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Your ref: Docket No. 52-006  
Our ref: DCP\_NRC\_003144

March 15, 2011

Subject: 10 CFR 50.46 Annual Report for the AP1000<sup>®</sup> Standard Plant Design

Pursuant to 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water reactors," Westinghouse Electric Company is submitting this report to document any emergency core cooling system (ECCS) evaluation model changes or errors that affect the temperature calculation for the AP1000 Standard Plant Design. There are no additional Best Estimate LOCA (BELOCA) model changes that affect the temperature calculation to the items reported in the last 10 CFR 50.46 report documented in letter DCP\_NRC\_002824, dated March 18, 2010.

Westinghouse reported an error that affected the Small Break LOCA (SBLOCA) where use of incorrect inputs were found to have been utilized in the calculation as the adiabatic rod heat-up during the 10-inch break analysis of the AP1000. The first error was related to inconsistent units being utilized in the equation for the rod average power. The second error was the use of an incorrect cross-sectional area term to represent the cladding in the adiabatic heat-up calculation. These changes represent Non-Discretionary changes in accordance with Section 4.1.2 of WCAP-13451. This information was reported in a 30 day reporting letter June, 2010 to the NRC (DCP\_NRC\_002943).

The limiting Transient for the AP1000 Certified Design as documented in the AP1000 DCD (Revision 15, dated December 8, 2005) is the Best Estimate Large Break Loss-of-Coolant Accident (BELOCA). The peak cladding temperature (PCT) is 2158°F for the BELOCA and does not exceed the 10 CFR 50.46 (b)(1) acceptance criterion of 2200°F. The summary of the updated PCT margin allocations and their bases are provided in Attachment 1. Westinghouse submitted the initial 10 CFR 50.46 report for the AP1000 Standard Plant Design in letter DCP/NRC2074, dated February 15, 2008. The limiting peak clad temperature of 2158°F for the BELOCA has not changed since the issuance of DCP/NRC2074.

In DCP/NRC2074 Westinghouse provided a schedule as required by 10 CFR 50.46 (a)(3)(iii) for the reanalysis of Best Estimate LOCA using the Automated Statistical Treatment of Uncertainty Method (ASTRUM) methodology. In accordance with the reanalysis schedule Westinghouse submitted the reanalysis of Best Estimate LOCA using the ASTRUM methodology to the NRC in letter DCP/NRC2182, dated June 30, 2008. Westinghouse included the reanalysis in Revision 17 of the DCD which was submitted to the NRC in letter DCP/NRC2266 dated September 22, 2008. As a result of Requests for Additional Information received from the NRC in November, 2008, Westinghouse revised the report documenting the reanalysis for Best Estimate LOCA using the ASTRUM methodology and resubmitted the report to the NRC in letter DCP/NRC2368, dated February 3, 2009. Attachment 1 also contains updated PCT margin allocations and their bases for the reanalysis of Best Estimate LOCA using ASTRUM.

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LFO

The information included in this letter is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and Design Certification Amendment Application. By copy of this letter, COL Applicants are hereby notified of any changes or errors in the AP1000 Standard Design PCT as required by 10 CFR 50.46(a)(3)(iii).

Questions or requests for additional information related to content and preparation of this information should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of letter.

Very truly yours,



R. F. Ziesing  
Director, U.S. Licensing

/Attachment

1. 10 CFR 50.46 Report

cc: E. McKenna - U.S. NRC  
P. Clark - U.S. NRC  
T. Spink - TVA  
P. Hastings - Duke Power  
R. Kitchen - Progress Energy  
A. Monroe - SCANA  
P. Jacobs - Florida Power & Light  
C. Pierce - Southern Company  
E. Schmiech - Westinghouse  
G. Zinke - NuStart/Entergy  
R. Grumbir - NuStart  
J. DeBlasio - Westinghouse  
J. Monahan - Westinghouse

