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

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1  
DOCKET NO. 50/395  
OPERATING LICENSE NO. NPF-12  
ECCS EVALUATION MODEL REVISIONS REPORT

South Carolina Electric & Gas Company (SCE&G), acting for itself and as agent for South Carolina Public Service Authority, hereby submits the 2011 Emergency Core Cooling System (ECCS) Evaluation Model Revisions Annual Report for VCSNS. This report is being submitted pursuant to 10 CFR 50.46, which requires licensees to notify the NRC on at least an annual basis of corrections to or changes in the ECCS Evaluation Models.

Summary sheets describing changes and enhancements to the ECCS Evaluation Models for 2011 are included in Attachment I. Peak Clad Temperature (PCT) sheets are included in Attachment II.

If you have any questions, please call Bruce L. Thompson at (803) 931-5042.

Very truly yours,

Thomas D. Gatlin

GAR/TDG/jw  
Attachments

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A002  
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## **Attachment I**

# **Changes and Enhancements to the ECCS Evaluation Models for 2011**

## **GENERAL CODE MAINTENANCE**

### **(Discretionary Change)**

#### **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 Model(s)**

1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model

#### **Estimated Effect**

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

## **RADIATION HEAT TRANSFER LOGIC**

### **(Non-Discretionary Change)**

#### **Background**

Two errors were discovered in the calculation of the radiation heat transfer coefficient in the SBLOCTA computer code. First, existing diagnostics did not preclude non-physical negative or large (negative or positive) radiation heat transfer coefficients from being calculated. These calculations occurred when the vapor temperature exceeded the cladding surface temperature or when the predicted temperature difference was less than 1 degree. Second, a temperature term incorrectly used degrees Fahrenheit instead of Rankine. These errors have been corrected in the SBLOCTA code and 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

#### **Estimated Effect**

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

## **MAXIMUM FUEL ROD TIME STEP LOGIC**

### **(Non-Discretionary Change)**

#### **Background**

An error was discovered in the SBLOCTA code that allowed the fuel rod time step to exceed the specified maximum allowable time step. The time step logic has been corrected in the SBLOCTA code. This change 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**

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

## **GENERAL CODE MAINTENANCE**

### **(Discretionary Change)**

#### **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.

## **Attachment II**

### **PCT Rackup Sheets**

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

**Plant Name:** V. C. Summer  
**Utility Name:** South Carolina Electric & Gas Company

**Revision Date:** 2/20/2012

**Composite**

**Analysis Information**

**EM:** CQD (1996)                      **Analysis Date:** 2/3/2003    **Limiting Break Size:** Guillotine  
**FQ:** 2.5                                      **FdH:** 1.7  
**Fuel:** Vantage +                      **SGTP (%):** 10  
**Notes:** Delta 75 Replacement Steam Generator Uprate Core Power 2900 MWt

	Clad Temp (°F)	Ref.	Notes
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	1988	1	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1. Backfit Through 2001 Reporting Year	0	2	
2. Revised Blowdown Heatup Uncertainty Distribution	5	3	
3. Transverse Momentum Cells for Zero Cross-flow Boundary Condition Error	-14	4	
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1. Fan Cooler Performance Increase	2	2	
2. Upflow Conversion Evaluation	-29	4	
<b>C. 2011 ECCS MODEL ASSESSMENTS</b>			
1. None	0		
<b>D. OTHER</b>			
1. None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT = 1952</b>		

**References:**

1. WCAP-16043, "Best Estimate Analysis of the Large Break Loss of Coolant Accident for the Virgil C. Summer Nuclear Station," June 2003.
2. CGE-03-12, "10 CFR 50.46 Annual Notification and Reporting for 2002," March 2003.
3. CGE-05-20, "10 CFR 50.46 Annual Notification and Reporting for 2004," April 2005.
4. LTR-LIS-08-578, Revision 2, "Large Break LOCA Evaluation for V. C. Summer (CGE) Upflow Conversion and Assessment of Transverse Momentum Cells for Zero Cross-flow Boundary Condition Error," January 2009.

