

WOLF CREEK

NUCLEAR OPERATING CORPORATION

Kevin J. Moles
Manager Regulatory Affairs

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RA 06-0055

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

Reference: Westinghouse Letter LTR-LIS-06-117, dated March 6, 2006, 10 CFR 50.46 Annual Notification and Reporting for 2005

Subject: Docket No. 50-482: 10 CFR 50.46 Annual Report of ECCS Model Changes

Gentlemen:

This letter provides the annual report for the Emergency Core Cooling System (ECCS) Evaluation Model changes and errors for the 2005 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 licensee 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 section 50.4. 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 section 50.46 requirements."

Wolf Creek Nuclear Operating Corporation (WCNOC) has reviewed the notification of 10 CFR 50.46 reporting information pertaining to the ECCS Evaluation Model changes that were implemented by Westinghouse for 2005 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 2005. Therefore, the report of the ECCS Evaluation Model changes is provided on an annual basis.

Attachment I provides an assessment of the specific changes and enhancements to the Westinghouse Evaluation Models for 2005. These model changes and enhancements do not have impacts on the PCT and, generally, will not be presented on the PCT rackup forms.

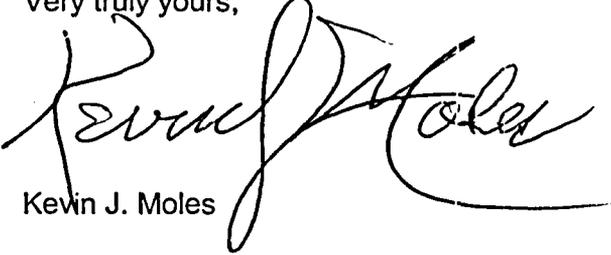
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Attachment II provides the calculated Large Break Loss of Coolant Accident (LOCA) and Small Break LOCA PCT margin allocations in effect for the 2005 WCGS evaluation models. The PCT values determined in the Small Break and Large Break LOCA analysis of record, combined with all of the PCT allocations, remain well below the 10 CFR 50.46 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) 364-4126, or Ms. Diane Hooper at (620) 364-4041.

Very truly yours,



Kevin J. Moles

KJM/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

cc: J. N. Donohew (NRC), w/a
W. B. Jones (NRC), w/a
B. S. Mallet (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 PCT Impact

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Non-Discretionary Changes With No PCT Impact

Pressurizer Fluid Volumes

Lower Guide Tube Assembly Weight

Discrepancy in NOTRUMP RWST Draindown Calculation

Enhancements/Forward-Fit Discretionary Changes

General Code Maintenance (BASH/NOTRUMP)

PRESSURIZER FLUID VOLUMES

Background

The Westinghouse Systems and Equipment Engineering group has recommended that the previously-transmitted pressurizer fluid volumes be replaced with nominal cold values. This change resolves a discrepancy in the prior calculations while providing a close approximation of the actual as-built values. The revised values have been evaluated for impact on current licensing-basis analyses and will be incorporated into the plant-specific input databases on a forward-fit basis. This change 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
1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

Estimated Effect

The differences between the previously-transmitted and revised volumes are very small and would be expected to produce a negligible effect on large and small break LOCA analysis results, leading to an estimated PCT impact of 0°F for 10 CFR 50.46 reporting purposes.

LOWER GUIDE TUBE ASSEMBLY WEIGHT

Background

An error was discovered in the lower guide tube assembly weight for three units that resulted in a small over-estimation of the upper plenum metal mass. The corrected values have been evaluated for impact on current licensing-basis analyses and will be incorporated into the plant-specific input databases on a forward-fit basis. This change 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
1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

Estimated Effect

The differences in upper plenum metal mass are very small and would be expected to produce a negligible effect on large and small break LOCA analysis results, leading to an estimated PCT impact of 0°F for 10 CFR 50.46 reporting purposes.

