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**Attachment 1 contains proprietary information.**

GNRO-2011/00037

May 11, 2011

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

SUBJECT: Request for Additional Information Regarding  
Extended Power Uprate  
Grand Gulf Nuclear Station, Unit 1  
Docket No. 50-416  
License No. NPF-29

REFERENCES: 1. Email from A. Wang to F. Burford dated April 12, 2011, GG EPU  
Nuclear Performance and Code Review Branch Request for Additional  
Information (ME4679) (Accession Number ML111030111)  
2. License Amendment Request, Extended Power Uprate, dated  
September 8, 2010 (GNRO-2010/00056, Accession Number  
ML102660403)

Dear Sir or Madam:

The Nuclear Regulatory Commission (NRC) requested additional information (Reference 1) regarding certain aspects of the Grand Gulf Nuclear Station, Unit 1 (GGNS) Extended Power Uprate (EPU) License Amendment Request (LAR) (Reference 2). Attachment 1 provides responses to the additional information requested by Nuclear Performance and Code Review Branch.

GE-Hitachi Nuclear Energy Americas, LLC (GEH) consider portions of the information provided in support of the responses to the request for additional information (RAI) in Attachment 1 to be proprietary and therefore exempt from public disclosure pursuant to 10 CFR 2.390. An affidavit for withholding information, executed by GEH, is provided in Attachment 3. The proprietary information was provided to Entergy in a GEH transmittal that is referenced in the affidavit. Therefore, on behalf of GEH, Entergy requests to withhold Attachment 1 from public disclosure in accordance with 10 CFR 2.390(b)(1). A non-proprietary version of the RAI responses is provided in Attachment 2.

No change is needed to the no significant hazards consideration included in the initial LAR (Reference 2) as a result of the additional information provided. There are no new commitments included in this letter.

**When Attachment 1 is removed, the entire letter is non-proprietary.**

If you have any questions or require additional information, please contact Jerry Burford at 601-368-5755.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 11, 2011.

Sincerely,



MAK/FGB/dm

Attachments:

1. Response to Request for Additional Information, Nuclear Performance and Code Review Branch (Proprietary)
2. Response to Request for Additional Information, Nuclear Performance and Code Review Branch (Non-Proprietary)
3. GEH Affidavit for Withholding Information from Public Disclosure

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. A. B. Wang, NRR/DORL (w/2)  
**ATTN: ADDRESSEE ONLY**  
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State Health Officer  
Mississippi Department of Health  
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NRC Senior Resident Inspector  
Grand Gulf Nuclear Station  
Port Gibson, MS 39150

**Attachment 2**

**GNRO-2011/00037**

**Grand Gulf Nuclear Station Extended Power Uprate**

**Response to Request for Additional Information**

**Nuclear Performance and Code Review Branch**

**Non-Proprietary**

This is a non-proprietary version of Attachment 1 from which the proprietary information has been removed. The proprietary portions that have been removed are indicated by double square brackets as shown here: [[ ]].

Non-Proprietary

**Response to Request for Additional Information  
Nuclear Performance and Code Review Branch**

By letter dated September 8, 2010, Entergy Operations, Inc. (Entergy) submitted a license amendment request (LAR) for an Extended Power Uprate (EPU) for Grand Gulf Nuclear Station, Unit 1 (GGNS). The U.S. Nuclear Regulatory Commission (NRC) staff has determined that the following additional information requested by the Nuclear Performance and Code Review Branch (Accession Number ML111030111) is needed for the NRC staff to complete their review of the amendment. Entergy's response to each item is also provided below.

**RAI # 1**

The previous small break LOCA analysis limiting break PCT was identified as 1322 F at 4025 Mwt. The EPU PCT for the limiting small break at 4408 Mwt is listed as 1360 F. Please explain why the increase is only 38 F when the power level increases by 383 Mwt.

