Xcel Energy®

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

May 13, 2013

L-MT-13-036
10 CFR 50.90

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

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

Monticello Extended Power Uprate and Maximum Extended Load Line Limit Analysis Plus License Amendment Requests: Supplement for Application of License Amendment 172 (TAC Nos. MD9990 and ME3145)

References:

1) Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "License Amendment Request: Extended Power Uprate (TAC MD9990)," L-MT-08-052, dated November 5, 2008. (ADAMS Accession No. ML083230111)
2) Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "License Amendment Request: Maximum Extended Load Line Limit Analysis Plus," TAC ME3145, L-MT-10-003, dated January 21, 2010. (ADAMS Accession No. ML100280558)
3) Letter from J G Giitter (NRC) to T J O'Connor (NSPM), "Subject: Monticello Nuclear Generating Plant - Linking of the Proposed Extended Power Uprate Amendment and the MELLLA+ Amendment (TAC NOS. MD9990 and ME2449)," dated November 23, 2009. (ADAMS Accession No. ML093160816)
4) Letter from T A Beltz (NRC) to M A Schimmel (NSPM), "Subject: Monticello Nuclear Generating Plant – Issuance of Amendment to Revise and Relocate Pressure Temperature Curves to a Pressure Temperature Limits Report (TAC No. ME7930)," dated February 27, 2013. (ADAMS Accession No. ML13025A155)
5) Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "Monticello Extended Power Uprate: Updates to Docketed Information (TAC MD9990)," L-MT-10-072, dated December 21, 2010. (ADAMS Accession No. ML103570026)

6) Letter from M A Schimmel (NSPM) to Document Control Desk (NRC), "Monticello Extended Power Uprate: Supplement to Revise Technical Specification Setpoint for the Automatic Depressurization System Bypass Timer (TAC MD9990)," L-MT-12-091, dated October 30, 2012. (ADAMS Accession No. ML12307A036)

Pursuant to 10 CFR 50.90, the Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy, requested in Reference 1 an amendment to the Monticello Nuclear Generating Plant (MNGP) Renewed Operating License (OL) and Technical Specifications (TS) to increase the maximum authorized power level from 1775 megawatts thermal (MWt) to 2004 MWt.

Also pursuant to 10 CFR 50.90, NSPM requested in Reference 2 an amendment to the MNGP Renewed OL and TS to allow operation within the Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating domain.

The Nuclear Regulatory Commission (NRC) permitted these two license amendment requests to be linked in Reference 3.

In Reference 1, Enclosure 5, Section 2.1.2, NSPM evaluated the effects of the proposed EPU change on the Pressure and Temperature (P-T) limits for the plant and addressed changes in neutron fluence and their effects on P-T limits. NSPM concluded that revised P-T curves would need to be submitted to the NRC under a separate license amendment.

In Reference 2, Enclosure 1, Attachment 3, Section 3.2.1, NSPM evaluated the effects of the proposed MELLLA+ change on the P-T limits for the plant and addressed changes in neutron fluence and their effects on P-T limits. NSPM concluded that there was a negligible change to the Monticello 54 Effective Full Power Year (EFPY) Vessel Internal Diameter (ID) peak fluence as a result of MELLLA+, and there was a negligible change to the beltline Adjusted Reference Temperature (ART). Therefore, NSPM concluded that the P-T curves did not require revision as a result of MELLLA+ operating domain expansion.

In Reference 4, the NRC approved NSPM's request to change the MNGP TS to incorporate a Reactor Coolant System P-T Limits Report and to modify the P-T limits using the methodology documented in SIR-05-044-A, "Pressure-Temperature Limits Report (PTLR) Methodology for Boiling Water Reactors." For all components, the EPU-only fluence values were determined to be more conservative than the EPU/MELLLA+ fluence values and the EPU-only fluence values were used in the determination of the pressure-temperature limits and curves in the PTLR. This LAR was approved as license amendment 172 to the MNGP operating license.

The purpose of this letter (see enclosure) is to provide the NRC with the basis for concluding that the analyses and conditions evaluated in license amendment 172

satisfy the P-T limits applicable under both EPU and MELLLA+ conditions. Further, since Reference 4 approved moving the P-T curves to the PTLR, and the NRC has agreed that the MNGP PTLR is implemented consistent with the MNGP P-T curves, then, the proposal herein to implement the PTLR meets the intent to implement P-T curves as described in Reference 1, Enclosure 5, Section 2.1.2, and there is no longer a need to submit revised P-T limit curves. Based on this conclusion the EPU and MELLLA+ license amendments should reference license amendment 172 as the basis for the MNGP P-T limits.

