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L-PI-18-035
10 CFR 50.46

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Prairie Island Nuclear Generating Plant, Units 1 and 2
Docket Nos. 50-282 and 50-306
Renewed Facility Operating License Nos. DPR-42 and DPR-60

2017 10 CFR 50.46 LOCA Annual Report

Pursuant to 10 CFR 50.46(a)(3)(ii), Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM"), submits the 2017 annual report of changes and errors associated with the Prairie Island Nuclear Generating Plant (PINGP) Units 1 and 2 Emergency Core Cooling System (ECCS) analyses (Enclosure 1).

The peak cladding temperature (PCT) for PINGP Unit 1 and Unit 2 were unchanged since the last annual report for the LOCA analyses. The plant specific changes and errors (absolute value) since the last annual report are summarized below:

LBLOCA Unit 1

None

SBLOCA Unit 1

None

LBLOCA Unit 2

None

SBLOCA Unit 2

None

There were no changes that resulted in more than a 0 degrees Fahrenheit PCT penalty. Enclosure 1 contains the 10 CFR 50.46 PCT Rack-up sheets addressed in the report.

If there is any question or if any additional information is needed, please contact Frank Sienczak, at 612-342-8987.

Summary of Commitments

This letter makes no new commitments and no revisions to existing commitments.

A handwritten signature in black ink that reads "Scott Sharp". The signature is written in a cursive style with a large, sweeping initial "S".

Scott Sharp
Site Vice President, Prairie Island Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosure (1)

cc: Regional Administrator, Region III, USNRC
Project Manager, Prairie Island Nuclear Generating Plant, USNRC
Resident Inspector, Prairie Island Nuclear Generating Plant, USNRC

ENCLOSURE 1

WESTINGHOUSE LETTER LTR-LIS-18-27

12 Pages Follow



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Our ref: LTR-LIS-18-27

February 22, 2018

**Prairie Island Units 1 and 2
10 CFR 50.46 Annual Notification and Reporting for 2017**

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 2017 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) will be 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), Danial Utley (412-374-6663), if there are any questions concerning this information.

Author: (Electronically Approved)*
Heather McMillen
LOCA Integrated Services II

Verified: (Electronically Approved)*
Danial W. Utley
LOCA Integrated Services II

Approved: (Electronically Approved)*
Jason R. Beebe
Manager, LOCA Integrated Services II

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

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

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GENERAL CODE MAINTENANCE

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

2004 Westinghouse Realistic Large Break LOCA Evaluation Model Using ASTRUM

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 Peak Cladding Temperature (PCT) impact of 0°F.

ERROR IN THE UPPER PLENUM FLUID VOLUME CALCULATION**Background**

An error was found in the fluid volume calculation in the upper plenum where the support column outer diameter was being used instead of the inner diameter. The correction of this error lead to a reduction in the upper plenum fluid volume used in the Appendix K Large Break LOCA and Small Break LOCA analyses. The corrected values represent a less than 1% change in the total RCS fluid volume and will be incorporated on a forward-fit basis, based on the evaluated impact on the current licensing basis analysis results. These changes represent a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

Estimated Effect

The differences in the upper plenum fluid volume are relatively minor and have been evaluated to have a negligible effect on large and small break LOCA analysis results, leading to an estimated PCT impact of 0°F.

INCONSISTENT APPLICATION OF NUMERICAL RAMP APPLIED TO THE ENTRAINED LIQUID / VAPOR INTERFACIAL DRAG COEFFICIENT

Background

A numerical ramp which was used to account for the disappearance of the entrained liquid phase was applied to the entrained liquid / vapor interfacial drag coefficient. The numerical ramp was applied such that the interfacial drag coefficient used in the solution of the entrained liquid and vapor momentum equations was not consistent. WCOBRA/TRAC was updated to apply the numerical ramp prior to usage of the interfacial drag coefficient in the momentum equations, such that a consistent interfacial drag coefficient was used in the entrained liquid and vapor momentum equations.

This item represents a Non-Discretionary Change in accordance with 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

Based on the code validation results, the impact of correcting the error is estimated to have a 0°F impact on PCT.

INAPPROPRIATE RESETTING OF TRANSVERSE LIQUID MASS FLOW

Background

In the WCOBRA/TRAC routine which evaluates the mass and energy residual error of the time step solution, the transverse liquid mass flow is reset as the liquid phase disappears. The routine is updated to remove the resetting of the transverse liquid mass flow since the routine is to only evaluate the residual error based on the time step solution values.

