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10 CFR 50.46

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

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

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

Subject: Duke Energy Carolinas, LLC (Duke Energy): 10 CFR 50.46 - Annual Report for 2014 for Catawba and McGuire Nuclear Stations

Reference:

10 CFR 50.46 (a)(3)(ii) requires the reporting of changes to or errors in Emergency Core Cooling System (ECCS) evaluation models (EMs). This report covers the time period from January 1, 2014, to December 31, 2014, for the Catawba Nuclear Station (CNS) and the McGuire Nuclear Station (MNS).

Several changes/errors associated with the Large Break Loss of Coolant Accident (LOCA) and Small Break LOCA evaluation models were identified during the reporting period. The specific details of these changes/errors are provided in Attachment 1, Table 1. These changes/errors were evaluated by Westinghouse as having no impact on the calculated Peak Cladding Temperature (PCT). Since there was no PCT impact due to these changes/errors, they are not included in the LOCA PCT margin summary sheets, Tables 2 through 4, for MNS Units 1 and 2 and CNS Units 1 and 2.

There are no new regulatory commitments contained in this letter.

Please address any comments or questions regarding this matter to Michael K. Leisure at (980) 373-3619 (Mike.Leisure@duke-energy.com).

Sincerely,

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Attachment: 2014 Annual Report of Peak Cladding Temperature xc (with attachment):

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Attachment

Duke Energy Carolinas, LLC

Catawba Nuclear Station, Units 1 and 2
McGuire Nuclear Station, Units 1 and 2

10 CFR 50.46
Acceptance Criteria for Emergency Core
Cooling Systems for Light-Water Nuclear Power Reactors

2014 Annual Report of Peak Cladding Temperature

Table 1
Errors / Evaluation Model Changes

GENERAL CODE MAINTENANCE

Affected Evaluation Models:
1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model
1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

Various changes have been made to enhance the usability of codes and to streamline future analyses. Examples of these changes include modifying input variable definitions, units and defaults; improving the input diagnostic checks; enhancing the code output; optimizing active coding; and eliminating inactive coding. These changes represent Discretionary Changes that will be implemented on a forward-fit basis in accordance with Section 4.1.1 of WCAP-13451.

The nature of these changes leads to an estimated peak cladding temperature impact of 0 °F.

REVISED TOTAL CODE UNCERTAINTY IN BE LBLOCA MONTE CARLO SIMULATIONS

Affected Evaluation Model: 1996 Westinghouse Best Estimate Large Break LOCA

As part of the WCOBRA/TRAC validation basis for use in Best-Estimate (BE) Large-Break Loss-of- Coolant Accident (LBLOCA) analysis, simulations of many separate effects tests (SETs) and integral effects tests (IETs) were performed. In the Westinghouse 1996 BE LBLOCA evaluation model (CQD evaluation model), the simulations of the test data which included core heat transfer measurements were used in the uncertainty methodology in two ways:

1. To develop heat transfer multiplier distributions which are used in the HOTSPOT code for local hot rod calculations.
2. To determine the minimum code uncertainties for blowdown and reflood that are used in the MONTECF code for the Monte Carlo uncertainty calculations.

The effects of several changes and error corrections to the WCOBRA/TRAC code were previously reported in 2013, including effects of revised heat transfer multiplier distributions. As a result of previously reported changes and error corrections made to WCOBRA/TRAC, the total code uncertainty values utilized in the MONTECF code for both blowdown and reflood were recalculated. The recalculated total code uncertainty values are lower than the previous values. Resolution of this issue represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

The total code uncertainty value is essentially a minimum limit for the superposition correction in the Monte Carlo simulations performed with the MONTECF code. As a result, a reduction in the minimum superposition correction would be expected to produce a small benefit, and will thus be conservatively assigned a 0 °F estimate of effect on peak cladding temperature.

FUEL ROD GAP CONDUCTANCE ERROR

Affected Evaluation Model: 1985 Small Break LOCA Evaluation Model with NOTRUMP

An error was identified in the fuel rod gap conductance model in the NOTRUMP computer code (reactor coolant system response model). The error is associated with the use of an incorrect temperature in the calculation of the cladding emissivity term. This error corresponds to a Non-Discretionary Change as described in Section 4.1.2 of WCAP-13451.

The estimated effect was determined based on a combination of engineering judgment of the phenomena and physics of a small break LOCA and sensitivity calculations performed with the advanced plant version of NOTRUMP. It was concluded that this error has a negligible effect on small break LOCA analysis results, leading to an estimated peak cladding temperature impact of 0 °F.