The supplemental information provided herein does not change the conclusions of the No Significant Hazards Consideration and the Environmental Consideration evaluations provided in Reference 1 as revised by References 5 and 6 for the Extended Power Uprate LAR. Further, the supplemental information provided herein does not change the conclusions of the No Significant Hazards Consideration and the Environmental Consideration evaluations provided in Reference 2 for the MELLLA+ LAR.

In accordance with 10 CFR 50.91(b), a copy of this application supplement, without enclosures is being provided to the designated Minnesota Official.

Summary of Commitments

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

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: May 13, 2013

Mark A. Schimmel
Site Vice-President
Monticello Nuclear Generating Plant
Northern States Power Company-Minnesota

Enclosure

cc: Administrator, Region III, USNRC (w/o enclosures)
Project Manager, Monticello Nuclear Generating Plant, USNRC
Resident Inspector, Monticello Nuclear Generating Plant, USNRC (w/o enclosures)
Minnesota Department of Commerce (w/o enclosures)

ENCLOSURE

Introduction

The purpose of this enclosure is to demonstrate that the analyses and conditions evaluated in Monticello Nuclear Generating Plant (MNGP) license amendment (LA) 172 (Reference 1) satisfy the pressure – temperature (P-T) limits applicable under both extended power uprate (EPU) and maximum extended load line limit analysis plus (MELLLA+) conditions. Based on this conclusion the EPU and MELLLA+ license amendments should reference LA 172 as the basis for the MNGP P-T limits.

Background

Extended Power Uprate and MELLLA+ LARs

In November 2008, Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy, submitted a license amendment request (LAR) applying for an EPU for the MNGP to 2004 MWt (Reference 2). Subsequently, in January 2010, NSPM submitted a LAR requesting application of the General Electric-Hitachi (GEH) MELLLA+ operating domain to the EPU conditions (Reference 3). A request for concurrent review of the MELLLA+ LAR together with the EPU LAR was submitted in October 2009 (Reference 4), and authorized by the NRC in November 2009 (Reference 5).

The EPU LAR indicated that revised P-T curves, developed in accordance with GEH methods, would be submitted in the future as a separate LAR.

The MELLLA+ LAR stated that there was a negligible change to the Monticello 54 Effective Full Power Year (EFPY) Vessel Internal Diameter (ID) peak fluence as a result of MELLLA+, and there was a negligible change to the beltline Adjusted Reference Temperature (ART). Therefore, NSPM concluded that the P-T curves did not require revision as a result of MELLLA+ operating domain expansion.

In a subsequent letter (Reference 10, Attachment 2, Enclosure 1) NSPM provided a detailed description of the fluence evaluation performed for EPU and MELLLA+. In this analysis NSPM stated that the fluence evaluation methodology used was based on NEDC-32983P-A which is NRC approved. For purposes of comparison, key numerical flux/fluence results and their respective parameters were provided in the analysis. These comparisons showed flux values for EPU, MELLLA+ and 120% of original licensed thermal power (OLTP) conditions.

Subsequent to development of the EPU and MELLLA+ license amendment requests, NSPM decided to pursue development of new P-T curves applying the NRC approved SIA methodology contained in SIR-05-044-A as described in the PTLR LAR above. The

P-T curves developed in the PTLR apply at EPU and at EPU within the MELLLA+ operating domain and bound current licensed thermal power operation.

Pressure Temperature Limits Report License Amendment Request

On January 20, 2012, NSPM submitted a LAR to revise the MNGP Technical Specifications (TS) to add a Pressure and Temperature Limits Report (PTLR) incorporating new P-T limit curves (Reference 6).

The proposed change was developed and analyzed in accordance with the following documents:

- U.S. Nuclear Regulatory Commission (NRC) Generic Letter (GL) 96-03, "Relocation of the Pressure Temperature Limit Curves and Low Temperature Overpressure Protection System Limits," (Reference 7) were applied during development of the proposed P-T curves.
- Technical Specification Task Force (TSTF) Traveler TSTF-419-A, "Revise PTLR Definition and References in Improved Standard Technical Specification 5.6.6, Reactor Coolant System PTLR" (Reference 8) was used to develop the TS changes.
- Structural Integrity Associates (SIA) methodology Report No. SIR-05-044-A, "Pressure Temperature Limits Report Methodology for Boiling Water Reactors" (Reference 9) was the analytical methodology used for development of the proposed P-T curves and the PTLR. SIR-05-044-A is an NRC approved methodology.

