



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-15-122

July 8, 2015

10 CFR 50.4

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

Browns Ferry Nuclear Plant, Units 1, 2, and 3  
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68  
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Presentation Slides for Closed Meeting on Browns Ferry Nuclear Plant  
Planned Submittal of Extended Power Uprate (EPU) License  
Amendment Request (TAC Nos. MF4851, MF4852, and MF4853)**

References: 1. Meeting Notice from NRC, "Forthcoming Closed Meeting with Tennessee Valley Authority (TVA) on Browns Ferry Nuclear Plant Planned Submittal of Extended Power Uprate (EPU) License Amendment Request (TAC Nos. MF4851, MF4852, AND MF4853)," dated April 8, 2015 (ADAMS Accession No. ML15097A230)

By memorandum dated April 8, 2015 (Reference 1), the Nuclear Regulatory Commission (NRC) scheduled a closed meeting with the Tennessee Valley Authority (TVA) for April 22, 2015. The purpose of the meeting was for TVA to provide information regarding the steam dryer replacement for the Browns Ferry Nuclear Plant (BFN) for its planned extended power uprate (EPU).

Enclosures 1 and 4 to this letter contain the slides and supplemental slides, respectively, presented at the April 22, 2015 closed meeting with the NRC. Enclosures 1 and 4 contain information that GE Hitachi (GEH) considers to be proprietary in nature and subsequently, pursuant to 10 CFR 2.390, "Public inspections, exceptions, request for withholding," paragraph (a)4, it is requested that such information be withheld from public disclosure. Enclosures 2 and 5 contain the non-proprietary version of the slides and supplemental slides, respectively, and are suitable for public disclosure. Enclosures 3 and 6 provide the affidavits supporting the request for withholding of Enclosures 1 and 4, respectively.

There are no new regulatory commitments contained in this submittal. Please address any questions regarding this submittal to Mr. Edward D. Schrull at (423) 751-3850.

Respectfully,

A handwritten signature in dark ink, appearing to read "J. W. Shea", is written over a light gray horizontal line.

J. W. Shea  
Vice President, Nuclear Licensing

Enclosures:

1. GEH Slides for TVA Presentation to the NRC in Support of Steam Dryer Replacement, GEH Proprietary Information (Enclosure 1 to GEH Letter No. 175528-011, Revision 1)
2. GEH Slides for TVA Presentation to the NRC in Support of Steam Dryer Replacement, Non-Proprietary Information (Enclosure 2 to GEH Letter No. 175528-011, Revision 1)
3. GEH Affidavit Supporting the Request to Withhold GEH Proprietary Information (included in Enclosure 1) from the Public (Enclosure 3 to GEH Letter No. 175528-011, Revision 1)
4. Supplemental GEH Slides for TVA Presentation to the NRC in Support of Steam Dryer Replacement, GEH Proprietary Information (Enclosure 1 to GEH Letter No. 175528-011, Revision 2)
5. Supplemental GEH Slides for TVA Presentation to the NRC in Support of Steam Dryer Replacement, Non-Proprietary Information (Enclosure 2 to GEH Letter No. 175528-011, Revision 2)
6. GEH Affidavit Supporting the Request to Withhold GEH Proprietary Information (included in Enclosure 4) from the Public (Enclosure 3 to GEH Letter No. 175528-011, Revision 2)

cc (Enclosures):

NRC Regional Administrator – Region II  
NRC Senior Resident Inspector – Browns Ferry Nuclear Plant  
NRC Project Manager - Browns Ferry Nuclear Plant

## **ENCLOSURE 2**

**GEH Slides for TVA Presentation to the NRC in Support of Steam Dryer Replacement,  
Non-Proprietary Information**

ENCLOSURE 2

GE Letter No. 175528-011, Revision 1

GEH Slides for TVA Presentation to the NRC in Support of Steam Dryer  
Replacement

Non-Proprietary Information

**NON-PROPRIETARY NOTICE**

This is a non-proprietary version of Enclosure 1 of GEH Letter No. 175528-011, Revision 1 which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [[ ]].



