

# WOLF CREEK NUCLEAR OPERATING CORPORATION

Steven R. Koenig  
Manager Regulatory Affairs

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RA 15-0025

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

Reference: Westinghouse Letter LTR-LIS-15-36, dated February 19, 2015,  
"Wolf Creek 10 CFR 50.46 Annual Notification and Reporting for  
2014"

Subject: Docket No. 50-482: 10 CFR 50.46 Annual Report of Emergency  
Core Cooling System (ECCS) Evaluation Model Changes

Gentlemen:

This letter provides the annual report for the Emergency Core Cooling System (ECCS) Evaluation Model changes and errors for the 2014 model year that affect the peak cladding temperature (PCT) for Wolf Creek Generating Station (WCGS). This letter is provided in accordance with the criteria and reporting requirements of 10 CFR 50.46(a)(3)(ii), as clarified in Section 5.1 of WCAP-13451, "Westinghouse Methodology for Implementation of 10 CFR 50.46 Reporting." Regulation 10 CFR 50.46(a)(3)(ii) states, in part, "For each change to or error discovered in an acceptable evaluation model or in the application of such a model that affects the temperature calculation, the applicant or holder of a construction permit, operating license, combined license, or manufacturing license shall report the nature of the change or error and its estimated effect on the limiting ECCS analysis to the Commission at least annually as specified in §50.4 or §52.3 of this chapter, as applicable. If the change or error is significant, the applicant or licensee shall provide this report within 30 days and include with the report a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with §50.46 requirements."

Wolf Creek Nuclear Operating Corporation (WCNOC) has reviewed the notification and reporting requirements of 10 CFR 50.46 pertaining to the ECCS Evaluation Model changes that were implemented by Westinghouse for 2014 as described in the above Reference. The review concludes that the effect of changes to, or errors in, the Evaluation Models on the limiting transient PCT is not significant for 2014. Therefore, changes to the ECCS Evaluation Models are being reported as an annual report.

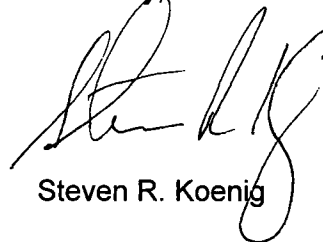
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Attachment I provides an assessment of the specific changes and enhancements to the Westinghouse Evaluation Models for 2014. With the exception of a Wolf Creek Containment Cooling Capacity error which resulted in an estimated effect of 6° Fahrenheit (F) for the BASH evaluation model, the other model changes and enhancements do not have impacts on the PCT and, generally, will not be presented on the PCT rack-up forms.

Attachment II provides PCT rack-up forms for the calculated Large Break Loss of Coolant Accident (LOCA) and Small Break LOCA PCT margin allocations in effect for the 2014 WCGS evaluation models. The PCT values determined in the Large Break and Small Break LOCA analysis of record, combined with all of the PCT allocations, remain below the 10 CFR 50.46(b)(1) regulatory limit of 2200°F. Therefore, WCGS is in compliance with 10 CFR 50.46 requirements and no reanalysis or other action is required.

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4041 or Bill Muilenburg at 620-364-4186.

Sincerely,



Steven R. Koenig

SRK/rit

Attachment I – Assessment of Changes to the Westinghouse Emergency Core Cooling System (ECCS) Evaluation Models for Large and Small Break Loss of Coolant Accidents (LOCA)

Attachment II – Emergency Core Cooling System (ECCS) Evaluation Model Peak Cladding Temperature (PCT) Margin Utilization Rack-up Forms

cc: M. L. Dapas (NRC), w/a  
C. F. Lyon (NRC), w/a  
N. F. O'Keefe (NRC), w/a  
Senior Resident Inspector (NRC), w/a

**ASSESSMENT OF CHANGES TO THE WESTINGHOUSE EMERGENCY  
CORE COOLING SYSTEM (ECCS) EVALUATION MODELS FOR LARGE  
AND SMALL BREAK LOSS OF COOLANT ACCIDENTS (LOCA)**

