HITACHI

GE Hitachi Nuclear Energy

Richard E. Kingston
Vice President, ESBWR Licensing

PO Box 780 M/C A-65
Wilmington, NC 28402-0780
USA

T 910 819 6192
F 910 362 6192
rick.kingston@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 08-581 Revision 1

Docket No. 52-010

April 1, 2009

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

Subject: **Revised Response to Portion of NRC Request for Additional Information Letter No. 175 – Related to ESBWR Design Certification Application – RAI Number 4.4-66 Supplement 1**

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) sent by the Reference 1 NRC letter.

The revised GEH response to RAI Number 4.4-66 Supplement 1 is addressed in Enclosures 1, 2, 3 and 4. This revised response supersedes the original response that was submitted in the Reference 2 GEH letter.

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 public version, which does not contain proprietary information and is suitable for public disclosure.

The affidavit contained in Enclosure 4 identifies that the information contained in Enclosure 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 10 CFR 9.17.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

D068
NRO

References:

1. MFN 08-349 Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 175 Related To ESBWR Design Certification Application,* dated April 4, 2008
2. MFN 08-581 Letter from Richard E. Kingston, GEH to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 175 – Related to ESBWR Design Certification Application – RAI Number 4.4-66 S01*, dated July 21, 2008.

Enclosures:

1. MFN 08-581 Revision 1 – Revised Response to Portion of NRC Request for Additional Information Letter No. 175 – Related to ESBWR Design Certification Application – RAI Number 4.4-66 S01 – GEH Proprietary Information
2. MFN 08-581 Revision 1 – Revised Response to Portion of NRC Request for Additional Information Letter No. 175 – Related to ESBWR Design Certification Application – RAI Number 4.4-66 S01 – Public Version
3. MFN 08-581 Revision 1 – Revised Response to Portion of NRC Request for Additional Information Letter No. 175 – Related to ESBWR Design Certification Application – RAI Number 4.4-66 S01 – DCD Markups
4. MFN 08-581 Revision 1 – Revised Response to Portion of NRC Request for Additional Information Letter No. 175 – Related to ESBWR Design Certification Application – RAI Number 4.4-66 S01 – Affidavit

cc:	AE Cubbage	USNRC (with enclosures)
	JG Head	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	eDRF	0000-0088-0056/R1

Enclosure 2

MFN 08-581 Revision 1

Revised Response to Portion of NRC Request for

Additional Information Letter No. 175

Related to ESBWR Design Certification Application

RAI Number 4.4-66 S01

Public Version

NRC RAI 4.4-66 S01

Explain the calculation process for TRACG channel model flow areas and loss coefficients and their conversion to PANACEA code input.

Provide an explanation of the calculation process for conversion of TRACG lumped channel flow areas and loss coefficients and how they correspond to those used as input to the PANACEA code hydraulic model.

GEH Response

The above request for additional information assumes that the fuel channel flow area and loss coefficient data are converted from the TRACG code input to the PANACEA code input. The inputs of both codes in fact are assembled independently from data retrieved from the BWR engineering databank (BWREDB) files. The BWREDB files, from which the qualified Engineering Computer Programs (ECPs) draw input to set up core and plant models, are populated through independently verified data transactions. The data to be placed in the BWREDB files come from either design basis documents, calculations performed with qualified ECPs or independently verified studies.

The channel flow area data in the BWREDB files are calculated and stored together with other data specific by fuel bundle design and associated lattices. The active coolant flow area inside the channel is calculated for each lattice (also defined as a fuel type in Section 1.4.10.2 of NEDC-33239P) using the following definition:

$$A_{ic}^{j} = W_{ch}^{2} + (\pi - 4)r_{ch}^{2} - N_{rod}^{j}\frac{\pi}{4}D_{rod}^{2} - N_{WR}^{j}\frac{\pi}{4}D_{WR}^{2}$$

A_{ic}^{j} flow area inside channel

W_{ch} channel inside width

r_{ch} channel corner radius

N_{rod}^{j} number of fuel rods in lattice j

D_{rod} fuel rod diameter

N_{WR}^{j} number of water rods in lattice j

D_{WR} water rod diameter in lattice j

The resulting channel flow area data are then placed in lattice-specific BWREDB files. For instance, the flow area data for the bundle design shown in Figure 2-1 of NEDC-33326P are stored in five separate BWREDB files. The following table lists the inside-channel flow area data for the same bundle design used in the initial core design. The flow areas below are expressed in square inches consistent with the British engineering unit system employed in the PANACEA core thermal hydraulic model.

