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Proprietary Notice
This letter forwards proprietary information in accordance with 10CFR2.390. Upon the removal of Enclosure 2, the balance of this letter may be considered non-proprietary.

MFN 09-333 Supplement 1

Docket No. 52-010

March 15, 2010

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Supplemental Response to NRC RAI Letter No. 314 Related to ESBWR Design Certification Application – DCD Tier 2 Section 3.9 – Mechanical Systems and Components; RAI Number 3.9-144 S02**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) supplemental response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) letter number 314 sent by NRC letter dated March 18, 2009 (Reference 1). Reference 2 originally transmitted our response to RAI 3.9-144 S02. After review of Reference 2 by the staff it was determined that supplemental information was required to close out this RAI. The supplemental information to our response to RAI Number 3.9-144 S02 is found in Enclosure 1. Enclosure 2 contains changes to GEH LTR NEDE-33313P as a result of GEH's supplemental response to this RAI. Verified LTR changes associated with this supplemental response are identified in the LTR markups by enclosing the text within a black box.

Enclosure 2 contains GEH proprietary information as defined by 10 CFR 2.390. GEH customarily maintains this information in confidence and withholds it from public disclosure. Enclosure 3 is the non-proprietary version, which does not contain proprietary information and is suitable for public disclosure.

The affidavit contained in Enclosure 4 identifies that the information contained in Enclosure 2 has been handled and classified as proprietary to GEH. GEH hereby requests that the information in Enclosure 2 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17.

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NRO

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

References:

1. MFN 09-174 Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 314 Related to ESBWR Design Control Document* dated March 18, 2009

2. MFN 09-333 Letter from Richard E. Kingston, GEH to U.S. Nuclear Regulatory Commission, *Partial Response to NRC RAI Letter No. 320 Related to ESBWR Design Certification Application – DCD Tier 2 Section 3.9 – Mechanical Systems and Components; RAI Numbers 3.9-138 S02 and 3.9-144 S02* dated June 8th

Enclosures:

1. Supplemental Response to NRC RAI Letter No. 314 Related to ESBWR Design Certification Application - DCD Tier 2 Section 3.9 – Mechanical Systems and Components; RAI Number RAI 3.9-144 S02
2. Supplemental Response to NRC RAI Letter No. 314 Related to ESBWR Design Certification Application - LTR Markups RAI Number RAI 3.9-144 S02 - Proprietary Version
3. Supplemental Response to NRC RAI Letter No. 314 Related to ESBWR Design Certification Application - LTR Markups RAI Numbers RAI 3.9-144 S02 - Public Version
4. Affidavit

cc:	AE Cubbage	USNRC (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	HA Upton	GEH/San Jose (with enclosures)
	eDRF Section	0000-0101-6098 Rev. 2 (RAI 3.9-144 S02)

Enclosure 1

MFN 09-333
Supplement 1

Response to Portion of NRC Request for

Additional Information Letter No. 320

Related to ESBWR Design Certification Application

DCD Tier 2 Section 3.9 –

Mechanical Systems and Components;

RAI Number 3.9-144 S02

NRC RAI 3.9-144 S02

In response to RAI 3.9-144 (a) and (b), the applicant states that a proper distribution of the steam dryer pressure instrumentation is selected to provide a good measure of the acoustic loading through the frequency range of interest. However, the evaluation of the layout of the steam dryer pressure instrumentation locations using the RPV acoustic FEA model is not submitted. Similarly, the applicant states that the strain gages and accelerometers are mounted in locations that provide measurements that are strongly coupled with projected high stress locations. The applicant further states that the specific information utilized to verify the flow-induced vibratory load definition during startup testing will be described in a revision to Topical Report NEDE-33312P. "Steam-Dryer-Acoustic Load Definition." The applicant is requested to submit the following:

(i) Layout of the steam dryer pressure instrumentation locations or additional information on how the instrument locations will be determined and verified;

(ii) Specific information regarding the strain gage and accelerometer mounting locations or additional information on how the instrument locations will be determined and verified; and

(iii) Revised Topical Report NEDE-33312P providing specific information to be used for verifying the FIV load definition during startup testing.

