Duke Energy®

10 CFR 50.46

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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555-001
Attention: Document Control Desk

Subject: Duke Energy Carolinas, LLC (Duke Energy)
Oconee Nuclear Station, Units 1, 2, and 3
Docket Numbers 50-269, 50-270, and 50-287

30-Day Report Pursuant to 10 CFR 50.46, Changes to or Errors in an Evaluation Model

10 CFR 50.46 (a)(3)(ii) requires the reporting of changes to or errors in Emergency Core Cooling System (ECCS) evaluation models (EMs), or in the application of such models that affect the temperature calculation. On February 23, 2012, Duke Energy received a letter from AREVA identifying two changes which affect the large break loss of coolant accident (LBLOCA) analysis of record for Oconee Units 1, 2, and 3. The first change is an EM application error, and the second change is an EM modeling change. The Oconee small break LOCA (SBLOCA) analyses are not affected by these issues.

The enclosed Attachments provide a description of each LBLOCA EM Error Correction, and the associated impact to the Oconee LBLOCA analysis of record. AREVA identified the first item as an error in the determination of the end of ECCS bypass. Based on information supplied by AREVA, an assessment of this error results in a peak cladding temperature (PCT) decrease of 80°F. AREVA identified the second item as an EM modeling change to include the effects of the upper plenum column weldments. Based on information supplied by AREVA, an assessment of this error results in a PCT increase of 80°F. Therefore, these two changes offset each other, resulting in no net change to the PCT results for the Oconee LBLOCA analysis of record.

An evaluation of the two changes identified above was performed by AREVA for the Oconee SBLOCA analyses. It was concluded that there is no change on the limiting SBLOCA analysis results. This conclusion is valid for the SBLOCA analyses performed at full-power, 75% partial-power, and 50% partial-power. Since there is no net change in the LOCA PCTs for these two changes, there are no plans for future reanalysis. This issue has been entered into Oconee's corrective action program as PIP O-12-2225.

Included in this report are Mk-B11 fuel LOCA PCT summary tables and Mk-B-HTP mixed-core LOCA PCT summary tables for Units 1 and 3, and a full-core Mk-B-HTP LOCA PCT summary table for Unit 2. The LOCA results for Units 1, 2 and 3 remain unchanged from those previously reported. Since the PCTs are unchanged, the oxidation and whole core hydrogen generation are similarly unaffected, and remain acceptable.

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This information satisfies the 30-day reporting requirements of 10 CFR 50.46 (a)(3)(ii).

There are no regulatory commitments associated with this letter.

Please address any comments or questions regarding this matter to Jeff Thomas at (704) 382-3438 *(Jeff.Thomas@duke-energy.com)*.

Sincerely,

David C. Culp
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Attachment
Report of Error Corrections on AREVA LBLOCA ECCS Evaluation Model
Table 1: Mk-B11 Peak Cladding Temperature Summary – Oconee Units 1 and 3
Table 2: Mk-B-HTP Mixed Core Peak Cladding Temperature Summary – Oconee Units 1 and 3
Table 3: Mk-B-HTP Full Core Peak Cladding Temperature Summary – Oconee Unit 2

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ATTACHMENT

Report of Error Corrections on AREVA LBLOCA ECCS Evaluation Model

Table 1: Mk-B11 Peak Cladding Temperature Summary – Oconee Units 1 and 3

Table 2: Mk-B-HTP Mixed Core Peak Cladding Temperature Summary – Oconee Units 1 and 3

Table 3: Mk-B-HTP Full Core Peak Cladding Temperature Summary – Oconee Unit 2

Report of Error Corrections on AREVA LBLOCA ECCS Evaluation Model

By letter dated February 23, 2012 (Reference 2), AREVA notified Duke Energy of two changes which affect the large break loss of coolant accident (LBLOCA) analysis of record for Oconee Units 1, 2, and 3. The first change is an EM application error, and the second change is an EM modeling change. The small break LOCA analyses are not affected by these issues.

