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April 6, 2017

Serial: BSEP 17-0029

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

Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2  
Renewed Facility Operating License Nos. DPR-71 and DPR-62  
Docket Nos. 50-325 and 50-324  
Response to Request for Additional Information Regarding Request for License  
Amendment Regarding Core Flow Operating Range Expansion (CAC  
Nos. MF8864 and MF8865)

Reference: 1. Letter from William R. Gideon (Duke Energy) to the U.S. Nuclear Regulatory  
Commission Document Control Desk, *Request for License Amendment  
Regarding Core Flow Operating Range Expansion*, dated September 6,  
2016, ADAMS Accession Number ML16257A410

2. NRC E-mail Capture, *Brunswick Unit 1 and Unit 2 Request for Additional  
Information related Containment Accident Pressure in the MELLLA+ LAR  
(CACs MF8864 and MF8865)*, dated March 9, 2017, ADAMS Accession  
Number ML17082A304

Ladies and Gentlemen:

By letter dated September 6, 2016 (i.e., Reference 1), Duke Energy Progress, LLC (Duke Energy), submitted a license amendment request (LAR) for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The proposed amendment would expand the core power-flow operating range (i.e., Maximum Extended Load Line Limit Analysis Plus (MELLLA+)).

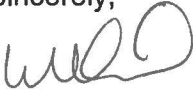
On March 9, 2017, by electronic mail (i.e., Reference 2), the NRC provided a request for additional information (RAI) regarding the LAR. Duke Energy's response is provided in the enclosure of this letter.

No regulatory commitments are contained in this letter.

Please refer any questions regarding this submittal to Mr. Lee Grzeck, Manager - Regulatory Affairs, at (910) 457-2487.

I declare, under penalty of perjury, that the foregoing is true and correct. Executed on April 6, 2017.

Sincerely,



William R. Gideon

WRM/wrm

Enclosure: NRC Response to Request for Additional Information SRXB-C-RAI-1

cc (with enclosure):

U.S. Nuclear Regulatory Commission, Region II  
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## **NRC Request for Additional Information SRXB-C-RAI-1**

### Regulatory Basis:

10 CFR 50 Appendix A, Criterion 38, "Containment heat removal"

### Background:

Reference 2 states that the Brunswick Steam Electric Plant (BSEP) Units 1 and 2 depend on the Containment Accident Pressure (CAP) developed during postulated accidents for assuring a positive Net Positive Suction Head (NPSH) margin for the Emergency Core Cooling System (ECCS) and the containment heat removal system pumps. In a letter dated May 31, 2002, the Nuclear Regulatory Commission (NRC) staff Safety Evaluation Report (SER) for the Extended Power Uprate (EPU) for BSEP, Units 1 and 2 (i.e., Amendment No. 222 to Facility Operating License No. DPR-71 and Amendment No. 247 to Facility Operating License No. DPR-62) approved use of CAP of up to 5.0 psig for NPSH requirements from the available post-LOCA containment pressure of 11.3 psig at EPU conditions. Subsequent to issuance of the SER for EPU, the NRC staff issued SECY-11-0014 (Reference 7) for addressing the Advisory Committee for Reactor Safeguards (ACRS) concerns for the use of CAP. Enclosure 1, (Reference 8) of SECY-11-0014, Section 6.0 provides staff guidance on the use of CAP in determining the NPSH margins of ECCS and containment heat removal system pumps.

### Requested additional information:

Since the BSEP Units 1 and 2 use CAP for assuring positive NPSH margins for the ECCS and the containment heat removal system pumps, the guidance in SECY-11-0014 is applicable for quantifying NPSH margins and supersedes the previously approved use of CAP in which the margins were not quantified. Sections 6.6.3 and Section 6.6.9 of Enclosure 1 (Reference 8) of SECY-11-0014 states:

A 95/95 lower tolerance limit should be used to calculate the containment accident pressure used to determine the NPSHa [NPSH available].

A realistic calculation of NPSHa should be performed to compare with the NPSHa determined from the Monte Carlo 95/95 calculation.

The licensee has not addressed Section 6.6.3 and 6.6.9 of Enclosure 1 (Reference 8) of SECY-11-0014. Specifically, the statistical analysis proposed by the Boiling Water Reactor Owners' Group (BWROG) described in References 3 and 4, approved by NRC in Reference 5 and 6, has not been performed by the licensee to demonstrate and quantify NPSH margin for the postulated design basis Loss of Coolant Accident (LOCA) in the Analysis of Record (AOR). Please provide the statistical analysis as described in Reference 4 to satisfactorily address the criteria in Sections 6.6.3 and 6.6.9 in Reference 8.

The licensee may note the Monticello EPU and Maximum Extended Load Line Limit Analysis Plus (MELLLA+) CAP document (Reference 9) as a precedent which addressed all criteria of Section 6.6 of Reference 8 including performing the statistical analysis described in Sections 6.6.3 and 6.6.9.

