

Enclosure

NL-19-094

Westinghouse Letter LTR-LIS-19-14

Indian Point Units 2 and 3

10 CFR 50.46 Annual Notification and Reporting for 2018

(14 pages)



Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066
USA

Direct tel: (412) 374-5598
e-mail: mcmillh@westinghouse.com

Our ref: LTR-LIS-19-14

February 13, 2019

**Indian Point Units 2 and 3
10 CFR 50.46 Annual Notification and Reporting for 2018**

Dear Sir or Madam:

This is a notification of 10 CFR 50.46 reporting information pertaining to the Westinghouse Electric Company Evaluation Models/analyses. As committed to in WCAP-13451, Westinghouse Methodology for Implementation of 10 CFR 50.46 Reporting, Westinghouse is providing an Annual Report for Emergency Core Cooling System (ECCS) Evaluation Model changes and errors for the 2018 model year. All necessary standardized reporting pages for any changes and errors for the Evaluation Models utilized for your plant(s) are enclosed, consistent with the commitment following the NUPIC audit in early 1999. Peak Clad Temperature (PCT) summary sheets are enclosed. All necessary revisions for any non-zero, non-discretionary PCT changes have been included. Changes with estimated PCT impacts of 0°F may not be presented on the PCT summary sheet. The Evaluation Model changes and errors (except any plant-specific errors in the application of the model) have been provided to the NRC via Westinghouse letter.

This information is for your use in making a determination relative to the reporting requirements of 10 CFR 50.46. The information that is provided in this letter was prepared in accordance with Westinghouse's Quality Management System (QMS). Please contact your LOCA plant cognizant engineer (PCE), Carmen Teolis (412-374-2202), if there are any questions concerning this information.

Lead Author: (Electronically Approved)*
Heather McMillen
LOCA Integrated Services II
Scope: All, except for PCT Summary sheets in the attachment

Co-Author: (Electronically Approved)*
Sean T. Kinnas
Containment and Radiological Analysis
Scope: PCT Summary sheets in the attachment

Verified: (Electronically Approved)*
Carmen D. Teolis
LOCA Integrated Services I

Approved: (Electronically Approved)*
Amy J. Colussy
Manager, LOCA Integrated Services I

Attachment: 10 CFR 50.46 Reporting Text and PCT Summary Sheets (13 Pages)

**Electronically approved records are authenticated in the electronic document management system.*

UO₂ FUEL PELLET HEAT CAPACITY**Background**

A typographical error was discovered in the implementation of the UO₂ fuel pellet heat capacity as described by Equation C-4 of WCAP-8301 [1] for fuel rod heat-up calculations within the Appendix K Large Break and Small Break LOCA evaluation models. The erroneous formulation results in an over-prediction of heat capacity that increases with fuel temperature. The corrected formulation results in a maximum decrease in heat capacity on the order of approximately 1.2% for existing analyses of record. This 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

The small over-prediction in UO₂ fuel pellet heat capacity has been evaluated to have a negligible effect on existing large and small break LOCA analysis results due to the small magnitude of the change, leading to an estimated PCT impact of 0°F.

Reference

- 1) WCAP-8301, "LOCTA-IV Program: Loss-of-Coolant Transient Analysis," June 1974.

VAPOR TEMPERATURE RESETTING**Background**

In the WCOBRA/TRAC and WCOBRA/TRAC-TF2 codes, when the vapor temperature is greater than the wall temperature, and several other conditions are met, the vapor temperature is reset to the saturation temperature for heat transfer calculations. It was discovered that this vapor temperature resetting logic results in an inconsistency between the conduction solution and the hydraulic solution, such that energy is not conserved between the two solutions. The correction of this error represents a Non-Discretionary Change in the Evaluation Model as described in Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)

1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model

2004 Westinghouse Realistic Large Break LOCA Evaluation Model Using ASTRUM

Estimated Effect

Engineering judgement supported by sensitivity calculations showed that correcting this error had minimal impact on LOCA transient calculations, leading to an estimated peak cladding temperature impact of 0°F.

LOCA Peak Cladding Temperature (PCT) Summary

Plant Name: INDIAN POINT 2
Utility Name: Entergy Nuclear Northeast
EM: NOTRUMP
AOR Description: Appendix K Small Break
Summary Sheet Status: Current

	PCT (°F)	Reference #	Note #
ANALYSIS-OF-RECORD	1028	1	

AOR + ASSESSMENTS	PCT = 1028.0 °F
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REFERENCES

- 1 WCAP-16157-P, "Indian Point Nuclear Generating Unit No. 2 Stretch Power Uprate NSSS and BOP Licensing Report," January 2004.