AREVA identified the first item as an error in the determination of the end of ECCS bypass. This issue is identified in AREVA Condition Report WebCAP 2012-165 as an error in the ECCS bypass calculational model that determines the end of total ECCS bypass. A mathematical error was discovered in the RELAP5/MOD2-B&W blowdown model control variables that calculate the time for total end of bypass. AREVA identified in the BWNT LOCA Evaluation Model (EM) BAW-10192PA Rev. 0 (Reference 1) that the end of bypass calculations determine when an 80 percent condensation efficiency on the core flood tank (CFT) injected liquid could condense all the steam reaching the upper downcomer region. The control variables incorrectly calculated the steam energy flowing into the upper downcomer region. When the control variables were corrected, the end of bypass time was predicted approximately 2 seconds earlier, resulting in a shorter lower plenum refill period with a quicker onset of lower core quench and lower PCT. Based on information supplied by AREVA, an assessment of this error results in a peak cladding temperature (PCT) decrease of 80°F.

AREVA identified the second item as an EM modeling change to include the effects of the upper plenum column weldments. This issue, identified in AREVA Condition Report WebCAP 2012-757, was discovered as part of a LBLOCA sensitivity study was being performed for the 205 FA Bellefonte plant with a revised upper plenum and upper head modeling that considered the changes in core cooling when upper plenum column weldments are explicitly modeled. This revised modeling reflects a more detailed noding arrangement in the reactor vessel upper plenum than was used and approved for application in the BWNT LOCA Evaluation Model (EM) BAW-10192P-A Rev. 0 (Reference 1). A simplified column weldment model was developed for the 177 FA Oconee model based on approximations from the 205 FA Bellefonte model. When this simplified model was used, the scoping case with the column weldment modeled over the top of the hot channel resulted in reduced cooling during portions of the blowdown phase. As a result, the end of blowdown fuel temperatures increased and these changes translate into roughly a 40 F increase in the unruptured segment PCTs, while the ruptured segment is increases by roughly 80 F. The more limiting temperature change for the ruptured segment is used by AREVA for assessing the EM modeling change PCT increase as 80 F.

Based on information supplied by AREVA, the scoping analyses indicated little change from the currently reported LBLOCA PCT prior to either error correction. In other words, the net decrease in PCT from the ECCS bypass error correction is roughly equivalent to the PCT increase when the column weldments are modeled in the 177 FA plants. Therefore, these two errors offset each other with no net change to the current LBLOCA PCTs for the ONS-1, ONS-2 and ONS-3 plants.

The ECCS bypass calculation is not applicable to the Oconee SBLOCA analyses. The upper plenum column weldment modeling change was considered for SBLOCA and it was concluded that it will not affect the limiting results because the SBLOCA is a slower evolving transient with up flows in the core hot bundles such that there is no net change from the presence of a column weldment in the upper plenum. Therefore, there is no change to the current SBLOCA PCTs for the ONS-1, ONS-2 and ONS-3 plants.

References

1. AREVA NP Topical Report BAW-10192P-A, Rev. 0, "BWNT LOCA - BWNT Loss-of-Coolant Accident Evaluation Model for Once-Through Steam Generator Plants," June 1998.
2. AREVA Letter FAB12-120 to S. B. Thomas (Duke Energy), "10 CFR 50.46 LOCA Report of Two EM Error Corrections (AREVA CR 2012-165: ECCS Bypass Mathematical Error and AREVA CR 2012-757: Upper Plenum Column Weldment EM Change)," February 23, 2012.