# Browns Ferry Nuclear Plant Replacement Steam Dryers

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Gerry Doyle

Director EPU

April 22, 2015

# Agenda

- Introductions G. Doyle
- Overview and Background G. Doyle
- Browns Ferry Replacement Steam Dryer Design P. Donahue
- Browns Ferry Replacement Steam Dryer Analysis P. Donahue
- Browns Ferry Replacement Steam Dryer Power Ascension Monitoring P. Donahue
- Browns Ferry Replacement Steam Dryer Inspection Plan P. Donahue
- Questions/Comments G. Doyle



# Overview and Background

- New Replacement Steam Dryers (RSDs) will be installed in all three Browns Ferry Units
  - To resolve any issues that existing steam dryers may have under EPU conditions
    - Previous submittals, now withdrawn, had over 260 RAIs associated with steam dryers
    - New EPU License Amendment Request (LAR) submittal will address previous issues , look to minimize RAIs, and support NRC approval
- Current strategy and design complies with existing and contemporary regulatory requirements
- Contracted with GEH to build our RSDs as they are the Original Equipment Manufacturer and have experience in other recent RSDs
- We are here to present an overview of our RSDs design, analysis, monitoring plan and inspection plan with an expectation that NRC fully understands the RSD information we plan to submit as part of our EPU LAR
- Presenter is Pete Donahue, Senior Manager for EPU Engineering
  - Supported by GEH personnel

# BFN Replacement Steam Dryer

- Based on the curved hood six bank prototype replacement dryer first used in a BWR/4 reactor.
- Design is significantly more robust than the original steam dryer it replaces.
- BFN acoustic load definition developed using MSL acoustic pressure measurements taken at the three Browns Ferry units.
- The FIV fatigue evaluation and primary stress methodologies used for BFN RSD analysis has been reviewed in detail on BWR/6 RSD and ESBWR projects.
- Analyzed for the applicable primary structural loads for normal operation and for transient and accident conditions.





# Browns Ferry RSD Design



# EPU Replacement Dryer Experience

Successful operating history for replacement dryers at EPU

- Quad Cities Units 1/2 RSD
- Dresden Units 2/3 RSD
- Susquehanna Units 1/2 RSD
- Grand Gulf RSD
- Vermont Yankee original dryer with modifications

# Steam Dryer Structural Design Timeline

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# Steam Dryer Structural Design Timeline

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# Steam Dryer Structural Design Timeline

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# BFN Replacement Dryer Design

- Based on the curved hood six bank prototype replacement dryer first used in a BWR/4 reactor.
- Design is significantly more robust than the original steam dryer it replaces.
- Both the Browns Ferry reactor vessel and the BWR/4 reactor vessel where the BWR/4 prototype RSD was installed have the same internal diameter; so in essence,  
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# BFN Replacement Dryer Design

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- Changes to prototype dryer design
  - Dryer/vessel interface changes
  - Address OE lessons learned
  - Stress reduction

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# BFN Replacement Dryer Design

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# BFN Replacement Dryer Design

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# BFN RSD Design Improvement

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# BFN RSD Design Improvement

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# BFN RSD Design Improvement

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# BFN RSD Design Refinement

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# Browns Ferry RSD Analysis



# BFN RSD Analysis Overview

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# Browns Ferry RSD Load Definition



# BFN RSD Analysis Load Definition

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# BFN RSD Analysis Load Definition

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# BFN RSD Analysis Load Definition

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# BFN RSD Analysis Load Definition

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# Potential SRV Resonance Frequencies

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# SRV Resonance Fundamental Frequency

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# MSL Acoustic Mode Interaction

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# MSL Acoustic Mode Interaction

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# Postulated SRV Resonances

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# SRV Adders for Design Load Definition

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# EPU SRV Scale Factor

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# EPU SRV Scale Factor

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# BFN RSD Analysis Load Definition

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# Dryer Load Comparison

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# Browns Ferry RSD FIV Analysis



