GE-Hitachi Nuclear Energy Americas LLC

James C. Kinsey
Project Manager, ESBWR Licensing

PO Box 780 M/C J-70
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

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 07-348

Docket No. 52-010

June 21, 2007

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

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 85 Related to ESBWR Design Certification Application – RAI Numbers 21.6-96, 21.6-99 and 21.6-100**

Enclosure 1 contains GHNEA's response to the subject NRC RAIs transmitted via the Reference 1 letter.

Enclosure 1 contains GHNEA proprietary information as defined by 10 CFR 2.390. GHNEA customarily maintains this information in confidence and withholds it from public disclosure. A non-proprietary version is provided in Enclosure 2.

The affidavit contained in Enclosure 3 identifies that the information contained in Enclosure 1 has been handled and classified as proprietary to GHNEA. GHNEA hereby requests that the information of 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 regarding the information provided here, please contact me.

Sincerely,

James C. Kinsey

James C. Kinsey
Project Manager, ESBWR Licensing

D068

NRO

Reference:

1. MFN 07-054, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 85 Related to the ESBWR Design Certification Application*, January 19, 2007

Enclosures:

1. MFN 07-348 – Response to Portion of NRC Request for Additional Information Letter No. 85 – Related to ESBWR Design Certification Application –RAI Numbers 21.6-96, 21.6-99 and 21.6-100 – GE Proprietary Information
2. MFN 07-348 – Response to Portion of NRC Request for Additional Information Letter No. 85 – Related to ESBWR Design Certification Application –RAI Numbers 21.6-96, 21.6-99 and 21.6-100 – Non-Proprietary Version
3. Affidavit – James C. Kinsey – dated June 21, 2007

cc:	AE Cubbage	USNRC (with enclosures)
	DH Hinds	GHNEA Wilmington (with enclosures)
	BE Brown	GHNEA Wilmington (with enclosures)
	eDRF	0000-0066-6193, 0000-0068-7438, 0000-0068-7516

Enclosure 2

MFN 07-348

Response to Portion of NRC Request for

Additional Information Letter No. 85

Related to ESBWR Design Certification Application

RAI Numbers 21.6-96, 21.6-99, and 21.6-100

Non-Proprietary Version

This is a non-proprietary version of Enclosure 1 of MFN 07-348, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space inside open and closed bracket as shown here [[ ]].

NRC RAI 21.6-96

During the NRC Staff audit of TRACG as applied to ESBWR loss of coolant accident (LOCA) on December 11-15, and 19-20, GE stated that GE is using the PC version of TRACG04 for ESBWR LOCA analyses. The audit team viewed a document on the comparison of TRACG04A (Alpha VMS version) to the TRACG04P (PC) version. ("Comparison of TRACG Results for ESBWR ECCS & CONT Cases - PC versus ALPHA versions," DRF 0000-0054-3548 Section 0000-0055-6820, July 19, 2006) Please address the following:

A. State what version of TRACG04 (A or P) is being used for all ESBWR analyses using TRACG in DCD Chapters 4, 6 and 15.

B. The TRACG04A and P comparison that the staff viewed during the audit was for the limiting breaks in DCD Rev. 1, show the differences between TRACG04A and P for the limiting breaks in the most recent version of the DCD using the updated nodalizations.

C. The comparison between TRACG04A and P shows that TRACG04P predicts a long term drywell containment pressure lower by roughly 20kPa (or 3psi). For the DCD, Rev. 1 analyses the peak pressure was reached in the short term. For that calculation you stated -10-that the long term differences were not important for the peak pressure calculation. Rev. 2 of the DCD shows that peak pressure is reached in the long-term. Address the possible non-conservatism between TRACG04A and P for the long term peak pressure analysis in the latest revision of the DCD.