**Notes:**

None



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

**Plant Name:** V. C. Summer  
**Utility Name:** South Carolina Electric & Gas Company

**Revision Date:** 2/20/2012

**Blowdown**

**Analysis Information**

**EM:** CQD (1996)    **Analysis Date:** 2/3/2003    **Limiting Break Size:** Guillotine  
**FQ:** 2.5    **FdH:** 1.7  
**Fuel:** Vantage +    **SGTP (%):** 10  
**Notes:** Delta 75 Replacement Steam Generator Uprate Core Power 2900 MWt

	Clad Temp (°F)	Ref.	Notes
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	<b>1860</b>	<b>1</b>	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1. Backfit Through 2001 Reporting Year	0	2	
2. Revised Blowdown Heatup Uncertainty Distribution	49	3	
3. Transverse Momentum Cells for Zero Cross-flow Boundary Condition	1	4	
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1. Fan Cooler Performance Increase	0	2	
2. Upflow Conversion Evaluation	-7	4	
<b>C. 2011 ECCS MODEL ASSESSMENTS</b>			
1. None	0		
<b>D. OTHER</b>			
1. None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT = 1903</b>		

**References:**

1. WCAP-16043, "Best Estimate Analysis of the Large Break Loss of Coolant Accident for the Virgil C. Summer Nuclear Station," June 2003.
2. CGE-03-12, "10 CFR 50.46 Annual Notification and Reporting for 2002," March 2003.
3. CGE-05-20, "10 CFR 50.46 Annual Notification and Reporting for 2004," April 2005.
4. LTR-LIS-08-578, Revision 2, "Large Break LOCA Evaluation for V. C. Summer (CGE) Upflow Conversion and Assessment of Transverse Momentum Cells for Zero Cross-flow Boundary Condition Error," January 2009.

**Notes:**

None

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

**Plant Name:** V. C. Summer  
**Utility Name:** South Carolina Electric & Gas Company

**Revision Date:** 2/20/2012

**Reflood 1**

**Analysis Information**

**EM:** CQD (1996)      **Analysis Date:** 2/3/2003      **Limiting Break Size:** Guillotine  
**FQ:** 2.5              **FdH:** 1.7  
**Fuel:** Vantage +      **SGTP (%):** 10  
**Notes:** Delta 75 Replacement Steam Generator Uprate Core Power 2900 MWt

	Clad Temp (°F)	Ref.	Notes
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	<b>1808</b>	<b>1</b>	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1. Backfit Through 2001 Reporting Year	0	2	
2. Revised Blowdown Heatup Uncertainty Distribution	5	3	
3. Transverse Momentum Cells for Zero Cross-flow Boundary Condition	-9	4	
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1. Fan Cooler Performance Increase	1	2	
2. Upflow Conversion Evaluation	-44	4	
<b>C. 2011 ECCS MODEL ASSESSMENTS</b>			
1. None	0		
<b>D. OTHER</b>			
1. None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT = 1761</b>		

**References:**

1. WCAP-16043, "Best Estimate Analysis of the Large Break Loss of Coolant Accident for the Virgil C. Summer Nuclear Station," June 2003.
2. CGE-03-12, "10 CFR 50.46 Annual Notification and Reporting for 2002," March 2003.
3. CGE-05-20, "10 CFR 50.46 Annual Notification and Reporting for 2004," April 2005.
4. LTR-LIS-08-578, Revision 2, "Large Break LOCA Evaluation for V. C. Summer (CGE) Upflow Conversion and Assessment of Transverse Momentum Cells for Zero Cross-flow Boundary Condition Error," January 2009.

**Notes:**

None

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

**Plant Name:** V. C. Summer  
**Utility Name:** South Carolina Electric & Gas Company

**Reflood 2**

**Revision Date:** 2/20/2012

**Analysis Information**

**EM:** CQD (1996)    **Analysis Date:** 2/3/2003    **Limiting Break Size:** Guillotine  
**FQ:** 2.5    **FdH:** 1.7  
**Fuel:** Vantage +    **SGTP (%):** 10  
**Notes:** Delta 75 Replacement Steam Generator Uprate Core Power 2900 MWt

	Clad Temp (°F)	Ref.	Notes
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	1988	1	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1. Backfit Through 2001 Reporting Year	0	2	
2. Revised Blowdown Heatup Uncertainty Distribution	5	3	
3. Transverse Momentum Cells for Zero Cross-flow Boundary Condition Error	-14	4	
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1. Fan Cooler Performance Increase	2	2	
2. Upflow Conversion Evaluation	-29	4	
<b>C. 2011 ECCS MODEL ASSESSMENTS</b>			
1. None	0		
<b>D. OTHER</b>			
1. None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT = 1952</b>		

**References:**

1. WCAP-16043, "Best Estimate Analysis of the Large Break Loss of Coolant Accident for the Virgil C. Summer Nuclear Station," June 2003.
2. CGE-03-12, "10 CFR 50.46 Annual Notification and Reporting for 2002," March 2003.
3. CGE-05-20, "10 CFR 50.46 Annual Notification and Reporting for 2004," April 2005.
4. LTR-LIS-08-578, Revision 2, "Large Break LOCA Evaluation for V. C. Summer (CGE) Upflow Conversion and Assessment of Transverse Momentum Cells for Zero Cross-flow Boundary Condition Error," January 2009.