[[

]]

[[

]]

[[

]]

DCD and LTR Impacts

DCD Tier 2, Table 1.6-1, and Sections 4.4.2.3.1, 4.4.2.3.2, 4.4.2.3.5, 4.4.2.4, and 4.4.8 will be revised, as noted in the markup in Enclosure 3, to address the GE14E pressure drop data and the Licensing Topical Report NEDC-33456.

LTR NEDC-33456P, Rev 0 will be issued as described above.

Enclosure 3

MFN 08-581 Revision 1

Revised Response to Portion of NRC Request for

Additional Information Letter No. 175

Related to ESBWR Design Certification Application

RAI Number 4.4-66 S01

DCD Markups

Table 1.6-1

Referenced GE / GEH Reports

Report No.	Title	Section No.
NEDE-33391	GE Hitachi Nuclear Energy, "ESBWR Safeguards Assessment Report," NEDE-33391, Revision 0, November 2007 – Safeguards Information.	13.6
NEDC-33408P NEDO-33408	GE Hitachi Nuclear Energy, "ESBWR Steam Dryer – Plant Based Load Evaluation Methodology," NEDC-33408P, Class III (Proprietary), and NEDO-33408, Class I (Non-proprietary), February 2008.	3L
NEDO-33411	GE Hitachi Nuclear Energy, "Risk Significance of Structures, Systems and Components for the Design Phase of the ESBWR," NEDO-33411, Class I (Non-proprietary), Revision 0, March 2008.	17.4
NEDC-33456P NEDO-33456	Global Nuclear Fuel, "Full-Scale Pressure Drop Testing for a Simulated GE14E Fuel Bundle," NEDC-33456P, Class III (Proprietary), and NEDO-33456, Class I (Non-proprietary), Revision 0, March 2009.	4.4

D_H = channel hydraulic diameter

A_{ch} = channel flow area

L = incremental length

f = friction factor

ϕ_{TPF} = two–phase friction multiplier

The formulation for the two-phase multiplier is similar to that presented in References 4.4-4 and 4.4-5. The single-phase friction factor and two-phase friction multiplier in the above equation were validated by extensive comparisons to full-scale rod bundle pressure drop data provided in References 4.4-14 and 14.4-22.

4.4.2.3.2 Local Pressure Drop

The local pressure drop is defined as the irreversible pressure loss associated with an area change, such as the orifice, lower tie plate, and spacers of a fuel assembly.

The general local pressure drop model is similar to the friction pressure drop and is

$$\Delta P_L = \frac{w^2}{2g_c\rho}\frac{K}{A^2}\phi_{TPL}^2 \quad \Delta P_L = \frac{w^2}{2g_c\rho}\frac{K}{A_{ch}^2}\phi_{TPL}^2$$