In response to RAI 3.9-144 A (c) and (d), the applicant states that the main steam lines are instrumented to measure the acoustic pressures in the piping. These measurements, along with the steam dryer pressure measurements, are used as input to an acoustic model for determining the pressures acting on the steam dryer. The applicant plans to use this load definition in performing confirmatory structural evaluations. The applicant is requested to provide a detailed description of how the pressures acting on the steam dryer will be determined using the measured acoustic pressures in the main steam lines and on the steam dryer. In addition, the applicant needs to explain how it will account for, (i) the plant noise and the electrical noise, which may be present in the instrumentation system, in determining the acoustic pressure acting in the main steam lines, and, (ii) any circumferential variation in the wall thickness of the main steam lines.

GEH Response

Response to *(i)*: See the response to RAI 3.9-138 S02.

Response to *(ii)*: See the response to RAI 3.9-138 S02.

Response to *(iii)*: Topical Report NEDE-33312P will not be revised to provide specific information to be used for verifying the FIV load definition during startup testing. Instead, the methodology described in NEDC-33408P and NEDC-33408P, Supplement 1, will be used. The DCD will be revised to replace the reference to NEDE-33312P with

a reference to NEDC-33408P and NEDC-33408P, Supplement 1. DCD Tier 2 Appendix 3L Section 3L-4.6 describes that pressure strain and accelerometer data will be monitored during startup testing to assure that the dryer stress is maintained within acceptance limits and that following power ascension the dryer FIV loads will be regenerated with test data and the calculated dryer response and stress are reconciled against the measured data. The commitment to revise NEDE-33312P was made in the revised responses to RAIs 3.9-62, 3.9-63, 3.9-135 and 3.9-144 (MFN Letter 08-322) and is superseded by this response.

Determining Steam Dryer Pressures Using Main Steamline and Dryer Acoustic Pressures

NEDC-33408P, Supplement 1, describes the methodology for determining the pressures acting on the steam dryer using measured acoustic pressure in the main steam lines. NEDC-33408P describes the methodology for determining the pressures acting on the steam dryer using measured acoustic pressure on the dryer., and NEDC-33408P and NEDC-33408P Supplement 1 benchmark the methodology against plant data. DCD Tier 2 Appendix 3L will be revised to reference these documents. Note that although measured data from both steam dryer and main steam line instrumentation may be available for some plants, only the data judged to be most accurate will be used to calculate steam dryer pressure loads.

Accounting for Electrical and Plant Noise

Zero volt excitation data will be captured to determine the electrical noise present at the plant. The averaged 0-volt power spectral density (PSD) data will be plotted for each strain gage ring and compared with the bridge excitation data to separate the electrical sources from the acoustical ones. Noise associated with recirculation pump vane pass frequency is not an issue since the ESBWR does not use recirculation pumps. Plant noise (other than potentially the 60 Hz line noise) is typically not significant. DCD Tier 2 Appendix 3L will be revised to provide this additional information.

Accounting for Circumferential Variation in the Wall Thickness and Diameter

Variations in pipe wall thickness and diameter will be accounted for as described in NEDC-33408P, Supplement 1 [Reference 3L-9]. At MSL strain gage installation locations, pipe thickness and diameter measurements are taken to determine the local dimensions, variation in dimensions, and minimize uncertainty due to dimensional tolerance. DCD Tier 2 Appendix 3L will be revised to provide this additional information.

DCD Impact

DCD Tier 2 Sections 3L.4.6 and 3L.6 will be revised as noted in the attached markup. Note that References 3L-1, 3L-5, 3L-6 and 3L-8 will be revised to change "General Electric Company" to "GE Hitachi Nuclear Energy."

