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April 9, 2003

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, 2002 to December 31, 2002.

During this time period no errors or changes were identified that resulted in a PCT impact. There are a number of errors in the Westinghouse evaluation models for which no PCT impact was assessed. In addition, Westinghouse made one enhancement to the small break LOCA (SBLOCA) evaluation model. This change is not considered to have any impact on the SBLOCA calculated PCTs. The specifics of these errors and changes are provided in Table 2. Since there was no PCT impact determined for these errors or changes, they are not included in the PCT summary table.

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

Please address any comments or questions regarding this matter to J. S. Warren at (704) 382-4986.

Very truly yours,

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Table 1  
Errors / Evaluation Model Changes with no PCT Impact

Broken Cold Leg Modeling Deviation (WCOBRA/TRAC Model)

The broken pipe modeling described in Section 22-6-1 of WCAP-12945-PA states that the piping between the reactor coolant pump (RCP) and the vessel is divided into 7 cells of the same length. The break location is assumed such that the RCP-side pipe has 3 cells and the vessel-side pipe has 4 cells. This noding scheme may result in the L/D of the cells being less than 1.5, which would cause the critical flow model in WCOBRA/TRAC to compute the stagnation enthalpy and entropy using the non-equilibrium option. This treatment is contrary to how the cold leg (a long nozzle) is viewed. A code change was made to ensure that the long pipe logic is applied for guillotine breaks. Sensitivity studies were performed using WCOBRA/TRAC models for two Marviken critical flow experiments, a LOFT integral effects test, and two PWRs. It was determined that the effect on existing code validation cases is negligible and therefore the estimated effect on plant calculation is 0 °F.

1-D Minimum Film Boiling Temperature Model Selection Error (WCOBRA/TRAC Model)

Section 6-3-6 of WCAP-12945-PA indicates that the minimum film boiling temperature calculation for one dimensional components is calculated as the maximum of the homogeneous nucleation temperature and that predicted by the Iloeje correlation. A coding error resulted in the Iloeje correlation not being considered. This error has the potential to affect the heat transfer calculation in the steam generator tubes of the STGEN component. The homogeneous nucleation temperature exceeds the minimum film boiling temperature predicted by the Iloeje correlation for pressures less than about 100 psia. Therefore, this error could only have an impact until the system pressure drops below 100 psia, which typically occurs within 20-30 seconds. Examination of a typical PWR transient indicated that the transition boiling regime occurs in the steam generator tubes for only a few seconds during blowdown. Given the short period of time in the transition boiling regime, and the relatively small difference between the homogeneous nucleation temperature and the Iloeje correlation results during this time period, the effect of the error is considered to be negligible. Therefore, the estimated effect of this error is 0 °F.

1-D Condensation Ramp Error (WCOBRA/TRAC Model)

Section 5-3-5 of WCAP-12945-PA indicates that condensation in specified one-dimensional components is suppressed if the pressure drops significantly below the containment pressure, using Equation 5-95a (containment ramp function). As a result of a coding error, this ramp function was also applied to the interfacial heat transfer for superheated liquids, affecting the evaporation process as well as the condensation due to subcooled liquid. Superheated liquid is not expected to be present for any significant portion of a large break LOCA. A sensitivity study was performed using a PWR model in which the coding error corrected. It was confirmed that the effect of the error correction on the peak cladding temperature was negligible. Therefore, the estimated effect of this error is 0 °F.

Table 1 (continued)

Cladding Axial Thermal Expansion Error (WCOBRA/TRAC Model)

A typographical error was discovered in the coding of the cladding axial thermal expansion such that the thermal expansion was incorrectly calculated. The cladding axial thermal expansion impacts the fuel rod internal pressure calculation. Rod internal pressures vary on the order of several hundred psi prior to burst, primarily as a result of the changes in temperature of the various gas volumes (plenum, pellet-clad gap, effective porosity, etc). Correction of the cladding thermal expansion error only affects the rod internal pressure by a few psi. Thus, this correction is considered to have a negligible impact and the estimated effect on plant calculation is 0 °F.

Error in Time After Shutdown for Neutron Capture Term (WCOBRA/TRAC Model)

The shutdown time used in the neutron capture correction factor was incorrectly programmed to use the total time which includes the steady state portion of the transient. The coding was corrected so that the time used is defined as the time after initiation of the break. The neutron capture factor is a multiplier slightly larger than unity, which increases with time after shutdown. The error resulted in the use of a longer time, which is slightly conservative. The effect was estimated using typical analysis values and resulted in a reduction of the total decay heat energy by about 0.4%. This difference is considered to be negligible and the estimated effect on plant calculations is 0 °F.

SBLOCTA Time Step Selection Logic Correction (NOTRUMP SBLOCA Model)

SBLOCTA was updated to resolve some inconsistencies in the time step selection logic, pertaining to the use of the fluid versus the fuel rod time step. To evaluate this correction, representative plant calculations using the SBLOCTA code were performed. These calculations indicate that for the McGuire/Catawba analysis the impact of this correction is negligible. Therefore the PCT impact of this correction is 0 °F.

SBLOCTA ZIRLO™ Cladding Specific Heat Model Revision (NOTRUMP SBLOCA Model)

The ZIRLO™ cladding specific heat model in SBLOCTA had been revised to reflect data collected at the Thermophysical Properties Research Laboratory. Sensitivities calculations using SBLOCTA code demonstrated that this change produces a negligible effect on the results and will be treated as a 0 °F PCT effect for 10 CFR 50.46 reporting purposes.