where

ΔP_L = local pressure drop, psi

K = local pressure drop loss coefficient

A = reference area for local loss coefficient

ϕ_{TPL} = two–phase local multiplier

and w, g_c, and ρ are as previously defined. The formulation for the two-phase multiplier is similar to that reported in Reference 4.4-5. The local loss component of the total pressure drop across a region inside the fuel assembly is deduced from the measured total pressure drop by subtracting the frictional, elevation and acceleration components. The corresponding local loss coefficient is then determined using the above local pressure drop formula. The pressure drop data taken for the specific designs of the BWR fuel assembly, discussed in Reference 4.4-14, were obtained from tests performed in single-phase water to calibrate the orifice, the lower tie plate, and the holes in the lower tie plate. Reference 4.4-14 also discusses the tests performed in both single and two-phase flow, to derive the best fit design values for spacer and upper tie plate pressure drop. The range of test variables was specified to include the range of interest for boiling water reactors. New test data are obtained whenever there is a significant design change to ensure the most applicable methods are used. However, the ESBWR reference fuel assembly (GE14E) utilizes the same hardware currently used in the GE14 fuel assembly, that is the same upper-tie plate, spacers, water rods, and the same bundle inlet design. Therefore, its pressure drop characteristics at the upper-tie plate region, spacers, water rods, and the bundle inlet region remains unchanged and no new test data is required. However, full-scale pressure drop testing for a simulated GE14E fuel was performed to better characterize the differences in active fuel length, spacer separation, and part-length rod height between the GE14 and GE14E fuel design and the spacer loss coefficients for the GE14E fuel are determined to best fit the full-sclae data obtained from the GE14E testing as dicussed in Reference 4.4-22. The applicability of the data to ESBWR is discussed in Subsection 4.4.2.3.5.

4.4.2.3.3 Elevation Pressure Drop

The elevation pressure drop is based on the relation:

$$\Delta P_E = \overline{\rho} \Delta L \frac{g}{g_c}$$

$$\overline{\rho} = \rho_f (1-\alpha) + \rho_g \alpha$$

where

ΔP_E = elevation pressure drop

ΔL = incremental length

$\overline{\rho}$ = average mixture density

g = acceleration of gravity

α = nodal average void fraction

ρ_f, ρ_g = saturated water and vapor density, respectively

Other terms are as previously defined. The TRACG void fraction model is described in Reference 4.4-10. The void fraction model utilized in the core design analysis is described in References 4.4-6 and 4.4-15.

4.4.2.3.4 Acceleration Pressure Drop

A reversible pressure change occurs when an area change is encountered, and an irreversible loss occurs when the fluid is accelerated through the boiling process. The basic formulation for the reversible pressure change resulting from a flow area change in the case of single–phase flow is given by:

$$\Delta P_{ACC} = \left(1 - \sigma_A^2\right) \frac{w^2}{2 g_c \rho_f A_2^2}$$

$$\sigma_A = \frac{A_2}{A_1} = \frac{\textit{final flow area}}{\textit{initial flow area}}$$

where:

ΔP_{ACC} = acceleration pressure drop

A_2 = final flow area

A_1 = initial flow area

In the case of two–phase flow, the liquid density is replaced by a density ratio so that the reversible pressure change is given by:

$$\Delta P_{ACC} = \left(1-\sigma_A^2\right)\frac{w^2 \rho_H}{2g_c \rho_{KE}^2 A_2^2}$$

where:

$\frac{1}{\rho_H} = \frac{x}{\rho_g} + \frac{1-x}{\rho_f}$, homogeneous density,

$\frac{1}{\rho_{KE}^2} = \frac{x^3}{\rho_g^2 \alpha^2} + \frac{(1-x)^3}{\rho_f^2 (1-\alpha)^2}$, kinetic energy density,

α = void fraction at A_2

x = steam quality at A_2

Other terms are as previously defined.

The basic formulation for the acceleration pressure change due to density change is:

$$\Delta P_{ACC} = \frac{w^2}{g_c A_{ch}^2}\left[\frac{1}{\rho_{OUT}} - \frac{1}{\rho_{IN}}\right]$$

where ρ is either the homogeneous density, ρ_H, or the momentum density, ρ_M

$$\frac{1}{\rho_M} = \frac{x^2}{\rho_g \alpha} + \frac{(1-x)^2}{\rho_f (1-\alpha)}$$

ρ is evaluated at the inlet and outlet of each axial node. Other terms are as previously defined. The total acceleration pressure drop in boiling water reactors is on the order of a few percent of the total pressure drop. Note that the TRACG model is different for the acceleration pressure drop modeling (Reference 4.4-10).