DISCREPANCY IN NOTRUMP RWST DRAINDOWN CALCULATION

Background

For small break LOCA calculations where the break size is greater than the safety injection (SI) line diameter, and where the SI line is connected directly to the reactor coolant system (RCS), it is assumed that the broken loop safety injection flows do not inject to the RCS, but rather spill to containment. Typically, this is modeled in NOTRUMP-EM analyses by setting the flows injected to the broken loop equal to zero, which neglects the continued depletion of the refueling water storage tank (RWST) inventory. As a result, the RWST draindown time is incorrectly calculated, potentially resulting in an inaccurate modeling of enthalpy changes and/or SI interruptions that can occur at switchover to sump recirculation. Therefore, the SI spilling flows need to be explicitly modeled in order to correctly calculate the RWST draindown time.

Affected Evaluation Models

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

Estimated Effect

For Westinghouse plants using the NOTRUMP-EM, the larger small breaks are typically non-limiting and the transients are of short duration. Therefore, correct modeling of the spilling flows in the RWST draindown calculation for these breaks would be expected to produce a negligible effect on SBLOCA results, leading to an estimated PCT impact of 0°F for 10 CFR 50.46 reporting purposes.

GENERAL CODE MAINTENANCE (BASH/NOTRUMP)

Background

Various changes in code input and output format have been made to enhance usability and help preclude errors in analyses. This includes both input changes (e.g., more relevant input variables defined and more common input values used as defaults) and input diagnostics designed to preclude unreasonable values from being used, as well as various changes to code output which have no effect on calculated results. In addition, various updates were made to eliminate inactive coding, improve active coding, and enhance commenting, both for enhanced usability and to facilitate code debugging when necessary. 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

1981 Westinghouse Large Break LOCA Evaluation Model with BASH
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.

***** LARGE BREAK LOCA PEAK CLAD TEMPERATURE (PCT) MARGIN UTILIZATION *****

Evaluation Model: 1981 EM with BASH
Fuel: 17X17 V5H w/IFM, non-IFBA, 275 psig
Peaking Factor: FQ=2.50, F_{dH}=1.65
SG Tube Plugging: 10%
Power Level: 3565 MW_{th}
Limiting transient: C_D=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	

B. PLANNED PLANT CHANGE EVALUATIONS

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

C. 2004 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 = 2043°F

CUMULATIVE ABSOLUTE MAGNITUDE OF PCT CHANGES SINCE LAST 30-DAY REPORT (LETTER ET 99-0045) $\Sigma|\Delta PCT| = 32^\circ\text{F}$

References:

1. Westinghouse Topical Report WCAP-13456, "Wolf Creek Generating Station NSSS Rerating Licensing Report," October 1992.
2. Westinghouse to WCNO 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 WCNO letter SAP-90-148, "Wolf Creek Nuclear Operating Corporation, RCS Loose Parts Evaluation," April 18, 1998.
4. Westinghouse to WCNO letter SAP-94-102, "Containment Mini purge Isolation Valve Stroke Time Increase," January 12, 1994.
5. Westinghouse to WCNO 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 WCNO 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 WCNO 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 WCNO 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 WCNO 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 WCNO 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 WCNO 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 WCNO 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 WCNO 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 WCNO letter SAP-02-32, "10 CFR 50.46 BART/BASH Evaluation Model Mid-Year Notification and Reporting for 2002," June 2002.

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 and 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 PEAK CLAD TEMPERATURE (PCT) MARGIN UTILIZATION *****

Evaluation Model:	1985 EM with NOTRUMP
Fuel:	17X17 V5H w/IFM, non-IFBA, 275 psig
Peaking Factor:	FQ=2.50, F _{dH} =1.65
SG Tube Plugging:	10%
Power Level:	3565 MW _{th}
Limiting transient:	3-inch Break

