



Steve Snider
Vice President

Nuclear Engineering
526 South Church Street, EC-07H
Charlotte, NC 28202
980-382-6195
Steve.Snider@duke-energy.com

10 CFR 50.46

Serial: RA-21-0051
April 5, 2021

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

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

Catawba Nuclear Station, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. NPF-35 and NPF-52
Docket Nos. 50-413 and 50-414

Shearon Harris Nuclear Power Plant, Unit 1
Renewed Facility Operating License No. NPF-63
Docket No. 50-400

McGuire Nuclear Station, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. NPF-9 and NPF-17
Docket Nos. 50-369 and 50-370

Oconee Nuclear Station, Unit Nos. 1, 2 and 3
Renewed Facility Operating License Nos. DPR-38, DPR-47 and DPR-55
Docket Nos. 50-269, 50-270 and 50-287

H. B. Robinson Steam Electric Plant, Unit 2
Renewed Facility Operating License No. DPR-23
Docket No. 50-261

SUBJECT: Annual Report of Changes Pursuant to 10 CFR 50.46

Ladies and Gentlemen:

Pursuant to 10 CFR 50.46(a)(3)(ii), Duke Energy hereby submits the enclosed annual reports of changes to, or errors in, Emergency Core Cooling System (ECCS) evaluation models. These reports cover the period from January 1, 2020 to December 31, 2020 for the Brunswick Steam Electric Plant (BNP), Catawba Nuclear Station (CNS), Shearon Harris Nuclear Power Plant (HNP), McGuire Nuclear Station (MNS), Oconee Nuclear Station (ONS), and H.B. Robinson Steam Electric Plant (RNP) are provided in Enclosures 1 through 6 respectively.

U.S. Nuclear Regulatory Commission

RA-21-0051

Page 2

No regulatory commitments are contained in this submittal.

Should you have any questions concerning this letter and its enclosures, please contact Art Zaremba, Manager - Nuclear Fleet Licensing at (980) 373-2062.

Sincerely,

A handwritten signature in black ink, appearing to read "Steve Snider". The signature is fluid and cursive, with the first name "Steve" and last name "Snider" clearly distinguishable.

Steve Snider

Vice President, Nuclear Engineering

Enclosures:

1. [BNP 10 CFR 50.46 Annual Report](#)
2. [CNS 10 CFR 50.46 Annual Report](#)
3. [HNP 10 CFR 50.46 Annual Report](#)
4. [MNS 10 CFR 50.46 Annual Report](#)
5. [ONS 10 CFR 50.46 Annual Report](#)
6. [RNP 10 CFR 50.46 Annual Report](#)

cc:

L. Dudes, USNRC, Region II Regional Administrator
A. Hon, USNRC NRR Project Manager for BNP
K. Cotton, USNRC NRR Project Manager for CNS
M. Mahoney, USNRC NRR Project Manager for HNP
J. Klos, USNRC NRR Project Manager for MNS and RNP
S. Williams, USNRC NRR Project Manager for ONS
G. Smith, USNRC Senior Resident Inspector for BNP
J. Austin, USNRC Senior Resident Inspector for CNS
J. Zeiler, USNRC Senior Resident Inspector for HNP
A. Hutto, USNRC Senior Resident Inspector for MNS
J. Nadel, USNRC Senior Resident Inspector for ONS
M. Fannon, USNRC Senior Resident Inspector for RNP

General Counsel to Chair of NC Utilities Commission (swatson@ncuc.net)

W. L. Cox III (lee.cox@dhhs.nc.gov), NC DHHS
P. D. Cox (patrick.cox@dhhs.nc.gov), NC DHHS

SC Attorney General (phunter@scag.gov)

L. Garner (garnerld@dhec.sc.gov); SC DHEC
A. Nair (naira@dhec.sc.gov); SC DHEC

ENCLOSURE 1: [BNP 10 CFR 50.46 Annual Report](#)

**Brunswick Steam Electric Plant, Units 1 and 2
Docket Nos. 50-325 and 50-324 / Renewed License Nos. DPR-71 and DPR-62**

Summary of Errors Reported

10 CFR 50.46 Report for Brunswick Steam Electric Plant Units 1 and 2

During this reporting period, there were zero error/change notices for ATRIUM 10XM or the ATRIUM 11 Lead Use Assemblies (LUA).