This item represents a Non-Discretionary Change in accordance with 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

Based on the code validation results and limited applicability of the logic removed, correcting the error is estimated to have a 0°F impact on PCT.

STEADY-STATE FUEL TEMPERATURE CALIBRATION METHOD**Background**

In the Automated Statistical Treatment of Uncertainty Method (ASTRUM) Best-Estimate (BE) Large-Break Loss-of-Coolant Accident (LBLOCA) Evaluation Model (EM), the steady-state fuel pellet temperature calibration method involves solving for the hot gap width (AGFACT) to calibrate the fuel temperature for each fuel rod. In some infrequent situations, small non-conservatisms can occur in the calibration process such that the resulting fuel pellet temperature will be slightly lower than intended and outside the acceptable range defined by Table 12-6 of WCAP-16009-P/NP-A [1].

This issue has been evaluated to estimate the impact on ASTRUM BE LBLOCA analysis results. The resolution of this issue represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)

2004 Westinghouse Realistic Large Break LOCA Evaluation Model Using ASTRUM

Estimated Effect

A review of licensing basis analyses concluded that the potential non-conservatisms in the fuel pellet temperature calibration did not occur for the limiting analysis cases. Therefore, an estimated PCT impact of 0°F is assigned for 10 CFR 50.46 reporting purposes.

Reference(s)

- 1) WCAP-16009-P/NP-A, "Realistic Large-Break LOCA Evaluation Methodology Using the Automated Statistical Treatment Of Uncertainty Method (ASTRUM)," January 2005.

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

Plant Name: Prairie Island Unit 1
Utility Name: Xcel Energy, Inc
Revision Date: 2/1/2018

Analysis Information

EM: ASTRUM (2004) **Analysis Date:** 11/30/2007 **Limiting Break Size:** Split
FQ: 2.5 **FdH:** 1.77
Fuel: 422 Vantage + **SGTP (%):** 10
Notes:

	Clad Temp (°F)	Ref.	Notes
LICENSING BASIS			
Analysis-Of-Record PCT	1765	1	
PCT ASSESSMENTS (Delta PCT)			
A. PRIOR ECCS MODEL ASSESSMENTS			
1 . Evaluation of Fuel Pellet Thermal Conductivity Degradation and Peaking Factor Burndown	227	2	(a)
2 . Revised Heat Transfer Multiplier Distributions	-2	3	
3 . Error in Burst Strain Application	25	4	
B. PLANNED PLANT MODIFICATION EVALUATIONS			
1 . None	0		
C. 2017 ECCS MODEL ASSESSMENTS			
1 . None	0		
D. OTHER*			
1 . None	0		

LICENSING BASIS PCT + PCT ASSESSMENTS **PCT =** 2015

* 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 . WCAP-17783-P, "Best-Estimate Analysis of the Large-Break Loss-of-Coolant Accident for Prairie Island Units 1 and 2 with Replacement Steam Generators Using ASTRUM Methodology," June 2013.
- 2 . LTR-LIS-12-414, "Prairie Island Units 1 and 2, 10 CFR 50.46 Notification and Reporting for Fuel Pellet Thermal Conductivity Degradation and Peaking Factor Burndown," September 20, 2012.
- 3 . LTR-LIS-13-366, Revision 1, "Prairie Island Units 1 and 2 10 CFR 50.46 Report for Revised Heat Transfer Multiplier Distributions," August 2013.
- 4 . LTR-LIS-14-50, "Prairie Island Units 1 and 2 10 CFR 50.46 Report for the HOTSPOT Burst Strain Error Correction," January 2014.

Notes:

- (a) This evaluation credits peaking factor burndown, see Reference 2.

Westinghouse LOCA Peak Clad Temperature Summary for Appendix K Small Break

Plant Name: Prairie Island Unit 1
Utility Name: Xcel Energy, Inc
Revision Date: 2/1/2018

Analysis Information

EM: NOTRUMP **Analysis Date:** 1/21/2008 **Limiting Break Size:** 3 inch
FQ: 2.5 **FdH:** 1.77
Fuel: 422 Vantage + **SGTP (%):** 10
Notes: Zirlo® (14X14), Framatome RSG

	Clad Temp (°F)	Ref.	Notes
LICENSING BASIS			
Analysis-Of-Record PCT	959	1	
PCT ASSESSMENTS (Delta PCT)			
A. PRIOR ECCS MODEL ASSESSMENTS			
1 . None	0		
B. PLANNED PLANT MODIFICATION EVALUATIONS			
1 . None	0		
C. 2017 ECCS MODEL ASSESSMENTS			
1 . None	0		
D. OTHER*			
1 . None	0		
LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 959		

* 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 . LTR-LIS-08-158, "Transmittal of Future Prairie Island Units 1 and 2 PCT Summaries," February 2008.

