at which the scram is enabled for TCV fast closure (low oil pressure) and TSV position, and is typically 25 to 40% of rated power. The disconnect between the turbine protection system performance and the ARTS analysis assumptions is that it may not have been confirmed that even though the scram is enabled for TCV fast closure above Pbypass, TCV fast closure will actually occur for load rejection events without bypass that initiate at all powers above Pbypass.

For off-rated power levels greater than Pbypass, the limiting transient events are a Feedwater Controller Failure – Maximum Demand (FWCF) and a Load Reject with No Bypass (LRNBP). The FWCF event is not a concern for this issue since it does not rely on a direct scram generated by the TCV fast closure to mitigate the event. However, it is assumed in analysis to support the ARTS off-rated Kp limits, that the turbine control system will initiate a TCV fast closure and direct scram for the LRNBP event for reactor powers above Pbypass.

There are no safety concerns with any transient analysis based on the value of Pbypass specified in the GENE ARTS analysis design records. However, GENE has a concern

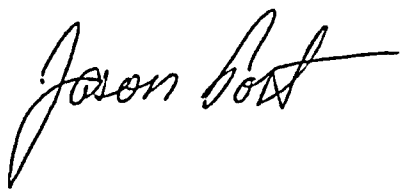
that TCV fast closure and direct scram may not occur for all power levels above Pbypass for a LRNBP event as assumed in the ARTS analysis. This condition could be made worse if the turbine control system has been modified in a way that could increase the power level at which TCV fast closure occurs.

Safety Basis

The deviation or failure to comply could produce a non-conservative Operating Limit MCPR (OLMCPR). If a limiting load rejection transient were to occur from limiting off-rated conditions, it could lead to a Safety Limit MCPR (SLMCPR) violation. This does not produce a significant safety hazard, but would be a reportable condition under 10CFR21 because it would be a Technical Specification Safety Limit violation. Even if the SLMCPR is violated, there is margin to boiling transition, and even if boiling transition were to occur, there is substantial margin to fuel failure.

If there are any questions on this information, please call me at (910) 675-6608.

Sincerely,



Jason. S. Post, Manager
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PRC File

Attachment 1 – Notified Plants

NR[1]	TI[2]	Utility	Plant
	X	AmerGen Energy Co.	Clinton
X		AmerGen Energy Co.	Oyster Creek
	X	Carolina Power & Light Co.	Brunswick 1
	X	Carolina Power & Light Co.	Brunswick 2
X		Constellation Nuclear	Nine Mile Point 1
X		Constellation Nuclear.	Nine Mile Point 2
X		Detroit Edison Co.	Fermi 2
		Dominion Generation	Millstone 1
		Energy Northwest	Columbia
	X	Entergy Nuclear Northeast	FitzPatrick
X		Entergy Nuclear Northeast	Pilgrim
		Entergy Operations, Inc.	Grand Gulf
		Entergy Operations, Inc.	River Bend
	X	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
		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	Nuclear Management Co.	Duane Arnold
	X	Nuclear Management Co.	Monticello
		Pooled Equipment Inventory Co.	PIM
		PPL Susquehanna LLC.	Susquehanna 1
		PPL Susquehanna LLC	Susquehanna 2
X		PSEG Nuclear	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
		Tennessee Valley Authority	Browns Ferry 3

1. NR = Not Reportable – GENE does the reload analysis and has confirmed that the plant is not affected
2. TI = Transfer of Information – GENE does the reload analysis, but does not have sufficient information to complete the evaluation to determine if the plant is affected

Attachment 2 – Transfer of Information per §21.21(b)

(i) Name and address of the individual providing the information:

J. S. Post, Manager, Engineering Quality & Safety Evaluations, GE Nuclear Energy, 3901 Castle Hayne Road, Wilmington, NC 28401

(ii) Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States that contains a deviation or failure to comply:

