



JUN 30 2015

L-PI-15-061  
10 CFR 50.46

U S Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-0001

Prairie Island Nuclear Generating Plant Units 1 and 2  
Dockets 50-282 and 50-306  
Renewed License Nos. DPR-42 and DPR-60

2014 10 CFR 50.46 LOCA Annual Report

Pursuant to 10 CFR 50.46, Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM") submits the 2014 Annual Report of changes and errors to the Prairie Island Nuclear Generating Plant (PINGP) Units 1 and 2 Large Break Loss of Coolant Accident (LBLOCA) and Small Break Loss of Coolant Accident (SBLOCA) analysis.

Enclosure 1 contains the "Non-Plant Specific LOCA Errors and Changes" and summarizes the changes made to both the large break LOCA (LBLOCA) and small break LOCA (SBLOCA) analyses. No changes to the peak cladding temperature (PCT) for Prairie Island Units 1 and 2 occurred since the last annual report for the LBLOCA analysis.

The SBLOCA and LBLOCA peak clad temperature (PCT) assessment sheets for Unit 1 and Unit 2 are included in Enclosure 2. The limiting LOCA analysis PCT for PINGP Unit 1 and Unit 2, with consideration of all 10 CFR 50.46 assessments, remains the LBLOCA analysis as summarized in Enclosure 2.

Summary of Commitments

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

A handwritten signature in cursive script that reads 'Kevin Davison'.

Kevin Davison  
Site Vice President, Prairie Island Nuclear Generating Plant  
Northern States Power Company - Minnesota

Enclosures (2)

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

## **ENCLOSURE 1**

### **Non-Plant Specific LOCA Errors and Changes**

**5 pages follow**

## **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 Models**

1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model

2004 Westinghouse Realistic Large Break LOCA Evaluation Model Using ASTRUM

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.

**ERRORS IN DECAY GROUP UNCERTAINTY FACTORS****Background**

Errors in the calculation of decay heat were discovered in the WCOBRA/TRAC code. The decay group uncertainty factors for each fissile isotope are provided in Table 8-14 of WCAP-16009-P-A. The uncertainty factors for  $^{239}\text{Pu}$  were applied to  $^{238}\text{U}$ , and those for  $^{238}\text{U}$  were applied to  $^{239}\text{Pu}$ . This error causes an over-prediction of the uncertainty in decay power from  $^{239}\text{Pu}$  and an under-prediction of the uncertainty in decay power from  $^{238}\text{U}$ . Further, the decay group uncertainty factor for Decay Group 6 of  $^{235}\text{U}$  was erroneously coded as 2.5% instead of 2.25%. Correction of these errors impacts the application of the sampled decay heat uncertainty, which may result in small changes to the decay heat power. These issues have been evaluated to estimate the impact on Automated Statistical Treatment of Uncertainty Method (ASTRUM) Best-Estimate (BE) Large-Break Loss-of-Coolant Accident (LBLOCA) analysis results. The resolution of these issues represents a closely-related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

**Affected Evaluation Model**

2004 Westinghouse Realistic Large Break LOCA Evaluation Model Using ASTRUM

**Estimated Effect**

The issues described above are judged to have either no effect or a negligible effect on the LBLOCA analysis results, leading to an estimated Peak Cladding Temperature (PCT) impact of 0°F for Prairie Island Units 1 and 2.

## **FUEL ROD GAP CONDUCTANCE ERROR**

### **Background**

An error was identified in the fuel rod gap conductance model in the NOTRUMP computer code (reactor coolant system response model). The error is associated with the use of an incorrect temperature in the calculation of the cladding emissivity term. This error corresponds to a Non-Discretionary Change as described in Section 4.1.2 of WCAP-13451.

### **Affected Evaluation Model(s)**

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

### **Estimated Effect**

The estimated effect was determined based on a combination of engineering judgment of the phenomena and physics of a small break LOCA and sensitivity calculations performed with the advanced plant version of NOTRUMP. It was concluded that this error has a negligible effect on small break LOCA analysis results, leading to an estimated Peak Cladding Temperature (PCT) impact of 0°F.

