HITACHI

Proprietary Notice

This letter forwards proprietary information in accordance with 10CFR2.390. Upon the removal of Enclosure 1, the balance of this letter may be considered non-proprietary.

GE Hitachi Nuclear Energy

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MFN 12-040

Docket number: 05200010

May 8, 2012

Attn: David Misenhimer
US Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: NRC Requests for Additional Information Related to the Audit of the Economic Simplified Boiling Water Reactor (ESBWR) Steam Dryer Design Methodology Supporting Chapter 3 of the ESBWR Design Control Document – Draft Versions

In regard to the Requests for Additional Information that you have transmitted in your May 1, 2012 Letter, Reference 1, to support the NRC ESBWR Steam Dryer Methodology Audit conducted March 21 – 23, 2012 Docket 5200010, please find attached draft responses for RAIs 3.9-274 and 3.9-277. Enclosure 1 contains proprietary information. The proprietary information is contained within brackets [[ ]] and is designated in red and underlined to assist in identification. These draft RAIs contain proprietary information identified by GE Hitachi Nuclear Energy, Americas LLC., and should be protected accordingly. It is our understanding that these documents will be either destroyed after the NRC has completed the audit report, or protected from disclosure. An affidavit (provided as Enclosure 3) dated May 8, 2012, sets forth the basis for requesting that Enclosure 1 be withheld.

In the event that further revisions to requested documents, or other documents, are required to support post audit activities, GEH requests that the enclosed affidavit apply accordingly. A separate cover letter and affidavit will be provided for the final submitted responses.

If you have any questions concerning this letter, please contact Peter Yandow at 910-819-6378.

Sincerely,

Jerald G. Head
Senior Vice President, Regulatory Affairs

Commitments: None

Reference:

1. MFN 12-037 Letter from USNRC to Jerald G. Head, GEH, Subject: Request for Additional Information Letter NO. 414 related to ESBWR Design Certification Application (DCD) Revision 9" received May 1, 2012

Enclosures:

1. Draft Responses to RAIs 3.9-274 and 3.9-277 – Proprietary versions
2. Draft Responses to RAIs 3.9-274 and 3.9-277 - Public versions
3. Affidavit

cc: Glen Watford, GEH
Peter Yandow, GEH
Patricia Campbell, GEH
Mark Colby, GEH

Enclosure 2

MFN 12-040

Draft Responses for RAI 3.9-274 and 3.9-277

Public

MFN-12-040
Enclosure 2

NRC RAI 3.9-277

Summary: The staff's question is in regard to the use of specific types of welds in the ESBWR steam dryer and the justification for fatigue and quality factors for each weld type.

GEH is requested to discuss the use of specific types of welds in the ESBWR steam dryer and the justification for fatigue and quality factors for each weld type. In addition, GEH is requested to discuss the [[ ]] in the ESBWR steam dryer as described in NEDE 33313P, Rev 2. During the audit, the staff asked GEH to address the [[ ]] in the ESBWR steam dryer design, and how the [[ ]] will be conducted. At the audit, GEH made a definitive statement that the ESBWR steam dryer design [[ ]]. The staff noted that this is inconsistent with NEDE 33313P, Rev 2. Please provide clarification if [[ ]] in the ESBWR steam dryer.

GEH Response

References:

1.) AWS A3.0:2001 "Standard Welding Terms and Definitions"
2.) Letter from Richard E. Kingston, (GEH), to NRC, "Response to Portion of NRC RAI Letter No. 220 Related to ESBWR Design Certification Application - DCD Tier 2, Section 3.9 - Mechanical Systems and Components; RAI Number 3.9-214," January 30, 2009. (ADAMS Accession No. ML090340672).
3.) Letter from Richard E. Kingston, (GEH), to NRC, "Response to Portion of NRC RAI Letter No. 392 Related to ESBWR Design Certification Application - DCD Tier 2, Section 3.9 - Mechanical Systems and Components; RAI Number 3.9-214S02," December 4, 2009.
4.) Letter from Richard E. Kingston, (GEH), to NRC, "Subject: Response to NRC Report of the August 25, 2009, and September 9, 2009, Regulatory Audit of Reactor Pressure Vessel Internals of the Economic Simplified Boiling Water Reactor," October 8, 2009 (ADAMS Accession No. ML092860177).
5.) NEDE-33313P-A rev. 2, "ESBWR Steam Dryer Structural Evaluation", October 2010.

