HITACHI

Proprietary Notice

This letter forwards proprietary information in accordance with 10 CFR 2.390. Upon the removal of Enclosure 1, the balance of this letter may be considered non-proprietary.

GE Hitachi Nuclear Energy

Jerald G. Head
Senior Vice President, Regulatory Affairs

PO Box 780 M/C A-18
Wilmington, NC 28402-0780
USA

T 910 819 5692
F 910 362 5692
jerald.head@ge.com

MFN 12-076

Docket number: 05200010

June 19, 2012

US Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Attn: David Misenhimer

Subject: **NRC Requests for Additional Information (RAI) 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 Response for RAI 3.9-285**

In regard to the Requests for Additional Information transmitted in your May 1, 2012, Letter (Reference 1) to support the NRC ESBWR Steam Dryer Methodology Audit conducted March 21–23, 2012, Docket 05200010, please find attached draft response for RAI 3.9-285.

Enclosure 1 contains the complete draft response, with proprietary information identified within brackets [[ ]], and designated in red and dotted underline text, to assist in identification. The proprietary information, as identified by GE Hitachi Nuclear Energy, should be protected accordingly.

Enclosure 2 contains the draft response with the proprietary information redacted, and is acceptable for public release. Enclosure 3 provides an affidavit which sets forth the basis for requesting that Enclosure 1 be withheld from the public.

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. 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 Response for RAI 3.9-285 - Proprietary Version
2. Draft Response for RAI 3.9-285- Non-Proprietary Version
3. Affidavit for MFN 12-076

cc: Glen Watford, GEH
Peter Yandow, GEH
Patricia Campbell, GEH
Mark Colby, GEH
Tim Enfinger, GEH
Gerald Deaver, GEH
eDRF Section: 0000-0146-9743

Enclosure 2

MFN 12-076

Draft Response for RAI 3.9-285

NRC RAI 3.9-285

Summary: The staff's question is in regard to clarifying the "peak" stress from the shell model.

During the audit, the staff and GEH discussed at length the calculation methods identified in Section 4.1 and Figure 4-1 of Reference 1, related to the prediction of the alternating peak stress intensity for the fatigue evaluation of fillet welds. As an example, GEH described in detail its response to a GGNS RAI that addressed the same issue. The response to the GGNS RAI provided a single comparison between 2 methods discussed in NEDE 33313P, Rev 2 for fillet welds. These are method (1) calculation of [[

]]; and method (2) selection of the [[

]].

The staff requested clarification of the [[ ]] stress from the shell model. GEH explained that this [[

]]. In the example presented by GEH, there are 6 shell elements sharing the target node. The local geometry is very complex. GEH [[

]]. This value is compared directly to the material fatigue endurance limit (10^{11} cycles), from the ASME applicable design fatigue curve.

Based on the one example presented, method (2) produced an acceptable result, compared to method (1). GEH has developed a post-processing procedure (which is discussed in the LTR on page 5 of 37) to calculate [[

]], for use in method (1).

There was no theoretical basis presented for method (2). Based on GEH's response to staff questions at the audit, there does not appear to be one. GEH apparently developed method (2) based on comparison of a very limited sample set.

At this time, the staff is seeking a more comprehensive, quantitative technical basis for GEH's conclusion that method (2) provides equal or greater conservatism, compared to method (1). To this end, the staff requests GEH to perform a series of simple confirmatory analyses that the staff can reference in its safety evaluation of this issue. The basic model is a T-connection of 304 stainless steel plates, which may be considered to be of infinite longitudinal length. A unit strip may be used, reducing the problem to 2-D. The basic loading is in-plane membrane force and out-of-plane bending moment applied to the free end of the vertical (web) plate. The horizontal (flange) plate is constrained at both ends.

The staff requests the applicant to conduct a parametric study, varying the lengths and thicknesses of the 2 plates, and the ANSYS shell element refinement. The shell element refinement should be varied by a factor of ten, and should envelope typical shell

element lengths used in the steam dryer shell models. For each configuration, analyze a "unit" membrane force, a "unit" bending moment, and both applied simultaneously.

Using the shell element stress results from the ANSYS analyses, calculate the peak alternating stress intensities using method (1) and method (2), for each permutation. In the method (1) calculation, assume a range of acceptable fillet weld sizes, based on the thicknesses of the plates being joined. In the method (2) calculation, tabulate the results with and without the [[ ]] defined in the last paragraph on page 5 of 37 of Reference 1. Given the simplicity of the model and loading, an extensive parametric study should be designed and implemented, to confirm the validity of method (2). In addition, as a check on the implementation of method (1), compare the results of method (1) to alternating stress intensity predictions "using traditional weld stress formulas", as defined in B. on page 5 of 37, assuming complete load reversal (stress ratio = -1), for a representative subset of cases.