**Non-Discretionary Changes With Peak Cladding Temperature (PCT) Impact**

WOLF CREEK CONTAINMENT COOLING CAPACITY (BASH)

**Non-Discretionary Changes With No PCT Impact**

FUEL ROD GAP CONDUCTANCE ERROR (NOTRUMP)

RADIATION HEAT TRANSFER MODEL ERROR (NOTRUMP)

SBLOCTA PRE-DEPARTURE FROM NUCLEATE BOILING (DNB) CLADDING SURFACE  
HEAT TRANSFER COEFFICIENT CALCULATION (NOTRUMP)

**Enhancements/Forward-Fit Discretionary Changes**

GENERAL CODE MAINTENANCE (NOTRUMP)

**Editorial Changes**

None

## **Summary**

### **WOLF CREEK CONTAINMENT COOLING CAPACITY** (Non-Discretionary Change with PCT Impact)

#### **Background**

Wolf Creek Nuclear Operating Corporation (WCNOC) identified an error in the containment fan cooler capacity transmitted for use in the large break loss-of-coolant accident (LBLOCA) Appendix K BASH analyses. This issue has been evaluated to estimate the impact on existing peak cladding temperature results. The resolution of this issue represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

#### **Affected Evaluation Models**

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

#### **Estimated Effect**

The estimated effect was determined for the LBLOCA evaluation model with BASH based on the change in calculated containment pressure resulting from the correct containment cooling capacity. The change in calculated containment pressure leads to an estimated PCT effect of 6° Fahrenheit (F) for the BASH evaluation model analysis.

### **FUEL ROD GAP CONDUCTANCE ERROR** (Non-Discretionary Change with no PCT Impact)

#### **Background**

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.

#### **Affected Evaluation Model(s)**

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

#### **Estimated Effect**

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 PCT impact of 0°F.

**RADIATION HEAT TRANSFER MODEL ERROR**  
(Non-Discretionary Change with no PCT Impact)

**Background**

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.

**Affected Evaluation Model(s)**

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

**Estimated Effect**

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 (PCT) impact of 0°F.

**SBLOCTA PRE-DNB CLADDING SURFACE HEAT TRANSFER COEFFICIENT CALCULATION**

(Non-Discretionary Change with no PCT Impact)

**Background**

Two errors were discovered in the pre-departure from nucleate boiling (pre-DNB) cladding surface heat transfer coefficient calculation in the SBLOCTA code (cladding heat-up calculations). The first error is a result of inconsistent time units (hours vs. seconds) in the parameters used for the calculation of the Reynolds and Prandtl numbers, and the second error relates to an incorrect diameter used to develop the area term in the cladding surface heat flux calculation. Both of these issues impact the calculation of the pre-DNB convective heat transfer coefficient, representing a closely related group of Non-Discretionary Changes to the Evaluation Model as described in Section 4.1.2 of WCAP-13451.

**Affected Evaluation Model(s)**

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

**Estimated Effect**

These errors have been corrected in the SBLOCTA code. Because this condition occurred prior to DNB, it was judged that these errors had no direct impact on the cladding heat-up related to the core uncover period. A series of validation tests were performed and confirmed that these errors have a negligible effect on SBLOCA analysis results, leading to an estimated PCT impact of 0°F.

## **GENERAL CODE MAINTENANCE**

(Enhancements/Forward-Fit Discretionary Changes)

### **Background**

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.

### **Affected Evaluation Models**

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

### **Estimated Effect**

The nature of these changes leads to an estimated PCT impact of 0°F.

