



**Nuclear Management Company, LLC**  
Prairie Island Nuclear Generating Plant  
1717 Wakonade Dr. East • Welch MN 55089

March 15, 2001

10 CFR Part 50  
Section 50.46

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

**PRAIRIE ISLAND NUCLEAR GENERATING PLANT**  
Docket Nos. 50-282 License Nos. DPR-42  
50-306 DPR-60

**Corrections to ECCS Evaluation Models**

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Attached is a report of corrections to the Prairie Island Nuclear Generating Plant (PINGP) Emergency Core Cooling System (ECCS) Evaluation Models. Since there is a reported error greater than 50 degrees F, this is a 30-day report. This report is being submitted in accordance with the provisions of 10 CFR 50, Section 50.46. The date that the results were accepted as valid by the Nuclear Management Company was February 14, 2001.

The applicable corrections noted in Attachment 1 have been applied to Prairie Island's current ECCS analyses of record, and all analyses were found to be in compliance with the applicable acceptance criteria (Attachment 2). Since all analyses remain in compliance, no reanalysis is required or planned.

In this letter we have made no new Nuclear Regulatory Commission commitments.

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Please contact Jack Leveille (651-388-1121, Ext. 4142) if you have any questions related to this letter.



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Attachments:

1. ECCS Evaluation Model Changes and Errors
2. Large Break LOCA Peak Clad Temperature (PCT) Margin Utilization Sheets

**ATTACHMENT 1**

**ECCS EVALUATION MODEL  
CHANGES AND ERRORS**

## **Modeling Updates and Unheated Conductor Input Corrections (Plant Specific)**

### **Background**

Several modeling corrections were made to address recently identified errors in the application of the model related to the SECY UPI Large Break LOCA (LBLOCA) analysis for the Prairie Island Units 1 & 2. The modeling updates included code input changes to correct minor discrepancies between design values and 'as analyzed' values for the accumulator line and minor errors in the inputs to the WCOBRA/TRAC computer code. The unheated conductor input corrections involved a number of code input recalculations in order to eliminate the use of structure multipliers which were less than one ( $RMULS < 1$ ) for TUBE geometry types. The heat conduction solution in TUBE geometries using multipliers less than one is not calculated correctly by WCOBRA/TRAC.

### **Estimated Effect**

A plant specific reanalysis for all modeling issues related to the SECY UPI LBLOCA analysis for the Prairie Island Units 1 & 2 was performed. All issues were addressed and the impact on the previously reported peak cladding temperature (PCT) in Reference 1 was determined. The calculated LBLOCA PCT based on the plant specific reanalysis for the application of these model errors is 1950°F. This result is well below the 2200°F criteria of 10 CFR 50.46 and represents a net PCT benefit of 147°F. This item has been added to the LBLOCA PCT Margin Utilization Sheet as a permanent assessment of PCT margin.

### **References:**

1. 00NS-G-0019 (CAB-00-126), 'Northern States Power Company, Prairie Island Units 1 and 2, Prairie Island Unit 2 Cycle 20 LOCA Reload Confirmation & Final Fuel Rod Design Report', W. H. Slagle, March 28, 2000

## **Evaluation for Steam Generator Tube Plugging Increases to 25%**

### **Background**

The Nuclear Management Company requested evaluations for increasing the steam generator tube plugging (SGTP) level from 15% to 25% for the Prairie Island Units 1 & 2. The evaluations are to assess the impact of the increased SGTP level with respect to the current analysis for the SECY UPI Large Break LOCA (LBLOCA), Boron Build-Up, and Long Term Core Cooling (LTCC). The Boron-Up and LTCC discussions are included for informational purposes only, and do not imply a 10 CFR 50.46 reporting requirement.

### **SECY UPI LBLOCA Evaluation**

The requested LBLOCA evaluation was performed at initial/boundary conditions consistent with the thermal design flow (TDF) modeled in the Reference 2 Small Break LOCA Analysis for 25% SGTP.

A new steady-state was developed to model the aforementioned initial/boundary conditions of the 25% SGTP SBLOCA. Upon achieving an acceptable steady-state balance, the LBLOCA transient was initiated. The results of the transient calculation showed a peak cladding temperature (PCT) benefit during the blowdown phase of the transient and a PCT penalty during the reflood phase of the transient. These results are consistent with the expected impact of increased SGTP. During blowdown, it is indeterminate whether an increase or decrease in PCT is expected due to the competing effects associated with increased tube plugging such as loop resistance, reduced TDF, and slightly different  $T_{hot}/T_{cold}$  compared to the 15% SGTP case. However, it is expected that the difference will be small. Figure 1 shows that the blowdown PCT difference is indeed small ( $\approx 15^{\circ}\text{F}$ ).