D. In your comparison between TRACG04A and P, you state that the reason for the difference in wetwell and drywell pressures was due to roundoff errors in non-condensible gas concentrations. The NRC staff is concerned that roundoff errors can have a substantial (roughly 7%) effect on calculated peak pressures. Address the concern that the TRACG04 and/or the ESBWR LOCA model may be hyper-sensitive to noncondensible gas concentrations.

GE Response

A. The version of TRACG04 (ALPHA or PC) being used for all ESBWR analyses using TRACG in DCD Tier 2 Revision 3 Chapters 4, 6 and 15 is addressed in the GE response to RAI 21.6-92.

B. The differences between ALPHA and PC versions of the TRACG04 code for the limiting break in the DCD Tier 2 Revision 3 analysis are summarized in Table 21.6-96-1 and Figures 21.6-96-1 to 21.6-96-3.

C. The main factors causing TRACG04 calculated containment pressure differences between ALPHA and PC code platforms are: (1) code changes in the PC to support larger size problems and (2) mathematical accuracy. The differences due to the code changes have been shown to be insignificant for the limiting break analysis. The differences due to mathematical accuracy, combined with the ability of the code to accurately predict non-condensable gas distribution in general can affect long-term DW pressure calculations. The maximum long-term DW pressure depends mainly on the amount of non-condensable gas remaining inside the DW.

In DCD Tier 2 Revision 3, configuration and nodalization changes (i.e., multiple flow path between the GDCS pool airspace and the DW) to improve circulation of non-condensable gas were applied to the containment design basis analyses. The implementation of these changes affected the limiting case response (i.e., long-term peak pressure) and maximized the calculated long-term DW pressure. The result of these changes is demonstrated in the limiting containment break case, where the non-condensable gas in the DW regions is purged completely at approximately 20 hrs into the transient in both code versions. This effect maximizes the long-term DW pressure and significantly reduces the containment pressure deviations caused by TRACG calculation of non-condensable gas distribution between the two code versions. Figures 21.6-96-4 to 21.6-96-6 compare the DW air pressures in the DW annulus regions (Level 30 and Level 34, Ring 6) and DW head airspace.

D. The differences in containment pressures between TRACG04 ALPHA and PC are mainly caused by mathematical accuracy differences between the two computer platforms and the ability of TRACG to accurately predict non-condensable gas distributions in general. The long-term peak pressure response is very sensitive to the amount of calculated non-condensable gas concentration remaining in the drywell. As such, small differences in input or numeric solution between the two codes can amplify containment pressure differences. In the DCD Tier 2 Revision 1 analysis, the drywell was not completely purged of non-condensable gas, thus causing long-term pressure differences to be in the order of 7%. A conservative approach to minimize the long-term pressure response sensitivity to non-condensable concentrations is to modify the input model nodalization to force all the air out of the drywell (see Response 21.6-96-C). This approach was applied in the DCD Tier 2 Rev. 3 analysis, reducing the long-term pressure differences between ALPHA and PC to < 1.0%, which is relatively small compared to the design limit margin of about 7% (413.7kPa). See Table 21.6-96-1 and Figures 21.6-96-1 to 21.6-96-3.

Similar levels of containment pressure differences between TRACG04 ALPHA and PC versions have been demonstrated in two of the ESBWR qualification test cases that simulate post-LOCA long-term cooling: PANDA Tests M03 (MSL break, base case) and M10B (M03 + all steam to DW1 and 1 PCCS out of service). Figures 21.6-96-7 and 21.6-96-8 compare predicted and measured drywell pressure response for PANDA M03 and PANDA M10B cases, respectively. The long-term pressure differences are < 2.0% among predicted TRACG04 ALPHA, predicted TRACG04 PC and test measurement plots for the two cases shown.

