Progress Energy

Benjamin C. Waldrep
Vice President
Brunswick Nuclear Plant
Progress Energy Carolinas, Inc.

March 21, 2008

SERIAL: BSEP 08-0040
TSC-2006-06

10 CFR 50.90

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

Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2
Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62
Additional Information in Support of Request for License Amendments Regarding Linear Heat Generation Rate and Core Operating Limits Report References for AREVA NP Fuel (NRC TAC Nos. MD4063 and MD4064)

Reference: Letter from James Scarola to the U.S. Nuclear Regulatory Commission (Serial: BSEP 06-0129), "Request for License Amendments Regarding Linear Heat Generation Rate and Core Operating Limits Report References for AREVA NP Fuel," dated January 22, 2007 (ADAMS Accession Number ML070300570)

Ladies and Gentlemen:

By letter dated January 22, 2007, as supplemented by letters dated June 21, 2007, July 18, 2007, July 31, 2007, October 15, 2007, January 24, 2008, February 14, 2008, and March 5, 2008, Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., requested license amendments to revise the Technical Specifications (TS) for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The proposed changes support the BSEP transition to AREVA fuel and core design methodologies.

On March 14, 2008, a telephone conference call was held with NRC, during which additional information was requested concerning the dynamic effects of bypass boiling on the Oscillation Power Range Monitor System. The requested information, which is provided in Enclosure 1, includes information that AREVA considers to be proprietary, as defined in 10 CFR 2.390. AREVA, as the owner of the proprietary information, has executed the affidavit provided in Enclosure 2, which identifies that the enclosed proprietary information has been handled and classified as proprietary, is customarily held in confidence, and has been withheld from public disclosure. AREVA requests that the enclosed proprietary information be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390. A non-proprietary version of the response is provided in Enclosure 3.

P.O. Box 10429
Southport, NC 28461

T> 910.457.3698

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NRR

There are no regulatory commitments associated with this submittal. Please refer any questions regarding this submittal to Mr. Randy C. Ivey, Manager - Support Services, at (910) 457-2447.

I declare, under penalty of perjury, that the foregoing is true and correct. Executed on March 21, 2008.

Sincerely,

Benjamin C. Waldrep

WRM/wrm

Enclosures:

1. Response to March 14, 2008, NRC Request for Information **(Proprietary Information – Withhold from Public Disclosure in Accordance With 10 CFR 2.390)**
2. AREVA Affidavit Regarding Withholding Proprietary Information from Public Disclosure
3. Response to March 14, 2008, NRC Request for Information (Non-Proprietary Version)

cc (with Enclosures 1, 2, and 3):

U. S. Nuclear Regulatory Commission, Region II
ATTN: Mr. Victor M. McCree, Regional Administrator (Acting)
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, GA 30303-8931

U. S. Nuclear Regulatory Commission
ATTN: Mr. Joseph D. Austin, NRC Senior Resident Inspector
8470 River Road
Southport, NC 28461-8869

U. S. Nuclear Regulatory Commission **(Electronic Copy Only)**
ATTN: Mrs. Farideh E. Saba (Mail Stop OWFN 8G9A)
11555 Rockville Pike
Rockville, MD 20852-2738

U. S. Nuclear Regulatory Commission **(Electronic Copy Only)**
ATTN: Mr. Stewart N. Bailey (Mail Stop OWFN 8B1)
11555 Rockville Pike
Rockville, MD 20852-2738

cc (with Enclosures 2 and 3):

Chair - North Carolina Utilities Commission
P.O. Box 29510
Raleigh, NC 27626-0510

Ms. Beverly O. Hall, Section Chief
Radiation Protection Section, Division of Environmental Health
North Carolina Department of Environment and Natural Resources
3825 Barrett Drive
Raleigh, NC 27609-7221

AREVA Affidavit Regarding Withholding Proprietary Information from Public Disclosure

AFFIDAVIT

COMMONWEALTH OF VIRGINIA)
) ss.
CITY OF LYNCHBURG)

1. My name is Mark J. Burzynski. I am Manager, Product Licensing, for AREVA NP Inc. (AREVA NP) and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by AREVA NP to determine whether certain AREVA NP information is proprietary. I am familiar with the policies established by AREVA NP to ensure the proper application of these criteria.

3. I am familiar with the AREVA NP information contained in the attachment to Progress Energy letter BSEP 08-0040 with subject entitled "Brunswick Steam Electric Plant, Unit Nos. 1 and 2 Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62 Additional Information in Support of Request for License Amendments Regarding Linear Heat Generation Rate and Core Operating Limits Report References for AREVA NP Fuel (NRC TAC Nos. MD4063 and MD4064)," and referred to herein as "Document." Information contained in this Document has been classified by AREVA NP as proprietary in accordance with the policies established by AREVA NP for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by AREVA NP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information."