GEH Response

References:

1.) Letter from Richard E. Kingston, (GEH), to NRC, "Response to Portion of NRC RAI Letter No. 339 Related to ESBWR Design Certification Application - DCD Tier 2, Section 3.9 - Mechanical Systems and Components; RAI Numbers 3.9-215 S01 Parts A, B, C & D (revised) and 3.9-244 S01 (revised)," July 10, 2009 (ADAMS Accession No. ML091950502)
2.) NEDE-33313P-A rev. 2, "ESBWR Steam Dryer Structural Evaluation", October 2010

SUMMARY

For this T-joint weld stress study, comparing methods 1 and 2, method 2 with its [[ ]] with LTR 33313P-A section 4.1.

BACKGROUND

The example provided during the 2012 NRC staff audit was RAI 3.9-215S01 Part B (ref. 1). The staff member requested background on GEH's (3) approaches to determining stress in steam dryer welds. These (3) approaches are described in RAI 3.9-215S01 Part B:

1) [[ ]], the SCF of 4 is applied [[ ]].
2) [[ ]], the SCF of 1.8 is applied [[ ]].
3) [[ ]], the SCF of 1.8 is applied [[ ]].

The theoretical basis was explained by GEH during the audit, additional information can be found in license topical report NEDE-33313P-A (ref. 2) and the response to RAI 3.9-215S01 Part B. These approaches wer e previously accepted by the NRC Staff as documented in NEDE-33313P- A. The RAI questions the basis for method (2) and GEH's limited presentation of the method's proof of acceptability.

ANALYSIS INPUT

To provide information to conclude that method (2) provides a more conservative result than method (1) the NRC Staff requested GEH to perform additional analy ses. The NRC Staff requested that GEH use a T-joint for the analyses and to reduce the configuration to a 2-D approac h. A typical double sided fillet welded T-joint used for ESBWR steam dryer design is shown in figure 1, an ASME BPV Code Section III N G-3352 Type V weld joint.

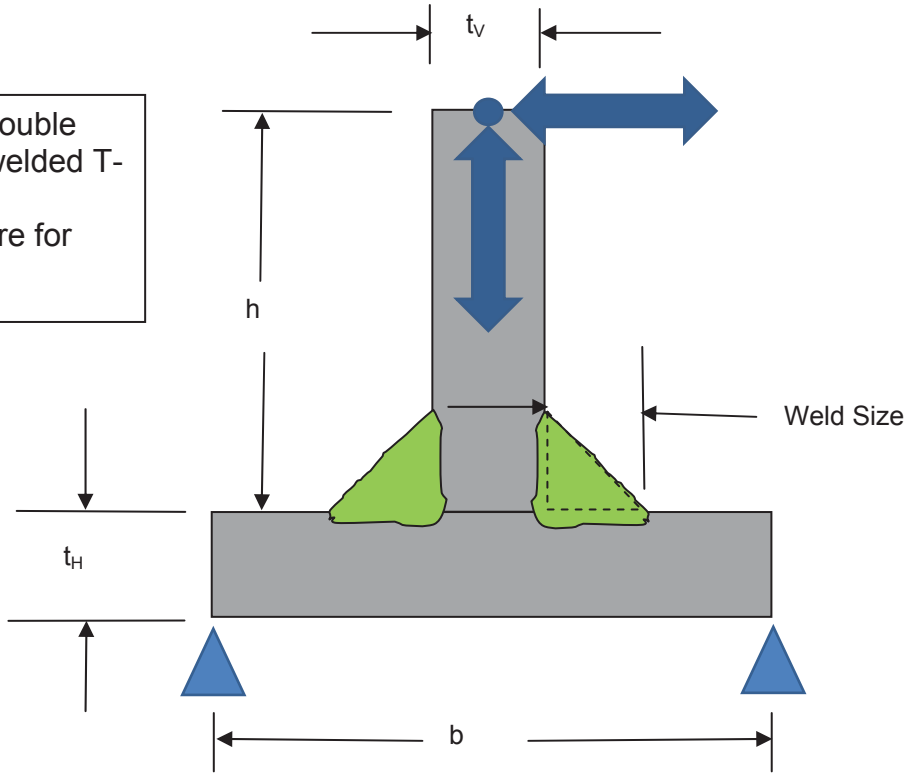

Figure 1: Double sided fillet welded T-joint with nomenclature for analyses.

