October 2, 2003

Mr. James F. Klapproth, Manager
Engineering & Technology
GE Nuclear Energy
175 Curtner Ave
San Jose, CA 95125

SUBJECT: NEDC-33006P, "MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS" (MELLLA+) AUDIT (TAC NO. MB6157)

Dear Mr. Klapproth:

By letter dated August 22, 2002, GE Nuclear Energy (GENE) submitted to the NRC Topical Report (TR) NEDC-33006P, "Maximum Extended Load Line Limit Analysis Plus," (MELLLA+) for NRC staff review. Boiling water reactors that implemented extended power uprates (EPU) up to 20 percent above the original licensed thermal power are limited to a smaller core flow range at the uprated power levels. The MELLLA+ TR proposes operation at an expanded operating domain that would increase the available core flow window at the uprated power level from 80 percent to the maximum licensed core flow. As part of this review, the NRC staff audited the GENE site in San Jose, California, the week of September 8–12, 2003.

As a pilot MELLLA+ application, Progress Energy submitted NEDC-33063, “Safety Analysis Report for Brunswick Steam Electric Plant (BSEP), Units 1 and 2, Maximum Extended Load Line Limit Analysis Plus.” As part of this review, the NRC staff audited: (1) the safety analyses (anticipated transient without scram and emergency core cooling system loss-of-coolant accident) supporting the BSEP, Units 1 and 2, MELLLA+ application, (2) the functional capability of the safety systems to operate at the expanded EPU/MELLLA+ operating domain, and (3) the effectiveness of the stability detect and suppress options to be implemented at BSEP. During the onsite review, the staff also evaluated the effectiveness of the currently available instability options other than Option III (e.g., Option 1D and Option E1A) in ensuring that plants implementing MELLLA+ would continue to meet General Design Criterion 12. Enclosed for your information is the agenda used during this audit which was e-mailed to you prior to the audit. We will be issuing a request for additional information (RAI) as a result of this audit. This RAI will provide GENE with a list of material which the staff’s wants docketed as result of the audit in support of the MELLLA+ review. This RAI will also include questions from our earlier discussions.

If you have questions regarding this letter, please contact me at (301) 415-1445.

Sincerely,

/RA/

Alan B. Wang, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 710

Enclosure: MELLA+ Audit

cc w/encl: See next page

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Maximum Extended Load Line Limit Analysis Plus (MELLLA+) Audit
September 8-12, 2003
San Jose, California

The main objective of the anticipated transients without SCRAM (ATWS) audit is to determine if plants operating at extended power uprate (EPU)/MELLLA+ condition would, (a) maintain vessel and containment integrity and core coolability, and (b) be able to shutdown the reactor and maintain long term shutdown condition without relying on control rods.

The NRC staff is interested in how GE Nuclear Energy (GENE), (1) analyzes the ATWS events, in order to predict and demonstrate that plants would meet the acceptance criteria, and (2) establishes the suppression pool temperature limit. ATWS is a symptom-based event. The operators would confirm and take actions based on the symptoms, as dictated by the plant-specific emergency operating procedures (EOPs). Assuming the plant-specific operator actions as dictated by the EOPs, the staff wants to determine if it can analytically demonstrate that the plants operating at EPU/MELLLA+ condition would meet the ATWS acceptance criteria.

The staff proposes to review the key input parameters and results for the following ATWS / and ATWS with instability analyses, if available.

(1) Mitigated ATWS/Instability case following the EOPs mitigation actions. For this case, the condenser and the feedwater are available. The goal of this calculation is to demonstrate that the mitigation actions as prescribed in the EOPs are still effective in suppressing the oscillations for plants operating at the EPU/MELLLA+ conditions.

(2) Isolation ATWS case (TRACG) for a bounding plant with a standpipe boron injection, following the EOPs and different water level strategies. The purpose of this analysis is:

- to demonstrate that the different water level strategies, 2 feet below the feedwater spargers to the minimum steam cooling reactor pressure vessel (RPV) water level (MSCRWL), are acceptable. The staff wants to determine if the conclusions that the different water level control strategies are acceptable remain valid for the EPU/MELLLA+ operation.

- to demonstrate that following the plant-specific EOP operator actions, EPU/MELLLA+ plants can meet the ATWS acceptance criteria.

(3) Comparison of ODYN and TRACG ATWS results: Due to numerical limitations, ODYN calculation does not follow the EOP procedures and does not lower the water level below top-of-active-fuel (TAF)+5. Compare ODYN and TRACG integrated safety relief valve (SRV) mass flows to determine if the ODYN results are more conservative.