Thermal Design Flow Input Error (WCOBRA/TRAC and NOTRUMP SBLOCA Models)

It was discovered that the McGuire/Catawba LOCA calculations assumed a thermal design flow that did not consider the flow measurement uncertainty. The correct thermal design flow is lower than the assumed value is by 2.2%. Evaluations were performed to determine the estimated effect on the McGuire/Catawba LOCA analyses. The SBLOCA evaluation concluded that the 2.2% reduction in thermal design flow has an insignificant impact on a design basis transient and thus no impact on the calculated PCT. The best estimate LBLOCA evaluation concluded that the 2.2% reduction in the thermal design flow has no impact on the 95<sup>th</sup> percentile PCT. Therefore the PCT impact of this error is 0 °F

Table 1 (continued)

Simplified Isothermal Solution for SBLOCTA Subroutine Rate (NOTRUMP SBLOCA Model)

In 1999 a revision was made to LOCBART to correct a logic error that caused the Baker-Just metal water reaction calculation to be performed three times per time step. During the review of the corresponding code logic, it was determined that the complicated solution technique, described in Section 3.3.2 of WCAP-8301, could be replaced with a simplified isothermal solution. This change was made in LOCBART in 2000, and a similar logic was implemented in SBLOCTA. Representative plant calculations using the revised SBLOCTA code demonstrate that this change produces a negligible effect on results that will be treated as a 0 °F for 10 CFR 50.46 reporting purposes. This change will therefore be implemented in future calculations on a forward-fit basis.

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

LBLOCA	Cladding Temp (°F)	Comments
Evaluation model : <u>WCOBRA/TRAC</u>		
Analysis of record PCT	2028	MNS/CNS Composite Model
Prior errors ( $\Delta$ PCT) 1. Decay heat in Monte Carlo calculations 2. MONTECF power uncertainty correction	8 20	Reference A Reference B
Prior evaluation model changes ( $\Delta$ PCT) 1. None	0	
Errors ( $\Delta$ PCT) 1. None	0	
Evaluation model changes ( $\Delta$ PCT) 1. None	0	
Absolute value of errors/changes for this report ( $\Delta$ PCT)	0	
Net change in PCT for this report	0	
Final PCT	2056	
SBLOCA		
Evaluation model : <u>NOTRUMP</u>		
Analysis of record PCT	1177	Note (1)
Prior errors ( $\Delta$ PCT) 1. Mixture level tracking/region depletion	13	Reference A
Prior evaluation model changes ( $\Delta$ PCT) 1. None	0	
Errors ( $\Delta$ PCT) 1. None	0	
Evaluation model changes ( $\Delta$ PCT) 1. None	0	
Absolute value of errors/changes for this report ( $\Delta$ PCT)	0	
Net change in PCT for this report	0	
Final PCT	1190	

Reference:

- A) Letter, M. S. Tuckman (DPC) 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 (DPC) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model", April 3, 2002.

Note:

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

Table 3  
 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 ( $\Delta$ PCT)		
1. Decay heat in Monte Carlo calculations	8	Reference A
2. MONTECF power uncertainty correction	20	Reference B
Prior evaluation model changes ( $\Delta$ PCT)		
1. None	0	
Errors ( $\Delta$ PCT)		
1. None	0	
Evaluation model changes ( $\Delta$ PCT)		
1. None	0	
Absolute value of errors/changes for this report ( $\Delta$ PCT)	0	
Net change in PCT for this report	0	
Final PCT	2056	
SBLOCA		
Evaluation model : NOTRUMP		
Analysis of record PCT	1177	Note (1)
Prior errors ( $\Delta$ PCT)		
1. Mixture level tracking/region depletion	13	Reference A
Prior evaluation model changes ( $\Delta$ PCT)		
1. None	0	
Errors ( $\Delta$ PCT)		
1. None	0	
Evaluation model changes ( $\Delta$ PCT)		
1. None	0	
Absolute value of errors/changes for this report ( $\Delta$ PCT)	0	
Net change in PCT for this report	0	
Final PCT	1190	

Reference:

- A) letter, G. R. Peterson (DPC) 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 (DPC) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model", April 3, 2002.

Note:

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

Table 4  
 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 ( $\Delta$ PCT) 1. Decay heat in Monte Carlo calculations 2. MONTECF power uncertainty correction	8 20	Reference A Reference B
Prior evaluation model changes ( $\Delta$ PCT) 1. None	0	
Errors ( $\Delta$ PCT) 1. None	0	
Evaluation model changes ( $\Delta$ PCT) 1. None	0	
Absolute value of errors/changes for this report ( $\Delta$ PCT)	0	
Net change in PCT for this report	0	
Final PCT	2056	
SBLOCA		
Evaluation model : NOTRUMP		
Analysis of record PCT	1073	Note (1)
Prior errors ( $\Delta$ PCT) 1. Mixture level tracking/region depletion	13	Reference A
Prior evaluation model changes ( $\Delta$ PCT) 1. None	0	
Errors ( $\Delta$ PCT) 1. None	0	
Evaluation model changes ( $\Delta$ PCT) 1. None	0	
Absolute value of errors/changes for this report ( $\Delta$ PCT)	0	
Net change in PCT for this report	0	
Final PCT	1086	

Reference:

- A) letter, G. R. Peterson (DPC) 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 (DPC) to USNRC, "Report Pursuant to 10 CFR 50.46, Changes to or Errors in an ECCS Evaluation Model", April 3, 2002.

Note:

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



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NRIA File/ELL

McGuire Master File – MG01DM

Catawba Master File 801.01 – Mail Code CN04DM