The proposed P-T curves were developed including the effects of operation throughout the twenty-year extended period of operation (54 Effective Full Power Years (EFPY)) in accordance with the Monticello Renewed Facility Operating License. The P-T curves also considered the effects of operation at the EPU power level of 2004 MWt and operation in the maximum extended load line limit analysis (MELLLA) and MELLLA+ operating domains including using plant-specific design and as-built information.

The LAR demonstrated how the proposed changes met the requirements of:

- 10 CFR 50 Appendix G - Appendix G to 10 CFR Part 50 requires that facility P-T limits for the reactor pressure vessel (RPV) be at least as conservative as those obtained by applying the linear elastic fracture mechanics methodology of Appendix G to Section XI of the American Society of Mechanical Engineers (ASME) Code.
- 10 CFR 50 Appendix H - Appendix H to 10 CFR Part 50 establishes requirements related to facility RPV material surveillance programs.
- Regulatory Guide (RG) 1.99, Revision 2 - RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials" contains methodologies for determining the increase in transition temperature and the decrease in upper-shelf energy resulting from neutron radiation.

The LAR also provided the calculations used to support development of the PTLR. The calculations included:

- an evaluation of the ART and reference temperature shifts,
- a finite element analysis (FEA) of the MNGP RPV feedwater nozzle,
- a FEA of the MNGP RPV Recirculation inlet nozzle, and
- revised P-T Curves

The LAR also referenced a fluence calculation[1] performed for the EPU power level (2004 MWt) in accordance with the RG 1.190 compliant, NRC approved General Electric-Hitachi (GEH) fluence methodology (NEDC-32983P-A, Revision 2). The fluence associated with EPU operation was determined to be more conservative (higher fluence values) than that for EPU operation in the MELLLA+ domain, and hence, the EPU fluence values were applied to determine the ART and related P-T limits / curves in the PTLR. This calculation was performed for the assumed fluence at the end of the renewed facility operating license period, i.e., 54 EFPY on September 8, 2030.

A multiplication factor of 1.3 was then applied to the fluence values determined by the GEH methodology to account for potential variation in future cycles of operation. EPU operation was conservatively assumed to begin at 28.82 EFPY (with exception of the later developed 36 and 40 EFPY hydrostatic / pressure testing curves - where EPU operation was postulated to begin at 33.4 EFPY). The P-T curves for plant operation - core not critical (Curve B), core critical (Curve C), and 54 EFPY hydrostatic / pressure test curve (Curve A), were developed applying a 1.3 multiplication factor to the fluence from 0 to 54 EFPY. The 36 and 40 EFPY hydrostatic / pressure testing curves (Curve A), were developed applying the 1.3 multiplication factor to the fluence above 33.4 EFPY. The neutron source distribution used in the calculations is based on the EPU equilibrium core, not on an extrapolation of the original licensed thermal power source distribution.

As noted in the LAR, in previous calculations the 1.3 factor was applied over the full assumed RPV lifetime (i.e., 0 EFPY through 54 EFPY), although the factor was established to account for potential fluence variation during *future cycles* of operation. For this analysis NSPM removed the 1.3 factor for the calculation of hydrostatic / pressure test curves (Curve A) between 0 EFPY and an assumed conservative EPU implementation value determined to be 33.4 EFPY. The basis for using 33.4 EFPY was the fluence accumulation on the vessel up to April 2011 (end of a cycle). This is reasonable as fluence is monitored every cycle and is known up to the current cycle. Therefore, the multiplication factor of 1.3 was applied only to the fluence values in future cycles (from 33.4 EFPY to 54 EFPY) as determined by the GEH methodology.

The fluence values for the components under EPU and EPU with MELLLA+ were compared to determine the ART and related P-T limits / curves, and the most

[1] This is the same fluence calculation discussed in Reference 10.

conservative values applied. The fluence associated with EPU operation was determined to be more conservative (higher fluence values) then that for EPU operation in the MELLLA+ domain, and hence, the EPU fluence values were applied to determine the P-T limits / curves in the PTLR.

Table A from the PTLR LAR (Reference 6) for 54 EFPY is reproduced below to demonstrate the limiting fluences between EPU and MELLLA+ conditions[2].

