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

Subject: Duke Energy Corporation
McGuire Nuclear Station, Units 1 and 2
Docket Number 50-369 and 50-370
Catawba Nuclear Station, Units 1 and 2
Docket Number 50-413 and 50-414

Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model

10 CFR 50.46 (a)(3)(ii) requires the reporting of errors or changes in the Emergency Core Cooling System (ECCS) evaluation models. This report covers the time period from January 1, 2004 to December 31, 2004.

During this time period, one error correction was identified in the Westinghouse large break LOCA analyses which had a peak cladding temperature (PCT) impact. This correction is not classified as significant per the 10 CFR 50.46 criterion. A revision to the blowdown heat transfer coefficients was developed and implemented. This correction resulted in a change in the overall code uncertainty for the blowdown phase of the event. A plant specific estimate of the impact of this change was determined to be 5 °F. Details of this correction are presented in Table 1.

Two enhancements were made to the large break LOCA (LBLOCA) evaluation model in 2004. These changes were not considered to have any impact on the LBLOCA calculated PCTs. The specifics of these enhancements are provided in Table 2. Since there was no PCT impact determined for these changes, they are not included in the PCT summary tables.

In 2004, McGuire Unit 1 was loaded with a core comprised entirely of Westinghouse Robust Fuel Assembly (RFA) fuel (i.e., no Framatome fuel). Thus, the mixed core penalty applied to the SBLOCA peak cladding temperature (PCT) is removed for that unit. All other units operated in 2004 with some Framatome fuel and therefore, the mixed core penalty is retained for these units.

A summary of the peak cladding temperatures for McGuire Units 1 and 2 is provided in Table 3. Tables 4 and 5 provide a summary of the peak cladding temperatures for Catawba Units 1 and 2 respectively.

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There are no regulatory commitments associated with this letter.

Please address any comments or questions regarding this matter to L. B. Jones at (704) 382-4753.

Very truly yours,

James R. Morris

Attachments

- Table 1 – Errors/Evaluation Model Changes with PCT Impact
- Table 2 – Errors/Evaluation Model Changes with no PCT Impact
- Table 3 – Peak Cladding Temperature Summary – McGuire Units 1 and 2
- Table 4 – Peak Cladding Temperature Summary – Catawba Unit 1
- Table 5 – Peak Cladding Temperature Summary – Catawba Unit 2

xc: (with attachments)

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ATTACHMENTS

Table 1 – Errors / Evaluation Model Changes with PCT Impact

Table 2 – Errors/Evaluation Model Changes with no PCT Impact

Table 3 – Peak Cladding Temperature Summary – McGuire Units 1 and 2

Table 4 – Peak Cladding Temperature Summary – Catawba Unit 1

Table 5 – Peak Cladding Temperature Summary – Catawba Unit 2

Table 1
Errors / Evaluation Model Changes with PCT Impact

Revised Blowdown Heatup Uncertainty Distribution (WCOBRA/TRAC Model)

Revised blowdown phase heatup heat transfer coefficients were developed based on analyses of the LOFT and ORNL test using the latest version of WCOBRA/TRAC. Using these heat transfer coefficients, a revised cumulative distribution function (CDF) was programmed into a new version of HOTSPOT. The overall code uncertainty for the blowdown phase was also recalculated and programmed into a new version of MONTECF. The overall code uncertainty for the reflood phase is not affected. An estimate of the PCT effect of the revised blowdown phase heatup CDF was performed. The estimates bound all of the 95th percentile HOTSPOT results. Plant specific MONTECF analysis was performed to estimate the effect of the revised overall code uncertainty for the blowdown phase. For the McGuire/Catawba large break LOCA analysis the PCT impact was estimated to be 5 °F.

Table 2
Errors / Evaluation Model Changes with no PCT Impact

Implementation of ASTRUM Capability in HOTSPOT (WCOBRA/TRAC Model)

The HOTSPOT code was modified to be compatible with the Automated Statistical Treatment of Uncertainty Methodology (ASTRUM) described in WCAP-16009-PA. An option was added to allow the ASTRUM HOTSPOT technique (single iteration mode) instead of the Monte Carlo mode that is used in the previous Best Estimate LBLOCA evaluation models. This change does not affect the results of design basis analyses performed with the previous evaluation models. Therefore, the PCT is unaffected by this change.

Improved Automation of End of Blowdown Time (WCOBRA/TRAC Model)

An automated end of blowdown selection logic was added to large break LOCA analysis method. The new end of blowdown selection is based on the time at which the system pressure stops decreasing. In the current method, the end of blowdown was chosen to be the time the system pressure dropped below 40 psia. For cases where the pressure did not drop below 40 psia, the analyst would manually redefine the end of blowdown. Blowdown cooling heat transfer multipliers are applied during the later period of the blowdown phase. These heat transfer multipliers are considered in the uncertainty methodology as a function of the time period in the transient. All prior analyses used the correct end of blowdown time and therefore are not impacted by this change. Therefore, the estimated PCT impact of this change is zero.