TYPES OF WELDS (ref. 1)

The specific types of welds used in ESBWR steam dryer design are groove welds and fillet welds. Note the other two basic types of welds, plug or slot welds and intermittent welds, are not used in ESBWR steam dryer design. This does not include the vanes used for moisture removal which may contain [[ ]]. The types of joints used in design may include butt joint, corner joint, T joint, lap joint, although an edge joint will not be considered as will be explained below.

In RAI 3.9-214 response (ref. 2), GEH states that the ESBWR steam dryer design maximizes the use of full penetration welds. In RAI 3.9-214S02 (ref. 3) GEH provided examples where joints were redesigned that increased the use of full penetration welds from BWR/6 to ABWR and then to ESBWR and BWR replacement steam dryers. In line with this type of design development philosophy, the ESBWR steam dryer [[ ]]. This design development philosophy is consistent across all ESBWR reactor internals (ref. 4's response to comment 1).

With respect to weld joint design philosophy for fatigue applications, the following is an explanation of how weld joints are considered for ESBWR design:

a.) Butt joints, NG-3352 Type I joints. Butt welds are full penetration groove welds. [[ ]].

b.) Corner joints, NG-3352 Type III joints. As indicated in DCD section 3L.2.3, joints are designed [[ ]].

c.) T-joint, NG-3352 Type V joints. T-joints will use [[ ]] as described in DCD Subsection 3L.2.3.

d.) Lap joint, NG-3352 Type V joints. All lap joints will be [[ ]].

e.) Edge joint, NG-3352 Type IV and VI joints. Not used, the edge joint [[ ]].

In summary, the welds used in ESBWR steam dryer design are full penetration groove welded butt joints, and [[ ]].

GEH discussed partial penetration welds in LTR NEDE-33313P-A and in a response to NRC Staff RAI 3.9-214.

In NEDE-33313P-A section 4.2, the 3rd paragraph discusses the difficulty of inspecting the root side of fillet welds, partial penetration welds and some groove welds. Partial

penetration welds were listed to provide an encompassing group of welds where the root side cannot be easily inspected. Listing partial penetration welds here does not imply their use in the ESBWR steam dryer.

In RAI 3.9-214, the fillet weld was [[

]]. The effective weld area is based on the effective throat or joint penetration times the effective weld length. For full penetration, the joint penetration is the thickness of the thinner member being joined (see figure 1).

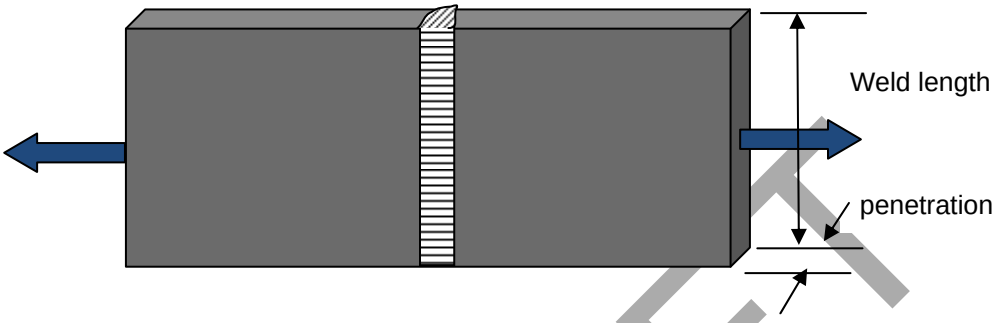

Figure 1: Full penetration groove welded butt joint.

