



Monticello Nuclear Generating Plant  
2807 W County Road 75  
Monticello, MN 55362

June 22, 2017

L-MT-17-045  
10 CFR 50.46(a)(3)(ii)

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

Monticello Nuclear Generating Plant  
Docket No. 50-263  
Renewed Facility Operating License No. DPR-22

June 2017, Thirty-Day Report of Changes in Emergency Core Cooling System  
Evaluation Models Pursuant to 10 CFR 50.46

- References:
- 1) Letter from NSPM to NRC, "License Amendment Request for Transition to AREVA ATRIUM 10XM Fuel and AREVA Safety Analysis Methodology," (L-MT-13-055), dated July 15, 2013 (Enclosure 20 provided AREVA Report ANP-3212(P) Revision 0, "Monticello EPU LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM™ 10XM Fuel," AREVA NP, May 2013
  - 2) Letter from NSPM to NRC, "2016 Annual Report of Changes in Emergency Core Cooling System Evaluation Models Pursuant to 10 CFR 50.46," (L-MT-16-071), dated December 19, 2016
  - 3) AREVA Report ANP-3558P Revision 0, "Monticello LOCA MAPLHGR Limits for EPU/EFW with ATRIUM 10XM Fuel and Revised ECCS Parameters," January 2017
  - 4) AREVA Report FS1-0032297 Revision 1, "Monticello 10 CFR 50.46 PCT Reporting for ATRIUM 10XM Fuel Through May 2017," May 25, 2017

Pursuant to 10 CFR 50.46(a)(3)(ii), the Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy, is providing this thirty-day report concerning changes or errors identified in the AREVA Emergency Core Cooling System (ECCS) evaluation models for the Monticello Nuclear Generating Plant (MNGP).

As part of the MNGP transition to AREVA fuel, Loss of Coolant Accident (LOCA) analyses were performed and included as part of the license amendment request (LAR) (Reference 1). The 2016 annual 10 CFR 50.46 report (Reference 2) reported an adjusted Peak Cladding Temperature (PCT) for this initial AREVA LOCA analysis of record (AOR) of 2083°F for the ATRIUM™ 10XM fuel.

In January 2017, a complete LOCA Maximum Average Planar Linear Heat Generation Rate reanalysis was performed (Reference 3)<sup>(1)</sup> to establish a new baseline, applying the same methodology as that for the initial AOR.

This thirty-day report is being made due to recent issuance of a notification letter (Reference 4) from AREVA for changes or errors in both the initial and also to the new, current, AOR analysis. These changes exceeded the 50°F threshold in 10 CFR 50.46(a)(3)(i) for a significant increase in PCT. The specific errors or changes, algebraic and absolute value of the changes, increases in PCT, and adjusted licensing basis PCT for the new and initial AORs, are provided in Enclosures 1 and 2, respectively.

For the new, current, AOR the adjusted licensing basis PCT is 2085°F for the ATRIUM™ 10XM fuel. This PCT is 115°F below the 2200°F acceptance criterion of 10 CFR 50.46(b)(1). This provides sufficient margin to justify taking no further action. No further reanalysis or other actions are planned.

Should you have questions regarding this letter, please contact Mr. Richard Loeffler at (763) 295-1247.

#### Summary of Commitments

This letter proposes no new commitments and does not revise any existing commitments.



Peter A. Gardner

Site Vice President, Monticello Nuclear Generating Plant  
Northern States Power Company – Minnesota

Enclosures (2)

cc: Administrator, Region III, USNRC  
Project Manager, Monticello, USNRC  
Resident Inspector, Monticello, USNRC

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1. The changes and errors reported for the AREVA fuel for the initial AOR in Enclosure 2 were corrected and included in the reanalysis.

**ENCLOSURE 1**

**MONTICELLO NUCLEAR GENERATING PLANT**

**SUMMARY OF MONTICELLO LOCA CHANGES AND ERRORS INVOLVING  
CHANGES IN PEAK CLADDING TEMPERATURE FOR ATRIUM 10XM FUEL FOR  
CURRENT ANALYSIS OF RECORD CONTAINED IN ANP-3558P REVISION 0**

(1 page follows)

**TABLE 1 – SUMMARY OF MONTICELLO LOCA CHANGES AND ERRORS INVOLVING CHANGES IN PEAK CLADDING TEMPERATURE (PCT) FOR ATRIUM 10XM FUEL FOR CURRENT ANALYSIS OF RECORD CONTAINED IN ANP-3558P REVISION 0**

<b>Applicable Analysis or Error / Change Description</b>	<b>Ref.</b>	<b>Licensing Basis PCT(°F) ATRIUM 10XM</b>
ANP-3558P Revision 0, "Monticello LOCA MAPLHGR Limits for EPU/EFW with ATRIUM 10XM Fuel and Revised ECCS Parameters" <sup>(1)</sup>	1-1	2034
<u>MSIV Closure</u> The impact of this MSIV closure change was estimated for the Monticello LOCA break spectrum and exposure-dependent MAPLHGR analyses.	1-2	+51
Sum of absolute value of changes for the current reporting period, which includes all changes since the 10 CFR 50.46 report.	N/A	
Sum of absolute value of changes since last AOR.	+51	
Algebraic sum of changes for the current reporting period, which includes all changes since the 10 CFR 50.46 report.	N/A	
Algebraic sum of changes since last AOR.	+51	
<b>Current Adjusted Peak Cladding Temperature</b>		<b>2085</b>

(1) AREVA report ANP-3558P reflects a new LOCA analysis performed to provide a new baseline AOR for the AREVA ATRIUM 10XM fuel at the MNGP.

