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AEP-NRC-2014-15
10 CFR 50.46

Docket No.: 50-315

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

Donald C. Cook Nuclear Plant Unit 1
30-DAY REPORT OF CHANGES TO OR ERRORS IN AN EVALUATION MODEL

- References:
1. Letter from Westinghouse Electric Company LLC, to Donald C. Cook Nuclear Plant, "D. C. Cook Units 1 and 2 10 CFR 50.46 Report for the HOTSPOT Burst Strain Error Correction," dated January 29, 2014.
 2. Letter from J. P. Gebbie, Indiana Michigan Power Company (I&M), to U. S. Nuclear Regulatory Commission (NRC), "License Amendment Request Regarding Restoration of Normal Reactor Coolant System Operating Pressure and Temperature Consistent with Previously Licensed Conditions," dated October 8, 2013.
 3. Letter from J. P. Gebbie, I&M, to NRC, "Donald C. Cook Nuclear Plant Units 1 and 2, Response to Information Request Pursuant to 10 CFR 50.54(f) Related to the Estimated Effect on Peak Cladding Temperatures Resulting from Thermal Conductivity Degradation in the Westinghouse-Furnished Realistic Emergency Core Cooling System Evaluation (TAC No. M99899)," dated March 19, 2012.

Pursuant to 10 CFR 50.46, Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1, is reporting significant changes to, or errors in, Emergency Core Cooling System evaluation models (EM), or in the application of such models that affect the calculated peak fuel cladding temperature. By Reference 1, Westinghouse notified I&M of an EM error which significantly affected the Best-Estimate Large-Break Loss-of-Coolant Accident (LBLOCA) analysis for CNP Unit 1. The impact of the errors is not significant to the CNP Unit 2 LBLOCA Analysis Calculated Peak Cladding Temperature (PCT). The CNP Unit 1 and Unit 2 Small-Break LOCA analyses are not affected by this error.

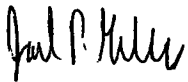
The enclosure to this letter provides a description of each LBLOCA EM error correction and the associated impact to the CNP Unit 1 LBLOCA analysis of record and the analysis performed for the CNP Unit 1 normal operating pressure/normal operating temperature (NOP/NOT) project currently under review, Reference 2. Based on information provided by Westinghouse, an assessment of

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these errors resulted in a PCT increase of 85°F for Unit 1 for both current operation and at NOP/NOT conditions. By Reference 3, I&M had provided a schedule for a reanalysis resulting from an unrelated error associated with thermal conductivity degradation. Based on the previously provided schedule for reanalysis, and since the changes from these errors did not lead to PCT temperatures in excess of the limit, there are no additional plans for a reanalysis as a result of these errors. This condition has been entered into CNP's corrective action program.

There are no new or revised commitments in this letter. Should you have any questions, please contact Mr. Michael K. Scarpello, Regulatory Affairs Manager, at (269) 466-2649.

Sincerely,



Joel P. Gebbie
Site Vice President

DB/amp

Enclosure: Donald C. Cook Nuclear Plant Unit 1 Report of Error Corrections on Westinghouse Large-Break Loss-of-Coolant Analysis Emergency Core Cooling System Evaluation Model

c: J. T. King, MPSC
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ENCLOSURE TO AEP-NRC-2014-15

DONALD C. COOK NUCLEAR PLANT UNIT 1

REPORT OF ERROR CORRECTIONS ON WESTINGHOUSE LARGE-BREAK LOSS-OF-COOLANT ANALYSIS EMERGENCY CORE COOLING SYSTEM EVALUATION MODEL

Abbreviations:

°F	degrees Fahrenheit
ECCS	emergency core cooling system
$F_{\Delta H}$	nuclear enthalpy rise hot channel factor
F_Q	heat flux hot channel factor
LOCA	loss of coolant accident
MWt	megawatts – thermal
NOP/NOT	normal operating pressure/ normal operating temperature
PCT	peak cladding temperature
SGTP	steam generator tube plugging

Summary:

By Westinghouse letter LTR-LIS-14-44, "D. C. Cook Units 1 and 2 10 CFR 50.46 Report for the HOTSPOT Burst Strain Error Correction," dated January 29, 2014, Westinghouse Electric Company notified Indiana Michigan Power, the licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1, of significant errors in the evaluation model for the Large-Break (LB) LOCA analysis of record for CNP Unit 1. This report contains a summary of changes and errors and their estimated effect on the calculated PCT of CNP Unit 1 LBLOCA analysis of record which also includes a PCT impact associated with the Unit 1 Cycle 25 operating cycle that began in May 2013. Additionally included is the impact of the error for the NOP/NOT project.

The error that has been identified in the HOTSPOT code affected the calculation of the fuel rod burst strain. The equation for the application of the burst strain is given as Equation 7-69 in WCAP-16009-P-A and in WCAP-12945-P-A. The outer radius of the fuel rod cladding, after burst occurs, should be calculated based on the burst strain, and the inner radius of the fuel rod cladding should be calculated based on the outer radius. The HOTSPOT code was found to have the burst strain applied to the calculation of the fuel rod cladding inner radius. The cladding outer radius was then calculated based on the inner radius. As such, the fuel rod burst strain was incorrectly applied to the inner radius rather than the outer radius, which impacts the resulting fuel rod cladding geometry at the fuel rod burst elevation (i.e., axial location in the core) after fuel rod burst was calculated to occur following a LBLOCA. The correction of the erroneous calculation results in thinner fuel rod cladding at the burst node (location/elevation) and leads to more fuel relocating into the burst node, leading to an increase in the calculated LBLOCA PCT at the burst node.