For partial penetration welds and fillet welds, the effective throat or joint penetration is based on the actual penetration (see figure 2 below). In automatic or mechanized welding processes, the weld penetration can be controlled through weld qualification and weld process controls. However, in manual welding the heat input and other welding variables can vary which will affect joint penetration. Regardless of welding process, the fabricator is required to achieve fusion at the edge of the joint face, the minimum root fusion, without consuming this edge will lead to incomplete fusion. Therefore, in design, when the welding process is not defined to control penetration beyond the initial root, the fillet weld throat is based on the theoretical throat and partial penetration weld is based on the joint preparation depth. As depicted in figure 2, when achieving minimum root fusion the fillet weld partially penetrates the faying surface between the members.

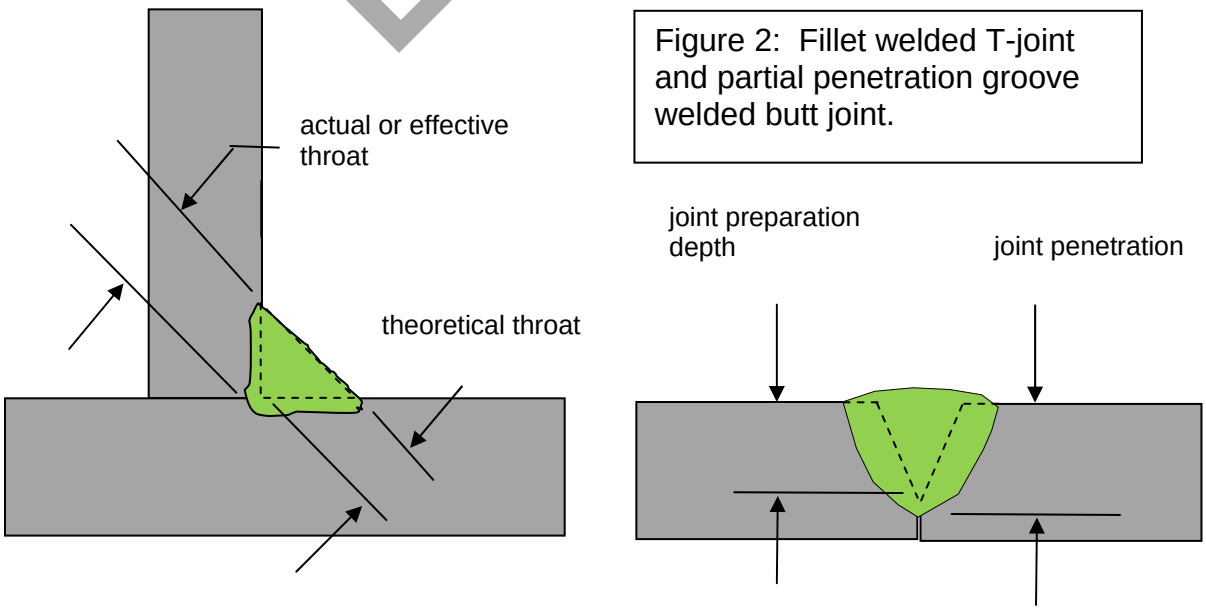

Figure 2: Fillet welded T-joint and partial penetration groove welded butt joint.

In NEDE-33313P-A, attachment 1, the NRC Staff discusses partial penetration welds in the final safety evaluation of the topical, where the weld [[

]].

[[

Figure 3: Full penetration groove welded butt joint
[[
]].

]]

Although [[

]].

JUSTIFICATION FOR FATIGUE AND QUALITY FACTORS

The SCFs (stress concentration factors), fatigue factors and quality factors, used for the ESBWR steam dryer welds are described in LTR 33313P-A section 4.1 and Figure 4-1.

Full penetration groove welded butt joints, corner joints and T-joints: NG-3352 Types I and III.

- for static applications [[

]].
- for fatigue applications where traditional strength of materials formulas are applied [[ ]]. This is consistent with ASME BPV Section III Subsection NG requirements.
- for fatigue applications where FEA is used, [[

]].

Fillet welded T-joints and lap joints: NG-3352 Type V.

