



HITACHI

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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.

MFN 08-895

Docket No. 52-010

November 13, 2008

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

Subject: 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 Numbers 3.9-215 and 3.9-216

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) letter number 220 sent by NRC letter dated July 29, 2008 (Reference 1). RAI Numbers 3.9-215 and 3.9-216 are addressed in Enclosure 1.

Enclosure 1 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 2 is the non-proprietary version, which does not contain proprietary information and is suitable for public disclosure.

The affidavit contained in Enclosure 3 identifies that the information contained in Enclosure 1 has been handled and classified as proprietary to GEH. GEH hereby requests that the information in Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17.

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

Sincerely,

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 08-609 Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 220 Related to NEDE-33312P, "ESBWR Steam Dryer Acoustic Load Definition," NEDE-33313P, "Steam Dryer Structural Evaluation," NEDC-33408P, "ESBWR Steam Dryer-Plant Based Load Evaluation Methodology," NEDE-33259P, "Reactor Internals Flow Induced Vibration Program," and ESBWR Design Control Document, Revision 5, dated July 29, 2008*

Enclosures:

1. 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 Numbers 3.9-215 and RAI 3.9-216 - Proprietary Version
2. 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 Numbers 3.9-215 and RAI 3.9-216 - Public Version
3. 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 Numbers 3.9-215 and RAI 3.9-216 - Public Version - Affidavit

cc: AE Cabbage
RE Brown
DH Hinds
eDRF Sections

USNRC (with enclosures)
GEH/Wilmington (with enclosures)
GEH/Wilmington (with enclosures)
0000-0092-7093 R1 (RAI 3.9-215)
0000-0092-7094 (RAI 3.9-216)

Enclosure 2

MFN 08-895

**Response to Portion of NRC Request for
Additional Information Letter No. 220
Related to ESBWR Design Certification Application
DCD Tier 2 Section 3.9
Mechanical Systems and Components
RAI Numbers 3.9-215 and 3.9-216
Public Version**

NRC RAI 3.9-215

Summary: Provide the basis for validation of weld factors

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However, GEH does not explain how it will develop and validate these weld factors. Therefore, GEH is requested to provide the basis for validation of weld factors applied to the finite element model (FEM) analysis results.

GEH Response

For the ESBWR dryer structural analysis, GEH will apply the following weld factors [[]]

- A factor of 1.8 for fillet welds
- A factor of 1.4 for full and partial penetration welds

These are the same weld factors that have been applied to the operating fleet replacement steam dryer analyses performed by GEH and submitted to the NRC staff for review.

The justification for the use of the weld fatigue factors applied to the finite element model stress results is contained in the document GENE Report, DRF GE-NE 0000-0092-7093-1P, Class II, April 2005, "Recommended Weld Quality and Stress Concentration Factors for use in the Structural Analysis of Exelon Replacement Steam Dryer", which is provided as an attachment to this response. Although GE-NE 0000-0092-7093-1P was originally produced to support the design of the Quad Cities replacement dryers, it is applicable to the GEH method of evaluation of all steam dryers. Section 2.3 of GE-NE 0000-0092-7093-1P justifies the GEH use of a 1.8 weld fatigue factor for fillet welds and a 1.4 factor for full penetration welds when these concentration factors are applied to the [[

]] as the alternating stress intensity.

As stated in Section 2.3 of GE-NE 0000-0092-7093-1P a weld fatigue factor of 4.0 [[

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DCD Impact

No changes to LTR NEDE-33313P will be made in response to this RAI.

NRC RAI 3.9-216

Summary: Provide information about mesh size used for modeling

In Section 5.1, NEDE-33313P, Rev. 0, GEH does not provide sufficient detail on their finite element modeling and analysis procedure for the staff to determine their adequacy. Provide information about the mesh size used for modeling different parts of the dryer. Also provide mesh convergence studies in high strain and stress regions in the ESBWR dryer to assess whether the dimensions and mesh spacing used for the model are adequate and determine the associated errors.

GEH Response

As stated in NEDE-33312P, the ESBWR steam dryer will be similar to the ABWR steam dryer with improvements incorporated from experience on GEH replacement steam dryers. Table 3.9-216-1 provides information for the [[

]]. Figure 3.9-216-1 provides information concerning the location of the components indicated in Table 3.9-216-1.

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Table 3.9-216-1

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Figure 3.9-216-1

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DCD Impact

No changes to LTR NEDE-33313P will be made in response to this RAI.



GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose CA 95125

GENE Report
DRF GE-NE 0000-0092-7093-1
Class II
April 2005

Recommended Weld Quality and Stress Concentration Factors For use in the Structural Analysis of Exelon Replacement Steam Dryer

Prepared by:

H.S. Mehta

Reviewed by:

H. Hwang
L.F. Wellstein

Verified by:

R.M. Horn

Manager:

M.R. Schrag



**IMPORTANT NOTICE REGARDING THE
CONTENTS OF THIS REPORT**

Please Read Carefully

The information contained in this document is furnished as reference to the NRC Staff for the purpose of obtaining NRC approval of the ESBWR Certification and implementation. The only undertakings of GE Hitachi Nuclear Energy (GEH) with respect to information in this document are contained in contracts between GEH and participating utilities, and nothing contained in this document shall be construed as changing those contracts. The use of this information by anyone other than for which it is intended is not authorized; and with respect to any unauthorized use, GEH makes no representation or warranty, and assumes no liability as to the completeness, accuracy, or usefulness of the information contained in this document.

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Table of Contents

1	INTRODUCTION.....	1
2	SUBSECTION NG GUIDANCE.....	1
2.1	The NG Weld Design Factors.....	2
2.2	Weld Quality Factors.....	2
2.3	Weld Fatigue Factors.....	2
3	GUIDANCE FOR APPLICATION TO REPLACEMENT STEAM DRYER.....	4
3.1	Weld Quality Factors.....	4
3.2	Weld Fatigue Factors.....	5
4	SUMMARY AND CONCLUSIONS.....	6
5	REFERENCES.....	6

1 INTRODUCTION

The stress analysis of the replacement steam dryer for the Quad Cities, Unit 1 will be conducted per the guidelines provided in Subsection NG of the ASME Boiler & Pressure Vessel Code (Reference 1). The allowable stress intensities in Subsection NG are essentially the same as that in Subsection NB. [[

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2 SUBSECTION NG GUIDANCE

The requirements for the acceptability of a design by analysis for a core support structure are set forth in Paragraph NG-3200. These requirements are essentially the same as those set forth in Paragraph NB-3200 of Subsection NB. Subparagraph NG-3350 sets forth the requirements for the design for welded construction of core support structures. This Subparagraph establishes the types of welded joints that may be used in the core support structures. Before discussing the details of NG guidance, [[

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2.1 The NG Weld Design Factors

As noted earlier, Paragraph NG-3350 recognizes several welded joint categories (A through E) and permissible types of welded joints (Types I through VIII). For each of these categories and weld joint types, Table NG-3352-1 (included here as Table 1) shows the values of 'n' and 'f' to be used. The value of 'n' can be considered as a joint efficiency factor. Subparagraph NG-3352 clarifies where the factors 'n' and 'f' are to be used in the stress analysis. The introductory paragraph of NG-3352 is reproduced below:

“Subject to the limitations given in NG-3351, core support structures may use any of the types of joints described in the following subparagraphs, providing the quality factor 'n' and fatigue factor 'f' used in the analysis meet the requirements of Table NG-3352-1 for the method of examination employed. The quality factor is used by multiplying the allowable stress limit for primary and secondary categories times the quality factor in evaluating the design. The use of weld quality factor n is for static, not fatigue applications. In performing a fatigue analysis, use the fatigue factor f, designated in Table NG-3352-1, and the applicable fatigue curve in Tables I-9.0.”

Detailed discussion on the use of the design factors is presented next.

2.2 Weld Quality Factors

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2.3 Weld Fatigue Factors

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The full value of SCF of 4.0 is to be [[

]] However, the SCF of 4 [[

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3 GUIDANCE FOR APPLICATION TO REPLACEMENT STEAM DRYER

Based on the discussion presented in the preceding section, recommended weld quality and fatigue factors for the replacement steam dryer are presented in this section.

3.1 Weld Quality Factors

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3.2 Weld Fatigue Factors

The recommended weld fatigue factors are a function of the details in the finite element model. [[

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For the case of Type I and III welded joints, the recommended SCF value is 1.4. [[

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4 SUMMARY AND CONCLUSIONS

This report was developed to provide guidance for the selection of weld quality and fatigue factors for the analysis of replacement steam dryer. Guidance from Subsections NG and NB of ASME Section III was used. [[

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5 REFERENCES

[1] ASME Boiler & Pressure Vessel Code, Section III, Subsection NG, 1998 Edition, including 2000 Addenda.

[2] ASME Boiler & Pressure Vessel Code, Section III, Subsection NB, 1998 Edition, including 2000 Addenda.

