Entergy

Entergy Operations, Inc.
P. O. Box 756
Port Gibson, MS 39150

Michael A. Krupa
Director, Extended Power Uprate
Grand Gulf Nuclear Station
Tel. (601) 437-6684

GNRO-2010-00035

May 18, 2010

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

SUBJECT: Responses to NRC Requests for Additional Information Pertaining to License Amendment Request for Power Range Neutron Monitoring System (TAC No. ME2531)

Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERENCES:

1. Entergy Operations, Inc. letter to the NRC, *License Amendment Request – Power Range Neutron Monitoring System Upgrade*, dated November 3, 2009 (ADAMS Accession No. ML093140463)

2. NRC letter to Entergy Operations, Inc., *Grand Gulf Nuclear Station, Unit 1 - Request for Additional Information Re: Power Range Neutron Monitoring System (TAC No. ME2531)*, dated April 22, 2010 (ADAMS Accession No. ML101090245)

Dear Sir or Madam:

In Reference 1, Entergy Operations, Inc. (Entergy) submitted to the NRC a license amendment request (LAR), which proposes to revise the Grand Gulf Nuclear Station (GGNS) Technical Specifications (TS) to reflect the installation of the digital General Electric-Hitachi (GEH) Nuclear Measurement Analysis and Control (NUMAC) Power Range Neutron Monitoring (PRNM) System.

In Reference 2, the NRC staff requested additional information needed to support their review and approval of Reference 1. Responses to the staff's Requests for Additional Information (RAIs) are provided in Attachment 1 to this letter.

The No Significance Hazards Determination and the Environmental Consideration provided in Reference 1 are not impacted by these responses.

This letter contains new commitments, which are identified in Attachment 2.

If you have any questions or require additional information, please contact Mr. Guy Davant at (601) 368-5756.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 18, 2010.

Sincerely,

MAK/ghd

Attachments: 1. Responses to NRC Requests for Additional Information Pertaining to License Amendment Request – Power Range Neutron Monitoring System Upgrade

2. Licensee-Identified Commitments

cc: Mr. Elmo E. Collins, Jr.
Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
612 East Lamar Blvd., Suite 400
Arlington, TX 76011-4005

U. S. Nuclear Regulatory Commission
ATTN: Mr. C. F. Lyon, NRR/DORL (w/2)
ATTN: ADDRESSEE ONLY
ATTN: Courier Delivery Only
Mail Stop OWFN/8 B1
11555 Rockville Pike
Rockville, MD 20852-2378

State Health Officer
Mississippi Department of Health
P. O. Box 1700
Jackson, MS 39215-1700

NRC Senior Resident Inspector
Grand Gulf Nuclear Station
Port Gibson, MS 39150

ATTACHMENT 1

GNRO-2010-00035

RESPONSES TO NRC REQUESTS FOR ADDITIONAL INFORMATION PERTAINING TO LICENSE AMENDMENT REQUEST POWER RANGE NEUTRON MONITORING SYSTEM UPGRADE

RESPONSES TO NRC REQUESTS FOR ADDITIONAL INFORMATION PERTAINING TO LICENSE AMENDMENT REQUEST POWER RANGE NEUTRON MONITORING SYSTEM UPGRADE

By a license amendment request (LAR), Entergy Operations, Inc. (Entergy) requested NRC staff approval of an amendment to the Grand Gulf Nuclear Station (GGNS) Technical Specifications (TS) to reflect installation of the digital General Electric - Hitachi Nuclear Management Analysis and Control Power Range Neutron Monitoring (PRNM) System.[1] Entergy has received a letter from the staff requesting additional information needed to support their review and approval of the LAR.[2] Provided below are the NRC's Requests for Additional Information (RAIs) and Entergy's responses to each.

NRC RAI No. 1

In its application dated November 3, 2009, the licensee stated that the Oscillation Power Range Monitor (OPRM) Upscale function will not be relied upon to mitigate a stability event during the initial OPRM Monitoring Period (for a minimum of 90 days not to exceed one fuel cycle after plant startup following the 2012 refueling outage) and GGNS will implement Backup Stability Protection (BSP) measures specified in Boiling Water Reactor Owners' Group (BWROG) document OG-02-0119-260, GE to BWROG Detect and Suppress II Committee, "BSP [Backup Stability Protection] for inoperable Option III Solution," as an alternate method for detecting and suppressing instabilities until the OPRM Monitoring Period has been successfully completed.