**References:**

1. Letter from Duke Energy to NRC dated September 6, 2016, "Brunswick Steam Electric Plant, Unit Nos. 1 and 2 Renewed Facility Operating License Nos. DPR-71 and DPR-62 Docket Nos. 50-325 and 50-324 Request for License Amendment Regarding Core Flow Operating Range Expansion," (ADAMS Accession Number ML16257A410)
2. Enclosure 11 to Reference 1, "SECY-11-0014 Discussion - Use of Containment Accident Pressure (CAP) in Analyzing ECCS and Containment Heat Removal System Pump Performance," (ADAMS Accession Number ML16257A411)
3. BWROG letter to NRC dated November 21, 2014, "Submittal of Revised BWROG Topical Reports NEDC-33347P Revision 1 (Proprietary Version) and NEDO-33347 Revision 1 (Non-Proprietary Version), "Containment Overpressure Credit for Net Positive Suction Head (NPSH)," (ADAMS Accession number ML14325A626)
4. Attachment 1 to Reference 1, "NEDC-33347P Revision 1 Proprietary Version Containment Overpressure Credit for Net Positive Suction Head (NPSH)," (ADAMS Accession Number ML14325A625)
5. Letter from NRC to BWROG dated December 21, 2016, "Final Safety Evaluation for Boiling Water Reactor Owners' Group Topical Report NEDC-33347P/NEDO-33347, Revision 1, "Containment Overpressure Credit for Net Positive Suction Head (NPSH)" (CAC No. Mf6708)," (ADAMS Accession Number ML16351A176)
6. Enclosure to Reference 5, "U.S. Nuclear Regulatory Commission Final Safety Evaluation for Topical Report NEDC-33347P/NEDO-33347, Revision 1, "Containment Overpressure Credit For Net Positive Suction Head (NPSH)" CAC NO. MF6708," (ADAMS Accession Number ML16351A179)
7. SECY 11-0014, "Use of Containment Accident Pressure in Analyzing Emergency Core Cooling System and Containment Heat Removal System Pump Performance in Postulated Accidents," (ADAMS Accession Number ML1025901961)
8. Enclosure 1 to SECY-11-0014, "The Use of Containment Accident Pressure in Reactor Safety Analysis ADAMS ML102110167," (ADAMS Accession Number ML102110167)
9. Letter from Northern States Power Company to NRC dated September 28, 2012, "Monticello Extended Power Uprate and Maximum Extended Load Line Limit Analysis Plus License Amendment Requests: Supplement to Address SECY 11-0014 Use of Containment Accident Pressure (TAC Nos. MD9990 and ME3145)," (ADAMS Accession Number ML12276A057)

**Response:**

In response to the Nuclear Regulatory Commission's (NRC) ongoing review of the Duke Energy Progress, LLC (Duke Energy) license amendment request (LAR) for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2 (i.e., Reference 1), Duke Energy is providing the following information to address the NRC's request for additional information (RAI) on Enclosure 11 of the submittal. The RAI is related to Duke's discussion of criteria 6.6.3 and 6.6.9 of Enclosure 1 of SECY-11-0014 (i.e., Reference 2).

As part of the BSEP Extended Power Uprate (EPU), a credit for containment overpressure of up to 5 psig was approved, in May 2002, by the NRC (i.e., Reference 3) for evaluating low pressure Emergency Core Cooling System (ECCS) pump net positive suction head (NPSH). The results of the NPSH evaluation for EPU conditions are discussed in BSEP Updated Final Safety

Analysis Report (UFSAR), Section 6.3.2.2.5. This section reflects the BSEP Analysis of Record (AOR) for ECCS NPSH. As discussed in UFSAR Section 6.3.2.2.5.2, "the maximum required overpressure needed to ensure NPSH is 2.65 psig, with 11.3 psig containment overpressure available. In all cases, the available containment overpressure is in excess of three times the amount required to ensure adequate NPSH."

The generic disposition of the ECCS NPSH topic in the MELLLA+ License Topical Report (i.e., Reference 4) describes that the MELLLA+ operating domain expansion does not result in an increase in the heat addition to the suppression pool following a LOCA. As discussed in Sections 3.9.3 and 4.2.6 of Enclosure 5 of Duke Energy's MELLLA+ submittal (i.e., Reference 1), consistent with the generic disposition (i.e., Reference 4), BSEP operation in the MELLLA+ domain has no negative impact on ECCS NPSH.

No new or increased credit for Containment Accident Pressure (CAP) is requested for assuring NPSH margins are acceptable. In contrast to the Monticello CAP analysis, which was provided due to an increase in the temperature, pressure, flow or mechanical loads due to EPU or MELLLA+, the BSEP NPSH analysis is unaffected by MELLLA+ as described in the MELLLA+ LAR. Therefore, applying the SECY-11-0014 criteria to the ECCS NPSH AOR is not required.