During reflood, the increase loop resistance is expected to be a penalty since the system will be at a slightly higher pressure. The higher pressure increases  $T_{sat}$ , which reduces the effect of steam cooling of the fuel cladding. Steam cooling is the primary heat transfer mechanism during this period of the transient so increased cladding heat-up is expected. Figure 1 compares the hot rod PCT transient for 25% SGTP with the 15% SGTP case. The WCOBRA/TRAC calculated reflood PCT difference is  $52^{\circ}\text{F}$ . This item has been added to the LBLOCA PCT Margin Utilization Sheet as a 10 CFR 50.59 Safety Evaluation assessment of PCT margin.

### **Boron Buildup and Long Term Core Cooling Sub-Criticality Evaluations**

In the Prairie Island Units 1&2 existing analysis for boron buildup, the reactor coolant system (RCS) boron concentration was modeled at a conservatively high value set by the mass weighted average of the two highest boron sources (BAST/RWST). The reduced RCS fluid mass that would be associated with the increased SGTP level would result in an analysis benefit since there would be less total sump boron available to be drawn into the core during the transient.

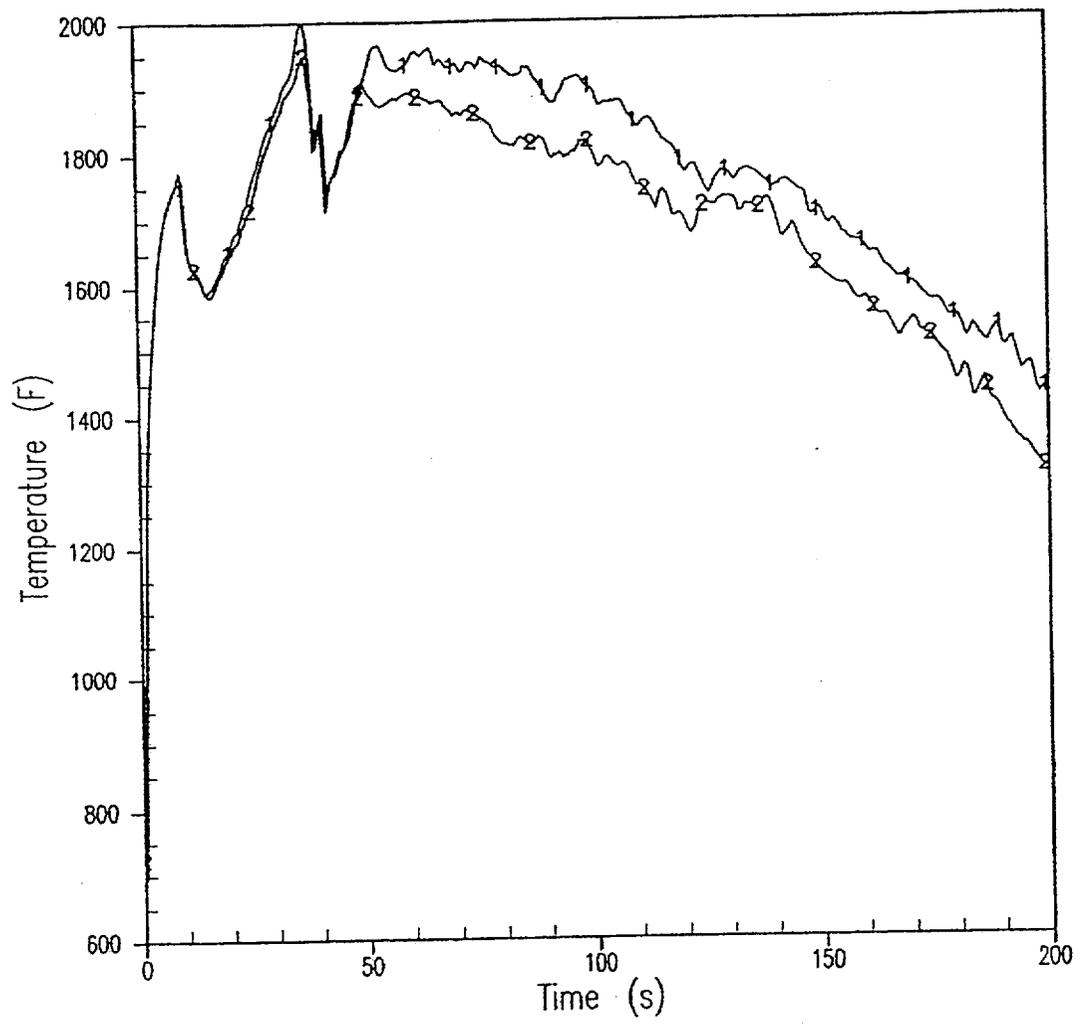
In the existing LTCC analysis for Prairie Island Units 1&2, the RCS contribution to the mixed mean boron concentration acts as a dilution source. The reduced RCS fluid mass that would be associated with the increased SGTP is an analysis benefit since there would be less boron dilution.