Please provide: (1) a description of the alternate method for detection and suppression of instabilities proposed in the application with respect to the approach stated in BWROG document OG-02-0119-260; (2) identification of the differences between the proposed alternate method and the Interim Corrective Actions (ICAs) specified in U.S. Nuclear Regulatory Commission (NRC) Bulletin 88-07; (3) description of which option is to be taken in compliance with five stability controls outlined in BWROG document OG-02-0119-260 when deliberate entry into the Controlled Entry Region occurs, and its analysis basis to confirm compliance; and (4) reason to take more than 90 days (up to one fuel cycle) to activate the OPRM system for GGNS, when there are more than 90 reactor years of fully-armed operational data already available for OPRM system.

Response

Items (1) and (2)

As discussed in Section 4.4.1.2 of the PRNM System LAR, GGNS will use BSP measures, specified in OG-02-0119-260, as an alternate method for detecting and suppressing thermal-hydraulic instability conditions during periods when the OPRM Upscale trip function (APRM Function 2.f of TS Table 3.3.1.1-1) is not operable.

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[1] Entergy Operations, Inc. letter to the NRC, *License Amendment Request – Power Range Neutron Monitoring System Upgrade*, November 3, 2009 (ADAMS Accession No. ML093140463)

[2] NRC letter to Entergy Operations, Inc., *Grand Gulf Nuclear Station, Unit 1 - Request for Additional Information Re: Power Range Neutron Monitoring System (TAC No. ME2531)*, April 22, 2010 (ADAMS Accession No. ML101090245)

The ICAs define three regions in the power/flow map that are excluded from planned entry and prescribe specific actions upon unplanned entry. The ICA regions are based upon empirical evaluations and experience, are defined in terms of relative core flow and control rod line, and are uniformly applicable to all GE BWRs.

The currently used ICA regions were established in 1994 based on original licensed thermal power, generally shorter fuel cycles, and more stable core designs. These regions were defined based on relative core flow and rod line points rather than specific stability criteria. New energy-intensive core design changes have generally reduced stability margins. As a result, GE Nuclear Energy proposed the BSP methodology as an enhancement to the ICA methodology. The BSP methodology is documented in OG-02-0119-260. The BSP methodology takes into account the new aggressive core designs.

The BSP characteristics that address the potential inadequacy of the long-term Option III solution ICAs are as follows:

- The size of the base BSP regions is equivalent to the current ICA regions.
- The BSP regions are reduced from three ICA regions (Scram, Exit, Controlled Entry) to two regions (Scram and Controlled Entry).
- Decay ratio criteria are established for plant/cycle-specific confirmation and, as necessary, the base BSP regions are adjusted.
- Operator actions in the two BSP regions are similar to the operator actions defined for the ICA Scram and Controlled Entry regions.
- Operator awareness is required when operating within 10% of rated core flow or power from the BSP Controlled Entry region.

The guidance and actions recommended by the BSP emphasize instability prevention, which minimizes the burden placed on the operator when monitoring for the onset of power oscillations.

The BSP directs the following actions pertaining to entry into the defined regions:

Region I – Scram Region

Upon determining that Region I has been entered, the operator is to initiate a manual scram. If entry is unavoidable, early scram initiation is appropriate.

Region II – Controlled Entry Region

If entry is inadvertent or forced, the operator is to immediately exit the region, which can be accomplished by either inserting control rods or increasing core flow.

The BSP recommends caution when operating near Region II; however, deliberate entry into the region is allowed but requires compliance with at least one of the following stability control actions:

1. Maintain core average boiling boundary (BB) $\geq$ 4.0 feet;

2. Maintain core average BB > reference value (demonstrated to produce stable operation) and ≥ 3.0 feet, and maintain radial peaking factor ≤ reference value (demonstrated to produce stable operation);

3. Maintain core decay ratio (DR) < 0.6 as calculated by an on-line core stability monitor;

4. The individual owner will determine appropriate limits for core DR (< 0.6) as calculated by a core stability monitor, or by pre-analysis of a reactor state trajectory through the Controlled Entry Region; or

5. Continuous dedicated monitoring of real time control room neutron monitoring instrumentation with manual scram required upon indication of a reactor instability induced power oscillation.

The BSP recommends minimizing the amount of time spent in Region II.

As discussed in Section 3.3 of the PRNMS LAR, the NRC approved the use of the BSP measures as an acceptable alternate method to detect and suppress thermal-hydraulic instability at Monticello.[3]

Item (3)

As discussed in the response to Items (1) and (2), above, OG-02-0119-260 allows deliberate entry into the Controlled Entry Region (Region II) if the licensee complies with at least one of five stability control actions. Of these five actions, Entergy would typically comply with Action #1 by maintaining the Fraction of Core Boiling Boundary (FCBB) ≤ 1.0, which ensures the core average BB remains ≥ 4.0 feet. The FCBB is the ratio of the power generated in the lower four feet of the active reactor core to the power required to produce bulk saturated boiling of the coolant entering the fuel channels. The value of 4 feet is set as the BB limit based on analysis described in Appendix B of BWROG-94078, *BWR Owners' Group Guidelines for Stability Interim Corrective Action*, which is referenced in OG-02-0119-260.[4]

The BB limit is established to ensure the core remains stable during normal reactor operations in the area of the core power/flow operating domain in which the reactor is susceptible to reactor instabilities in the absence of restrictions on core void distributions. By operating at or above the BB limit in Region II, the Minimum Critical Power Ratio (MCPR) safety limit remains protected.