Affected Evaluation Models

1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model
2004 Westinghouse Realistic Large Break LOCA Evaluation Model using ASTRUM

Estimated Effect

As shown in the PCT rack-up tables below, the calculated LBLOCA PCT, with assessments, becomes 2175°F for Unit 1 (i.e., current Cycle 25 operation) which includes a PCT adjustment of +14°F associated with core reload effects. The Unit 1 value for the NOP/NOT program with assessments becomes 2037°F. Thus, it is seen that the 10 CFR 50.46 acceptance criterion of not exceeding 2200°F continues to be satisfied for both CNP units.

References:

1. WCAP-12945-P-A, Volume 1, Revision 2, and Volumes 2 through 5, Revision 1, "Code Qualification Document for Best Estimate LOCA Analysis," dated March 1998.
2. WCAP-16009-P-A, "Realistic Large-Break LOCA Evaluation Methodology Using the Automated Statistical Treatment Of Uncertainty Method (ASTRUM)," dated January 2005.
3. LTR-LIS-14-44, "D. C. Cook Units 1 and 2 10 CFR 50.46 Report the HOTSPOT for Burst Strain Error Correction" dated January 29, 2014.
4. AEP-NRC-2013-79, "Donald C. Cook Nuclear Plant Unit 1 Docket No. 50-315 License Amendment Request Regarding Restoration of Normal Reactor Coolant System Operating Pressure and Temperature Consistent with Previously Licensed Conditions," dated October 2013.
5. AEP-NRC-2013-68, "Donald C. Cook Nuclear Plant Unit 1 30-Day Report of Changes to or Errors in an Evaluation Model," dated August 2013.

Estimated Effect On The Calculated PCT For CNP Unit 1 Large Break LOCA:

Evaluation Model: ASTRUM (2004)			
$F_Q = 2.15$	$F_{\Delta H} = 1.55$	SGTP = 10% ^(a.)	Break Size: Split
Analysis Date: November 20, 2007			

LICENSING BASIS

Analysis-of-Record

PCT = 2128°F

MARGIN ALLOCATIONS (Delta PCT)

A.	PREVIOUS 10 CFR 50.46 ASSESSMENTS	384°F ^(a.)
B.	PLANNED PLANT MODIFICATION EVALUATIONS	
	1. Design Input Changes with Respect to Plant Operation	-381°F ^(a.)
	2. PBOT/PMID Evaluation	14°F ^(b.)
C.	NEW 10 CFR 50.46 ASSESSMENTS	
	1. Revised Input Changes with Respect to Plant Operation	-55°F ^(c.)
	2. Error in Burst Strain Application	85°F
D.	OTHER	0°F

LICENSING BASIS PCT + MARGIN ALLOCATIONS

PCT = 2175°F

Notes:

- These assessments are coupled via an evaluation of burnup effects which include thermal conductivity degradation, peaking factor burndown and design input changes (e.g., reduction in the maximum allowed steam generator tube plugging from 10% to 2% and maximum FdH reduced to 1.545). Evaluation details provided in a letter dated March 19, 2012, (ADAMS Accession No. ML12088A104), and supplemented by letter dated June 11, 2012, (ADAMS Accession No. ML12173A025), and subsequently found acceptable by U. S. Nuclear Regulatory Commission (NRC) letter dated March 7, 2013 (ADAMS Accession No. ML13077A137).
- This PCT impact is only applicable to the Unit 1 Cycle 25 operating cycle, which began in May 2013 and is scheduled to end in October 2014.
- This impact was due to revised heat transfer multiplier distributions identified in AEP-NRC-2013-68.

Estimated Effect On The Calculated PCT For CNP Unit 1 Large Break LOCA at NOP/NOT Conditions:

Evaluation Model: ASTRUM (2004)			
F _Q = 2.15	F _{ΔH} = 1.55	SGTP = 10% ^(a)	Break Size: Split
Analysis Date: November 20, 2007			

LICENSING BASIS

Analysis-of-Record

PCT = 2128°F

MARGIN ALLOCATIONS (Delta PCT)

A.	PREVIOUS 10 CFR 50.46 ASSESSMENTS	0°F ^(a)
B.	PLANNED PLANT MODIFICATION EVALUATIONS	
	1. Design Input Changes with Respect to Plant Operation for Return to NOP/NOT Evaluation	-489°F ^(a)
C.	2013 ECCS MODEL ASSESSMENTS	
	1. Design Input NOP/NOT Including Pellet Thermal Conductivity Degradation and Peaking Factor Burndown	404
	2. Revised Heat Transfer Multiplier Distributions	-91 ^(b)
	3. Error in Burst Strain Application	85
D.	OTHER	0°F

LICENSING BASIS PCT + MARGIN ALLOCATIONS

PCT = 2037°F

Notes:

- a. These assessments are coupled via an evaluation of burnup effects which include thermal conductivity degradation, peaking factor burndown and design input changes (e.g., reduction in the maximum allowed steam generator tube plugging from 10% to 2% and maximum FdH reduced to 1.545). Evaluation details provided in a letter dated March 19, 2012, (ADAMS Accession No. ML12088A104), and supplemented by letter dated June 11, 2012, (ADAMS Accession No. ML12173A025), and subsequently found acceptable by NRC letter dated March 7, 2013 (ADAMS Accession No. ML13077A137).
- b. The return to NOP/NOT evaluation in AEP-NRC-2013-79 contains revised heat transfer multiplier distribution.