A new Licensing Basis Analysis of Record for ATRIUM 11 LOCA Analysis (Reference 1) was implemented to support operation of ATRIUM 11 fuel. Per Reference 1, the ATRIUM 11 Licensing Basis PCT was calculated to be 1957°F at 0 GWd/MTU exposure. One subsequent error notice on this ATRIUM 11 analysis was received, Reference 2.

The ATRIUM 11 error notice (Reference 2) documents 7 new evaluations with a cumulative impact of -75°F, bringing the ATRIUM 11 PCT to 1882°F. This notice includes the -5°F ATRIUM 11 impact previously reported to Duke Energy in Reference 3. Additionally, four of the evaluations resulted in a 0°F PCT impact (issue with AUTOSR5LOCA axial power shapes, coding issue in RODEX4 model for pellet gap condition, issue with AUTOBLT pressure location for SRV controller, and issue with AUTOSR5BDK-LOCA heat structure initialization) and one resulted in a +5°F PCT impact (error identified in MICROBURN-B2 loss coefficient for the upper tie plate (UTP)).

One error in S-RELAP5 resulted in a PCT impact of -75°F. S-RELAP5 is the computer code used within the AURORA-B LOCA methodology to perform the break spectrum analysis. The proprietary and non-proprietary description of the AURORA-B LOCA methodology error was submitted to NRC as a 30-day report pursuant to 10 CFR 50.46(a)(3)(ii) in letter dated February 9, 2021 (Reference 4).

References:

- 1) Framatome Report ANP-3674P, "Brunswick Units 1 and 2 LOCA Analysis for ATRIUM 11 Fuel," Revision 2, May 2019
- 2) FS1-0052486 Revision 2.0, "10 CFR 50.46 PCT Error Report for Brunswick Units 1 and 2 ATRIUM 11 Fuel," Framatome Inc., January 2021
- 3) FS1-0040060 Revision 2.0, "10 CFR 50.46 PCT Error Report for Brunswick Units 1 and 2 for MELLLA+ Operation", Framatome Inc., January 2020
- 4) Duke Energy Progress, LLC letter to NRC, *30-Day Report Pursuant to 10 CFR 50.46, Changes to or Errors in an Acceptable Loss of Coolant Evaluation Model*, dated February 9, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML21040A382 and ML21040A383).

A10XM Summary

10 CFR 50.46 Report for Brunswick Steam Electric Plant Units 1 and 2

Plant:	Brunswick Steam Electric Plant, Units 1 and 2	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):		
Evaluation Model:	EMF-2361(P)(A), Revision 0 EXEM BWR-2000 ECCS Evaluation Model, May 2001	
Fuel:	ATRIUM 10XM (A10XM)	
A. Analysis of Record PCT	1923 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +2 °F	Absolute PCT Effect +2 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1925 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	-	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + net E)	1925 °F	

ATRIUM 11 LUA Summary

10 CFR 50.46 Report for Brunswick Steam Electric Plant Units 1 and 2

Plant:	Brunswick Steam Electric Plant, Unit 2	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):		
Evaluation Model:	EMF-2361(P)(A), Revision 0 EXEM BWR-2000 ECCS Evaluation Model, May 2001	
Fuel:	ATRIUM 11 (A11) Lead Use Assemblies (LUA)	
A. Analysis of Record PCT	1762 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +2 °F	Absolute PCT Effect +2 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1764 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	-	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + net E)	1764 °F	