[3] [[

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[4] [[

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[5] [[

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[6] [[

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[7] [[

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**TABLE NG-3352-1
PERMISSIBLE WELDED JOINTS AND DESIGN FACTORS**

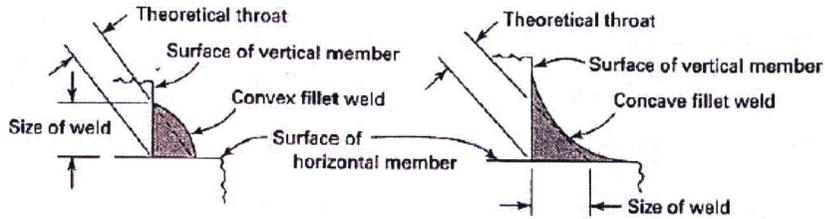
Type of Welded Joint	Permissible for Category Shown Below	Quality Factor and Fatigue Factor ¹				
		RT or UT ² and PT or MT Examination NG-5220	Progressive PT or MT Examination NG- 5231	Root and Final PT or MT Examination NG- 5232	Surface PT or MT Examination NG- 5233	Surface Visual Examination NG- 5260
I. Full penetration	A,B,C,D,E	$n = 1.0 f = 1$	$n = 0.9 f = 1$	$n = 0.75 f = 1$	$n = 0.65 f = 1$	$n = 0.5 f = 1$
II. Full penetration	A,B,C,D,E	$n = 1.0 f = 2$	$n = 0.9 f = 2$	$n = 0.75 f = 2$	$n = 0.65 f = 2$	$n = 0.5 f = 2$
III. Full penetration	C,D,E	$n = 1.0 f = 1$	$n = 0.9 f = 1^3$	$n = 0.75 f = 1^3$	$n = 0.65 f = 1^3$	$n = 0.5 f = 1^3$
IV. Double groove (RT not applicable)	A,B,C	$n = 0.5 f = 4$	$n = 0.45 f = 4$	$n = 0.4 f = 4$	$n = 0.35 f = 4$	$n = 0.25 f = 4$
	D,E	$n = 0.9 f = 4$	$n = 0.8 f = 4$	$n = 0.7 f = 4$	$n = 0.6 f = 4$	$n = 0.4 f = 4$
V. Double fillet (RT not applicable)	B,C	$n = 0.5 f = 4$	$n = 0.45 f = 4$	$n = 0.4 f = 4$	$n = 0.35 f = 4$	$n = 0.25 f = 4$
	D,E	$n = 0.9 f = 4$	$n = 0.8 f = 4$	$n = 0.7 f = 4$	$n = 0.6 f = 4$	$n = 0.4 f = 4$
VI. Single groove (RT not applicable)	D,E	$n = 0.6 f = 4$	$n = 0.55 f = 4$	$n = 0.45 f = 4$	$n = 0.4 f = 4$	$n = 0.35 f = 4$
VII. Single fillet (RT not applicable)	D,E	$n = 0.6 f = 4$	$n = 0.55 f = 4$	$n = 0.45 f = 4$	$n = 0.4 f = 4$	$n = 0.35 f = 4$
VIII. Intermittent fillet or plug	E	Not applicable	$n = 0.45 f = 4$	$n = 0.4 f = 4$	$n = 0.35 f = 4$	$n = 0.3 f = 4$

NOTES:

- (1) See NG-3352 for definitions.
- (2) Electroslag butt welds shall be examined by radiography. Electroslag welds in ferritic material shall also be examined for their full length by the ultrasonic method after a grain refining heat treatment, when performed, or after a postweld heat treatment.
- (3) A minimum fatigue strength reduction factor of 1.0 is permitted when both sides of weld are examined; otherwise a factor of 2.0 must be used in analysis for cyclic operation.

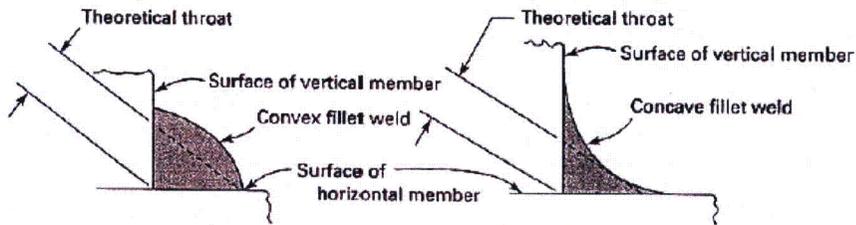
Table 1 Permissible Welded Joints and Design Factors in Subsection NG

Figure 2 Fillet Weld Details and Dimensions (NG-4427-1)



GENERAL NOTE: The size of an equal leg fillet weld is the leg length of the largest inscribed right isosceles triangle. Theoretical throat = $0.7 \times$ size of weld.

(a) Equal Leg Fillet Weld



GENERAL NOTE: The size of an unequal leg fillet weld is the shorter leg length of the largest right triangle which can be inscribed within the fillet weld cross section.

(b) Unequal Leg Fillet Weld

Figure 3 Weld Fatigue Factor Flow Diagram

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{3}]]

MFN 08-895

Enclosure 3

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, **David H. Hinds**, state as follows:

- (1) I am the Manager, New Units 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 1 of GEH letter MFN 08-895, Mr. Richard E. Kingston to U.S. Nuclear Regulatory Commission, entitled *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 Numbers 3.9-215 and 3.9-216*, dated November 13, 2008. The GEH proprietary information in Enclosure 1, which is entitled *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 Numbers 3.9-215 and 3.9-216 - 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 2, *2. 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 Numbers 3.9-215 and 3.9-216 - 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 GE ESBWR design information. GE 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 13th day of November 2008.



David H. Hinds
GE-Hitachi Nuclear Energy Americas LLC