- for static applications [[

]].
- for fatigue applications where traditional strength of materials formulas are applied [[ ]]. This is consistent with ASME BPV Section III Subsection NG requirements.
- for fatigue applications for FEA [[

]].
- for fatigue applications for FEA [[

]].

As stated in LTR 33313P-A section 4.1, if [[

]].

The specific types of welds used in ESBWR steam dryer design and the approach for analysis has not changed since responding to NRC staff RAI 3.9-214 with supplements, therefore GEH sees no changes to the referenced report or DCD.

DCD Impact

No change will be made to the DCD.

Licensing Topical Report Impact

No change will be made to LTR NEDE-33313P-A (ref. 2). This RAI response provides justification for continued applicability of the LTR.

NRC RAI 3.9.274

GEH is requested to describe the resolution of the main steam line (MSL) strain gage calibration errors in support of the ESBWR design certification application. GEH should include the 'pipe and beam' calibration report and the procedure used to correct for differences between benchmark and future plant strain gage models and installation configurations. GEH is requested to specify applicable ITAAC to confirm the accuracy of the strain gages prior to plant startup.

GEH response:

GEH identified certain under predictions of MSL gauges. These under predictions were not accounted for in the ESBWR LTRs submitted to the NRC for ESBWR design certification application reviews. GEH evaluated these under predictions and included them in the bias and uncertainty for the PBLE methodology described in NEDC-33601P. Later, during reviews of the GGNS steam dryer instrumentation, GEH undertook further evaluations. As explained below, these under predictions are included in the application of PBLE in the ESBWR LTRs. In addition, instrumentation requirements are further evaluated prior to use in testing as part of COL Information Item 3.9.9-1-A in accordance with RG 1.20 programmatic guidance for flow-induced vibration program pre-operational and startup testing.

The approximately [[

]] are not all directly related to each other. [[ ]] addresses the models of strain gages used at Quad Cities Unit 2 (QC2), Susquehanna Unit 1 (SSES1), and Grand Gulf Nuclear Station Unit 1 (GGNS). [[

]]

The model number nomenclature of the Hitec weldable gages is as follows:

H – Hitec

B - Bonded

W – Weldable

A – Adhesive: Flame Sprayed Alumina

K – Sensing Alloy: “K” Alloy

35 – Gage resistance of 350 Ω

250 – Active Grid Length, thousandths of an inch

6 - Compensation for Steel

6 or 10 – Cable length in feet

FG - Fiberglass Braid Lead Wire

Shield or SHLD – Cable incorporates a shield

HB – Half Bridge configuration (1 active gage and 1 compensating gage)

The strain gages used on the MSLs at these plants [[.

]]

[[

]] The following sections discuss the MSL strain measurements at QC2 in May, 2005, at SSES1 in April and May, 2008, and at GGNS in October and November, 2008. The gages discussed in [[

]]

[[

]]

The last section discusses on-dryer instrumentation. GGNS is moving forward on instrumentation of the GGNS replacement dryer in order to supplement the MSL

strain gage measurements. The procedures used and lessons learned for on-dryer instrumentation at QC2 and SSES1 will be implemented.

The following sections address:

1. QC2 MSL measurements, May 2005
2. SSES1 MSL measurements, April-May 2008
3. GGNS and JAF MSL measurements, October-November 2008
4. [[
   ]]
5. [[ ]]
6. Accounting for MSL Pressure Under-Measurement in PBLE Process
7. Grand Gulf Unit 1 On-dryer Instrumentation

1. Quad Cities Unit 2

A replacement steam dryer was installed at QC2 in May 2005. Following the installation, MSL strain, dryer strain, dryer acceleration, and dryer dynamic pressure was recorded as the unit ascended in power.

The MSL strain gage measurement system was designed and installed by Exelon. The MSL strain gages were Hitec Products Model Number HBWAK-35-250-6-50FG-F. They were configured as opposed ½ bridges, with diametrically opposite gages forming the opposing arms of the bridge. [[

]]

MSL strain gage measurements were not taken during the primary system pressurization test at QC2.