**EMERGENCY CORE COOLING SYSTEM (ECCS) EVALUATION MODEL PEAK  
CLADDING TEMPERATURE (PCT) MARGIN UTILIZATION RACK-UP FORMS**

**\*\*\* LARGE BREAK LOCA PCT MARGIN UTILIZATION \*\*\***

Evaluation Model: 1981 EM with BASH  
 Fuel: 17x17 V5H w/IFM, non-IFBA, 275 psig  
 Peaking Factor: FQ=2.50, FdH=1.65  
 SG Tube Plugging: 10%  
 Power Level: 3565 MWth  
 Limiting transient: Cd=0.4, Min. SI, Reduced Tav<sub>g</sub>

**LICENSING BASIS**

<b>Analysis of Record (AOR) PCT</b>	<b>Clad Temp (°F)</b> 1916 °F	<b>Ref.</b> 1	<b>Notes</b> (a)
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**MARGIN ALLOCATIONS (ΔPCT)**

**A. PRIOR PERMANENT ECCS MODEL ASSESSMENTS**

1. Structural Metal Heat Modeling	-25	8	
2. LUCIFER Error Corrections	-6	10	
3. Skewed Power Shape Penalty	152	11	
4. Hot Leg Nozzle Gap Benefit	-136	11	
5. SATAN-LOCTA Fluid Error	15	2	
6. LOCBART Spacer Grid Single-Phase Heat Transfer Error	15	9	
7. LOCBART Vapor Film Flow Regime Heat Transfer Error	9	12	
8. LOCBART Cladding Emissivity Errors	6	13	
9. LOCBART Radiation to Liquid Logic Error Correction	17	14	
10. LOCBART Pellet Volumetric Heat Generation Rate	45	15	
11. PWROG TCD EVALUATION - Rebaseline of AOR	87	16	(e)
12. PWROG TCD Evaluation - Effect of TCD and Assembly Power/Peaking Factor Burndown	0	16	(e)

**B. PLANNED PLANT CHANGE EVALUATIONS**

1. Loose Parts Evaluation	20	3	
2. Effects of Containment Purging	0	4	
3. Cycle 10 Fuel Assembly Design Changes	95	5	
4. Fuel Rod Crud	0	6	

**C. 2014 PERMANENT ECCS MODEL ASSESSMENTS**

1. Containment Fan Cooler Capacity	6	17	
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**D. TEMPORARY ECCS MODEL ISSUES**

0

**E. OTHER**

1. Cold Leg Streaming Temperature Gradient	0	8	(b)
2. Rebaseline of AOR (12/96)	-63	9	(c)
3. LOCBART Zirc-Water Oxidation Error	28	7	(d)

**LICENSING BASIS PCT + MARGIN ALLOCATIONS PCT = 2181 °F**

**CUMULATIVE ABSOLUTE MAGNITUDE OF PCT CHANGES SINCE LAST 30-DAY REPORT (LETTER ET 12-0023, ADAMS Accession No. ML12298A504) Σ | ΔPCT | = 6 °F**