### **References**

1. PN78035SQ/0000, Task 12, 'LOCA SGTP Evaluation', R. P. Pearson, June 13, 2000
2. WCAP-13920, 'Small Break Loss of Coolant Accident Engineering Report for the Prairie Island Fuel Upgrade', J. S. Spaargaren, M. A. Emery, 11/93

Figure 1: Comparison of 25% SGTP and 15% SGTP Cases  
Hot Rod Peak Cladding Temperature

1 — 25% SGTP Evaluation Case  
2 — 15% SGTP Base Case



## ATTACHMENT 2

### Large Break LOCA Peak Clad Temperature (PCT) Margin Utilization Sheets

Westinghouse LOCA Peak Clad Temperature Summary For SECY UPI Large Break

Plant Name: Prairie Island Units 1 & 2  
 Utility Name: Northern States Power  
 Revision Date: 12/ 7/00

Analysis Information

EM: SECY UPI WC/T Analysis Date: 03/95 Limiting Break Size: Cd = 0.4  
 FQ: 2.4 FdH: 1.77  
 Fuel: OFA SGTP (%): 15  
 Notes: Zirlo™, SGTP Evaluated up to 25%

	Clad Temp ( °F)	Ref.	Notes
<b>LICENSING BASIS</b>	2180	1,2	(a)
Analysis-Of-Record PCT			
<b>MARGIN ALLOCATIONS (Delta PCT)</b>			
<b>A. PRIOR PERMANENT ECCS MODEL ASSESSMENTS</b>			
1 . Fixed Heat Transfer Node Assignment Error/Accumulator Water Injection Error (1995 Report)	-175	3	
2 . 1-D Transition Boiling Heat Transfer Error (1997 Report)	59	5	
3 . Vessel Channel DX Error (1997 Report)	-14	5	
4 . Input Consistency (1997 Report)	-66	5	
5 . No Items for 1996 & 1998 Reports	0	4,6	
6 . Accumulator Line Pressurizer Surge Line Data / Plant Specific Accumulator Level & Line Volume / Plant Specific Restart Error: Reanalysis	113	7	(b)
<b>B. 10 CFR 50.59 SAFETY EVALUATIONS</b>			
1 . Sensitivity Study for Steam Generator Tube Plugging Increase to 25%	52	8	
<b>C. 2000 10 CFR 50.46 MODEL ASSESSMENTS (Permanent Assessments of PCT Margin)</b>			
1 . Modeling Updates and Unheated Conductor Input Corrections (plant specific)	-147	8	(c)
<b>D. TEMPORARY ECCS MODEL ISSUES*</b>			
1 . None	0		
<b>E. OTHER</b>			
1 . None	0		

**LICENSING BASIS PCT + MARGIN ALLOCATIONS PCT = 2002**

\* It is recommended that these temporary PCT allocations which address current LOCA model issues not be considered with respect to 10 CFR 50.46 reporting requirements.

**References:**

- 1 . 95NS-G-0021, "Updated UPI LBLOCA," March 24, 1995.
- 2 . WCAP-13919, Addendum 1, "Prairie Island Units 1 and 2 WCOBRA/TRAC Best Estimate UPI Large Break LOCA Analysis Engineering Report Addendum 1: Updated Results," December 1996.
- 3 . NSP-96-202, "Northern States Power Company Prairie Island Units 1 and 2 10 CFR 50.46 Annual Notification and Reporting," February 20, 1996.
- 4 . NSP-97-201, "Northern States Power Company Prairie Island Units 1 and 2 10 CFR 50.46 Annual Notification and Reporting," April 17, 1997.

**Westinghouse LOCA Peak Clad Temperature Summary For SECY UPI Large Break**

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**Plant Name:** Prairie Island Units 1 & 2

**Utility Name:** Northern States Power

**Revision Date:** 12/ 7/00

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- 5 . NSP-98-012, "Northern States Power Company Prairie Island Units 1 and 2 10 CFR 50.46 Annual Notification and Reporting for 1997," February 27, 1998.
- 6 . NSP-99-010, "Northern States Power Company Prairie Island Units 1 and 2 10 CFR 50.46 Annual Notification and Reporting for 1998," April 29, 1999.
- 7 . NSP-00-005, "Northern States Power Company Prairie Island Units 1 and 2 10 CFR 50.46 Annual Notification and Reporting for 1999," February 2000.
- 8 . 25% SGTP Report

**Notes:**

- (a) P-bar-HA increased from 1.57 to 1.59
- (b) Renalysis for all listed issues
- (c) Renalysis for both issues