Table 21.6-96-1. Summary of Compared Results

Maximum DW Pressures and Minimum Chimney Collapsed Levels **Limiting Case: MSL Break, Bounding Conditions with Failure of 1 DPV**			
	ALPHA Version	**PC Version**	**% Diff (ALPHA – PC /ALPHA)**
Peak DW Pressure	384.23 kPa	384.18 kPa	<1.0%
Minimum Chimney Collapsed Level	9.349 m	9.275 m	<1.0%

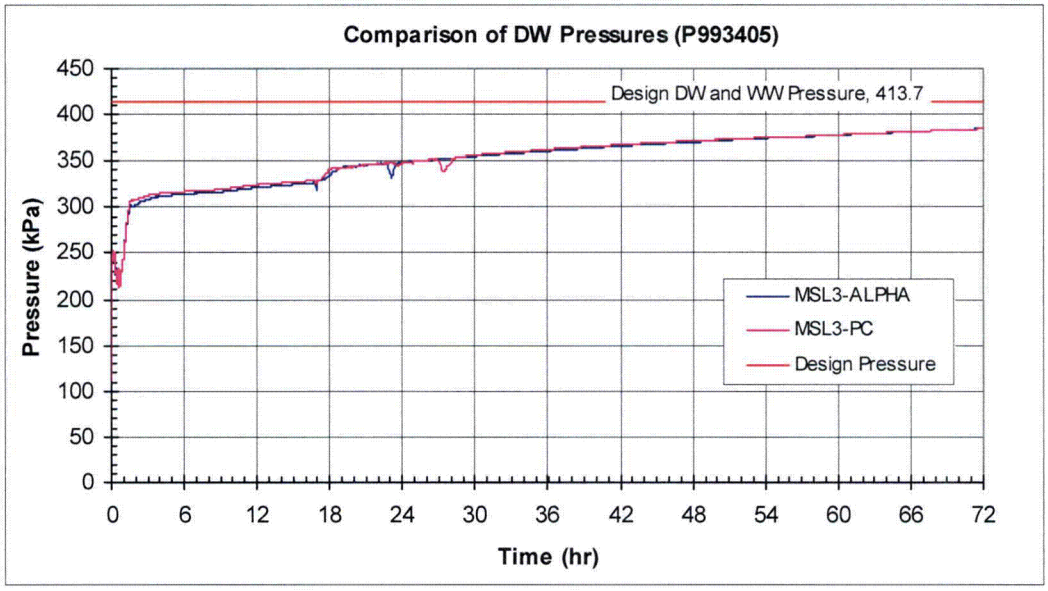

Figure 21.6-96-1. DCD (Rev.3) Analysis: MSL Break Containment Case – Comparison of Drywell Pressures