It is Duke Energy's position that the guidance in SECY-11-0014 does not supersede the previously approved use of CAP for BSEP. Specifically, the SECY itself states as option 1 (i.e., option 1 as later adopted by the NRC Commissioners):

*The staff resumes work on EPU applications. The staff's evaluation of current EPU applications, **as well as future applications for new or increased credit for CAP**, would be consistent with staff practice in implementing the current risk review guidance (SRP Section 19.2), including the review of nonrisk-informed applications such as EPUs (Appendix D of SRP Section 19.2) and the recently-developed deterministic guidance based on ACRS recommendations to include uncertainty and margins in CAP calculations. The staff would not further consider the issue of CAP credit, per se, as a generic safety matter. The staff will update the regulatory guidance to remove the specific guidance disfavoring the use of CAP in determining NPSH margin. [Emphasis Added]*

Therefore, MELLLA+ has no adverse impact on ECCS NPSH and SECY-11-0014 does not supersede BSEP's previously approved use of CAP.

At a meeting with the NRC on January 8, 2013 (i.e., Reference 5), the use of the "new uncertainty methods" for the NPSH analyses associated with MELLLA+ were discussed for the purpose of confirming the suitability of the existing 5 psig CAP credit. In the BSEP response to SECY criterion 1, included with Enclosure 11 of the MELLLA+ submittal (i.e., Reference 1), the vendor-supplied NPSH<sub>R</sub> value was increased by 21% to perform the NPSH margin calculations for the Design Basis Accident-Loss of Coolant Accident (DBA-LOCA). The results of the analysis are discussed in Enclosure 11 of the MELLLA+ submittal and demonstrate that NPSH margin existed for all cases with the most limiting case providing a minimum margin of 1.1 feet for Residual Heat Removal (RHR) and 0.6 feet for Core Spray (CS) pumps. Although the Reference 5 meeting notes only address the 21% margin, Duke Energy elected to evaluate key SECY-11-004 criteria in a manner that demonstrates no additional CAP is needed after applying the SECY guidance.

The specific RAI states that Sections 6.6.3 and 6.6.9 of Enclosure 1 of SECY-11-0014 were not addressed in Enclosure 11 of the MELLLA+ submittal (i.e., Reference 1) and requests that the statistical 95/95 analysis be performed as outlined in SECY-11-0014. These sections of SECY-11-0014, Enclosure 1, are interrelated in that Section 6.6.3 specifies that a 95/95 lower tolerance limit be used to calculate the containment accident pressure used to determine  $NPSH_A$  and that Section 6.6.9 specifies that a realistic calculation of  $NPSH_A$  be performed and compared to the 95/95 calculation. Though a 95/95 calculation was not performed for Enclosure 11 of the MELLLA+ submittal, the NPSH margin demonstrated by the realistic analysis relative to the conservative analysis and the BSEP design basis containment analysis allows an appropriate comparison for satisfying the SECY-11-0014, Enclosure 1, Section 6.6.9 criteria of demonstrating margins. Furthermore, the wetwell pressure response from the realistic model demonstrated significant margin, with the calculated available containment overpressure in excess of two times the 5 psi CAP used in the NPSH margin calculations.

In conclusion, MELLLA+ has no adverse impact on ECCS NPSH and SECY-11-0014 does not supersede BSEP's previously approved use of CAP. Duke Energy elected to evaluate key criteria from SECY-2011-14 as a confirmation that no additional CAP is needed after applying SECY-11-0014 guidance. The margins demonstrated in these evaluations, as presented in Enclosure 11 of the MELLLA+ LAR submittal (i.e., Reference 1), satisfy this purpose without further evaluation.

References:

1. Letter from William R. Gideon (Duke Energy) to U.S. Nuclear Regulatory Commission, *Brunswick Steam Electric Plant, Unit Nos. 1 and 2 Renewed Facility Operating License Nos. DPR-71 and DPR-62 Docket Nos. 50-325 and 50-324 Request for License Amendment Regarding Core Flow Operating Range Expansion*, dated September 6, 2016, ADAMS Accession No. ML16257A410
2. SECY-11-0014, *Use of Containment Accident Pressure in Analyzing Emergency Core Cooling System and Containment Heat Removal System Pump Performance in Postulated Accidents*, dated January 31, 2011, ADAMS Accession No. ML102590196
3. Letter from Brenda L. Mozafari (NRC) to John S. Keenan (CP&L), *Brunswick Steam Electric Plant, Units 1 and 2 – Issuance of Amendment Re: Extended Power Uprate (TAC Nos. MB2700 and MB2701)*, May 31, 2002, ADAMS Accession No. ML021430551
4. GE Hitachi Nuclear Energy, *General Electric Boiling Water Reactor Maximum Extended Load Line Limit Analysis Plus*, NEDC-33006P-A, Revision 3, June 2009
5. Letter from Christopher Gratton (NRC) to Carolina Power & Light Company, *Summary of January 8, 2013 Meeting with Duke Energy Carolinas to Discuss Planned Amendment Requests at Brunswick Steam Electric Plants Units 1 and 2 (TAC Nos. MF0359 and MF0360)*, dated January 17, 2013, ADAMS Accession No. ML13016A014