ATRIUM 11 Summary

10 CFR 50.46 Report for Brunswick Steam Electric Plant Units 1 and 2

Plant:	Brunswick Steam Electric Plant, Unit 1	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):		
Evaluation Model:	ANP-10332P-A, Revision 0 AURORA-B LOCA Evaluation Model, March 2019	
Fuel:	ATRIUM 11 (A11)	
A. Analysis of Record PCT	1957 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1957 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period		
1. RODEX4 Axial PCMI Onset	-5 °F	
2. AUTOSR5LOCA Axial Power Shapes	+0 °F	
3. RODEX4 Pellet Gap Condition	+0 °F	
4. AUTOBLT Pressure Location for the SRV Controller	+0 °F	
5. AUTOSR5BDK-LOCA Heat Structure Initialization	+0 °F	
6. S-RELAP5 CCFL Model	-75 °F	
7. MICROBURN-B2 UTP Loss Coefficient	+5 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect -75 °F	Absolute PCT Effect 85 °F
F. Licensing Basis PCT (C + net E)	1882 °F	

ENCLOSURE 2: [CNS 10 CFR 50.46 Annual Report](#)

**Catawba Nuclear Station, Units 1 and 2
Docket Nos. 50-413 and 50-414 / Renewed License Nos. NPF-35 and NPF-52**

Summary of Errors Reported

10 CFR 50.46 Report for Catawba Units 1 and 2

No errors in the LOCA evaluation models for Catawba Units 1 and 2 were assessed for impact to PCT in calendar year 2020.

10 CFR 50.46 Report for Catawba Unit 1 – Large Break LOCA

Plant:	Catawba Nuclear Station, Unit 1	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Large Break	
Evaluation Model:	WCAP-12945-P-A, Revision 0 Code Qualification Document for Best Estimate LOCA Analysis	
Fuel:	17x17 RFA	
A. Analysis of Record PCT	2028 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +58 °F	Absolute PCT Effect 378 °F
C. Baseline PCT for assessing new changes for significance (A + B)	2086 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	2086 °F	

10 CFR 50.46 Report for Catawba Unit 1 – Small Break LOCA

Plant:	Catawba Nuclear Station, Unit 1	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Small Break	
Evaluation Model:	WCAP-10054-P-A, Revision 0 NOTRUMP	
Fuel:	17x17 RFA	
A. Analysis of Record PCT	1323 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +0 °F	Absolute PCT Effect 0 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1323 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	1323 °F	

10 CFR 50.46 Report for Catawba Unit 2 – Large Break LOCA

Plant:	Catawba Nuclear Station, Unit 2	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Large Break	
Evaluation Model:	WCAP-12945-P-A, Revision 0 Code Qualification Document for Best Estimate LOCA Analysis	
Fuel:	17x17 RFA	
A. Analysis of Record PCT	2028 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +42 °F	Absolute PCT Effect 362 °F
C. Baseline PCT for assessing new changes for significance (A + B)	2070 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	2070 °F	

10 CFR 50.46 Report for Catawba Unit 2 – Small Break LOCA

Plant:	Catawba Nuclear Station, Unit 2	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Small Break	
Evaluation Model:	WCAP-10054-P-A, Revision 0 NOTRUMP	
Fuel:	17x17 RFA	
A. Analysis of Record PCT	1243 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +0 °F	Absolute PCT Effect 0 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1243 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	1243 °F	

ENCLOSURE 3: [HNP 10 CFR 50.46 Annual Report](#)

**Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400 / Renewed License No. NPF-63**

Summary of Errors Reported

10 CFR 50.46 Report for Shearon Harris Unit 1

There were no impacts to the applicable Large Break LOCA nor Small Break LOCA analyses for Shearon Harris Unit 1 during the 2020 calendar year.