Based on the equipment user's manual and operating experience [2], it is believed that the strain gage sensitivity was determined by a shunt calibration of the strain gage using an external shunt at the junction box for the MSL strain

gages in the data collection area. This shunt calibration was performed prior to the data acquisition after the MSLs were at operating temperature.

[[

]]

2. Susquehanna Unit 1

A replacement steam dryer was installed at SSES1 in April 2008. Following the installation, MSL strain, dryer strain, dryer acceleration, and dryer dynamic pressure were recorded as the unit ascended in power.

The MSL strain gage measurement system was designed and installed by PPL. The MSL strain gages were Hitec Products Model Number HBWAK-35-250-6-10FG-SHLD-HB. Note that these gages have the new design or wider cross-section. Figure 1 compares the original design to the new design.

MSL strain gage measurements were not taken during the primary system pressurization test at SSES1.

Based on the user's manual and operating experience, it is believed that the strain gage sensitivity was determined by a shunt calibration of the strain gage using the internal shunt capability of the VXI Technology EX1629 [3].

[[

]]

3. Grand Gulf Nuclear Station Unit 1 and James A. Fitzpatrick Unit 1

During RF-16 in September and October of 2008, strain gages were installed on the MSLs at GGNS. During RF-18 in September and October of 2008, strain gages were installed on the MSLs at JAF. [[

]] Further details of the GGNS MSL strain gage installation and testing are documented in [1].

[[

[[ ]]

]]

4. [[

]]

[[

]]

5. [[

]]

6. Accounting for MSL Under-Measurement in PBLE Process

No MSL strain data recording was performed during the primary system pressurization tests (hydro tests) at QC2 and SSES at the time of data collection from the sensors. [[

]]

During the QC2 PBLE benchmarking process, [[ ]] was developed for prediction of steam dryer loads based on the MSL acoustic pressure measurements. The [[

]]

[[

]]

[[

[[

]]

7. Grand Gulf Unit 1 On-dryer instrumentation

GGNS has elected to pursue on-dryer instrumentation for the GGNS replacement dryer. Specific details of the data acquisition system (DAS) are still being finalized. The planned strain gages are Kyowa Model KHC-10-120-G9, the model used on the QC2 and SSES1 replacement dryers, or an equivalent model.

[[

]]

For the GGNS on-dryer instrumentation, [[

|] The uncertainties used previously for on-dryer instrumentation are currently planned to be used for the GGNS on-dryer instrumentation.

The installation and data acquisition procedures for the GGNS on-dryer instrumentation will follow the procedures used at QC2 and SSES1 and incorporate operating experience from those measurement sessions.[[

]] The installation procedure, data acquisition procedure, instrumentation acceptance criteria, and instrumentation startup report from the previous work will be updated for GGNS. Examples of these documents from QC2 and SSES are [7], [8], [9], and [10]. Figure 3 is strain gage S9 as installed on the QC2 replacement steam dryer.