NOTES:

- (a) None

LOCA Peak Cladding Temperature (PCT) Summary

Plant Name: INDIAN POINT 2
Utility Name: Entergy Nuclear Northeast
EM: ASTRUM (2004)
AOR Description: Best Estimate Large Break
Summary Sheet Status: Current

	PCT (°F)	Reference #	Note #	
ANALYSIS-OF-RECORD	1962	1		
	Delta PCT (°ΔF)	Reference #	Note #	Reporting Year**
1. HOTSPOT Fuel Relocation Error	0	3		2007
2. Evaluation of Pellet Thermal Conductivity Degradation and Peaking Factor Burndown	209	4,5	(a)	2012
3. Revised Heat Transfer Multiplier Distributions	-32	6		2013
4. Error in Burst Strain Application	38	7		2013
5. Bent Fuel Assembly Alignment Pins	5	1		2005
6. Changes to Containment Sump Strainer Evaluation	0	2		2006
7. Evaluation of Design Input Changes with Respect to Plant Operation	-63	4,5	(a,b,c)	2012
8. Evaluation of Increased Containment Metal due to Control Rod Drive Shafts and Water Shields	0	8	(d)	2016

AOR + ASSESSMENTS PCT = 2119.0 °F

* The licensee should determine the reportability of these assessments pursuant to 10 CFR 50.46.

** The "Reporting Year" refers to the annual reporting year in which this assessment was included.

Version: INDIAN POINT 2 IPP_LOCA-50.46_IPP_Base_ASTRUM – 1.1 V.V

REFERENCES

- 1 WCAP-16405-P, "Best Estimate Analysis of the Large Break Loss of Coolant Accident for Indian Point Unit 2 Nuclear Plant Using the ASTRUM Methodology," May 2005.
- 2 LTR-LIS-06-299, "Evaluation of Sump Strainer Modification on Indian Point Unit 2 (IPP) Best Estimate Large Break LOCA Analyses and Transmittal of Revised PCT Sheets," May 2006.
- 3 LTR-LIS-07-379, "10 CFR 50.46 Reporting Text for HOTSPOT Fuel Relocation Error for Indian Point 2," June 2007.
- 4 LTR-NRC-12-27, "Letter from J. A. Gresham (Westinghouse) to NRC, Westinghouse Input Supporting Licensee Response to NRC 10 CFR 50.54(f) Letter Regarding Nuclear Fuel Thermal Conductivity Degradation (Proprietary/Non-Proprietary)," March 2012.
- 5 NF-ECH-12-23, "Information Regarding the Evaluation of Fuel Pellet Thermal Conductivity Degradation and Peaking Factor Burndown Including Design Input Changes for Indian Point Unit 2," May 2012.
- 6 LTR-LIS-13-350, "Indian Point Units 2 and 3 10 CFR 50.46 Report for Revised Heat Transfer Multiplier Distributions," July 2013.
- 7 LTR-LIS-14-34, "Indian Point Units 2 and 3 10 CFR 50.46 Report for the HOTSPOT Burst Strain Error Correction," January 2014.
- 8 IPP-16-20, "Evaluation of Additional Containment Metal on the Indian Point Unit 2 (IPP) Best-Estimate Large Break LOCA (BE LBLOCA) Analysis," March 2016.

NOTES:

- (a) These assessments are coupled via an evaluation of burnup effects which include thermal conductivity degradation, peaking factor burndown and design input changes.
- (b) Design input changes were a reduction in FQ(tr) from 2.5 to 2.3; FQ(ss) from 2.0 to 1.8, FΔH from 1.7 to 1.65 and a corresponding reduction in Pbar-HA, and maximum steam generator tube plugging from 10% to 5%.
- (c) The peaking factor limits and steam generator tube plugging limit in note (b) supersede the values cited for the analysis-of-record.
- (d) The evaluation of the added control rod drive shafts and water shields takes credit for margin in several post-analysis-of-record evaluations.

LOCA Peak Cladding Temperature (PCT) Summary

Plant Name: INDIAN POINT 3
Utility Name: Entergy Nuclear Northeast
EM: NOTRUMP
AOR Description: Appendix K Small Break
Summary Sheet Status: Current

	PCT (°F)	Reference #	Note #	
ANALYSIS-OF-RECORD	1543	1		
ASSESSMENTS*	Delta PCT (°ΔF)	Reference #	Note #	Reporting Year**
1. Thimble Plug Removal	0	4		2010
2. AFW Flow Mismatch	0	2,3		2009
AOR + ASSESSMENTS		PCT = 1543.0 °F		

* The licensee should determine the reportability of these assessments pursuant to 10 CFR 50.46.