RADIATION HEAT TRANSFER MODEL ERROR

Affected Evaluation Model: 1985 Small Break LOCA Evaluation Model with NOTRUMP

Two errors were discovered in the calculation of the radiation heat transfer coefficient within the fuel rod model of the NOTRUMP computer code (reactor coolant system response model). First, existing logic did not preclude non-physical negative or large (negative or positive) radiation heat transfer coefficients from being calculated. These erroneous calculations occurred when the vapor temperature exceeded the cladding surface temperature or when the predicted temperature difference was less than 1 °F. Second, a temperature term incorrectly used degrees Fahrenheit instead of Rankine. These errors represent a closely related group of Non-Discretionary problems in accordance with Section 4.1.2 of WCAP-13451.

The estimated effect was determined based on a combination of engineering judgment of the phenomena and physics of a small break LOCA and sensitivity calculations performed with the advanced plant version of NOTRUMP. It was concluded that this error has a negligible effect on small break LOCA analysis results, leading to an estimated peak cladding temperature impact of 0 °F.

Table 2
LOCA Peak Cladding Temperature Margin Summary – McGuire Units 1 & 2

LBLOCA	**Cladding Temp (°F)**	**Comments**
Evaluation model : WCOBRA/TRAC, CQD 1996		
Analysis of record PCT (Reflood 2)	2028	McGuire Units 1 & 2/Catawba Units 1 & 2 Composite Model
Prior errors (ΔPCT)		
1. Decay heat in Monte Carlo calculations	8	Reference M
2. MONTECF power uncertainty correction	20	Reference B
3. Safety Injection temperature range	59	Reference C
4. Input error resulting in an incomplete solution matrix	25	Reference D
5. Revised Blowdown Heatup Uncertainty Distribution	5	Reference E
6. Vessel Unheated Conductor Noding	0	Reference F
7. Thermal Conductivity Degradation with Peaking Factor Burndown	15	References H, I
8. Revised Heat Transfer Multiplier Distribution	-85	Reference K
9. HOTSPOT Clad Burst Strain Error	70	Reference L
Prior evaluation model changes (ΔPCT)		
1. Revised Algorithm for Average Fuel Temperature	0	Reference F
2. PAD 3.4 to PAD 4.0	-75	References H, I
3. Peak FQ = 2.7 in bottom third of core	0	References H, I
4. MUR Uprate to 101.7% of 3411 MWt	16	References H, I
New errors (ΔPCT) 1. None		
New evaluation model changes (ΔPCT) 1. None		
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	2086	
SBLOCA		
Evaluation model : NOTRUMP		
Analysis of record PCT	1323	2 inch break, Reference G
Prior errors (ΔPCT) 1. Evaluation of Fuel Pellet Thermal Conductivity Degradation	0	Reference J
Prior evaluation model changes (ΔPCT) 1. None	0	
New errors (ΔPCT) 1. None		
New evaluation model changes (ΔPCT) 1. None		
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	1323	

Table 3
LOCA Peak Cladding Temperature Margin Summary – Catawba Unit 1

LBLOCA	**Cladding Temp (°F)**	**Comments**
Evaluation model : WCOBRA/TRAC, CQD 1996		
Analysis of record PCT (Reflood 2)	2028	McGuire Units 1 & 2/Catawba Units 1 & 2 Composite Model
Prior errors (ΔPCT) 1. Decay heat in Monte Carlo calculations 2. MONTECF power uncertainty correction 3. Safety Injection temperature range 4. Input error resulting in an incomplete solution matrix 5. Revised Blowdown Heatup Uncertainty Distribution 6. Vessel Unheated Conductor Noding 7. Thermal Conductivity Degradation with Peaking Factor Burndown 8. Revised Heat Transfer Multiplier Distribution 9. HOTSPOT Clad Burst Strain Error	 8 20 59 25 5 0 15 -85 70	 Reference A Reference N Reference C Reference D Reference E Reference F References H, I Reference K Reference L
Prior evaluation model changes (ΔPCT) 1. Revised Algorithm for Average Fuel Temperature 2. PAD 3.4 to PAD 4.0 3. Peak FQ = 2.7 in bottom third of core	 0 -75 0	 Reference F References H, I References H, I
New errors (ΔPCT) 1. None		
New evaluation model changes (ΔPCT) 1. None		
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	2070	
SBLOCA		
Evaluation model : NOTRUMP		
Analysis of record PCT	1323	2 inch break, Reference G
Prior errors (ΔPCT) 1. Evaluation of Fuel Pellet Thermal Conductivity Degradation	 0	 Reference J
Prior evaluation model changes (ΔPCT) 1. None	 0	
New errors (ΔPCT) 1. None		
New evaluation model changes (ΔPCT) 1. None		
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	1323	