Item (4)

Entergy agrees there is ample run-time for the OPRM system among the GE BWR nuclear fleet. Therefore, Entergy will conduct the OPRM Monitoring Period for 90 days following startup from the 2012 refueling outage. This action replaces the one in the PRNM System

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[3] NRC letter to Northern States Power Company, *Monticello Nuclear Generating Plant (MNGP) – Issuance of Amendment Regarding the Power range Neutron Monitoring System (TAC No. MD8064),* January 30, 2009 (ADAMS Accession No. ML083440681)

[4] The BWROG transmitted a copy of BWROG-94078 to the NRC via letter from Mr. L. A. England to Mr. M. J. Virgilio on June 6, 1994.

LAR that states, "Entergy will conduct a monitoring period of the OPRM for a minimum of 90 days not to exceed one fuel cycle after plant startup following the 2012 refueling outage to be successfully completed prior to enabling the OPRM."

NRC RAI No. 2

Please provide, in detail, the action to be taken (if applicable, to GGNS) should an error occur in the Global Nuclear Fuel-Americas (GNF-A) 3D MONICORE (3DM) software with application of a generic constant 10% bypass flow assumption in the BWROG's methodology to calculate the Boiling Boundary (BB) which can lead to an error in the calculation of the BB value which would be non-conservative with regard to stability.

Response

As discussed in the response to Item (3) of NRC RAI No. 1, above, GGNS ensures the BB $\geq$ 4.0 feet by maintaining the FCBB $\leq$ 1.0; FCBB is calculated by 3DM. In order to address the non-conservative condition that existed in the 3DM software regarding the 10% bypass flow[5], Entergy revised the generic constant for GGNS from 10% to 15% during Cycle 17. This change ensures the calculated FCBB is conservative and bounding for operation.

NRC RAI No. 3

Please provide a description for the proposed PRNM system design features other than an OPRM capability such as Detect and Suppress Solution – Confirmation Density (DSS-CD) and a future plan to implement extended power uprate in conjunction with the Maximum Extended Load Line Limit Analysis Plus (MELLLA+) for GGNS.

Response

The PRNM System being installed at GGNS is described in Section 3.2 of the PRNM System LAR. Section 3.0 of GEH Licensing Topical Report (LTR) NEDC-32410P-A, *Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function,* identifies the functions and design features of the PRNM System. Other than the DSS-CD function, which is discussed below, there are no design features of the PRNM System beyond those described in the LTR and the PRNM System LAR.

Entergy is installing the PRNM System to support the GGNS Extended Power Uprate (EPU) project. As part of a phased approach to increase plant power output and improve operational flexibility, Entergy is planning to submit a separate LAR for the MELLLA+ operating domain following approval of the EPU LAR. Operating with MELLLA+ requires a modification to the traditional Option III solution. This modification enables the trip function of the DSS-CD solution, a fourth algorithm. [6, 7]

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[5] General Electric – Hitachi 10 CFR Part 21 Communication SC 10-01, "10% Bypass Flow Assumption and 3D MONICORE Bypass Flow Error in Boiling boundary Calculation," February 1, 2010

[6] GE Nuclear Energy Licensing Topical Report (LTR) NEDC-33075P-A, Rev. 6, *General Electric Boiling Water Reactor Detect and Suppress Solution - Confirmation Density (DSS-CD)*, January 2008

The use of the DSS-CD algorithm trip is not within the scope of the PRNM System LAR; therefore, it will be jumpered out until GGNS implements MELLLA+.

NRC RAI No. 4

Please provide a realistic schedule to implement Option III stability solution for GGNS including an upgrade of the simulator for operator training.

Response

As discussed in Section 3.3 of the PRNM System LAR, Entergy will enable the OPRM Upscale trip function after successfully completing the OPRM Monitoring Period, which will be conducted following startup from the 2012 refueling outage. To support operation with the new PRNM System, including the OPRM, Entergy is scheduled to upgrade the simulator to reflect the PRNM System during the third quarter 2011 with operator training courses to begin during the fourth quarter. In addition, Entergy is planning to conduct startup simulator training (taking the "plant" from "Cold Shutdown" to "Run") for operation crews during the 2012 refueling outage. This training is to include operating aspects of the PRNM System, including the Option III stability solution.