## **RADIATION HEAT TRANSFER MODEL ERROR**

### **Background**

Two errors were discovered in the calculation of the radiation heat transfer coefficient within the fuel rod model of the NOTRUMP computer code (reactor coolant system response model). First, existing logic did not preclude non-physical negative or large (negative or positive) radiation heat transfer coefficients from being calculated. These erroneous calculations occurred when the vapor temperature exceeded the cladding surface temperature or when the predicted temperature difference was less than 1°F. Second, a temperature term incorrectly used degrees Fahrenheit instead of Rankine. These errors represent a closely related group of Non-Discretionary problems 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 estimated effect was determined based on a combination of engineering judgment of the phenomena and physics of a small break LOCA and sensitivity calculations performed with the advanced plant version of NOTRUMP. It was concluded that this error has a negligible effect on small break LOCA analysis results, leading to an estimated Peak Cladding Temperature (PCT) impact of 0°F.

## **SBLOCTA PRE-DNB CLADDING SURFACE HEAT TRANSFER COEFFICIENT CALCULATION**

### **Background**

Two errors were discovered in the pre-departure from nucleate boiling (pre-DNB) cladding surface heat transfer coefficient calculation in the SBLOCTA code (cladding heat-up calculations). The first error is a result of inconsistent time units (hours vs. seconds) in the parameters used for the calculation of the Reynolds and Prandtl numbers, and the second error relates to an incorrect diameter used to develop the area term in the cladding surface heat flux calculation. Both of these issues impact the calculation of the pre-DNB convective heat transfer coefficient, representing a closely related group of Non-Discretionary Changes to the Evaluation Model as described in Section 4.1.2 of WCAP-13451.

### **Affected Evaluation Model(s)**

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

### **Estimated Effect**

These errors have been corrected in the SBLOCTA code. Because this condition occurred prior to DNB, it was judged that these errors had no direct impact on the cladding heat-up related to the core uncover period. A series of validation tests were performed and confirmed that these errors have a negligible effect on SBLOCA analysis results, leading to an estimated Peak Cladding Temperature (PCT) impact of 0°F.



## **ENCLOSURE 2**

**LOCA Peak Clad Temperature Summary (Rack-Up Sheets)  
Prairie Island Nuclear Generating Plant  
(includes plant specific changes and non-zero non-plant specific changes)**

**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: 2/5/2015

**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
<b>LICENSING BASIS</b>			
Analysis-Of-Record PCT	1765	1	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
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>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1 . None	0		
<b>C. 2014 ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>D. OTHER*</b>			
1 . None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT =</b>	<b>2015</b>	
* 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: 2/5/2015

**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
<b>LICENSING BASIS</b>			
Analysis-Of-Record PCT	959	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. 2014 ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>D. OTHER*</b>			
1 . None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT =</b>	<b>959</b>	
* 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: 2/5/2015

**Analysis Information**

EM: ASTRUM (2004) Analysis Date: 11/30/2007 Limiting Break Size: Split

FQ: 2.5 PdH: 1.77

Fuel: 422 Vantage + SGTP (%): 10

Notes:

	Clad Temp (°F)	Ref.	Notes
<b>LICENSING BASIS</b>			
Analysis-Of-Record PCT	1765	1	
<b>PCT ASSESSMENTS (Delta PCT)</b>			
<b>A. PRIOR ECCS MODEL ASSESSMENTS</b>			
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>B. PLANNED PLANT MODIFICATION EVALUATIONS</b>			
1 . None	0		
<b>C. 2014 ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>D. OTHER*</b>			
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:** 2/5/2015**Analysis Information**

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

	Clad Temp (°F)	Ref.	Notes
<b>LICENSING BASIS</b>			
<b>Analysis-Of-Record PCT</b>	959	1, 2	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. 2014 ECCS MODEL ASSESSMENTS</b>			
1 . None	0		
<b>D. OTHER*</b>			
1 . None	0		
<b>LICENSING BASIS PCT + PCT ASSESSMENTS</b>	<b>PCT =</b>	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.