GEH Supplemental Response

~~Based on f~~Further discussion between GEH and the NRC identified concerns for follow-on ESBWR applications. The specific concerns were with respect to how potential differences in the MSL pressure measurement noise floor and the main steam line design configuration between the lead plant and follow-on units would be addressed,

Plant noise is inherent in the Transmatrix and bias and uncertainty evaluations used to determine the dryer pressure loads. A Transmatrix and biases developed from a plant with a higher noise floor may be less conservative if used on a plant with lower noise floor. The dryer and main steamlines will be instrumented for the lead ESBWR unit. An ESBWR-specific Transmatrix as well as biases and uncertainties will be developed based on the measurements taken during initial startup testing. The biases and uncertainties are evaluated in reference to the MSL noise floor of the initial plant based on the comparison of the measured and the predicted on-dryer pressures. Plant noise is implicitly included in the Transmatrix and bias evaluations from the MSL pressures, thus reducing the bias values. Therefore, the Transmatrix and biases developed from a plant with a higher noise floor may be less conservative if used on a plant with lower noise floor. The noise floor for the follow-on unit will be compared to the noise floor for the lead plant. If the noise floor on the follow-on unit is lower, then the impact of the lower noise floor on the ESBWR Transmatrix and the biases and uncertainties of the PBLE loads for that unit will be determined.

It should be noted that the noise floor concern is only relevant to the confirmatory dryer analyses for the follow-on units. The geometrical configuration of the vessel, steam dryer and main steamlines are the same as those for the instrumented lead plant. The follow-on unit operating conditions are also the same as those for the lead plant. Therefore, the dryer loading and stresses for the follow-on unit are expected to be the same as those for the lead plant. The noise floor only affects the measurements and confirmatory dryer analyses performed after startup of the follow-on unit.

The second concern is that changes in the main steamline configuration may invalidate the applicability of the ESBWR Transmatrix to the follow-on unit. It is expected that the design configuration of the Main Steamlines in the follow-on units will be the same as that for the initial ESBWR unit, a valid prototype. If a follow-on unit includes main steamline configuration design changes that may affect the pressure loading on dryer below 70 Hz (the upper cutoff frequency for the Transmatrix), then the MSL measurements from the follow-on unit will be compared to those from the lead plant. The Transmatrix and the load definition bias and uncertainty will be reevaluated as needed and used, or a safety factor agreed upon with the NRC will be applied to ~~in~~ the non-prototype plant confirmatory dryer stress analyses performed after the startup of the follow-on unit.

~~a~~Additional changes to NEDE-33313P and NEDO-33313 will be made to clarify the following.

- ~~The TransMatrix shall be developed from the on-dryer and MSL pressure measurements for the initial ESBWR plant. The corresponding bias and uncertainty is evaluated in reference to the MSL noise floor of the initial plant. The bias is based on the comparison of the measured and the predicted on-dryer pressures. Plant noise is implicitly included in the bias evaluation from the MSL pressures, thus reducing the bias value. Therefore, the bias from a plant with higher noise floor may be less conservative if used on a plant with lower noise floor.~~ If the noise floor on the follow-on unit is lower than that for the initial unit, then the impact of the lower noise floor on the ESBWR Transmatrix and the bias and uncertainty of the PBLE loads shall be determined for the follow-on unit. Revisions to the Transmatrix or the load definition bias and uncertainty values shall be documented in the confirmatory dryer stress evaluation report for the follow-on unit.~~If the noise floor for follow-on ESBWR plants is lower than the noise floor for the initial plant, the impact of the lower noise floor on the bias and uncertainty of the PBLE loads shall be determined. must be evaluated, and t~~The adjusted bias and uncertainty values must~~shall be approved by the NRC before being used in the stress evaluation of the follow-on plant~~, and
- If a follow-on unit includes Main Steamline configuration design changes that may affect the steam dryer pressure loads below 70 Hz (the upper cutoff frequency for the Transmatrix), then the MSL measurements from the follow-on unit will be compared to the measurements from the initial ESBWR unit, a valid prototype. The ESBWR Transmatrix and the bias and uncertainty of the PBLE loads will be reviewed and revised if needed for the follow-on non-prototype plant~~unit~~, or a safety factor agreed upon with the NRC will be applied to the non-prototype plant. Revisions to the Transmatrix or the load definition bias and uncertainty values shall be documented in the confirmatory dryer stress evaluation report for the follow-on unit.~~If the main steam line~~Main Steamline ~~design configuration for the follow-on plants is changed from~~not the same as that ~~for the initial plant and the associated design changes may affect the pressure loading on dryer, the MSL measurements from the follow-on plants will be compared to those from the initial plant and the bias and uncertainty will be re-evaluated. The adjusted bias and uncertainty values shall be approved by NRC before being used in confirmatory stress evaluations. , the Transmatrix from the initial plant cannot be used.~~

DCD/LTR Impact for Supplemental Response

NEDE-33313P and NEDO-33313 will be revised as shown in the attached markup.