10 CFR 50.46 Report for Shearon Harris Unit 1 – Large Break LOCA

Plant:	Shearon Harris, Unit 1	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Large Break	
Evaluation Model:	EMF-2103(P)(A), Revision 0 Realistic Large Break LOCA for PWRs	
Fuel:	17x17 HTP	
A. Analysis of Record PCT	1935 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +160 °F	Absolute PCT Effect 160 °F
C. Baseline PCT for assessing new changes for significance (A + B)	2095 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	2095 °F	

10 CFR 50.46 Report for Shearon Harris Unit 1 – Small Break LOCA

Plant:	Shearon Harris, Unit 1	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Small Break	
Evaluation Model:	EMF-2328(P)(A), Revision 0 PWR Small Break LOCA Evaluation Model	
Fuel:	17x17 HTP	
A. Analysis of Record PCT	1664 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +63 °F	Absolute PCT Effect 63 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1727 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	1727 °F	

ENCLOSURE 4: [MNS 10 CFR 50.46 Annual Report](#)

**McGuire Nuclear Station, Units 1 and 2
Docket Nos. 50-369 and 50-370 / Renewed License Nos. NPF-9 and NPF-17**

Summary of Errors Reported

10 CFR 50.46 Report for McGuire Units 1 and 2

No errors in the LOCA evaluation models for McGuire Units 1 and 2 were assessed for impact to PCT in calendar year 2020.

10 CFR 50.46 Report for McGuire Units 1 & 2 – Large Break LOCA

Plant:	McGuire Nuclear Station, Units 1 & 2	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Large Break	
Evaluation Model:	WCAP-12945-P-A, Revision 0 Code Qualification Document for Best Estimate LOCA Analysis	
Fuel:	17x17 RFA	
A. Analysis of Record PCT	2028 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +58 °F	Absolute PCT Effect 378 °F
C. Baseline PCT for assessing new changes for significance (A + B)	2086 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	2086 °F	

10 CFR 50.46 Report for McGuire Units 1 & 2 – Small Break LOCA

Plant:	McGuire Nuclear Station, Units 1 & 2	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Small Break	
Evaluation Model:	WCAP-10054-P-A, Revision 0 NOTRUMP	
Fuel:	17x17 RFA	
A. Analysis of Record PCT	1323 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +0 °F	Absolute PCT Effect 0 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1323 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	1323 °F	

ENCLOSURE 5: [ONS 10 CFR 50.46 Annual Report](#)

**Oconee Nuclear Station, Units 1, 2 and 3
Docket Nos. 50-269, 50-270 and 50-287
Renewed License Nos. DPR-38, DPR-47 and DPR-55**

Summary of Errors Reported

10 CFR 50.46 Report for Oconee Units 1, 2, & 3

Three modeling changes in the LOCA evaluation models that were assessed for PCT impact were identified in 2020.

1) BWNT LOCA EM inside cladding initial base metal reacted thickness

The inside oxidation model in the NRC-approved BWNT LOCA EM was shown to be non-conservative based on the current understanding of the inside oxide growth during normal plant operation. A revised initial inside oxidation input model was developed for use in future LOCA analyses for M5 clad fuel. A lower bound initial thickness is used as an input to the LOCA analysis-of-record (AOR) PCT analyses because it increases the metal-water reaction energy for the ruptured fuel segment only. This change reduces the local oxidation values marginally in unruptured segment, but it has no impact on the PCTs in unruptured segments.

Evaluation results showed that the limiting PCT was produced in an unruptured segment. The evaluations were performed to determine that the limiting LBLOCA PCT did not change with the revised thinner initial oxidation inputs applied. The ruptured segment local oxidation could increase slightly but the maximum local oxidation is limiting for the unruptured segment. Since the unruptured segment is limiting, the local oxidation actually decreases slightly due to the thinner initial inside oxide thickness. Therefore, the previously calculated local oxidation remains limiting. The change in whole core hydrogen generation is negligible considering the substantial margin to the local oxidation and whole core hydrogen generation criteria. Therefore, all analyses remain in compliance with the acceptance criteria.

The SBLOCA limiting PCT was not impacted by this change. An impact on PCT is 0 °F for SBLOCA licensing basis analyses. The SBLOCA maximum local oxidation and whole core hydrogen generation is less than that for the LBLOCA, so the SBLOCA analyses remain in compliance with the 10 CFR 50.46 regulatory limits as well.