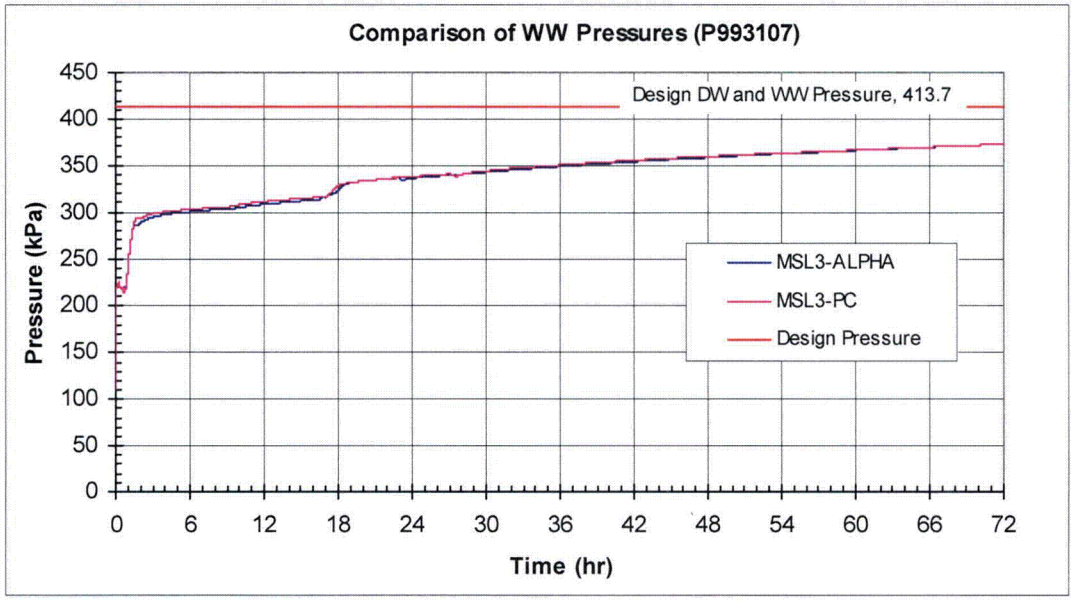

Figure 21.6-96-2. DCD (Rev.3) Analysis: MSL Break Containment Case – Comparison of Wetwell Pressures

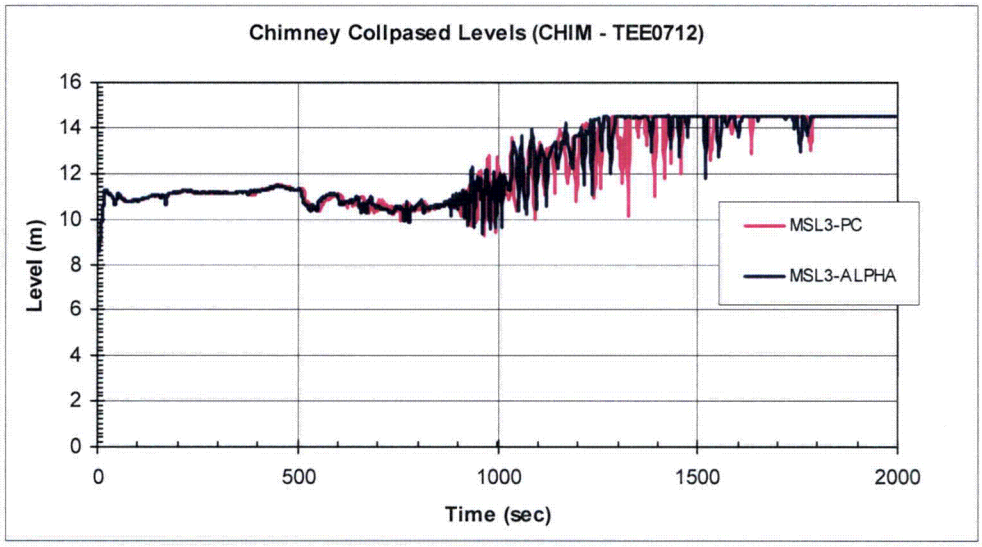

Figure 21.6-96-3. DCD (Rev.3) Analysis: MSL Break Containment Case – Comparison of Chimney Collapsed Levels