Enclosure 3

MFN 09-333 Supplement 1

Supplemental Response to NRC Request for

Additional Information Letter No. 314

Related to ESBWR Design Certification Application

LTR Markup for RAI Number 3.9-144 S02

Public Version

9.0 STARTUP TEST ~~INSTRUMENTATION FOR MONITORING DRYER RESPONSE~~

9.1 ~~9.1~~ Instrumentation for Monitoring Steam Dryer Response

The ESBWR steam dryer is instrumented with temporary vibration sensors to obtain flow induced vibration data during power operation. The primary function of this vibration measurement program is to verify that the steam dryer can adequately withstand stresses from flow induced vibration forces for the design life of the steam dryer. Strain gages and accelerometers are used to monitor the structural response during power ascension and to validate the fatigue stress predictions in Section 7 for normal operation. Accelerometers are also used to identify potential rocking and to measure the accelerations resulting from support and vessel movements.

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In addition [[

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9.2 Startup Testing Acceptance Criteria

The structural analysis performed for the steam dryer design consists of a dynamic FEA. To address the uncertainty in the structural natural frequencies, the load definition frequencies are varied over a range of ±10% of nominal in 2.5% steps (nine cases total).

Similar to Subsection 3L.5.5.2, Step 5, for one-dimensional (uni-axial) structural responses and with the strain gage located at the maximum stress location in the steam dryer, the determination of strain measurement acceptance criteria would be:

$$\varepsilon = \sigma / (E)$$

where

σ = peak stress intensity allowable limit

E = Young's Modulus, 1.78 x 10^5 MPa (25.8 x 10^6 psi) at 288°C (550°F) for steam dryer material.

With a peak stress intensity allowable limit of 93.8 MPa (13,600 psi), the strain acceptance limit with the strain gage at the maximum stress location, is calculated as follows:

$\varepsilon = \sigma/(E) = 527$ με (zero-peak) or 1054 με (peak-peak)

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MFN 09-333 Supplement 1

Enclosure 4

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Larry Tucker, state as follows:

(1) I am the Manager, ESBWR Engineering, GE Hitachi Nuclear Energy ("GEH"), 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 2 of GEH letter MFN 09-333 Supplement 1, Mr. Richard E. Kingston to U.S. Nuclear Regulatory Commission, entitled *Supplemental Response to NRC RAI Letter No. 314 Related to ESBWR Design Certification Application – DCD Tier 2 Section 3.9 – Mechanical Systems and Components; RAI Number 3.9-144 S02,* dated March 15, 2010. The GEH proprietary information in Enclosure 2, which is entitled *Supplemental Response to NRC RAI Letter No. 314 Related to ESBWR Design Certification Application - LTR Markups RAI Number RAI 3.9-144 S02 - Proprietary Version* is delineated by a [[dotted underline inside double square brackets.{3}]]. Figures and large equation objects are identified with double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination. A non-proprietary version of this information is provided in Enclosure 3, *Supplemental Response to NRC RAI Letter No. 314 Related to ESBWR Design Certification Application - LTR Markups RAI Numbers RAI 3.9-144 S02 - Public Version*

(3) In making this application for withholding of proprietary information of which it is the owner, 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 qualify 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, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which 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 competitors without license from GEH constitutes a competitive economic advantage over other companies;
b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;
c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a., and (4)b, above.

(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, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on 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, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, 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 agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it identifies detailed GEH ESBWR design information. GEH utilized prior design information and experience from its fleet with significant resource allocation in developing the system over several years at a substantial cost.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GEH asset.

(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 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 15th day of March 2010.

Larry Tucker
GE-Hitachi Nuclear Energy Americas LLC