**Response**

The small break peak clad temperature (PCT) results at current licensed thermal power (CLTP) are bounded by the small break PCT results at uprated power. The increased decay heat associated with power uprate results in a longer automatic depressurization system (ADS) blowdown and a higher PCT for the small break loss-of-coolant accident (LOCA). The magnitude of the increase of 38°F for the small break PCT from CLTP to EPU is consistent with the small break increase in PCT results observed in representative analyses for other boiling water reactor (BWR) EPU applications. For example, the increase in PCT of 38°F for a 10 % increase in power from CLTP LOCA Analysis Basis power of 4025 MWt to EPU power of 4408 MWt is consistent with an increase in PCT of approximately 51°F for another plant implementing a 15 % increase in power from a stretch uprate power of 105 % original licensed thermal power (OLTP) to 120 % OLTP.

**RAI # 2**

Were any of the inputs or assumptions to the small break LOCA analysis changed or modified in the EPU analysis. If so, please describe and explain these changes.

**Response**

The only input parameters to the small break LOCA analysis that were changed from the CLTP to the EPU small break LOCA analysis were the reactor heat balance parameters regarding core thermal power and vessel steam flow. There were no changes to the emergency core cooling system (ECCS) performance parameters in the design input. There were no changes to the assumptions in the small break LOCA analysis in the EPU analysis.

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**RAI # 3**

Since the power level increases in the average and low power bundles, the higher power levels in the peripheral bundles is expected to degrade the downflow from core spray pooling in the upper plenum. As such, the top down flow and bottom up cooling from the core spray is expected to be decreased, increasing PCT in the hot bundle, even though the hot bundle power level remains the same. Please explain.

**Response**

NEDE-23785-1-PA, *The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident*, indicates SAFER is essentially a one-dimensional model. In order to use SAFER to realistically predict BWR LOCA transients when multi-dimensional effects are important, semi-mechanistic multi-dimensional models have been implemented. Different flow regimes can exist simultaneously inside the channels during the LOCA event due to different channel power levels and orificing conditions as well as local subcooling in the peripheral upper plenum region when the core spray is actuated and the sparger is submerged. The different flow regimes are modeled with co-current upflow in the centrally located high power channels, countercurrent flow in the average power channels and liquid downflow in the peripheral low power channels.

The local fuel conditions are not significantly changed with constant pressure power uprate (CPPU) because the hot bundle operation is still constrained by the same operating thermal limits and the hot bundle power is held constant and unchanged with power uprate. CPPU affects the relative flow distribution between the hot and average channel. As the average channel power increases with power uprate, the fraction of the flow passing through the hot channel increases. The increased flow keeps the cladding temperature from increasing with CPPU. Because CPPU has such a small effect on the PCT, the system response over the large break spectrum will not be affected.

The single failure for the limiting PCT case is the high pressure core spray (HPCS) single failure event, which means both low pressure core spray (LPCS) and low pressure coolant injection (LPCI) are available. The LPCS and LPCI are from different locations, from the top for LPCS and from the side for LPCI, so this is not a LPCS injection only event. Therefore, given all these competing factors involved with the event the net result is usually a small change in the PCT and not necessarily an increase from CLTP to EPU. EPU LAR Attachment 5 Table 2.8-7 shows a small decrease in PCT for the limiting Appendix K large break from CLTP to EPU.

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**RAI # 4**

While the hot bundle power is stated to remain the same at EPU conditions, some power increases although small could occur at EPU conditions. Do the LOCA analyses take into account these small power differences. Please explain.

**Response**

The hot bundle power is held constant and unchanged with power uprate. CPPU affects the relative flow distribution between the hot and average channel. As the average channel power increases with power uprate, the fraction of the flow passing through the hot channel increases. The increased flow keeps the cladding temperature from increasing with CPPU. The hot bundle is assumed to be operating at the thermal limits (minimum critical power ratio (MCPR), maximum average planar linear heat generation rate (MAPLHGR), and linear heat generation rate (LHGR)) in the analysis. These limits are not changed for EPU. The thermal limits are very conservative in the analysis and apply a 2 % uncertainty for the power.

**RAI # 5**

Please identify the References or provide the results and plots of the SBLOCA break spectrum analyses at EPU conditions.