NRC RAI No. 5

Please identify which cycle-specific parameters specified in TS 5.6.5.a will be supported by the proposed two approved methodologies for TS 5.6.5.b. According to guidance in NRC Generic Letter (GL) 88-16, "Removal of Cycle-Specific Parameter Limits from Technical Specifications," dated October 3, 1988, all the approved methodologies listed in TS 5.6.5.b should: (1) identify which cycle-specific parameters listed in TS 5.6.5.a corresponding to approved methods are used to calculate the parameters; and (2) identify the revision or date of approval, if applicable, for the methodologies listed in TS 5.6.5.b. In accordance with GL 88-16, please provide, as necessary, the revised TS 5.6.5.a and TS 5.6.5.b for NRC staff review.

Response

The two methodologies being added to TS 5.6.5.b, NEDO-31960-A, *BWR Owners' Group Long-Term Stability Solutions Licensing Methodology,* and NEDO-32465-A, *Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications,* support the OPRM Upscale trip function (APRM Function 2.f of TS Table 3.3.1.1-1), which protects the MCPR safety limit. The dates of approval for these documents are November 1995 and August 1996, respectively.

Section 3.3 of the GGNS COLR contains a list of the methodologies used to determine the core operating limits. Included in the entry for each methodology is its associated revision or date of approval and the TS supported by the methodology. Entergy transmitted the current Cycle 17 COLR to the NRC via letter dated October 28, 2008 (ADAMS Accession No.

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[7] NRC letter to GE Nuclear Energy, *Final Safety Evaluation for General Electric Nuclear Energy (GENE) Licensing Topical Report (LTR) NEDC-33075P, Revision 5, "General Electric Boiling Water Reactor Detect and Suppress Solution - Confirmation Density," (TAC No. MC1737),* November 27, 2006

ML083030084). In accordance with the requirements of TS 5.6.5.b, NEDO-31960-A and NEDO-32465 will be incorporated into the COLR to support Cycle 19 operation.

Regarding application of GL 88-16, this GL provides guidance for preparing an LAR to modify TS that contain cycle-specific parameter limits. The alternative discussed in GL 88-16 consists of three actions needed to modify the TS:

(1) The addition of the definition of a named report that includes the values of cycle-specific parameter limits that have been established using an NRC-approved methodology and consistent with all applicable limits of the safety analysis;

(2) The addition of an administrative reporting requirement to submit the formal report on cycle-specific parameter limits to the Commission for information; and

(3) The modification of individual TS to note that cycle-specific parameters shall be maintained within the limits provided in the defined formal report.

Entergy originally implemented this alternative at GGNS via TS Amendment 106.[8]

To aid licensees with implementing the alternative of GL 88-16, the nuclear industry's Technical Specification Task Force developed and submitted to the NRC staff for approval Technical Specification Task Force Improved Standard Technical Specifications Change Traveler TSTF-363-A, *Revise Topical Report References in ITS 5.6.5, COLR*. The TSTF revised the requirement to identify the topical reports by number, title, date, and NRC staff approval document in Improved Technical Specifications (ITS) Section 5.6.5, "Core Operating Limits Report (COLR)," to allow the topical reports to be identified by number and title, only. TSTF-363-A added a requirement to specify the complete citation in the COLR for each topical report, including the report number, title, revision, date and any supplements. The NRC approved the use of this TSTF on April 13, 2000.

The information currently provided in GGNS TS 5.6.5.a and 5.6.5.b conforms to the guidance contained in both GL 88-16, as implemented via TS Amendment 106, and TSTF-363-A. Therefore, no revisions to this information are required at this time.

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[8] NRC Letter to Entergy Operations, Inc., *Issuance of Amendment No. 106 to Facility No. NPF-29 – Grand Gulf Nuclear Station, Operating License Unit 1 (TAC No. M84829)*, January 21, 1993

ATTACHMENT 2

GNRO-2010-00035

LICENSEE-IDENTIFIED COMMITMENTS

LICENSEE-IDENTIFIED COMMITMENTS

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
1. Entergy will conduct the OPRM Monitoring Period for 90 days following startup from the 2012 refueling outage. This action replaces the one in the PRNM System LAR that stated, "Entergy will conduct a monitoring period of the OPRM for a minimum of 90 days not to exceed one fuel cycle after plant startup following the 2012 refueling outage to be successfully completed prior to enabling the OPRM."	√		90 days following startup from the 2012 refueling outage
2. The use of the DSS-CD algorithm trip is not within the scope of the PRNM System LAR; therefore, it will be jumpered out until GGNS implements MELLLA+.		√	Until implementation of MELLLA+