# BFN RSD Finite Element Model

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# BFN-Specific Design Improvements

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# BFN-Specific Design Improvements

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# BFN-Specific Design Improvements

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# BFN RSD FEM Mesh Convergence

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# BFN RSD FIV Analysis

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# BFN RSD FIV Analysis

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# End to End Bias and Uncertainty

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# End to End Bias and Uncertainty

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# FIV Stress Adjustment

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# FIV Stress Adjustment

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# BFN RSD Fatigue Analysis Results

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# Browns Ferry RSD Primary Stress Evaluation



# BFN RSD Primary Stress Evaluation

- The steam dryer is a non-safety related item and is classified as an Internal Structure as defined in ASME Subsection NG, Paragraph NG-1122.
- The steam dryer is not an ASME Code component, [[  
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# Non-Proprietary Information – Class I (Public)

Load Case	Service Conditions	Operating Condition	Load Combination
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			]]

BFN RSD  
Primary Stress  
Analysis Load  
Combinations

# BFN RSD Primary Stress Results

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# Browns Ferry RSD Power Ascension Monitoring



# BFN Power Ascension Monitoring

- The BFN lead unit is classified as a [[ ]]
- Power ascension monitoring process similar to previous RSD projects
- BFN Lead Unit
  - Both RSD and MSLs instrumented
  - Monitor using strain gauges, on-dryer pressure transducers, and accelerometer

# BFN Power Ascension Monitoring

- BFN Lead Unit (continued)

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- Confirmatory structural analysis for lead unit at EPU [[

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- Follow-on Units

- MSLs instrumented

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- Confirmatory structural evaluation based on MSL measurements

# BFN RSD Instrumentation Locations

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# BFN RSD Instrumentation

# BFN On-dryer Acceptance Limits

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# BFN MSL Acceptance Limits

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# BFN Lead Unit CLTP Evaluation

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# BFN Lead Unit Test Plan

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# BFN Power Ascension Monitoring

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# BFN RSD Inspection Plan

- During the first two scheduled refueling outages after reaching EPU conditions, a visual inspection will be conducted on the replacement steam dryer for each unit. The inspection plan will be consistent with the industry guidance. The inspection plan will include all accessible exterior and interior critical locations identified in the vibration and stress analyses for the Browns Ferry RSDs.



# Acronyms



## Non-Proprietary Information – Class I (Public)

Short Form	Description
ASME	American Society of Mechanical Engineers
ASR	Alternating Stress Ratio
AVS	Acoustic Vibration Suppressor
BFN	Browns Ferry Nuclear Plant
BWR	Boiling Water Reactor
CLTP	Current Licensed Thermal Power
DP	Differential Pressure
DW	Deadweight
EPU	Extended Power Uprate
FE	Finite Element
FEM	Finite Element Model
FIV	Flow Induced Vibration
FRF	Frequency Response Function
HF	High Frequency
IN	Information Notice
LAR	License Amendment Request
LF	Low Frequency
MASR	Minimum alternating stress ratio

Short Form	Description
MPC	Multi Point Constraint
MSL	Main Steam Line
MSLB	Main Steam Line Break
OBE	Operating Basis Earthquake
PBLE	Plant Based Load Evaluation
PBLE01	PBLE Input On-Dryer Based
PBLE02	PBLE Input MSL Based
PSD	Power Spectral Density
RMS	Root-Mean-Squared
RPV	Reactor Pressure Vessel
RSD	Replacement Steam Dryer
SDAR	Steam Dryer Analysis Report
SG	Strain Gauge
SRV	Safety Relief Valve
SSE	Safe Shutdown Earthquake
TSV	Turbine Stop Valve
VFD	Variable Frequency Drive
VPF	Vane Passing Frequency

Thank you!

Questions?

Comments?