Report of Error Corrections on AREVA LBLOCA ECCS Evaluation Model

Table 1: Mk-B11 Peak Cladding Temperature Summary
Oconee Units 1 and 3

Table 2: Mk-B-HTP Mixed Core Peak Cladding Temperature Summary
Oconee Units 1 and 3

Table 3: Mk-B-HTP Full Core Peak Cladding Temperature Summary
Oconee Unit 2

References for Tables 1, 2, & 3

A) Letter, T. C. Geer (Duke) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an Evaluation Model", December 18, 2007. [ADAMS ML073580171]

B) Letter, T. C. Geer (Duke) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an Evaluation Model", July 29, 2008. [ADAMS ML082130096]

C) Letter, T. C. Geer (Duke) to USNRC, "30-Day Report Pursuant to 10 CFR 50.46, Changes to or Errors in an Evaluation Model", August 19, 2010. [ADAMS ML102360485]

D) Letter, G. J. St.Clair (AREVA) to S. B. Thomas (Duke), "10 CFR 50.46 LOCA Report of Two EM Error Corrections (AREVA CR 20120165: ECCS Bypass Mathematical Error and AREVA CR 2012-757: Upper Plenum Column Weldment EM Change)", Dated February 23, 2012, AREVA Letter FAB12-120.

E) Letter, R. M. Glover (Duke) to USNRC, "30-Day Report Pursuant to 10 CFR 50.46, Changes to or Errors in an Evaluation Model", December 8, 2011. [ADAMS ML11347A193]

Table 1: Mk-B11 Peak Cladding Temperature Summary – Oconee Units 1 and 3

LBLOCA	PCT(°F)	Comments
Evaluation model: RELAP5/MOD2-B&W		
Analysis of record PCT	2035	Mark-B11 (M5), 17.7 kW/ft at 6.021 ft elevation
Prior errors (ΔPCT) 1. Various	0	References A and B
Prior evaluation model changes (ΔPCT) 1. None	0	
Errors (ΔPCT) 1. Error in ECCS Bypass Calculation	-80	Reference D
Evaluation model changes (ΔPCT) 1. Upper Plenum Column Weldment Modeling	+80	Reference D
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	2035	
SBLOCA Full Power -100% FP	**PCT(°F)**	**Comments**
Evaluation model: RELAP5/MOD2-B&W		
Analysis of record PCT	1461	(2 HPI Case) 0.15 ft^2 break
Prior errors (ΔPCT) 1. None	0	
Prior evaluation model changes (ΔPCT) 1. None	0	
Errors (ΔPCT) 1. EOC SBLOCA Axial Power Shape Error	+225	Reference C
Evaluation model changes (ΔPCT) 1. Upper Plenum Column Weldment Modeling	0	Reference D
Absolute value of errors/changes for this report (ΔPCT)	225	
Net change in PCT for this report	+225	
Final PCT	1686	
SBLOCA Reduced Power – 75% FP [1]	**PCT(°F)**	**Comments**
Analysis of record PCT	1774	(1 HPI case) 0.075 ft^2 break
Prior errors (ΔPCT) 1. None	0	
Prior evaluation model changes (ΔPCT) 1. None	0	
Errors (ΔPCT) 1. EOC SBLOCA Axial Power Shape Error	Unknown	Reference C
Evaluation model changes (ΔPCT) 1. Upper Plenum Column Weldment Modeling	0	Reference D
Absolute value of errors/changes for this report (ΔPCT)	Unknown	
Net change in PCT for this report	Unknown	
Final PCT	Unknown	Operation Not Justified [2]

Notes

1. Partial power SBLOCA analysis with one HPI pump out of service, supports 30 day LCO for TS 3.5.2 Condition B. Also supports TS 3.5.2 Condition C1 and C2.
2. Entry to LCO window administratively not allowed. Refer to Oconee corrective action program item PIP O-10-6229 for details.