**Notes:**

None

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

**Plant Name:** V. C. Summer  
**Utility Name:** South Carolina Electric & Gas Company  
**Revision Date:** 2/20/2012

**Analysis Information**

**EM:** NOTRUMP                      **Analysis Date:** 9/12/2006                      **Limiting Break Size:** 3 Inch  
**FQ:** 2.45                              **FdH:** 1.62  
**Fuel:** Vantage +                      **SGTP (%):** 10

**Notes:**

	<b>Clad Temp (°F)</b>	<b>Ref.</b>	<b>Notes</b>
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	<b>1775</b>	<b>9</b>	<b>(a)</b>
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
1. None	0		
<b>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1. Upflow Conversion	148	10,11	
<b>C. 2011 ECCS MODEL ASSESSMENTS</b>			
1. None	0		
<b>D. OTHER</b>			
1. None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT = 1923</b>		

**References:**

1. CGE-94-205, "South Carolina Electric and Gas Company, Virgil C. Summer Station, 10 CFR 50.46 Notification and Reporting Information," February 8, 1994.
2. CGE-94-228, "South Carolina Electric and Gas Company, Virgil C. Summer Station, SBLOCTA Axial Nodalization," October 27, 1994.
3. CGE-95-201, "South Carolina Electric and Gas Company, Virgil C. Summer Station, 10 CFR 50.46 Notification and Reporting Information," February 3, 1995.
4. CGE-96-202, "South Carolina Electric and Gas Company, Virgil C. Summer Station, 10 CFR 50.46 Annual Notification and Reporting," February 9, 1996.
5. CGE-96-213, "South Carolina Electric and Gas Company, Virgil C. Summer Station, 10 CFR 50.46 Small Break LOCA Notification and Reporting," July 8, 1996.
6. CGE-00-044, "South Carolina Electric and Gas Company, Virgil C. Summer Nuclear Station, 10 CFR 50.46 Appendix K (BART / BASH / NOTRUMP) Evaluation Model, Mid-Year Notification and Reporting for 2000," June 30, 2000.
7. CGE-03-80, "10 CFR 50.46 Mid-Year Notification and Reporting for 2003," January 2004.

8. LTR-LIS-06-344, "Transmittal of Updated V. C. Summer SBLOCA PCT Rackup Sheets," November 2006.
9. LTR-LIS-06-662, Transmittal of V. C. Summer SBLOCTA PCT Rackup Sheets for HHSI Throttle Valve Replacement," November 2006.
10. WCAP-16980-P, Revision 1, "Reactor Internals Upflow Conversion Program Engineering Report V. C. Summer Nuclear Station Unit 1," December 2008.
11. LTR-LIS-09-18, 10 CFR 50.46 Report for the V. C. Summer (CGE) Upflow Conversion Program Small Break LOCA Evaluation," January 2009.

**Notes:**

- (a) The Rebaseline Analysis includes the impacts of the following model assessments:
  - 1-LUCIFER Error Corrections (Ref. 1)
  - 2-Effect of SI in Broken Loop (Ref. 1)
  - 3-Effect of Improved Condensation Model (Ref. 1)
  - 4-Axial Nodalization, RIP Model Revision and SBLOCTA Error Corrections Analysis (Ref. 2)
  - 5-Boiling Heat Transfer Error (Ref. 3)
  - 6-Steam Line Isolation Logic Error (Ref. 3)
  - 7-NOTRUMP Specific Enthalpy Error (Ref. 4)
  - 8-SALIBRARY Double Precision Error (Ref. 4)
  - 9-SBLOCTA Fuel Rod Initialization Error (Ref. 5)
  - 10-NOTRUMP Mixture Level Tracking / Region Depletion Errors (Ref. 6)
  - 11-NOTRUMP Bubble Rise / Drift Flux Model Inconsistency Corrections (Ref. 7)
  - 12-Refined Break Spectrum (Ref. 8)
  - 13-High Head Safety Injection (HHSI) Flow Increase (Ref. 9)