**ENCLOSURE 3**

**GEH Affidavit Supporting the Request to Withhold GEH Proprietary Information  
(included in Enclosure 1) from the Public**

ENCLOSURE 3

GEH Letter No. 175528-011, Revision 1

GEH Affidavit

## AFFIDAVIT

I, Peter M. Yandow, state as follows:

- (1) I am the Vice President, Nuclear Plant Projects/Services Licensing, Regulatory Affairs, 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 letter, GEH Letter No. 175528-011, Revision 1, Scott Gowdy (GEH) to Peter Donahue (TVA) entitled “GEH Slides for TVA Presentation to the NRC in Support of Steam Dryer Replacement,” dated April 14, 2015. The GEH proprietary information in Enclosure 1, which is entitled “GEH Slides for TVA Presentation to the NRC,” is identified by a dotted underline inside double square brackets. [[This sentence is an example. {3}]] Figures and large objects containing proprietary information 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 U.S.C. Sec. 552(b)(4), and the Trade Secrets Act, 18 U.S.C. 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 F.2d 871 (D.C. Cir. 1992), and *Public Citizen Health Research Group v. FDA*, 704 F.2d 1280 (D.C. 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 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, resulting in potential products to GEH;
  - d. Information that discloses trade secret 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 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 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.
- (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 or confidentiality agreements.
- (8) The information identified in paragraph (2), above, is classified as proprietary because it contains the details of GEH methodology. These methods, techniques, and data along with their application to the design, modification, and analyses were achieved at a significant cost to GEH.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience databases that constitute 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 and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 14<sup>th</sup> day of April 2015.

A handwritten signature in blue ink that reads "Peter M. Yandow". The signature is fluid and cursive, with the first and last names being more prominent than the middle initial.

Peter M. Yandow  
Vice President, Nuclear Plant Projects/Services  
Licensing, Regulatory Affairs  
GE-Hitachi Nuclear Energy Americas LLC  
3901 Castle Hayne Rd.  
Wilmington, NC 28401  
Peter.Yandow@ge.com

## **ENCLOSURE 5**

**Supplemental GEH Slides for TVA Presentation to the NRC in Support of Steam Dryer Replacement, Non-Proprietary Information**

ENCLOSURE 2

GE Letter No. 175528-011, Revision 2

Supplemental GEH Slides for TVA Presentation to the NRC in  
Support of Steam Dryer Replacement

Non-Proprietary Information

**NON-PROPRIETARY NOTICE**

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# Box Beam

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**HITACHI**



# BFN SDAR Report Format

Main Body – BFN-Specific Analyses and Results

Appendix A – Overall Dryer Analysis Methodology

Appendix B – PBLE01 On-dryer Based Load Definition Model Description

Appendix C – PBLE02 MSL-Based Load Definition Model Description

Appendix D – Supporting BFN Analysis Inputs and Results

Appendix E – Power Ascension Test Plan and Limit Curves



**HITACHI**

**ENCLOSURE 6**

**GEH Affidavit Supporting the Request to Withhold GEH Proprietary Information  
(included in Enclosure 4) from the Public**

ENCLOSURE 3

GEH Letter No. 175528-011, Revision 2

GEH Affidavit

## AFFIDAVIT

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- (2) The information sought to be withheld is contained in Enclosure 1 of GEH letter, GEH Letter No. 175528-011, Revision 2, Scott Gowdy (GEH) to Peter Donahue (TVA) entitled “Supplemental GEH Slides for TVA Presentation to the NRC in Support of Steam Dryer Replacement,” dated April 30, 2015. The GEH proprietary information in Enclosure 1, which is entitled “Supplemental GEH Slides for TVA Presentation to the NRC,” is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] Figures and large objects containing proprietary information 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.
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I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 30<sup>th</sup> day of April 2015.

A handwritten signature in blue ink that reads "Peter M. Yandow". The signature is fluid and cursive, with the first name "Peter" and last name "Yandow" being clearly legible.

Peter M. Yandow  
Vice President, Nuclear Plant Projects/Services  
Licensing, Regulatory Affairs  
GE-Hitachi Nuclear Energy Americas LLC  
3901 Castle Hayne Rd.  
Wilmington, NC 28401  
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