** The "Reporting Year" refers to the annual reporting year in which this assessment was included.

REFERENCES

- 1 WCAP-16212-NP (Class 3), "Indian Point Nuclear Generating Unit No. 3 Stretch Power Uprate NSSS and BOP Licensing Report," June 2004.
- 2 LTR-LIS-09-340, "Indian Point Unit 3 Auxiliary Feedwater (AFW) Flow Mismatch SBLOCA Evaluation," May 2009.
- 3 LTR-LIS-09-343, "10 CFR 50.46 Reporting for Indian Point Unit 3 Auxiliary Feedwater (AFW) Flow Mismatch SBLOCA Evaluation," May 2009.
- 4 INT-10-15, "10 CFR 50.46 Report for Thimble Plug Removal," December 2010.

NOTES:

- (a) None

Version: INDIAN POINT 3 INT_LOCA-50.46_INT_Base_Appendix_K_SBLOCA – 1.1 V.V

LOCA Peak Cladding Temperature (PCT) Summary

Plant Name: INDIAN POINT 3
Utility Name: Entergy Nuclear Northeast
EM: CQD (1996)
AOR Description: Best Estimate Large Break - Composite
Summary Sheet Status: Current

	PCT (°F)	Reference #	Note #	
ANALYSIS-OF-RECORD	1944	1		
ASSESSMENTS*	Delta PCT (°ΔF)	Reference #	Note #	Reporting Year**
1. Revised Blowdown Heatup Uncertainty Distribution	5	3		2004
2. HOTSPOT Fuel Relocation Error	0	6	(a)	2012
3. Evaluation of Pellet Thermal Conductivity Degradation and Peaking Factor Burndown	185	6	(b)	2012
4. Revised Heat Transfer Multiplier Distributions	-35	7		2013
5. Error in Burst Strain Application	25	8		2013
6. Bent Fuel Assembly Alignment Pins	5	2		2004
7. Evaluation of Increased Containment Sump Strainer Metal and 80°F Initial Containment/Accumulator Temperature	12	4		2009
8. Thimble Plug Removal	0	5		2010
9. Design Input Changes with Respect to Plant Operation	-95	6	(b,c)	2012
AOR + ASSESSMENTS				
PCT = 2046.0 °F				

* The licensee should determine the reportability of these assessments pursuant to 10 CFR 50.46.

** The "Reporting Year" refers to the annual reporting year in which this assessment was included.

Version: INDIAN POINT 3 INT_LOCA-50.46_INT_Base_CQD_Composite – 1.1 V.V

REFERENCES

- 1 WCAP-16178-P, "Best-Estimate Analysis of the Large Break Loss of Coolant Accident for Indian Point Unit 3 Nuclear Plant Stretch Power Uprate," March 2004.
- 2 IPP-04-126, "Revised PCT Rackups for 10 CFR 50.46 Annual Notification and Reporting for 2003," October 2004.
- 3 INT-05-15, "10 CFR 50.46 Annual Notification and Reporting for 2004," April 2005.
- 4 INT-08-14, Revision 1, "Evaluation of Containment Sump Strainer Modifications, Reduced Containment Initial Temperature and Accumulator Water Temperature on Indian Point Unit 3 (INT) Best Estimate Large Break LOCA Analysis," February 2010.
- 5 INT-10-15, "10 CFR 50.46 Report for Thimble Plug Removal," December 2010.
- 6 NF-ECH-12-24, "Information Regarding the Evaluation of Fuel Pellet Thermal Conductivity Degradation and Peaking Factor Burndown Including Design Input Changes for Indian Point Unit 3," May 2012.
- 7 LTR-LIS-13-350, "Indian Point Units 2 and 3 10 CFR 50.46 Report for Revised Heat Transfer Multiplier Distributions," July 2013.
- 8 LTR-LIS-14-34, "Indian Point Units 2 and 3 10 CFR 50.46 Report for the HOTSPOT Burst Strain Error Correction," January 2014.

NOTES:

- (a) The magnitude of this assessment was changed from prior versions of the PCT rackup sheet due to a recalculation in Reference 6.
- (b) These assessments are coupled via an evaluation of burnup effects which include thermal conductivity degradation, peaking factor burndown and design input changes.
- (c) Design input changes were a reduction in FQ(tr) from 2.5 to 2.3, FQ(ss) from 2.0 to 1.8, FAH from 1.7 to 1.65, and a corresponding reduction in Pbar-HA. These peaking factor limits supersede the values cited for the analysis-of-record.