LICENSING BASIS	Clad Temp (°F)	Ref.	Notes
Analysis of Record PCT	1510	1	
MARGIN ALLOCATIONS (ΔPCT)			
A. PRIOR PERMANENT ECCS MODEL ASSESSMENTS			
1. Effect of SI in Broken Loop	150	10	
2. Effect of Improved Condensation Model	-150	10	
3. Drift Flux Flow Regime Errors	-13	11	
4. LUCIFER Error Corrections	-16	11	
5. Boiling Heat Transfer Correlation Error	-6	12	
6. Steam Line Isolation Logic Error	18	12	
7. Axial Nodalization, RIP Model Revision and SBLOCTA Error Corrections Analysis	26	13	
8. NOTRUMP Specific Enthalpy Error	20	2	
9. SBLOCTA Fuel Rod Initialization Error	2	14	
10. NOTRUMP Mixture Level Tracking/Region Depletion Errors	13	15	
11. NOTRUMP Bubble Rise/Drift Flux Model Inconsistency Corrections	0	16	
B. PLANNED PLANT CHANGE EVALUATIONS			
1. Loose Parts Evaluation	45	3	
2. Cycle 10 Fuel Assembly Design Change	1	6	
3. Reduced Feedwater Inlet Temperature	10	4	
4. Fuel Rod Crud	4	5	(a)
5. Auxiliary Feedwater Temperature Increase	16	8,9	(b)
6. High Head SI Flow Reduction	35	17	
C. 2004 PERMANENT ECCS MODEL ASSESSMENTS			
1. None	0		
D. TEMPORARY ECCS MODEL ISSUES			
1. None	0		
E. OTHER			
1. Cold Leg Streaming Temperature Gradient	7	7	

LICENSING BASIS PCT + MARGIN ALLOCATIONS

PCT = 1672

**CUMULATIVE ABSOLUTE MAGNITUDE OF PCT CHANGES
SINCE LAST 30-DAY REPORT (LETTER ET 99-0024)**

$\Sigma|\Delta PCT| = 35^{\circ}F$

References:

1. Westinghouse Topical Report WCAP-13456, "Wolf Creek Generating Station NSSS Rerating Licensing Report," October 1992.
2. Westinghouse to WCNOC letter SAP-96-705, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, 10 CFR 50.46 Notification and Reporting," February 9, 1996.
3. Westinghouse to WCNOC letter SAP-90-148, "Wolf Creek Nuclear Operating Corporation, FCS Loose Parts Evaluation," April 18, 1990.
4. Westinghouse to WCNOC letter SAP-96-119, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, Small Break LOCA Evaluation for Reduced Feedwater Temperature," May 30, 1996.
5. 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. (This penalty will be carried until such time it is determined to no longer apply).
6. 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.
7. 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.
8. Westinghouse to WCNOC letter SAP-98-138, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, Assessment of an Increase in Auxiliary Feedwater Temperature," July 23, 1998.
9. 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.
10. Westinghouse to WCNOC letter SAP-93-718, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, Safety Injection in the Broken Loop," September 22, 1993.
11. 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.
12. Westinghouse to WCNOC letter SAP-94-722, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, 10 CFR 50.46 Notification and Reporting," August 18, 1994.
13. Westinghouse to WCNOC letter SAP-94-727, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, SBLOCTA Axial Nodalization," October 27, 1994.
14. 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.
15. 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.
16. Westinghouse to WCNOC letter SAP-03-33, "10 CFR 50.46 Mid-Year Notification and Reporting for 2003," November 14, 2003.
17. Westinghouse to WCNOC letter SAP-04-33, "Wolf Creek Nuclear Operating Corporation, Wolf Creek Generating Station, High Head Safety Injection Flow Rate Reduction – Final Evaluation," June 11, 2004.

Notes:

- (a) This penalty will be carried until such time it is determined to no longer apply.

(b) This increase in auxiliary feedwater temperature was originally evaluated in Reference 8 as a 16°F penalty. However, this change was not implemented until the Cycle 12 reload. Reference 9 represents the transmittal of the Cycle 12 LOCA Reload Current Limits.