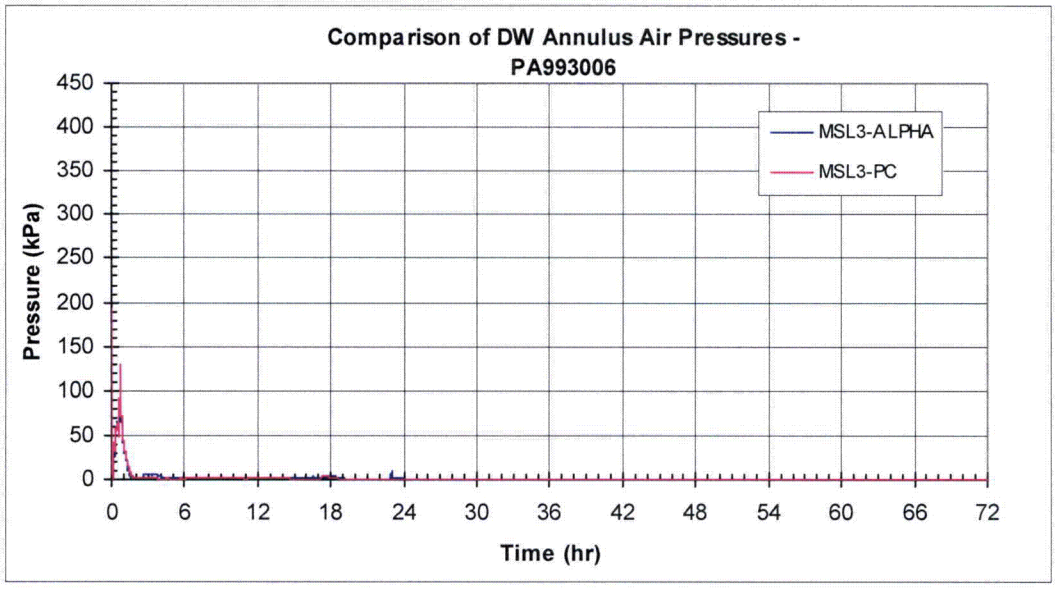

Figure 21.6-96-4. DCD (Rev.3) Analysis: MSL Break Containment Case – Comparison of DW Air Pressure at Level 30 (1 Level Below DW-WW Leakage Hole)

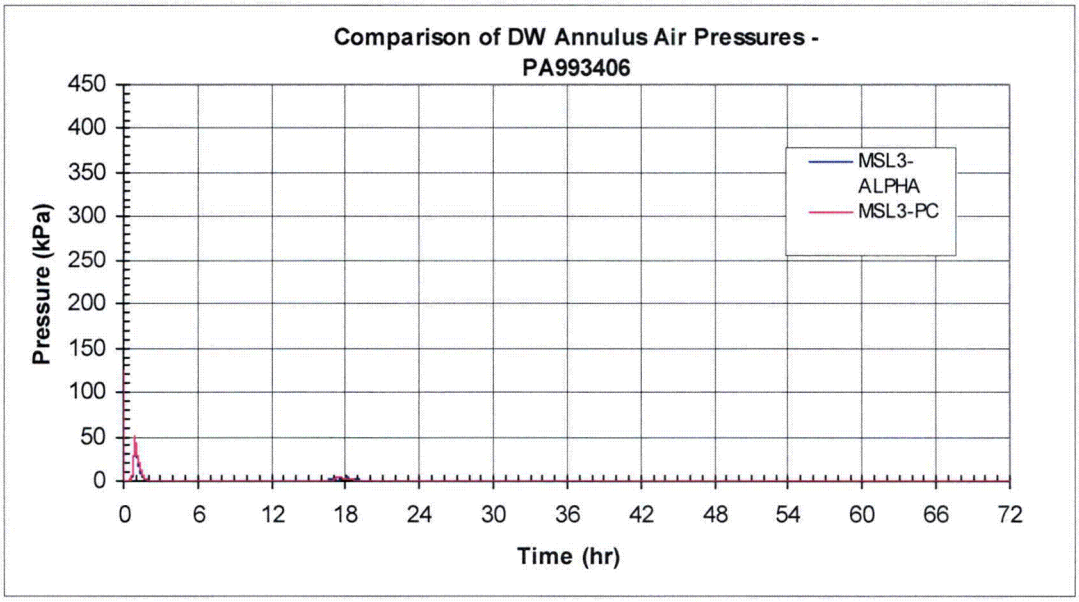

Figure 21.6-96-5. DCD (Rev.3) Analysis: MSL Containment Case – Comparison of DW Air Pressure at Level 34 (3 Levels Above DW-WW Leakage Hole)