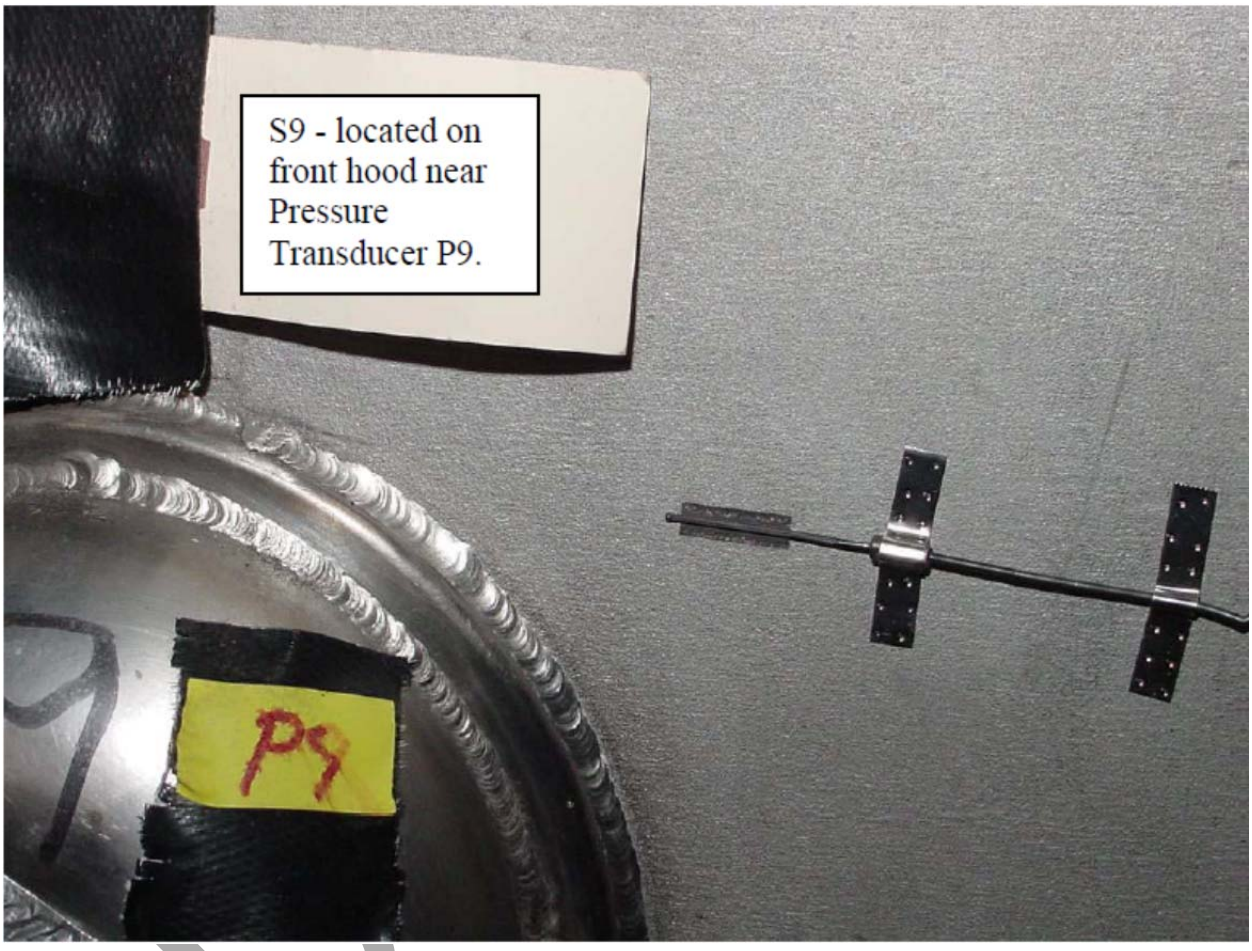

Figure 3: QC2 Replacement Dryer, Strain Gauge S9.

Specific ITAAC Criteria

Section 2.1.1, Reactor Pressure Vessel and Internals, of DCD Tier 1, Items (12), (13) and (14) all describe the strain gauges installed on the Steam Dryer. ITAAC 12, and 13 are the specific ITAAC related to the strain gauges. Section 3.9.2.3, which is designated as Tier 2*, describes the performance criteria of the strain gauges. Section 3.9.2.4 further amplifies the Initial Startup testing requirements including a discussion of the process, using the guidance of Regulatory Guide 1.20, for analyzing and using the information from these strain gauges.

In addition Section 3.9.2.4 of the DCD, Tier 2 states "*The Combined License (COL) Applicant will classify its reactor per the guidance in RG 1.20 and provide a milestone for submitting a description of the inspection and measurement programs to be performed (including measurement locations and analysis predictions) and the results of the vibration analysis, measurement and test program (COL 3.9.9-1-A*)." COL item 3.9.9-1-A states:

3.9.9-1-A Reactor Internals Vibration Analysis, Measurement and Inspection Program

The COL Applicant will classify its reactor per the guidance in RG 1.20 and provide a milestone for submitting a description of the inspection and measurement programs to be performed (including measurement locations and analysis predictions) and the results of the vibration analysis, measurement and test program (Subsection 3.9.2.4). This description of the inspection includes analysis predictions and the results of the tests which would address accuracy of the strain gauges.