**References**

- 1-1 AREVA Report ANP-3558P Revision 0, "Monticello LOCA MAPLHGR Limits for EPU/EFW with ATRIUM 10XM Fuel and Revised ECCS Parameters," January 2017
- 1-2 AREVA Report FS1-0032297 Revision 1, "Monticello 10 CFR 50.46 PCT Reporting for ATRIUM 10XM Fuel Through May 2017," May 25, 2017

**ENCLOSURE 2**

**MONTICELLO NUCLEAR GENERATING PLANT**

**SUMMARY OF MONTICELLO LOCA CHANGES AND ERRORS INVOLVING  
CHANGES IN PEAK CLADDING TEMPERATURE FOR ATRIUM 10XM FUEL FOR  
PREVIOUS ANALYSIS OF RECORD CONTAINED IN ANP-3212(P) REVISION 0**

(5 pages follow)

**TABLE 2 – SUMMARY OF MONTICELLO LOCA CHANGES AND ERRORS INVOLVING CHANGES IN PEAK CLADDING TEMPERATURE (PCT) FOR ATRIUM 10XM FUEL FOR PREVIOUS ANALYSIS OF RECORD CONTAINED IN ANP-3212(P) REVISION 0**

Applicable Analysis or Error/Change Description	Ref.	Licensing Basis PCT(°F) ATRIUM 10XM
ANP-3212(P) Revision 0, "Monticello EPU LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM™ 10XM Fuel"	2-1	2088
<u>Implementation of ACE in RELAX</u> The approved interpolation scheme required by Licensing Topical Report (LTR) EMF-2361 (Section 3.2.2) was not employed when the ACE Critical Heat Flux (CHF) correlations were implemented in RELAX.	2-2	+0
<u>Error in Modified Analysis Approach (1)</u> Extraneous messages written in RELAX minor edits can impact a cooling methodology in the modified analysis approach. This error did not impact the limiting PCT.	2-2	+0
<u>Error in Modified Analysis Approach (2)</u> The cooling methodology applied in the modified analysis approach causes the analysis to be overly conservative.	2-2	+0
<u>Error in Modified Analysis Approach (3)</u> The time when the cooling methodology began in the modified analysis approach could cause incorrect reporting in the calculation documentation. The error did not impact the time used in any of the MNGP LOCA calculations.	2-2	+0

**TABLE 2 – SUMMARY OF MONTICELLO LOCA CHANGES AND ERRORS INVOLVING CHANGES IN PEAK CLADDING TEMPERATURE (PCT) FOR ATRIUM 10XM FUEL FOR PREVIOUS ANALYSIS OF RECORD CONTAINED IN ANP-3212(P) REVISION 0**

Applicable Analysis or Error/Change Description	Ref.	Licensing Basis PCT(°F) ATRIUM 10XM
<p><u>Low Pressure Coolant Injection (LPCI) Loop Selection Logic</u></p> <p>Relates to an input error when modeling breaks smaller than 0.4 ft<sup>2</sup>. MNGP has instrumentation and logic to detect which recirculation line contains a break. When a break is detected, the logic injects all LPCI flow into the recirculation line that does not contain the break and closes the discharge isolation valve in that same recirculation line. If a break is not detected, the LPCI flow is injected and the discharge isolation valve is closed in a predefined recirculation line. LOCA analyses for breaks smaller than 0.4 ft<sup>2</sup> conservatively assumed the break was in the recirculation line that was predefined to receive the LPCI flow and should have closed the discharge isolation valve in the same recirculation line. Instead, the discharge isolation valve was modeled as closing in the intact recirculation line.</p>	2-2	+0
<p><u>End of Blowdown</u></p> <p>A modeling assumption was made that could result in an error in the time when rated Low Pressure Core Spray (LPCS) is reached. The time when rated LPCS flow is reached is used in two parts of the LOCA calculation and it relates to the use of the modified analysis approach. This error did cause a small change in the time when the heat transfer coefficients in the heatup calculation change from the calculated values to the values specified in 10 CFR 50 Appendix K.</p>	2-2	-5
<p><u>Modeling Assumption for Time of Bypass Reflood</u></p> <p>A modeling assumption could result in an error in the time of bypass reflood. The time of bypass reflood is the time the heat transfer coefficient beneath the bypass mixture level is set to 25 Btu/hr-ft<sup>2</sup>-°F.</p>	2-2	+0