4.4.2.3.5 Total Pressure Drop Qualification

The GE14 pressure drop is characterized in Reference 4.4-14. The loss coefficients are qualified against pressure drop test data. The test range includes the operating conditions for the ESBWR. The ESBWR reference fuel assembly (GE14E) utilizes the same hardware currently used in the GE14 fuel assembly, that is the same upper-tie plate, spacers, water rods, and the same bundle inlet design. Therefore, its pressure drop characteristics at the upper-tie plate region, spacers, water rods, and the bundle inlet region remains unchanged. However, full-scale pressure drop testing for a simulated GE14E fuel was performed to better characterizeMoreover, the differences in active fuel length, spacer separation, and part-length rod height between the GE14 and GE14E fuel design and to qualify the spacer loss coefficients for the ESBWR application. Test results and associated analysis are provided in Reference 4.4-22.are accounted for in determining the local loss coefficients from the experimental data as explained in Subsection 4.4.2.3.2. Because operating conditions and geometry are compatible, the loss coefficients for the upper-tie plate, water rods, and bundle inlet based on the GE14 pressure drop data can be applied to the ESBWR. The spacer loss coefficients for the GE14E fuel are determined to best fit the full-scale data obtained from the GE14E testing. The uncertainty in the core pressure drop is defined by Reference 4.4-9 Subsection 4.4.1 item C23.

4.4.2.3.6 Hydraulic Loads

Hydraulic loads are determined based on the reactor internal pressure differences (RIPDs) discussed in Subsection 3.9.5.3. The TRACG computer code is used to analyze the transient conditions within the reactor vessel following AOOs, infrequent events and accidents (for example, LOCA).

4.4.2.4 Core Coolant Flow Distribution Methods

The core coolant flow distribution methods used in TRACG are described in Reference 4.4-10 Chapters 6 and 7. TRACG treats all fuel channels as one-dimensional (axial) components, but the vessel is modeled as a three-dimensional component. Hence, the pressure drop across two planes in the vessel is the same at all radial and azimuth locations if the geometry of the components in the vicinity of these planes has radial and azimuthal symmetry. Otherwise, this pressure differential displays some (locally) radial and azimuth non-uniformity.

The flow distribution to the fuel assemblies and bypass flow paths in the core simulator model is calculated on the assumption that the pressure drop across all fuel assemblies and bypass flow paths is the same. The bundle pressure drop evaluation includes frictional, local, elevation, and acceleration losses (Subsections 4.4.2.3.1 - 4.4.2.3.4). The pressure drop methodology has been qualified to the whole range of test data discussed in References 4.4-14 and 4.4.-22. The core inlet flow is an input to the core simulator model. The value used in the core design analysis is determined based on the TRACG prediction of the natural circulation core inlet flow. In operation, the core monitoring system determines core inlet flow based on plant instrumentation (Chapter 7).

The bypass flow methodology is described in Reference 4.4-10 Subsection 7.5.1. The same methodology supports the core simulator model.

4.4.2.5 Fuel Heat Transfer Methods

The Jens-Lottes (Reference 4.4-7) heat transfer correlation is used in fuel design to determine the cladding-to-coolant heat transfer coefficients for nucleate boiling. For the single-phase convection or liquid region, the well-established Dittus-Boelter correlation is used. The methodology for fuel cladding, gap and pellet heat transfer is described in Section 4.2.

4.4.2.6 Maximum Linear Heat Generation Rate Methods

The Maximum Linear Heat Generation Rate (MLHGR) methods are described in Section 4.2. Margin to design limits for circumferential cladding strain and centerline fuel temperature is evaluated for AOOs in accordance with Reference 4.4-9 Subsection 4.6.2.1.

4.4.3 Reactor Core Thermal and Hydraulic Evaluations

Typical thermal-hydraulic parameters for the ESBWR are compared to those for a typical BWR/6 plant and the ABWR in Table 4.4-1a and Table 4.4-1b.