Table 2: Mk-B-HTP Mixed Core Peak Cladding Temperature Summary – Oconee Units 1 & 3

LBLOCA	PCT(°F)	Comments
Evaluation model: RELAP5/MOD2-B&W		
Analysis of record PCT	2020	
Prior errors (ΔPCT) 1. None	0	
Prior evaluation model changes (ΔPCT) 1. None	0	
Errors (ΔPCT) 1. Error in ECCS Bypass Calculation	-80	Reference D
Evaluation model changes (ΔPCT) 1. Upper Plenum Column Weldment Modeling	+80	Reference D
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	2020	
SBLOCA Full Power -100% FP	**PCT(°F)**	**Comments**
Evaluation model: RELAP5/MOD2-B&W		
Analysis of record PCT	1397	(2 HPI Case) 0.15 ft^2 break
Prior errors (ΔPCT) 1. None	0	
Prior evaluation model changes (ΔPCT) 1. None	0	
Errors (ΔPCT) 1. EOC SBLOCA Axial Power Shape Error	+225	Reference C
Evaluation model changes (ΔPCT) 1. Upper Plenum Column Weldment Modeling	0	Reference D
Absolute value of errors/changes for this report (ΔPCT)	225	
Net change in PCT for this report	+225	
Final PCT	1622	
SBLOCA Reduced Power – 75% FP [1]	**PCT(°F)**	**Comments**
Analysis of record PCT	1788	(1 HPI case) 0.075 ft^2 break
Prior errors (ΔPCT) 1. Not Applicable (New Analysis performed in 2008)	N/A	
Prior evaluation model changes (ΔPCT) 1. Not Applicable (New Analysis performed in 2008)	N/A	
Errors (ΔPCT) 1. EOC SBLOCA Axial Power Shape Error	Unknown	Reference C
Evaluation model changes (ΔPCT) 1. Upper Plenum Column Weldment Modeling	0	Reference D
Absolute value of errors/changes for this report (ΔPCT)	Unknown	
Net change in PCT for this report	Unknown	
Final PCT	Unknown	Operation Not Justified [2]

Notes

1. Partial power SBLOCA analysis with one HPI pump out of service, supports 30 day LCO for TS 3.5.2 Condition B. Also supports TS 3.5.2 Condition C1 and C2.
2. Entry to LCO window administratively not allowed. Refer to Oconee corrective action program item PIP O-10-6229 for details.

Table 3: Mk-B-HTP Full Core Peak Cladding Temperature Summary – Oconee Unit 2

LBLOCA	PCT(°F)	Comments
Evaluation model: RELAP5/MOD2-B&W		
Analysis of record PCT	1913	
Prior errors (ΔPCT) 1. None	0	
Prior evaluation model changes (ΔPCT) 1. None	0	
Errors (ΔPCT) 1. Error in ECCS Bypass Calculation	-80	Reference D
Evaluation model changes (ΔPCT) 1. Upper Plenum Column Weldment Modeling	+80	Reference D
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	1913	
SBLOCA Full Power -100% FP	**PCT(°F)**	**Comments**
Evaluation model: RELAP5/MOD2-B&W		
Analysis of record PCT	1598	(2 HPI Case) 0.15 ft^2 break
Prior errors (ΔPCT) 1. None	0	
Prior evaluation model changes (ΔPCT) 1. None	0	
Errors (ΔPCT) 1. None	0	
Evaluation model changes (ΔPCT) 1. Upper Plenum Column Weldment Modeling	0	Reference D
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	1598	
SBLOCA Reduced Power – 50% FP [1]	**PCT(°F)**	**Comments**
Analysis of record PCT	N/A	Will be reported under a separate LAR (Reference E)
Prior errors (ΔPCT) 1.	N/A	
Prior evaluation model changes (ΔPCT) 1.	N/A	
Errors (ΔPCT) 1.	N/A	
Evaluation model changes (ΔPCT) 1. Upper Plenum Column Weldment Modeling	0	Reference D
Absolute value of errors/changes for this report (ΔPCT)	N/A	
Net change in PCT for this report	N/A	
Final PCT	N/A	Operation Not Justified [2]

Notes

1. Partial power SBLOCA analysis with one HPI pump out of service, supports 30 day LCO for TS 3.5.2 Condition B. Also supports TS 3.5.2 Condition C1 and C2.
2. Pending review and approval of separate LAR. Refer to Reference E for additional details.