**ATTACHMENT 1**

**10 CFR 50.46 Report**

**TREATMENT OF VESSEL AVERAGE TEMPERATURE UNCERTAINTY  
(Non-Discretionary Change)**

**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

1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model

1999 Westinghouse Best Estimate Large Break LOCA Evaluation Model, Application to PWRs with Upper Plenum Injection

2004 Westinghouse Realistic Large Break LOCA Evaluation Model Using ASTRUM

**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.

**AP1000 SBLOCA 10-INCH TRANSIENT ADIABATIC HEAT-UP CALCULATION**  
**(Non-Discretionary Change)**

**Background**

Incorrect inputs were found to have been utilized in the calculation as the adiabatic rod heat-up during the 10-inch break analysis of the AP1000. The first error was related to inconsistent units being utilized in the equation for the rod average power. The second error was the usage of an incorrect cross-sectional area term to represent the cladding in the adiabatic heat-up calculation. These changes represent Non-Discretionary changes in accordance with Section 4.1.2 of WCAP-13451.

**Affected Evaluation Model(s)**

1985 Westinghouse Advanced Plant Small Break LOCA Evaluation Model with NOTRUMP

**Estimated Effect**

The estimated effect of these changes on the Adiabatic Rod heat-up for the 10-inch break is an increase in Peak Cladding Temperature of 264 °F.

**Westinghouse LOCA Peak Clad Temperature Summary for Best Estimate Large Break**

**Plant Name:** AP1000  
**Utility Name:** Westinghouse Nuclear Power Plants

**Revision Date:** 1/14/11

**Composite**

**Analysis Information**

**EM:** CQD-AP (1998)      **Analysis Date:** 9/13/02      **Limiting Break Size:** Guillotine  
**FQ:** 2.6      **FdH:** 1.65  
**Fuel:** RFA      **SGTP (%):** 0  
**Notes:** Bounds 10% SGTP

	Clad Temp (°F)	Ref.	Notes
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	2124	1	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1 . HOTSPOT Fuel Relocation Error	70	3	
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1 . None	0		
<b>C. 2010 ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>D. OTHER*</b>			
1 . Re-evaluation for Plant Design Changes and Pressurizer Surge Line Resistance Correction	-36	2	

**LICENSING BASIS PCT + PCT ASSESSMENTS**      **PCT =** 2158

\* It is recommended that the licensee determine if these PCT allocations should be considered with respect to 10 CFR 50.46 reporting requirements.

**References:**

- 1 . APP-GW-GL-700, Tier 2, Chapter 15, Rev. 15, "Design Certification Document: Accident Analysis" December 8, 2005.
- 2 . CN-LIS-04-113, "AP1000 MONTECF Calculations of 95th Percentile PCT for IR03-251-M002 Reanalysis," June 2004.
- 3 . LTR-LIS-08-39, "10 CFR 50.46 Report for AP1000 Best Estimate Large Break LOCA," January 2008.

**Notes:**

None

**Westinghouse LOCA Peak Clad Temperature Summary for Best Estimate Large Break**

**Plant Name:** AP1000  
**Utility Name:** Westinghouse Nuclear Power Plants

**Revision Date:** 1 /14/11

**Reflood 1**

**Analysis Information**

**EM:** CQD-AP (1998)      **Analysis Date:** 9/13/02      **Limiting Break Size:** Guillotine  
**FQ:** 2.6      **FdH:** 1.65  
**Fuel:** RFA      **SGTP (%):** 0  
**Notes:** Bounds 10% SGTP

	Clad Temp (°F)	Ref.	Notes
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	2124	1	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1 . HOTSPOT Fuel Relocation Error	70	3	
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1 . None	0		
<b>C. 2010 ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>D. OTHER*</b>			
1 . Re-evaluation for Plant Design Changes and Pressurizer Surge Line Resistance Correction	-36	2	

**LICENSING BASIS PCT + PCT ASSESSMENTS**      **PCT =** 2158

\* It is recommended that the licensee determine if these PCT allocations should be considered with respect to 10 CFR 50.46 reporting requirements.

**References:**

- 1 . APP-GW-GL-700, Tier 2, Chapter 15, Rev. 15, "Design Certification Document: Accident Analysis" December 8, 2005.
- 2 . CN-LIS-04-113, "AP1000 MONTECF Calculations of 95th Percentile PCT for IR03-251-M002 Reanalysis," June 2004.
- 3 . LTR-LIS-08-39, "10 CFR 50.46 Report for AP1000 Best Estimate Large Break LOCA," January 2008.