**References:**

1. Westinghouse Topical Report WCAP-13456, "Wolf Creek Generating Station NSSS Rerating Licensing Report," October 1992.
2. Westinghouse to WCNOC letter SAP-97-102, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, 10 CFR 50.46 Annual Notification and Reporting," February 17, 1997.
3. Westinghouse to WCNOC letter SAP-90-148, "Wolf Creek Nuclear Operating Corporation, RCS Loose Parts Evaluation," April 18, 1998.
4. Westinghouse to WCNOC letter SAP-94-102, "Containment Mini purge Isolation Valve Stroke Time Increase," January 12, 1994.
5. Westinghouse to WCNOC letter 97SAP-G-0009, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, Safety Assessment for the Wolf Creek Generating Station with ZIRLO™ Fuel Assemblies," February 7, 1997.
6. Westinghouse to WCNOC letter 97SAP-G-0075, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, Wolf Creek Crud Deposition/Axial Offset Anomaly Safety Evaluation," September 29, 1997.
7. Westinghouse to WCNOC letter 00SAP-G-0006, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, Wolf Creek Cycle 12 LOCA Current Limits," February 10, 2000.
8. Westinghouse to WCNOC letter SAP-93-701, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, 10 CFR 50.46 Notification and Reporting Information," January 25, 1993.
9. Westinghouse to WCNOC letter SAP-99-148, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, 10 CFR 50.46 BART/BASH Evaluation Model Mid-Year Notification and Reporting for 1999," September 22, 1999.
10. Westinghouse to WCNOC letter SAP-94-703, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, 10 CFR 50.46 Notification and Reporting," February 8, 1994.
11. Westinghouse to WCNOC letter SAP-95-716, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, LOCA Axial Power Shape Sensitivity Model," August 14, 1995.
12. Westinghouse to WCNOC letter SAP-00-118, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, 10 CFR 50.46 Appendix K (BART/BASH/NOTRUMP) Evaluation Model, Mid-Year Notification and Reporting for 2000," June 30, 2000.
13. Westinghouse to WCNOC letter SAP-00-150, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, 10 CFR 50.46 BART/BASH Evaluation Model Mid-Year Notification and Reporting for 2000," December 2000.
14. Westinghouse to WCNOC letter SAP-02-32, "10 CFR 50.46 BART/BASH Evaluation Model Mid-Year Notification and Reporting for 2002," June 2002.
15. Westinghouse to WCNOC letter LTR-LIS-07-312, "10 CFR 50.46 Reporting Text for LOCBART Version 37.0 Issues and Revised PCT Rackup sheets for Wolf Creek," May 14, 2007.
16. Westinghouse to WCNOC letter LTR-LIS-12-515, "Wolf Creek, 10 CFR 50.46 Notification and Reporting for Fuel Pellet Thermal Conductivity Degradation and Peaking Factor Burndown," September 20, 2012.
17. Westinghouse to WCNOC letter LTR-LIS-14-400, "10 CFR 50.46 Report for the Wolf Creek Large Break LOCA Evaluation of the Change in Containment Cooling Capacity," August 28, 2014.



**Notes:**

- (a) An evaluation was performed to support removal of the transition core penalty for Cycle 12 (Ref. 7).
- (b) A PCT benefit of < 2.5 °F was assessed, however, a benefit of 0 °F will be tracked for reporting purposes.
- (c) This previously unclaimed benefit was realized through prior rebaseline of the limiting case.
- (d) This assessment is a function of analysis PCT plus certain margin allocations and as such may increase/decrease with margin allocation changes.
- (e) This effect was estimated based on the bounding value from the available plant-specific calculations.

**\*\*\* SMALL BREAK LOCA PCT MARGIN UTILIZATION \*\*\***

Evaluation Model: 1985 EM with NOTRUMP  
 Fuel: 17x17 RFA-2 w/IFM  
 Peaking Factor: FQ=2.50, FdH=1.65  
 SG Tube Plugging: 10%  
 Power Level: 3565 MWth  
 Limiting transient: 4-inch Break

**LICENSING BASIS**

	<b>Clad Temp (°F)</b>	<b>Ref.</b>	<b>Notes</b>
<b>Analysis of Record PCT</b>	936 °F	1	

**MARGIN ALLOCATIONS (ΔPCT)**

<b>A. PRIOR PERMANENT ECCS MODEL ASSESSMENTS</b>			
1. None	0		
<b>B. PLANNED PLANT CHANGE EVALUATIONS</b>			
1. Loose Part Evaluation	45	2	(a)
<b>C. 2014 PERMANENT ECCS MODEL ASSESSMENTS</b>			
1. None	0		
<b>D. TEMPORARY ECCS MODEL ISSUES</b>			
1. None	0		
<b>E. OTHER</b>			
1. None	0		

**LICENSING BASIS PCT + MARGIN ALLOCATIONS** **PCT = 981 °F**

**CUMULATIVE ABSOLUTE MAGNITUDE OF PCT CHANGES** **Σ |ΔPCT| = 0 °F**

**References:**

1. WCAP-16717-P, Rev. 0, "Wolf Creek Generating Station (SAP), MSIV/MFIV Replacement Project, Small Break Loss of Coolant Accident Analysis Engineering Report," January 2007.
2. SAP-90-148/NS-OPLS-OPL-I-90-239, "Wolf Creek Nuclear Operating Corporation, RCS Loose Part Evaluation," April 1990.

**Notes:**

(a) This penalty will be carried to track the loose part which has not been recovered.