6. The following criteria are customarily applied by AREVA NP to determine whether information should be classified as proprietary:

(a) The information reveals details of AREVA NP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA NP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for AREVA NP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by AREVA NP, would be helpful to competitors to AREVA NP, and would likely cause substantial harm to the competitive position of AREVA NP.

The information in the Document is considered proprietary for the reasons set forth in paragraphs 6(b) and 6(c) above.

7. In accordance with AREVA NP's policies governing the protection and control of information, proprietary information contained in this Document have been made available,

on a limited basis, to others outside AREVA NP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. AREVA NP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

Mark J. Burzynski

SUBSCRIBED before me this 20th

day of March, 2008.

Sherry L. McFaden
NOTARY PUBLIC, COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES: 10/31/10
Reg. # 7079129

SHERRY L. MCFADEN
Notary Public
Commonwealth of Virginia
7079129
My Commission Expires Oct 31, 2010

Response to March 14, 2008, NRC Request for Information
(Non-Proprietary Version)

Response to March 14, 2008, NRC Request for Information

On March 14, 2008, a telephone conference call was held with NRC, during which additional informational information was requested concerning the dynamic effects of bypass boiling on the Oscillation Power Range Monitor System. The responses below include information that AREVA considers to be proprietary as defined in 10 CFR 2.390. The AREVA proprietary information is identified by a double underline inside double square brackets. [[This sentence is an example.]] AREVA, as the owner of the proprietary information, has executed an enclosed affidavit which identifies that the identified proprietary information has been handled and classified as proprietary, is customarily held in confidence, and has been withheld from public disclosure. AREVA requests that the identified proprietary information be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390. A non-proprietary version of these responses is also provided.

NRC Question

Individual LPRM signals underestimate power measurement due to miscalibration when bypass voiding occurs at the detector elevation. In particular, time-dependent bypass voiding driven by the prompt energy deposition component is maximal at the power peak, and minimal at the power trough, which could underestimate the measurement of the oscillation amplitude. Please quantify this dynamic effect of the bypass boiling on the relative signal amplitude of the OPRM system, and if significant estimate a corresponding penalty on the amplitude setpoint.

Response

The dynamic effect of bypass voiding is addressed in two ways. The first is a qualitative discussion from first principles, and the second is through a simulation of a realistic bypass channel subjected to oscillating power input under conditions representing natural circulation.

First Principles Discussion:

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[[

]] would lead to a net signal damping requiring assessment of a compensating penalty, a calculation example is presented next.

Numerical Example of Bypass Voiding with Oscillating Power:

The calculation of a bypass voiding oscillation was performed by integrating a system of differential equations representing two-phase flow mass, momentum, and energy balance formulated similar to RAMONA5-FA. While the balance differential equations are identical to RAMONA5-FA, the boundary conditions and closing relations are simplified to suit the bypass calculation. These differences are:

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- [[

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]] A bottom-peaked axial power shape typical of BWR operation at natural circulation is specified where a fraction of the energy generation in the fuel assembly is deposited directly in the bypass flow.

The power is specified as a source function driving the bypass channel thermal-hydraulics. The power source in the presented example, as shown in Figure 1, is specified as initially constant at [[

]]

The selected power and flow conditions result in calculated steady state void fraction at the elevation of the level-D detector of [[ ]] and [[ ]] at the C-level detectors. This is slightly higher than expected values under typical natural circulation conditions at the Maximum Extended Load Line Limit Analysis (MELLLA) boundary. Detailed MICROBURN-B2 studies, using a [[ ]], have shown that the maximum local bypass void fraction at the D-level detectors is approximately [[ ]] and approximately [[ ]] at the C-level detectors at the MELLLA boundary at natural circulation. The power and flow conditions used in this case were chosen to provide a conservative representation of the void profile that would exist at natural circulation.

As shown in Figure 2, the level-C and level-D void fractions start to oscillate when the power source starts to oscillate, and the magnitude of the void oscillations [[

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An example OPRM signal is composed of four Local Power Range Monitor (LPRM) detectors at levels A, B, C, and D. Assuming no bypass boiling effect on the calculated signal, an OPRM time trace is obtained. The effect of the bypass voiding on the reduction of the LPRM detector response is conservatively taken as [[

]] The effect of bypass boiling at levels C and D on the contribution of the corresponding detectors is used to construct a second OPRM signal which is shown in Figure 3 to be lower than the first signal constructed without accounting for the bypass boiling. [[

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The absolute OPRM signals, with and without the bypass boiling effect, [[

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It is concluded that the steady state and dynamic effects of bypass boiling on lowering the sensitivity of individual LPRM detectors cause [[

]] OPRM signals used for comparison with the OPRM amplitude setpoint.

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Figure 1 Bypass Power Source Function Representing a Growing Oscillation

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Figure 2 Bypass Void Fraction at Detector Levels C and D

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Figure 3 [[ ]]

With and Without the Effect of Bypass Voiding

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Figure 4 [[ ]]
With and Without the Effect of Bypass Voiding

[[

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Figure 5 [[**]]**