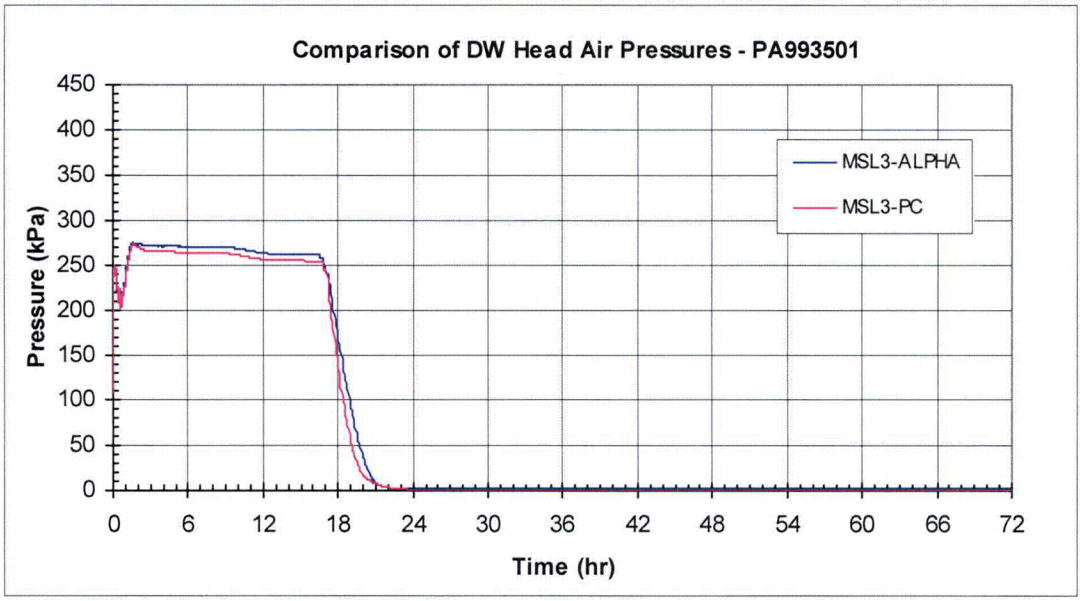

Figure 21.6-96-6. DCD (Rev.3) Analysis: MSL Containment Case – Comparison of DW Head Air Pressure at Level 35, Ring 1

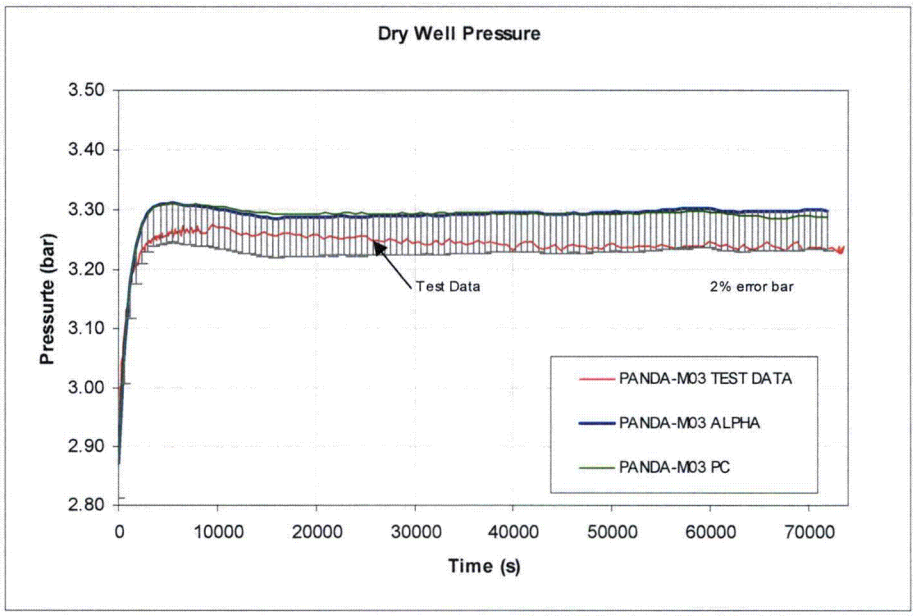

Figure 21.6-96-7. Qualification Test Case: PANDA M03 – Comparison of Drywell Pressures