4.4-10 GE Hitachi Nuclear Energy, "Licensing Topical Report TRACG Model Description," NEDE-32176P, Revision 4, Class III (Proprietary), January 2008, NEDO-32176, Revision 4, Class I (Non-proprietary), January 2008.

4.4-11 GE Nuclear Energy, "Licensing Topical Report TRACG Qualification," NEDE-32177P Revision 3, Class III (Proprietary), August 2007.

4.4-12 [*Global Nuclear Fuel, "GE14 for ESBWR-Critical Power Correlation, Uncertainty, and OLMCPR Development," NEDC-33237P, Revision 3, Class III (Proprietary), December 2007.*]*

4.4-13 GE Nuclear Energy, "Methodology and Uncertainties for Safety Limit MCPR Evaluations," NEDC–32601P-A, Class III (Proprietary), August 1999.

4.4-14 GE Nuclear Energy, "GE14 Pressure Drop Characteristics," NEDC-33238P, Class III (Proprietary), December 2005.

4.4-15 "TASC-03A, A Computer Program for Transient Analysis of a Single Channel," NEDC-32084P-A, Revision 2, Class III (Proprietary), July 2002.

4.4-16 Letter, J.S. Charnley (GE) to C. O. Thomas (NRC), Amendment 15 to General Electric Licensing Topical Report NEDE-24011-P-A, January 25, 1986.

4.4-17 GE Hitachi Nuclear Energy, "ESBWR Initial Core Transient Analysis," NEDO-33337, Class I, October 2007.

4.4-18 GE Hitachi Nuclear Energy, "ESBWR Feedwater Temperature Operating Domain Transient and Accident Analysis," NEDO-33338, Class I, October 2007.

4.4-19 GE Nuclear Energy, "Regulatory Relaxation for BWR Loose Parts Monitoring Systems," BWR Owner's Group Licensing Topical Report NEDC-32975P-A, Class III (Proprietary), Revision 0, February 2001.

4.4-20 [*Global Nuclear Fuel, "GE14E for ESBWR Initial Core Nuclear Design Report," NEDC-33326-P, Class III (Proprietary), Revision 0, July 2007, NEDO-33326, Class I (Non-proprietary), Revision 0, July 2007.*]*

4.4-21 [*Global Nuclear Fuel, "GE14 for ESBWR Nuclear Design Report," NEDC-33239-P, Class III (Proprietary), Revision 2, April 2007, NEDO-33239, Class I (Non proprietary), Revision 2, April 2007.*]*

4.4-22 [*Global Nuclear Fuel, "Full-Scale Pressure Drop Testing for a Simulated GE14E Fuel Bundle," NEDC-33456P, Class III (Proprietary), Revision 0, March 2009, NEDO-33456, Class I (Non-proprietary), Revision 0, March 2009*]*

* References that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2*. Prior NRC approval is required to change Tier 2* information.

Enclosure 4

MFN 08-581 Revision 1

Revised Response to Portion of NRC Request for

Additional Information Letter No. 175

Related to ESBWR Design Certification Application

RAI Number 4.4-66 S01

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, David H. Hinds, state as follows:

(1) I am Manager, New Units Engineering, GE Hitachi Nuclear Energy ("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 08-581 Revision 1, Mr. Richard E. Kingston to U.S. Nuclear Energy Commission, entitled "*Revised Response to Portion of NRC Request for Additional Information Letter No. 175 – Related to ESBWR Design Certification Application – RAI Number 4.4-66 Supplement 1,*" dated April 1, 2009. The proprietary information in enclosure 1, which is entitled "*MFN 08-581 Revision 1 – Revised Response to Portion of NRC Request for Additional Information Letter No. 175 – Related to ESBWR Design Certification Application – RAI Number 4.4-66 S01 – GEH 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, 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's 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 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) is classified as proprietary because it contains details of GEH's design and licensing methodology. The development of the methods used in these analyses, along with the testing, development and approval of the supporting methodology was achieved at a significant cost to GEH.

(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 1st day of April 2009.

David H. Hinds
GE-Hitachi Nuclear Energy Americas LLC