Table 3
Peak Cladding Temperature Summary – McGuire Units 1 & 2

LBLOCA	Cladding Temp (°F)	Comments
Evaluation model : WCOBRA/TRAC		
Analysis of record PCT	2028	MNS/CNS 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	 8 20 59 25	 Reference A Reference B Reference C Reference D
Prior evaluation model changes (ΔPCT) 1. None	 0	
Errors (ΔPCT) 1. Revised Blowdown Heatup Uncertainty Distribution	 5	
Evaluation model changes (ΔPCT) 1. None	 0	
Absolute value of errors/changes for this report (ΔPCT)	5	
Net change in PCT for this report	5	
Final PCT	2145	
SBLOCA		
Evaluation model : NOTRUMP	MNS-1 / MNS-2	
Analysis of record PCT	1167 / 1177	Note (1)
Prior errors (ΔPCT) 1. Mixture level tracking/region depletion 2. NOTRUMP bubble rise/drift flux model corrections	 13 35	 Reference A Reference D
Prior evaluation model changes (ΔPCT) 1. None	 0	
Errors (ΔPCT) 1. None	 0	
Evaluation model changes (ΔPCT) 1. None	 0	
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	1215 / 1225	

Reference:

A) letter, M. S. Tuckman (Duke) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model", May 3, 2001

B) letter, M. S. Tuckman (Duke) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model", April 3, 2002

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

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

Note:

(1) The analysis of record PCT for MNS-2 includes a 10 °F allowance for the presence of FANP fuel.

Table 4
Peak Cladding Temperature Summary – Catawba Unit 1

LBLOCA	Cladding Temp (°F)	Comments
Evaluation model : WCOBRA/TRAC		
Analysis of record PCT	2028	MNS/CNS 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	 8 20 59 25	 Reference A Reference B Reference C Reference D
Prior evaluation model changes (ΔPCT) 1. None	 0	
Errors (ΔPCT) 1. Revised Blowdown Heatup Uncertainty Distribution	 5	
Evaluation model changes (ΔPCT) 1. None	 0	
Absolute value of errors/changes for this report (ΔPCT)	5	
Net change in PCT for this report	5	
Final PCT	2145	
SBLOCA		
Evaluation model : NOTRUMP		
Analysis of record PCT	1177	Note (1)
Prior errors (ΔPCT) 1. Mixture level tracking/region depletion 2. NOTRUMP bubble rise/drift flux model corrections	 13 35	 Reference A Reference D
Prior evaluation model changes (ΔPCT) 1. None	 0	
Errors (ΔPCT) 1. None	 0	
Evaluation model changes (ΔPCT) 1. None	 0	
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	1225	

Reference:

A) letter, G. R. Peterson (Duke) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model", April 11, 2001

B) letter, M. S. Tuckman (Duke) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model", April 3, 2002

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

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

Note:

(1) The analysis of record PCT includes a 10 °F allowance for the presence of FANP fuel.

Table 5
Peak Cladding Temperature Summary – Catawba Unit 2

LBLOCA	Cladding Temp (°F)	Comments
Evaluation model : WCOBRA/TRAC		
Analysis of record PCT	2028	MNS/CNS Composite Model
Prior errors (ΔPCT)		
1. Decay heat in Monte Carlo calculations	8	Reference A
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
Prior evaluation model changes (ΔPCT)		
1. None	0	
Errors (ΔPCT)		
1. Revised Blowdown Heatup Uncertainty Distribution	5	
Evaluation model changes (ΔPCT)		
1. None	0	
Absolute value of errors/changes for this report (ΔPCT)	5	
Net change in PCT for this report	5	
Final PCT	2145	
SBLOCA		
Evaluation model : NOTRUMP		
Analysis of record PCT	1073	Note (1)
Prior errors (ΔPCT)		
1. Mixture level tracking/region depletion	13	Reference A
2. NOTRUMP bubble rise/drift flux model corrections	35	Reference D
Prior evaluation model changes (ΔPCT)		
1. None	0	
Errors (ΔPCT)		
1. None	0	
Evaluation model changes (ΔPCT)		
1. None	0	
Absolute value of errors/changes for this report (ΔPCT)	0	
Net change in PCT for this report	0	
Final PCT	1121	

Reference:

A) letter, G. R. Peterson (Duke) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model", April 11, 2001

B) letter, M. S. Tuckman (Duke) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model", April 3, 2002

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

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

Note:

(1) The analysis of record PCT includes a 10 °F allowance for the presence of FANP fuel.