2) LBLOCA EM method change for the lower plenum pressure in the BEACH analysis

The EM change adds the downcomer (DC) liquid elevation head to the REFLOD3B code upper DC pressure used in the BEACH code lower plenum time-dependent volume to assure the volume remains liquid conditions during the reflooding phase consistent with the REFLOD3B code calculations. This change assures the fluid state entering the core during the reflooding phase is appropriately calculated. This change accurately reflects the pressure in the lower plenum, and it precludes the unrealistic phase change that can occur after the PCT was predicted.

For ONS, the full core Mark-B-HTP TCD compensatory penalized Linear Heat Rate (LHR) analyses did not use this analytical method. The PCT impact of this EM change is evaluated to be negligible so it is estimated to be 0 °F. Since the REFLOD3B and BEACH codes are not used in the B&W plant SBLOCA methods, this EM change is not applicable to SBLOCA analyses, and therefore no change is required for SBLOCA analysis results.

3) LBLOCA EM method change for the adjustment of the refill period adjustment to account for the RELAP5 CFT gas temperature

The EM change increases the length of the BEACH refill period to offset a slight non-conservatism in the accumulator discharge rate associated with a minimum nitrogen gas temperature limit in the RELAP5/MOD2-B&W code. For LBLOCA analyses, the RELAP5/MOD2-B&W code has a minimum cap of 250 K (~ -9.7 °F) for the CFT tank. If the calculations are performed beyond the time that this minimum temperature is achieved, the CFT gas pressure can be slightly higher than it would be calculated if the

gas temperature was allowed to continue to decrease, which could reduce the PCT if it occurs near the bottom of core recovery (BOCR) time.

The review of the ONS compensatory TCD-penalized LBLOCA analyses was performed and it was confirmed that the CFT minimum temperature was reached during blowdown of the LBLOCA TCD-penalized analyses. Therefore, an evaluation was performed to determine the LBLOCA PCT estimates with different changes based on the cladding rupture status and the fuel pin burnups. Based on the evaluation, the PCT impact was determined to be a 10 °F increase, which was applied to the TCD-penalized compensatory LHR limit LBLOCA PCTs estimated for the ONS 1, 2, and 3 units. The small PCT increases calculated for the LBLOCA PCTs for the Oconee units have a negligible impact on the peak local oxidation and whole core hydrogen generation rates. While these two values can marginally increase, there is significant margin between the maximum local oxidation and the whole core hydrogen rates. Therefore the negligible changes do not impact compliance with the 10 CFR 50.46 regulatory limits.

Since the REFL0D3B and BEACH codes are not used in the B&W plant SBLOCA methods, this EM change is not applicable to SBLOCA analyses; therefore, no PCT change is required for SBLOCA analysis results.

10 CFR 50.46 Report for Oconee Units 1, 2, & 3 – Large Break LOCA

Plant:	Oconee Nuclear Station, Units 1, 2, & 3	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Large Break	
Evaluation Model:	BAW-10192P-A, Revision 0, BWNT LOCA Evaluation Model for Once-Through Steam Generator Plants	
Fuel:	15x15 Mark-B-HTP	
A. Analysis of Record PCT	1852 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +2 °F	Absolute PCT Effect 858 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1854 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period		
1. BWNT LOCA EM Inside Cladding Initial Base Metal Reacted Thickness Model Change	+0 °F	
2. BEACH Lower Plenum Pressure Elevation Head Adjustment Model Change	+0 °F	
3. RELAP5/MOD2-B&W CFT Temperature Limit Adjustment or the Refill Period Model Change	+10 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect +10 °F	Absolute PCT Effect 10 °F
F. Licensing Basis PCT (C + E)	1864 °F	