**TABLE 2 – SUMMARY OF MONTICELLO LOCA CHANGES AND ERRORS INVOLVING CHANGES IN PEAK CLADDING TEMPERATURE (PCT) FOR ATRIUM 10XM FUEL FOR PREVIOUS ANALYSIS OF RECORD CONTAINED IN ANP-3212(P) REVISION 0**

Applicable Analysis or Error/Change Description	Ref.	Licensing Basis PCT(°F) ATRIUM 10XM
<p><u>Using End-of-Blowdown (EOB) Time for Selecting HUXY Boundary Conditions</u></p> <p>At the EOB (which is the time of rated core spray), the hottest axial slab in the RELAX hot channel calculation is identified. This establishes the boundary conditions that are passed into the HUXY calculation. While this is appropriate under some conditions when the slabs continue to heat up after EOB, it may not be appropriate for other conditions when the EOB time is much later and the nodes have cooled down.</p>	2-2	+0
<p><u>Pressure Permissive for Closing Recirculation Discharge Isolation Valve (RDIV) during Single Loop Operation (SLO)</u></p> <p>MNGP has two recirculation lines. Each line has a location for injecting LPCI flow and a RDIV on the discharge side of the recirculation pump. Monticello also has Loop Selection Logic which will route all of the LPCI flow to the unbroken loop and close the RDIV in the same loop.</p> <p>During SLO the pressure must be less than or equal to 900 psig before the RDIV will begin to close. This pressure permissive during SLO was not modeled in the SLO LOCA calculations. Evaluations were performed that indicate modeling the pressure permissive would not impact the limiting SLO break.</p> <p>This issue does not impact a LOCA initiated during Two-Loop Operation (TLO) because the RDIV pressure permissive is modeled correctly. Therefore, this issue has zero impact on the limiting PCT.</p>	2-3	+0
<p><u>MSIV Closure</u></p> <p>Closure of MSIV was changed. Some large breaks experienced very early Appendix K lockouts for CHF and 300°F (less than 10 seconds) resulting in a large increase in PCT.</p>	2-4	+300
<p><u>Monticello Specific Neutronics Input</u></p> <p>Removing excessive conservatism from the neutronics input eliminated the early lockouts.</p>	2-4	-300



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Applicable Analysis or Error/Change Description	Ref.	Licensing Basis PCT(°F) ATRIUM 10XM
Input changes in the Cycle 29 LOCA analyses are described in ANP-3557P Revision 0 plus changes between the representative Cycle 28 neutronics lattices and the actual Cycle 29 core design.	2-5	-49
Sum of absolute value of changes since the last 10 CFR 50.46 report.		649
Sum of absolute value of changes since the last AOR.		654
Algebraic sum of changes since the last 10 CFR 50.46 report.		-49
Algebraic sum of changes since the last AOR.		-54
<b>Current Adjusted Peak Cladding Temperature</b>		2034
In accordance with the guidance of 10 CFR 50.46(a)(3)(ii), corrections to the initial AOR for these changes and errors were included in the reanalysis for the new AOR, the results of which are provided in Enclosure 1. These LOCA analyses performed in support of Cycle 29 (Reference 2-7) are the new baseline AOR for future 10 CFR 50.46 reports.		

**References**

- 2-1 AREVA Report ANP-3212(P) Revision 0, “Monticello EPU LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM™ 10XM Fuel,” AREVA NP, May 2013 (Enclosure 20 of NSPM letter to NRC, “License Amendment Request for Transition to AREVA ATRIUM 10XM Fuel and AREVA Safety Analysis Methodology,” L-MT-13-055, dated July 15, 2013
- 2-2 AREVA Report FS1-0026440 Revision 1, “Monticello 10 CFR 50.46 PCT Reporting Estimates for ATRIUM 10XM Fuel,” approved May 13, 2016
- 2-3 AREVA Report FS1-0029081 Revision 1, “Monticello 10 CFR 50.46 PCT Reporting Estimates for ATRIUM 10XM Fuel – Through July 2016,” approved October 12, 2016

**TABLE 2 – SUMMARY OF MONTICELLO LOCA CHANGES AND ERRORS INVOLVING CHANGES IN PEAK CLADDING TEMPERATURE (PCT) FOR ATRIUM 10XM FUEL FOR PREVIOUS ANALYSIS OF RECORD CONTAINED IN ANP-3212(P) REVISION 0**

- 2-4 AREVA Report FS1-0032297 Revision 1, “Monticello 10 CFR 50.46 PCT Reporting for ATRIUM 10XM Fuel Through May 2017,” May 25, 2017
- 2-5 AREVA Report ANP-3557P Revision 0, “Monticello LOCA Break Spectrum for EPU/EFW with ATRIUM 10XM Fuel and Revised ECCS Parameters,” January 2017
- 2-6 Letter from P. Gardner (NSPM) to NRC, “2016 Annual Report of Changes in Emergency Core Cooling System Evaluation Models Pursuant to 10 CFR 50.46,” (L-MT-16-071) dated December 19, 2016
- 2-7 AREVA Report ANP-3558P Revision 0, “Monticello LOCA MAPLHGR Limits for EPU/EFW with ATRIUM 10XM Fuel and Revised ECCS Parameters,” January 2017