References

[1] NEDC-33601P, Revision 0, Appendix G, Grand Gulf Nuclear Station Main Steam Line Strain Gauge Report, February 2009

[2] Yokogawa DL750/DL750P ScopeCorder User's Manual, IM 701210-05E, IM 701210-06E (filename: IM701210-04E_031_DL750Manual.pdf)

[3] VXI Technology EX1629 48-Channel Strain Gage Instrument User's Manual, P/N: 82-0109-000 (filename: EX1629 manual.pdf)

[4] NEDC-33601P Revision 1 Appendix C, GGNS Plant Based Load Evaluation Methodology Supplement 1, Sections 4.5.1.2 and 4.5.2.1.

[5] NEDC-33601P Appendix A, Steam Dryer Integrity Analysis Methodology.

[6] NEDC-33601P Revision 0, Engineering Report Grand Gulf Replacement Steam Dryer Fatigue Stress Analysis Using PBLE Methodology.

[7] 26A6487R3-NP, Steam Dryer Vibration Instrument Installation Procedure, April 2005 (NRC ADAMS Database ML051440097).

[8] 26A6492R2-NP, Steam Dryer Vibration Instrument Installation Procedure, April 2005 (NRC ADAMS Database ML051330051).

[9] Susquehanna Replacement Steam Dryer Instrumentation Acceptance Criteria – Dryer Mounted Instrumentation, Revision 2, February 2008 (NRC ADAMS Database ML080660255).

[10] Susquehanna Unit 1 Replacement Steam Dryer Vibration Instrumentation Program NRC Summary Test Report, July 2008 (NRC ADAMS Database ML082830074).

DCD and LTR Impact

No changes will be made to the DCD or applicable LTRs.

Enclosure 3

MFN 12-040

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, **Jerald G. Head**, state as follows:

(1) I am the Senior Vice President, Regulatory Affairs of 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 and have determined that it should be withheld from public disclosure for reason(s) identified in paragraph (4).

(2) The information sought to be withheld is contained in GEH draft responses to NRC Requests for Additional Information, as provided, in the NRC Letter "Requests for Additional Information Letter NO. 414 Related To ESBWR Design Certification Application (DCD) Revision 9." The information includes draft documents transmitted electronically as attachments to an electronic message from Peter Yandow (GEH) to David Misenhimer (NRC), with the subject "Draft ESBWR SD RAIs", dated May 8, 2012. GEH considers parts or all of these documents to be proprietary and therefore are so delineated by a [[dotted underline inside double square brackets $^{(3)}$]] and are GEH proprietary information. In each case, the superscript notation $^{(3)}$ refers to Paragraph (3) of this affidavit, which provides the basis for this proprietary information. GEH does not consider these documents to be transmitted to the NRC as records. Rather, the documents are provided solely for purposes of facilitating the referenced NRC/GEH discussions in a timely manner and GEH expects that the documents will be returned to GEH at the end of the discussions. This affidavit also covers any other proprietary documents that GEH may provide to the NRC during further discussions related to the subject RAIs, while those documents may be in the possession of the NRC for purposes of the discussion. GEH will submit final responses using its' normal process and include a separate affidavit accordingly. Providing this affidavit to cover proprietary information that the NRC may have in its possession for purposes of performing a review of information during said discussions is consistent with NRC guidance (see NRC MC 0620).

(3) In making this application for withholding and determination 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 GEH and/or 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, that may include potential products of GEH.

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 the 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 communicates sensitive business information regarding commercial communications, plans, and strategies associated with future actions related to GEH's extensive body of technology, design, and regulatory information.

(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 8th day of May 2012.

Jerald G. Head
GE-Hitachi Nuclear Energy Americas LLC