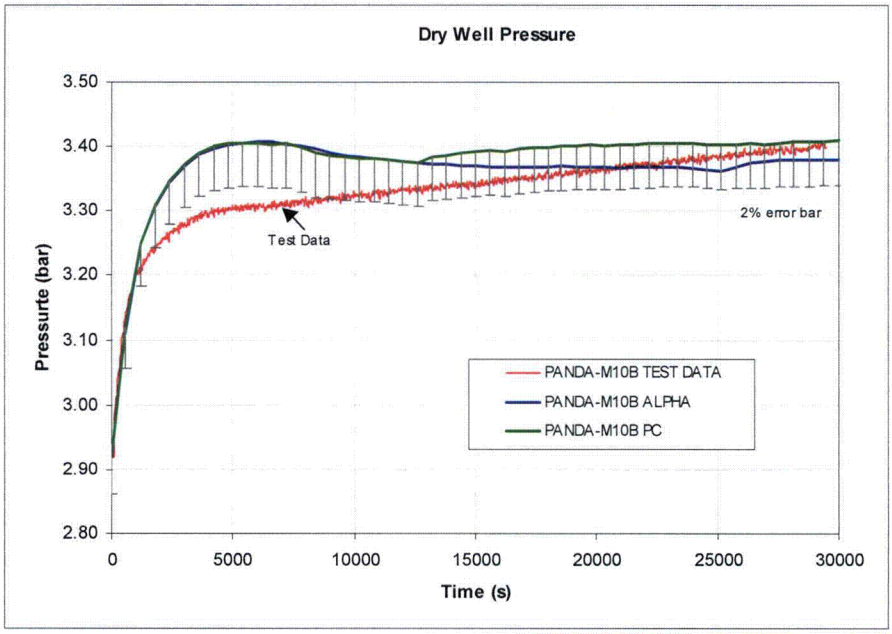

Figure 21.6-96-8. Qualification Test Case: PANDA M10B – Comparison of Drywell Pressures

Affected Documents

No DCD changes will be made in response to this RAI.

NRC RAI 21.6-99

During the NRC staff's audit of TRACG as applied to ESBWR LOCA, the staff reviewed a document (Reference 1) that contained a GE internal review of the TRACG qualification, as part of GE QA processes. This document stated that the TRACG application statement should document that the boron mixing model is not qualified and its use is not recommended. GE confirmed that this was added to the application statement in the TRACG04 User's Manual. Please explain this statement and GE's subsequent use of the boron mixing model in ESBWR ATWS applications (Reference 2). References:

1. "TRACG04A Qualification Design Review Closure Items," DRF 0000-0041-0817

2. NEDE-33083P Supplement 2, "TRACG Application for ESBWR Anticipated Transient Without Scram Analyses," January 2006 -12-

GE Response

The "boron mixing" model in TRACG is [[ ]], Reference [1], as the RAI text indicates.

[[

]]

TRACG04 has [[

]]

The ESBWR ATWS TRACG04 analyses in DCD Rev. 3, and in the ATWS LTR Reference [2], uses the [[

]]

[[

]]

References

1. "TRACG04A Qualification Design Review Closure Items," eDR 0000-0041-0817
2. NEDE-33083P Supplement 2, TRACG Application for ESBWR Anticipated Transient Without Scram Analyses, January 2006 -12-
3. TRACG Model Description, NEDE-32176P, Revision 3, April 2006
4. TRACG04A,P User's Manual, UM-0136, Rev 0, December 2005.

Affected Documents

No DCD changes will be made in response to this RAI.

No changes to the subject LTR will be made in response to this RAI.

NRC RAI 21.6-100

Please answer the following questions regarding the CHAN leakage model:

A. Are you using the "GE Design Leakage Flow correlations" derived from Reference 1 to calculate leakage flow in the ESBWR anticipated transients without scram (ATWS) calculations? Since this correlation was derived for loss of coolant accident (LOCA) conditions, is it applicable for high pressure conditions, such as those seen in an ESBWR ATWS event? Provide the correlation's applicability range.