(a) Provide a comparison of the calculated integrated SRV mass flows calculated using,
  (i) ODYN run at TAF+5 water level, and
  (ii) TRACG calculations at TAF+5 and TAF-2.

The staff proposes that GE include the following items in their generic MELLLA+ presentations.

1. Discuss the ATWS emergency operating guidelines (EPGs), including the bases for the key parameters and limits such as the boron injection initiation temperature, suppression pool heat capacity temperature limit, hot shut boron weight, and minimum steam cooling pressure. State if the EPU/MELLLA+ operation may require changes to these limits and key parameters. Explain why the heat capacity temperature limit used in plant-specific applications are based on the emergency core cooling system (ECCS)-loss-of-coolant accident (LOCA) analysis.

2. For all BWRs, tabulate the ATWS results (e.g., peak pressure, suppression pool temperature) before the 5 percent power stretch (if available), after the 5 percent power stretch (if applicable), EPU and EPU/MELLLA+. Include in the table the results from the initial GENE generic ATWS analyses. Since the initial plant licensing, many BWRs have adopted range of operating condition changes that affected their ATWS response. These changes include increases in the fuel cycle length (cycle extension from 18 months to 24 months), power (from 5% to 20% uprates above the original licensed thermal power) and licensed operating domain (LLLL, ELLLA, MELLLA, maximum core flow). The objective of this table is to assess how the previous changes in the operating conditions affected BWR plants ATWS margins. This would also serve as means to evaluate the capability of BWRs to meet the vessel and containment response with the additional EPU/MELLLA+ changes. The staff acknowledges that GENE may not have access to the plant-specific ATWS analysis-of-record for plants with other reload vendors.

3. The topical report states that the slope of the MELLLA+ boundary was derived primarily from reactor operator data. Explain this statement. State what operator training and plant testing is recommended to the ensure that plants would be operated within the MELLLA+ domain. During the initial MELLLA+ implementation, describe the initial power accession that would be recommended. Describe the changes that would be made in the on-line core monitoring systems (e.g., 3D MONICORE).

4. Evaluate the effectiveness of the currently available instability options other than Option III (e.g., Option 1D and Option E1A) in ensuring that plants implementing MELLLA+ would continue to meet General Design Criterion 12.

<u>Bunswick MELLLA+ Application Audit</u>:

The primary focus of the NRC staff audit would be to evaluate the safety analyses supporting the Brunswick MELLLA+ application. The Brunswick MELLLA+ analyses audit would include the following:

(1) the key input parameters, assumptions and results of the Brunswick ATWS analysis,

(2) <u>the Brunswick EOP ATWS mitigation strategies</u>. The on-site review would cover the consistency between the mitigation action and system actuation assumed in the MELLLA+ ATWS analysis and the plant-specific operator actions delineated in the Brunswick EOPs. (Presentation item)

(3) the proposed scope of the MELLLA+ ECCS-LOCA analyses and the key assumption and inputs used for the results presented in the application.

(4) any planned testing or operator training necessary, during the initial implementation of MELLLA+ operation.

(5) the proposed TS changes associated with the implementation of the DSS-CD Option and the automatic backup instability protection. The staff would also review additional TS changes necessary in order to reflect the operating flexibility options prohibited under the MELLLA+ operation, such as the single loop operation (SLO), feedwater heaters out of service (FWHOOS) and safety relief valve out-of-service (SRVOOS). Discuss any recirculation pump trip TS requirement. (Presentation items)

(6) the capability of the BSEP systems to perform their safety function, when the systems are called upon to actuate and inject, considering the changes in reactor core conditions under the MELLLA+ operation,

(7) the results of the Brunswick TRACG anticipated operational occurrences (AOO) and ASME overpressure analyses. Compare the results with the previous equilibrium core results.

(8) the spent fuel pool criticality analysis. This on-site review entails examining if the assumptions made during the spent fuel pool re-rack remain valid, considering the large batch fractions of hot bundles that may be loaded into the pool due to the EPU/MELLLA+ core design. (Presentation Item).

(9) the bases and key assumptions used in generating the average power range monitors (APRM) flow-biased scram and rod block setpoints for the automatic backup stability protection (BSP) option for Brunswick. How would the cycle-specific APRM setpoints generated for normal and end-of-cycle, all-rods-out reduced feedwater conditions be implemented during the operating cycle? Does the generic DSS-CD setpoints demonstrate that the specified acceptable design fuel limits (SAFDL) would not be violated for Brunswick operation with final feedwater temperature reduction. Discuss the current Brunswick Units 1 and 2 cycles stability performance (presentation item).

cc:
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