LOCA Peak Cladding Temperature (PCT) Summary

Plant Name: INDIAN POINT 3
Utility Name: Entergy Nuclear Northeast
EM: CQD (1996)
AOR Description: Best Estimate Large Break - Reflood 1
Summary Sheet Status: Current

	PCT (°F)	Reference #	Note #	
ANALYSIS-OF-RECORD	1904	1		
	Delta PCT (°ΔF)	Reference #	Note #	Reporting Year**
ASSESSMENTS*				
1. Revised Blowdown Heatup Uncertainty Distribution	5	3		2004
2. HOTSPOT Fuel Relocation Error	0	6	(a)	2012
3. Evaluation of Pellet Thermal Conductivity Degradation and Peaking Factor Burndown	205	6	(b)	2012
4. Revised Heat Transfer Multiplier Distributions	5	7		2013
5. Error in Burst Strain Application	20	8		2013
6. Bent Fuel Assembly Alignment Pins	5	2		2004
7. Evaluation of Increased Containment Sump Strainer Metal and 80°F Initial Containment/Accumulator Temperature	3	4		2009
8. Thimble Plug Removal	0	5		2010
9. Design Input Changes with Respect to Plant Operation	-130	6	(b,c)	2012
AOR + ASSESSMENTS				
PCT = 2017.0 °F				

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Version: INDIAN POINT 3 INT_LOCA-50.46_INT_Base_CQD_Reflood1 – 1.1 V.V

REFERENCES

- 1 WCAP-16178-P, "Best-Estimate Analysis of the Large Break Loss of Coolant Accident for Indian Point Unit 3 Nuclear Plant Stretch Power Uprate," March 2004.
- 2 IPP-04-126, "Revised PCT Rackups for 10 CFR 50.46 Annual Notification and Reporting for 2003," October 2004.
- 3 INT-05-15, "10 CFR 50.46 Annual Notification and Reporting for 2004," April 2005.
- 4 INT-08-14, Revision 1, "Evaluation of Containment Sump Strainer Modifications, Reduced Containment Initial Temperature and Accumulator Water Temperature on Indian Point Unit 3 (INT) Best Estimate Large Break LOCA Analysis," February 2010.
- 5 INT-10-15, "10 CFR 50.46 Report for Thimble Plug Removal," December 2010.
- 6 NF-ECH-12-24, "Information Regarding the Evaluation of Fuel Pellet Thermal Conductivity Degradation and Peaking Factor Burndown Including Design Input Changes for Indian Point Unit 3," May 2012.
- 7 LTR-LIS-13-350, "Indian Point Units 2 and 3 10 CFR 50.46 Report for Revised Heat Transfer Multiplier Distributions," July 2013.
- 8 LTR-LIS-14-34, "Indian Point Units 2 and 3 10 CFR 50.46 Report for the HOTSPOT Burst Strain Error Correction," January 2014.

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Version: INDIAN POINT 3 INT_LOCA-50.46_INT_Base_CQD_Reflood1 – 1.1 V.V

LOCA Peak Cladding Temperature (PCT) Summary

Plant Name: INDIAN POINT 3
Utility Name: Entergy Nuclear Northeast
EM: CQD (1996)
AOR Description: Best Estimate Large Break - Reflood 2
Summary Sheet Status: Current

	PCT (°F)	Reference #	Note #	
ANALYSIS-OF-RECORD	1944	1		
	Delta PCT (°ΔF)	Reference #	Note #	Reporting Year**
ASSESSMENTS*				
1. Revised Blowdown Heatup Uncertainty Distribution	5	3		2004
2. HOTSPOT Fuel Relocation Error	0	6	(a)	2012
3. Evaluation of Pellet Thermal Conductivity Degradation and Peaking Factor Burndown	185	6	(b)	2012
4. Revised Heat Transfer Multiplier Distributions	-35	7		2013
5. Error in Burst Strain Application	25	8		2013
6. Bent Fuel Assembly Alignment Pins	5	2		2004
7. Evaluation of Increased Containment Sump Strainer Metal and 80°F Initial Containment/Accumulator Temperature	12	4		2009
8. Thimble Plug Removal	0	5		2010
9. Design Input Changes with Respect to Plant Operation	-95	6	(b,c)	2012
AOR + ASSESSMENTS	PCT = 2046.0 °F			

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Version: INDIAN POINT 3 INT_LOCA-50.46_INT_Base_CQD_Reflood2 – 1.1 V.V

REFERENCES

- 1 WCAP-16178-P, "Best-Estimate Analysis of the Large Break Loss of Coolant Accident for Indian Point Unit 3 Nuclear Plant Stretch Power Uprate," March 2004.
- 2 IPP-04-126, "Revised PCT Rackups for 10 CFR 50.46 Annual Notification and Reporting for 2003," October 2004.
- 3 INT-05-15, "10 CFR 50.46 Annual Notification and Reporting for 2004," April 2005.
- 4 INT-08-14, Revision 1, "Evaluation of Containment Sump Strainer Modifications, Reduced Containment Initial Temperature and Accumulator Water Temperature on Indian Point Unit 3 (INT) Best Estimate Large Break LOCA Analysis," February 2010.
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10 CFR 50.46 Reporting SharePoint Site Check:**EMs applicable to Indian Point:****Best Estimate Large Break – CQD (1996)****Realistic Large Break – ASTRUM (2004)****Appendix K Small Break – NOTRUMP****2018 Issues**

Transmittal Letter	Issue Description
None	None