10 CFR 50.46 Report for Oconee Units 1, 2, & 3 – Small Break LOCA

Plant:	Oconee Nuclear Station, Units 1, 2, & 3	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Small Break	
Evaluation Model:	BAW-10192P-A, Revision 0, BWNT LOCA Evaluation Model for Once-Through Steam Generator Plants	
Fuel:	15x15 Mark-B-HTP	
A. Analysis of Record PCT Full Power – 100% FP	1598 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +0 °F	Absolute PCT Effect 0 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1598 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. BWNT LOCA EM Inside Cladding Initial Base Metal Reacted Thickness Model Change	+0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect +0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	1598 °F	
A. Analysis of Record PCT Reduced Power – 50% FP	1480 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect +0 °F	Absolute PCT Effect 0 °F
C. Baseline PCT for assessing new changes for significance (A + B)	1480 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1) BWNT LOCA EM Inside Cladding Initial Base Metal Reacted Thickness Model Change	+0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect +0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	1480 °F	

ENCLOSURE 6: [RNP 10 CFR 50.46 Annual Report](#)

**H. B. Robinson Steam Electric Plant, Unit 2
Docket No. 50-261 / Renewed License No. DPR-23**

Summary of Errors Reported

10 CFR 50.46 Report for H.B. Robinson Unit 2

One error which impacts the Large Break LOCA analysis was reported by Framatome. The error is related to rod-to-rod thermal radiation heat transfer modeling for analyses that use the EMF-2103, Revision 3 RLBLOCA methodology. Fuel stored energy uncertainty established for simulation of limiting fuel rods, were inadvertently applied to the hot fresh and once-burned UO₂ rod radiation enclosures. The intent of the methodology is that the uncertainty for enclosure stored energy matches that of the hot fuel assembly, which has no applied uncertainty. The PCT impact to the Large Break LOCA analysis is 0°F.

Changes to the H.B. Robinson Unit 2 PCT were previously reported due to implementation of Cycle 33 LOCA analysis for W15-LC fuel. The proprietary and non-proprietary description of impact of W15-LC fuel on LOCA analyses was submitted to NRC as a 30-day report pursuant to 10 CFR 50.46(a)(3)(ii) in letter dated December 17, 2020 (Reference 1).

References:

- 1) Duke Energy Progress, LLC letter to NRC, *30-Day Report Pursuant to 10 CFR 50.46, Changes to or Errors in an Acceptable Loss of Coolant Evaluation Model*, dated December 17, 2020 (ADAMS Accession Nos. ML20352A463, ML20352A464, and ML20352A465).

10 CFR 50.46 Report for H.B. Robinson Unit 2 – Large Break LOCA

Plant:	H.B. Robinson, Unit 2	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Large Break	
Evaluation Model:	EMF-2103(P)(A), Revision 3 Realistic Large Break LOCA for PWRs	
Fuel:	W15-LC, W15 HTP	
A. Analysis of Record PCT	1771 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect N/A	Absolute PCT Effect N/A
C. Baseline PCT for assessing new changes for significance (A + B)	1771 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period		
1. Estimated effect of error in rod-to-rod thermal radiation modeling.	0 °F	
2. Evaluation of resident once-burned W15 HTP fuel in mixed cores of W15-LC and W15 HTP fuel, using EMF-2103, Revision 3.	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	1771 °F	

10 CFR 50.46 Report for H.B. Robinson Unit 2 – Small Break LOCA

Plant:	H.B. Robinson, Unit 2	
Reporting Period:	January 1, 2020 – December 31, 2020	
LOCA Analysis Type (if applicable):	Small Break	
Evaluation Model:	EMF-2328(P)(A), Revision 0 and EMF-2328(P)(A), Rev. 0, Supplement 1, Rev. 0 PWR Small Break LOCA Evaluation Model	
Fuel:	W15-LC, W15 HTP	
A. Analysis of Record PCT	1538 °F	
B. Net Cumulative 10 CFR 50.46 Changes and Error Corrections - Previously Reported	Net PCT Effect N/A	Absolute PCT Effect N/A
C. Baseline PCT for assessing new changes for significance (A + B)	1538 °F	
D. Cumulative 10 CFR 50.46 Changes and Error Corrections – This Reporting Period 1. None	0 °F	
E. Sum of 10 CFR 50.46 Changes and Error Corrections against Baseline PCT	Net PCT Effect 0 °F	Absolute PCT Effect 0 °F
F. Licensing Basis PCT (C + E)	1538 °F	