**Response**

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**RAI # 6**

Please provide the results to show that a break in one of the ancillary lines line connect to the lower head is not limiting at EPU conditions (i.e. instrument line and drain line).

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**Response**

The instrument line and bottom drain line breaks were not explicitly analyzed because they are very small breaks with relatively low inventory loss and are bounded by the recirculation line break spectrum. The analysis of the recirculation line break conservatively includes the bottom drain line break with the recirculation line break since these lines are connected via the reactor water cleanup (RWCU) piping. The results for the recirculation line break analysis, which include the bottom drain line break, are provided in PUSAR Table 2.8-7. The instrument line is smaller than the drain line and higher in elevation than the drain line and therefore bounded by the recirculation line break.

**RAI # 7**

Please provide the analysis of a ruptured core spray line to show a break in this location is not more limiting at EPU conditions.

**Response**

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**RAI # 8**

Does a RELAP5 input deck exist for this plant? If so, please provide the input deck and nodalization.

**Response**

No, the SAFER/GESTR methodology is used with SAFER base-deck input files.

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Figure 1-a. Water Level in Hot and Average Channels,  
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Figure 1-b. Reactor Vessel Pressure,  
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Figure 1-c. Peak Cladding Temperature,  
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Figure 1-d. Heat Transfer Coefficients,  
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[[ Figure 1-e. ECCS Flows,

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Figure 2-a. Water Level in Hot and Average Channels,

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[[ Figure 2-b. Reactor Vessel Pressure,

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Figure 2-c. Peak Cladding Temperature,  
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Figure 2-d. Heat Transfer Coefficients,  
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[[ Figure 2-e. ECCS Flows,

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Figure 3-a. Water Level in Hot and Average Channels,

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[[ Figure 3-b. Reactor Vessel Pressure,

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Figure 3-c. Peak Cladding Temperature,  
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Figure 3-d. Heat Transfer Coefficients,  
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Figure 3-e. ECCS Flows,

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**Attachment 3**

**GNRO-2011/00037**

**Grand Gulf Nuclear Station Extended Power Uprate**

**GEH Affidavit for Withholding Information from Public Disclosure**

# GE-Hitachi Nuclear Energy Americas LLC

## AFFIDAVIT

**I, James F. Harrison**, state as follows:

- (1) I am Vice President, Fuel Licensing, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas LLC (GEH), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.
- (2) The information sought to be withheld is contained in Enclosure 1 of GEH letter, GEH-GGNS-AEP-440, “NRC Nuclear Performance and Code Review Branch RAIs,” dated May 11, 2011. The GEH proprietary information in Enclosure 1, which is entitled “GEH Responses to GGNS NRC SNPB RAIs (Proprietary)” is identified by a dotted underline inside double square brackets. [[This sentence is an example.<sup>{3}</sup>]] Figures containing GEH proprietary information are identified with double square brackets before and after the object. In each case, the superscript notation <sup>{3}</sup> refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.
- (3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act (“FOIA”), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F2d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F2d 1280 (DC Cir. 1983).
- (4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:
  - a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;
  - b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;
  - c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;



## GE-Hitachi Nuclear Energy Americas LLC

- d. Information that discloses trade secret and/or potentially patentable subject matter for which it may be desirable to obtain patent protection.
- (5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary and/or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).
- (6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited to a “need to know” basis.
- (7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary and/or confidentiality agreements.
- (8) The information identified in paragraph (2), above, is classified as proprietary because it contains results of analysis performed by GEH to support Grand Gulf Nuclear Station Extended Power Uprate (EPU) license application. This analysis is part of the GEH EPU methodology. Development of the EPU methodology and the supporting analysis techniques and information, and their application to the design, modification, and processes were achieved at a significant cost to GEH.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience databases that constitute a major GEH asset.

## GE-Hitachi Nuclear Energy Americas LLC

- (9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 11<sup>th</sup> day of May 2011.



James F. Harrison  
Vice President, Fuel Licensing  
GE-Hitachi Nuclear Energy Americas LLC  
3901 Castle Hayne Rd.  
Wilmington, NC 28401