Notes:

None

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

Plant Name: Prairie Island Unit 2
Utility Name: Xcel Energy, Inc
Revision Date: 2/1/2018

Analysis Information

EM: ASTRUM (2004) **Analysis Date:** 11/30/2007 **Limiting Break Size:** Split
FQ: 2.5 **FdH:** 1.77
Fuel: 422 Vantage + **SGTP (%):** 10
Notes:

	Clad Temp (°F)	Ref.	Notes
LICENSING BASIS			
Analysis-Of-Record PCT	1765	1	
PCT ASSESSMENTS (Delta PCT)			
A. PRIOR ECCS MODEL ASSESSMENTS			
1 . Evaluation of Fuel Pellet Thermal Conductivity Degradation and Peaking Factor Burndown	227	2	(a), (b)
2 . Revised Heat Transfer Multiplier Distributions	-2	3	
3 . Error in Burst Strain Application	25	4	
B. PLANNED PLANT MODIFICATION EVALUATIONS			
1 . None	0		
C. 2017 ECCS MODEL ASSESSMENTS			
1 . None	0		
D. OTHER*			
1 . None	0		

LICENSING BASIS PCT + PCT ASSESSMENTS **PCT =** 2015

* 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 . WCAP-17783-P, "Best-Estimate Analysis of the Large-Break Loss-of-Coolant Accident for Prairie Island Units 1 and 2 with Replacement Steam Generators Using ASTRUM Methodology," June 2013.
- 2 . LTR-LIS-12-414, "Prairie Island Units 1 and 2, 10 CFR 50.46 Notification and Reporting for Fuel Pellet Thermal Conductivity Degradation and Peaking Factor Burndown," September 20, 2012.
- 3 . LTR-LIS-13-366, Revision 1, "Prairie Island Units 1 and 2 10 CFR 50.46 Report for Revised Heat Transfer Multiplier Distributions," August 2013.
- 4 . LTR-LIS-14-50, "Prairie Island Units 1 and 2 10 CFR 50.46 Report for the HOTSPOT Burst Strain Error Correction," January 2014.

Notes:

- (a) This evaluation credits peaking factor burndown, see Reference 2.
- (b) The reporting text and line item originally identified for Unit 1 in Reference 2 is applicable to Unit 2 with RSGs.

Westinghouse LOCA Peak Clad Temperature Summary for Appendix K Small Break

Plant Name: Prairie Island Unit 2
Utility Name: Xcel Energy, Inc
Revision Date: 2/1/2018

Analysis Information

EM: NOTRUMP **Analysis Date:** 1/21/2008 **Limiting Break Size:** 3 inch
FQ: 2.5 **FdH:** 1.77
Fuel: 422 Vantage + **SGTP (%):** 10
Notes: Zirlo® (14X14), AREVA RSG

	Clad Temp (°F)	Ref.	Notes
LICENSING BASIS			
Analysis-Of-Record PCT	959	1, 2	a
PCT ASSESSMENTS (Delta PCT)			
A. PRIOR ECCS MODEL ASSESSMENTS			
1 . None	0		
B. PLANNED PLANT MODIFICATION EVALUATIONS			
1 . None	0		
C. 2017 ECCS MODEL ASSESSMENTS			
1 . None	0		
D. OTHER*			
1 . None	0		
LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 959		

* 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 . LTR-LIS-08-158, "Transmittal of Future Prairie Island Units 1 and 2 PCT Summaries," February 2008.
- 2 . LTR-LIS-13-274, "Prairie Island Units 1 and 2, 10 CFR 50.46 Summary Sheets for the Evaluation to Support the Unit 2 Installation of AREVA Model 56/19 Replacement Steam Generators (RSGs)," June 2013.

Notes:

- (a) The Unit 1 AOR is applicable to Unit 2 with the RSGs installed.

10 CFR 50.46 Reporting SharePoint Site Check:

**EMs applicable to Prairie Island:
Realistic Large Break – ASTRUM (2004)
Appendix K Small Break – NOTRUMP**

2017 Issues

Transmittal Letter	Issue Description
None	None

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