**Notes:**

None

**Westinghouse LOCA Peak Clad Temperature Summary for Best Estimate Large Break**

**Plant Name:** AP1000  
**Utility Name:** Westinghouse Nuclear Power Plants

**Revision Date:** 1 /14/11

**Blowdown**

**Analysis Information**

**EM:** CQD-AP (1998)      **Analysis Date:** 9/13/02      **Limiting Break Size:** Guillotine  
**FQ:** 2.6      **FdH:** 1.65  
**Fuel:** RFA      **SGTP (%):** 0  
**Notes:** Bounds 10% SGTP; Ref. 3 used to collect Analysis Information

	<b>Clad Temp (°F)</b>	<b>Ref.</b>	<b>Notes</b>
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	1944	1	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1 . HOTSPOT Fuel Relocation Error	0	3	
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1 . None	0		
<b>C. 2010 ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>D. OTHER*</b>			
1 . Re-evaluation for Plant Design Changes and Pressurizer Surge Line Resistance Correction	-44	2	

**LICENSING BASIS PCT + PCT ASSESSMENTS**      **PCT =** 1900

\* It is recommended that the licensee determine if these PCT allocations should be considered with respect to 10 CFR 50.46 reporting requirements.

**References:**

- 1 . CN-LIS-02-69, "AP1000 Best Estimate Large Break Loss of Coolant Accident Analysis MONTECF Calculations of 95th Percentile PCT," September 2002.
- 2 . CN-LIS-04-113, "AP1000 MONTECF Calculations of 95th Percentile PCT for IR03-251-M002 Reanalysis," June 2004.
- 3 . LTR-LIS-08-39, "10 CFR 50.46 Report for AP1000 Best Estimate Large Break LOCA," January 2008.

**Notes:**

None

**Westinghouse LOCA Peak Clad Temperature Summary for ASTRUM Best Estimate Large Break**

**Future**

**Plant Name:** AP1000  
**Utility Name:** Westinghouse Nuclear Power Plants  
**Revision Date:** 1/14/11

**Analysis Information**

**EM:** ASTRUM (2004)      **Analysis Date:** 5/9/08      **Limiting Break Size:** Split  
**FQ:** 2.6      **FdH:** 1.75  
**Fuel:** RFA      **SGTP (%):** 10  
**Notes:**

	<b>Clad Temp (°F)</b>	<b>Ref.</b>	<b>Notes</b>
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	1837	1	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1 . None	0		
<b>C. 2010 ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>D. OTHER*</b>			
1 . None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT =</b> 1837		
* It is recommended that the licensee determine if these PCT allocations should be considered with respect to 10 CFR 50.46 reporting requirements.			

**References:**

- 1 . APP-GW-GLE-026, Rev. 1 "Application of ASTRUM Methodology for Best-Estimate Large-Break Loss-of-Coolant Accident Analysis for AP1000," January 2009.

**Notes:**

None

**Westinghouse LOCA Peak Clad Temperature Summary for Appendix K Small Break**

**Plant Name:** AP1000  
**Utility Name:** Westinghouse Nuclear Power Plants  
**Revision Date:** 1 /14/11

**Analysis Information**

**EM:** NOTRUMP-AP      **Analysis Date:** 8/23/02      **Limiting Break Size:** 10 Inch  
**FQ:** 2.6      **FdH:** 1.65  
**Fuel:** RFA      **SGTP (%):** 10  
**Notes:**

	<b>Clad Temp (°F)</b>	<b>Ref.</b>	<b>Notes</b>
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	1370	1	(a)
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1 . None	0		
<b>C. 2010 ECCS MODEL ASSESSMENTS</b>			
1 . Adiabatic Heat-up Calculation	264	2	(a)
<b>D. OTHER*</b>			
1 . None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT =</b> 1634		

\* It is recommended that the licensee determine if these PCT allocations should be considered with respect to 10 CFR 50.46 reporting requirements.

**References:**

- 1 . APP-GW-GL-700, Tier 2, Chapter 15, Rev. 15, "Design Certification Document: Accident Analysis" December 8, 2005.
- 2 . LTR-LIS-10-373, "10 CFR 50.46 Report for the Evaluation of AP1000 SBLOCA 10-inch Transient Adiabatic Heat-up Calculation," June 2010.

**Notes:**

- (a) This is an adiabatic heat-up calculated PCT.