

WOLF CREEK NUCLEAR OPERATING CORPORATION

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Manager Regulatory Affairs

March 16, 2011

RA 11-0034

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

Reference: Westinghouse Letter LTR-LIS-11-68, dated January 26, 2011, Wolf Creek 10 CFR 50.46 Annual Notification and Reporting for 2010

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 2010 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 2010 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 2010. Therefore, changes to the ECCS Evaluation Model are being reported as an annual report.

Attachment I provides an assessment of the specific changes and enhancements to the Westinghouse Evaluation Models for 2010. These model changes and enhancements do not have impacts on the PCT and, generally, will not be presented on the PCT rackup forms.

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Attachment II provides the calculated Large Break Loss of Coolant Accident (LOCA) and Small Break LOCA PCT margin allocations in effect for the 2010 WCGS evaluation models. The PCT values determined in the Small Break and Large Break LOCA analysis of record, combined with all of the PCT allocations, remain well below the 10 CFR 50.46(b)(1) regulatory limit of 2200 degrees Fahrenheit. Therefore, WCGS is in compliance with 10 CFR 50.46 requirements and no reanalysis or other action is required.

No commitments are identified in this correspondence.

If you have any questions concerning this matter, please contact me at (620) 364-4175, or Diane Hooper at (620) 364-4041.

Sincerely,



Gautam Sen

GS/rt

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

cc: E. E. Collins (NRC), w/a
G. B. Miller (NRC), w/a
J. R. Hall (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

None

Non-Discretionary Changes With No PCT Impact

Urania-Gadolinia Pellet Thermal Conductivity Calculation (NOTRUMP)
Pellet Crack and Dish Volume Calculation (NOTRUMP/BASH)
Treatment of Vessel Average Temperature Uncertainty (NOTRUMP)

Enhancements/Forward-Fit Discretionary Changes

General Code Maintenance (NOTRUMP)

Editorial Changes

None

Summary

Urania-Gadolinia Pellet Thermal Conductivity Calculation

(Non-Discretionary Changes with no PCT Impact)

Background

Two errors were discovered in the pellet thermal conductivity calculation for uranium-gadolinia pellets in the SBLOCTA code. First, the calculation did not include the terms required to adjust for pellet densities other than 95% of the theoretical density. Second, the conversion from Fahrenheit to Rankine used an adder of 459 instead of 459.67. These errors have been corrected and evaluated for impact on existing Small Break LOCA analysis results. These changes represent a closely-related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451, "Westinghouse Methodology for Implementation of 10 CFR 50.46 Reporting."

Affected Evaluation Model(s)

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

Estimated Effect

SBLOCTA sensitivity calculations led to an estimated PCT effect of 0°F for existing Small Break LOCA analysis results.

Pellet Crack and Dish Volume Calculation

(Non-Discretionary Changes with no PCT Impact)

Background

Two errors were discovered in the calculation of the normalized pellet crack and dish volumes in the SBLOCTA code. First, an incorrect operator was used to select between two tables of normalized volume vs. linear heat generation rate. Second, the normalized volume at 18 kW/ft was incorrectly programmed in one of the tables as 1.58 instead of 1.59. These errors have been corrected in the SBLOCTA code and will be corrected (where applicable) in future versions of the BASH and LOCBART codes. These changes represent a closely-related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP
1981 Westinghouse Large Break LOCA Evaluation Model with BASH

Estimated Effect

A combination of SBLOCTA sensitivity calculations and engineering judgment led to an estimated PCT effect of 0°F for existing Large and Small Break LOCA analysis results.

Treatment of Vessel Average Temperature Uncertainty
(Non-Discretionary Changes with no PCT Impact)

Background

Historically, the overall vessel average temperature uncertainty calculated by Westinghouse considered only “-” instrument uncertainties, corresponding to the indicated temperature being lower than the actual temperature. This uncertainty was then applied as a “+/-” uncertainty in some LOCA analyses, rather than using specific “+” and “-” uncertainties. This discrepancy has been evaluated for impact on existing Large and Small Break LOCA analysis results, and its resolution represents a Non-Discretionary Change 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

This issue was judged to have a negligible impact on existing Large and Small Break LOCA 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 the codes and to help preclude errors in analyses. This includes items such as 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 Model(s)

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

***** 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 _g

LICENSING BASIS

	Clad Temp (°F)	Ref.	Notes
Analysis of Record PCT	1916°F	1	(a)

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

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. 2010 PERMANENT ECCS MODEL ASSESSMENTS

1.	None	0	
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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 = 2088°F

CUMULATIVE ABSOLUTE MAGNITUDE OF PCT CHANGES SINCE LAST 30-DAY REPORT (LETTER ET 07-0021)

Σ |ΔPCT| = 0°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, 1990.
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 Information," 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. 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 2007.

Notes:

- (a) An evaluation was performed to support removal of the transition core penalty for Cycle 12 (Ref. 7).
- (b) A PCT benefit of $< 2.5^{\circ}\text{F}$ 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.

***** 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

	Clad Temp (°F)	Ref.	Notes
Analysis of Record PCT	936	1	

MARGIN ALLOCATIONS (ΔPCT)

A. PRIOR PERMANENT ECCS MODEL ASSESSMENTS

1. None	0		
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B. PLANNED PLANT CHANGE EVALUATIONS

1. Loose Part Evaluation	45	2	(a)
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C. 2010 PERMANENT ECCS MODEL ASSESSMENTS

1. None	0		
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D. TEMPORARY ECCS MODEL ISSUES

1. None	0		
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E. OTHER

1. None	0		
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LICENSING BASIS PCT + MARGIN ALLOCATIONS PCT = 981°F

CUMULATIVE ABSOLUTE MAGNITUDE OF PCT CHANGES $\Sigma |\Delta PCT| = 0^\circ F$

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.