Table 4
LOCA Peak Cladding Temperature Margin Summary – Catawba Unit 2

LBLOCA	**Cladding Temp (°F)**	**Comments**
Evaluation model : WCOBRA/TRAC, CQD 1996		
Analysis of record PCT (Reflood 2)	2028	McGuire Units 1 & 2/Catawba Units 1 & 2 Composite Model
Prior errors (ΔPCT) 1. Decay heat in Monte Carlo calculations 2. MONTECF power uncertainty correction 3. Safety Injection temperature range 4. Input error resulting in an incomplete solution matrix 5. Revised Blowdown Heatup Uncertainty Distribution 6. Vessel Unheated Conductor Noding 7. Thermal Conductivity Degradation with Peaking Factor Burndown 8. Revised Heat Transfer Multiplier Distribution 9. HOTSPOT Clad Burst Strain Error	 8 20 59 25 5 0 15 -85 70	 Reference A Reference N Reference C Reference D Reference E Reference F References H, I Reference K Reference L
Prior evaluation model changes (ΔPCT) 1. Revised Algorithm for Average Fuel Temperature 2. PAD 3.4 to PAD 4.0 3. Peak FQ = 2.7 in bottom third of core	 0 -75 0	 Reference F References H, I References H, I
New errors (ΔPCT) 1. None		
New evaluation model changes (ΔPCT) 1. None		
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	2070	
SBLOCA		
Evaluation model : NOTRUMP		
Analysis of record PCT	1243	4 inch break, Reference G
Prior errors (ΔPCT) 1. Evaluation of Fuel Pellet Thermal Conductivity Degradation	 0	 Reference J
Prior evaluation model changes (ΔPCT) 1. None	 0	
New errors (ΔPCT) 1. None		
New evaluation model changes (ΔPCT) 1. None		
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	1243	

References for Tables 2, 3, and 4:

A) Letter, G. R. Peterson (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model*, April 11, 2001. (ADAMS ML011070266)

B) Letter, M. S. Tuckman (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model*, April 3, 2002. (ADAMS ML021070672)

C) Letter, W. R. McCollum, Jr. (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model*, July 29, 2003. (ADAMS ML032170639)

D) Letter, W. R. McCollum, Jr. (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model*, May 26, 2004. (ADAMS ML041560349)

E) Letter, J. R. Morris (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model*, June 21, 2005. (ADAMS ML051790210)

F) Letter, T. C. Geer (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model*, March 13, 2007. (ADAMS ML070800546)

G) Letter, T. C. Geer (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model*, May 22, 2007. (ADAMS ML071500297)

H) Letter, D. C. Culp (Duke Energy) to USNRC, *Response to Information Request Pursuant to 10 CFR 50.54(f) Related to the Estimated Effect on Peak Cladding Temperature Resulting from Thermal Conductivity Degradation in the Westinghouse-Furnished Realistic Emergency Core Cooling System Evaluation and 30-Day Report Pursuant to 10 CFR 50.46, Changes to or Errors in an Evaluation Model*, March 16, 2012. (ADAMS ML12079A180)

I) Letter, J. Thompson (USNRC) to K. Henderson and S. D. Capps (Duke Energy), *Catawba Nuclear Station Units 1 and 2, and McGuire Nuclear Station Units 1 and 2, Closure Evaluation for Report Pursuant to Title 10 of the Code of Federal Regulations, Part 50, Section 50.46, Paragraph (a)(3)(ii) Concerning Significant Emergency Core Cooling System Evaluation Model Error Related to Nuclear Fuel Thermal Conductivity Degradation (TAC Nos. ME8447, ME8448, ME8449, and ME8450),*" November 16, 2012. (ADAMS ML12314A031)

J) Letter, M. J. Annacone, (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model*, July 11, 2013. (ADAMS ML13199A279)

K) Letter, R. J. Duncan, (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model,* August 29, 2013. (ADAMS ML13246A103).

L) Letter, B. C. Waldrep (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an Evaluation Model*, February 25, 2014. (ADAMS ML14063A278)

M) Letter, M. S. Tuckman (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model*, May 3, 2001. (ADAMS ML011310391)

N) Letter, M. S. Tuckman (Duke Energy) to USNRC, *Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Mode*l, April 3, 2002. (ADAMS ML021070656)