The potential deviation or failure to comply is in the transient calculations for plants that have been supplied the APRM Rod Block Technical Specification (ARTS) improvement program off-rated Kp limits. The GE Standard Application for Fuel Reload, GESTAR II, NEDE-24011-P-A-14, June 2000, Section S.2.2.1.1, Generator Load Rejection Without Bypass, describes how the power/load unbalance (PLU) device senses a load rejection event and initiates a direct scram upon sensing turbine control valve (TCV) fast closure. The transient analysis assumes that TCV fast closure and direct scram are initiated (by the PLU or other devices) for reactor power above the Technical Specification value of Pbypass for a load rejection event with no turbine bypass. This is the reactor power level at which scram is enabled for a TCV fast closure (below this power level it is bypassed), but it may not have been confirmed that TCV fast closure will occur for power levels above Pbypass. The potential deviation is that the PLU or other devices may not initiate TCV fast closure and direct scram for a load rejection event with no turbine bypass for all reactor power levels above Pbypass as has been assumed in development of the ARTS off-rated Kp limits.

(iii) Identification of the firm constructing the facility or supplying the basic component that contains a deviation or failure to comply:

The analysis is supplied by GE Nuclear Energy (GENE) and/or Global Nuclear Fuels-America (GNF-A), 3901 Castle Hayne Road, Wilmington, NC 28401.

(iv) Nature of the defect or safety hazard that could be created by such a deviation or failure to comply:

The deviation or failure to comply could produce a non-conservative Operating Limit MCPR (OLMCPR). If a limiting load rejection transient were to occur from limiting off-rated conditions, it could lead to a Safety Limit MCPR (SLMCPR) violation. This does not produce a significant safety hazard, but would be a reportable condition under 10CFR21 because it would be a Technical Specification Safety Limit violation. Even if the SLMCPR is violated, there is margin to boiling transition, and even if boiling transition were to occur, there is substantial margin to fuel failure.

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

This issue was initiated as a potential reportable condition on September 1, 2004.

(vi) In the case of a basic component which contains a deviation or failure to comply, the locations of all such components in use or being supplied:

The plants that have been supplied ARTS off-rated Kp limits, and which have not confirmed to GENE that a load rejection event will cause TCV fast closure and a direct scram for power levels above Pbypass, are identified in Attachment 1 as a TI. Some of the identified plants may have not yet implemented the ARTS limits. Plants which have not been supplied ARTS limits, or which do not have reload analysis performed by GENE are not affected by this potential deviation in the GENE analysis.

(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 deviation or failure to comply):

Recommended licensee actions are as follows:

1. If ARTS has not yet been implemented, confirm that the turbine control system performance is consistent with the ARTS analysis assumptions prior to implementing ARTS.

2. If ARTS has been implemented, and the plant has a PLU device, confirm that the device settings are consistent with the turbine control system performance in the ARTS analysis assumptions[1].

3. If ARTS has been implemented and the plant does not have a PLU device (e.g., the plant has a MHC control system), confirm that the turbine control system performance is consistent with the ARTS analysis assumptions[1].

If it cannot be confirmed that the turbine control system performance is consistent with the ARTS analysis assumptions, the GNF-A Customer Account Leader should be contacted to determine if revised off-rated Kp limits are needed.

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

1. GENE has confirmed that ARTS off-rated Kp limits are not affected as long as
   - TCV fast closure and direct scram are initiated for load rejection events with no turbine bypass for reactor power above Pbypass, or
   - The load rejection event occurs at up to ~40% of rated thermal power with normal off-rated feedwater temperature and with credit for full turbine bypass operation.
2. If a plant's turbine bypass capacity exceeds the power level where the PLU device will not generate a TCV fast closure, then the turbine bypass will effectively mitigate the load rejection event and the ARTS off-rated Kp limits are not affected.

[1] ARTS analysis assumes that for a load rejection event with no turbine bypass and thermal power above Pbypass, there is not a significant pressure transient on the reactor prior to initiation of the direct scram.