ANALYSIS SET-UP

The following conditions were set up for the analysis:

a.) Horizontal and vertical plate thick nesses, t_H and t_V respectively, were selected to be representative of austenitic st ainless steel plate us ed in ESBWR steam dryer T-joint design. See table 1. To be representative $t_V \leq t_H$ for all cases.

b.) Fillet welds were select ed that represent the range that would be used for the plate thickness combination. See Table 1.

c.) Horizontal plate length "b" [[

]].

d.) Vertical plate height "h" was set equal to "b".

e.) The NRC Staff stated GEH may use of a T connection assuming infinite length and reduce the model to 2-D model elements, [[

]].

Table 1: Model Dimensions (inches)

[[

]]

ANALYSIS PROCEDURE – METHOD 1

a.) A force was applied parallel and perpendicular to the free end of the vertical plate.
$F_X = F_V = 100$ lb
$F_Z = F_H = 100$ lb
$M_Y = F_Z h = 2000$ in-lb

b.) The stress was determined using classical equations. Case 1 dimensions are used to provide the work.

[[

]]

c.) The [[ ]] was multiplied by the FSRF = 4.

ANALYSIS PROCEDURE – METHOD 2

a.) T-Joint cross-section was created similar to that shown in figure 2 for selec ted plate dimensions and weld size shown in Table 1.

[[

]]

b.) Nominal [[

]]. Mesh size 10x the nominal was used for the low density model (10”x10” element size). Mesh size 0.1x nominal was for the high density study (0.1”x0.1” element size).

[[

]]

Figure 3: Shell models for T-joints arranged according to mesh density (from left to right: 10x, Nom, 0.1x)

c.) A force was simultaneously applied parallel and perpendicular to the free end of the vertical plate, see figure 4.
$F_X = F_V = 100$ lb
$F_Z = F_H = 100$ lb
$M_Y = F_Z h = 2000$ lb-in

[[

]]

Figure 4: ANSYS model showing boundary conditions and loading applications.

d.) The peak or highest stress was determined as explained in NEDE-33313P-A and multiplied by the FSRF = 1.8.
e.) The mesh sizes were varied and results obtained.
The [[

]].

g.) After running each shell model, [[

]].

ANALYSIS RESULTS

Table 2: Weld stress (psi) from methods 1 and 2 for varying plate lengths, plate thicknesses, weld sizes and mesh sizes.

[[

]]

Legend:
Dimensions in inches (t_H, t_V, w)
M(1) = method 1
M(2)N = method 2 with nominal mesh size
M(2)10N = method 2 with nominal mesh size increased
M(2) .1N = method 2 with nominal mesh size decreased
M(2)NW_R = method 2 with nominal mesh size and W_R
M(2)10NW_R = method 2 with nominal mesh size increased and W_R
M(2) .1NW_R = method 2 with nominal mesh size decreased and W_R

Weld stress for T-joint model using method 2 nominal mesh size:
was [[

-

]].

Weld stress for T-joint model using method 2 with 10X nominal mesh size:
was [[

-

]].

Weld stress for T-joint model using method 2 with 0.1X nominal mesh size:
was [[

-

]].

Figure 5 provides a graphical representation of the Table 2 results.

[[

]]

Figure 5: Weld Stress results comparing methods 1 and 2 with different plate sizes, weld sizes and [[
]].

CONCLUSIONS

For this T-joint weld stress study:

1.) when using a [[
]] weld stress.

2.) when using a [[
]] weld stresses.

3.) using method 2, with its [[ ]] with LTR 33313P-A section 4.1.

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).

MFN 12-076, Enclosure 3

GE-Hitachi Nuclear Energy Americas LLC AFFIDAVIT

I, **Patricia L. Campbell**, state as follows:

(1) I am the Vice President, Washington 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.

(2) The information sought to be withheld is contained in enclosure 1 of GEH's letter, MFN 12-076, Mr. Jerald G. Head to U.S. Nuclear Regulatory Commission, entitled "NRC Requests for Additional Information (RAI) 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 Response for RAI 3.9-285," dated June 19, 2012. The proprietary information in enclosure 1, entitled "Draft Response for RAI 3.9-285 - 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.

(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 ESBWR technology, design, and regulatory information and its protection is important to the design certification process.

(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 19th day of June 2012.

Patricia L. Campbell

Patricia L. Campbell
GE-Hitachi Nuclear Energy Americas LLC