B. The TRACG04 ESBWR ATWS input decks indicate that GE may be overlaying the default values of coefficients for the GE Design Leakage Flow correlations via specification of CWF and CWB. If so, justify the selection of these coefficients.

C. The CHAN leakage model described in Section 7.5.1 in Reference 2 is based on a driving pressure for each of the leakage paths. Provide a discussion on how TRACG04 selects the reference pressures where the leakage flow is calculated. Include details such as the cells used for calculating these pressures. References:

1. B.S. Shiralkar and J. R. Ireland, "Analytical Model for Loss-of-Coolant Analysis in Accordance with 10CFR Appendix K, Amendment No. 5, Backflow Leakage from the Bypass Region for ECCS Calculations," NEDE-20566-5P, GE Proprietary Report, June 1978.

2. NEDE-32176P, Revision 3, "TRACG Model Description," April 20, 2006

GE Response

Part A:

The "GE Design Leakage Flow correlations" derived from Reference 1 in the RAI text is used to calculate the leakage flow in the ESBWR TRACG ATWS calculations.

These correlations are applicable for ESBWR ATWS conditions since the leakage flow depends mainly on the pressure drop across the leakage paths, and the fluid temperature. [[

]], of Reference 2 cited in the RAI text.

The data on which the correlations are based include [[

]]

The magnitude of the maximum pressure drop across the channel to bypass leakage paths for the ATWS MSIVC TRACG analysis in Section 8 of NEDE-33083P Supplement 2, "ESBWR Anticipated Transient Without Scram Analyses", is [[

]] of Reference 1 in the RAI text.

As indicated by the numerical values above, the data used for the leakage flow correlations were obtained for water at high pressure, high temperature, and cover sufficient range of differential pressures to be valid for ESBWR ATWS applications.

Part B:

The CWB and CWF inputs in the TRACG04 ESBWR ATWS Analysis in Section 8 of NEDE-33083P Supplement 2, "ESBWR Anticipated Transient Without Scram Analyses", are [[

]], and is appropriate for the fuel bundles used in ATWS analysis in NEDE-33083P Supplement 2.

Part C:

The channel leakage flows (forward and reverse), are calculated based on TRACG04 CHAN component [[ ]], where the CHAN component is located. Leakage flows through the core support plate leakage paths are calculated based on fluid cells in [[
]].

Affected Documents

No DCD changes will be made in response to this RAI.

No changes to the subject LTR will be made in response to this RAI.

Enclosure 3

MFN 07-348

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, James C. Kinsey, state as follows:

(1) I am Project Manager, ESBWR Licensing, GE-Hitachi Nuclear Energy Americas LLC ("GHNEA"), 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 GHNEA's letter, MFN 07-348, Mr. James C. Kinsey to U.S. Nuclear Energy Commission, entitled "*Response to Portion of NRC Request for Additional Information Letter No. 85 Related to ESBWR Design Certification Application – RAI Numbers 21.6-96, 21.6-99 and 21.6-100*", dated June 21, 2007. The proprietary information in enclosure 1, which is entitled "*Response to Portion of NRC Request for Additional Information Letter No. 85 Related to ESBWR Design Certification Application – RAI Numbers 21.6-96, 21.6-99 and 21.6-100 – GHNEA Proprietary Information*", 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 of proprietary information of which it is the owner or licensee, GHNEA 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 GHNEA's competitors without license from GHNEA 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 GHNEA customer-funded development plans and programs, resulting in potential products to GHNEA;

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 GHNEA, 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 GHNEA, 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 GHNEA. Access to such documents within GHNEA 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 for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GHNEA 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 contains details of GHNEA's evaluation methodology.

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 GHNEA asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GHNEA's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GHNEA'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 GHNEA.

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.

GHNEA's competitive advantage will be lost if its competitors are able to use the results of the GHNEA 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 GHNEA 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 GHNEA 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 21st day of June 2007.

James C. Kinsey
GE-Hitachi Nuclear Energy Americas LLC