"Table A - Comparison of EPU and MELLLA+ Fluences

Area/Component	*Fluence in 10^{18} n/cm^2*		*Elevation from BAF (inches)*
	EPU	*EPU with MELLLA+*	
Upper/Intermediate Shell Plates 1-12/1-13	*0.406*	*0.395*	*158.6*
Lower/Intermediate Shell Plates 1-14/1-15	*6.43*	*6.39*	*N/A**
Lower Shell Plates 1-16/1-17	*4.46*	*4.43*	*27.1*
Limiting Weld – Beltline	*6.43*	*6.39*	*N/A**
Bounding N-2 Nozzle	*1.01*	*0.955*	*-3.2*

** Since these components are contained completely in the beltline region. The highest fluence value in the beltline or the peak fluence is used in the evaluation."*

In summary, a projected fluence calculation was performed for the EPU power level (2004 MWt) in accordance with the Regulatory Guide 1.190 compliant, NRC approved GEH fluence methodology. The fluence associated with EPU operation (not including MELLLA+) was determined to be the more limiting condition and was applied to determine the ART and related P-T limits / curves. This calculation was performed for the assumed fluence at the end of the renewed facility operating license period, i.e., 54 EFPY. The P-T curves discussed in the LAR were developed to apply to current MELLLA operation, at the current license thermal power level (1775 MWt), and to bound EPU / MELLLA+ operation, through the 20-year term of the Renewed Facility Operating License. The P-T curves apply at EPU and at EPU within the MELLLA+ operating domain.

[2] The term BAF used in Table A means bottom of active fuel.

The LAR also discusses testing results obtained from a surveillance capsule and development of hydrostatic/pressure test curves. These items were also considered in the development of the final P-T curves. See Reference 6 for detailed discussions of these items.

License Amendment 172

Based on the PTLR LAR (Reference 6) described above and one request for additional information (RAI) response dated December 7, 2012 (ADAMS Accession No. 12349A210), the NRC approved the requested changes to add a PTLR incorporating new P-T limit curves in a safety evaluation (SE) dated February 27, 2013 (Reference 1).

The NRC stated that

"The neutron fluence values were calculated in accordance with the NRC-approved method described in licensing topical report GEH-NEDO-32983-A, Revision 2 ... The NRC staff's SE in approving NEDO-32983-A concludes that the plant specific neutron fluence values calculated following this methodology would be adherent to the RG 1.190 guidance and hence acceptable. RG 1.190 provides guidance concerning the calculation of acceptable reactor pressure vessel neutron fluence values. Since the fluence calculations were performed in accordance with an NRC-approved methodology and using the guidance in RG 1.190, the NRC staff finds the fluence calculations acceptable insofar as they support the requested PTLR implementation.

The NRC staff notes that operation with an EPU and MELLLA+ is anticipated at MNGP. These operating domain changes cause the steady-state void fractions in the core to increase, reducing the neutron moderation and resulting in the neutron 'flux energy spectrum at the vessel wall to increase. The result is a slight increase to the reactor vessel neutron fluence above 1 MeV. Since the licensee's calculations include both this change and the multiplication factor of 1.3, the fluence values are conservative relative to operation in the currently licensed operating domain. This conservatism is acceptable to the NRC staff.

Operation in the MELLLA+ operating domain, in particular, is addressed by a separate NRC review activity. The NRC SE approving the MELLLA+ licensing topical report (NEDO-33006-A, Revision 3, "Maximum Load Line Limit Analysis Plus" (ADAMS Accession No. ML091800512)) states that demonstration of the performance of the reactor vessel materials will be dependent on plant-specific evaluations under MELLLA+ conditions using plant-specific design and as-built information."

Further, the NRC determined that the MNGP PTLR was developed from the template PTLR of the SIR-05-044-A report and meets the following seven technical criteria:

(1) The PTLR methodology describes the transport calculation methods including computer codes and formula used to calculate neutron fluences (Section 3.0, "Methodology," of the MNGP PTLR).

(2) The PTLR methodology describes the surveillance program (Appendix A, "Monticello Reactor Vessel Materials," of the MNGP PTLR).

(3) The PTLR methodology describes how the low temperature overpressure protection system limits are calculated applying system/thermal hydraulics and fracture mechanics (not applicable to boiling-water reactors).

(4) The PTLR methodology describes the method for calculating the ART values using RG 1.99, Revision 2 (Section 3.0, "Methodology," of the MNGP PTLR).

(5) The PTLR methodology describes the application of fracture mechanics in the construction of P-T limits based on ASME Code, Section XI, Appendix G, and the guidance in the NRC's Standard Review Plan (SRP). The MNGP PTLR provided information regarding the finite element analyses performed to generate part of the P-T limits. The submittal stated that the equations and values were calculated in accordance with the SIR-05-044-A report.

(6) The PTLR methodology describes how the minimum temperature requirements in Appendix G to 10 CFR Part 50 are applied to P-T limits for bolt-up temperature and hydrotest temperature (the MNGP PTLR stated that the P-T limits were calculated in accordance with the SIR-05-044-A report. This description is sufficient because the SIR-05-044-A report contained detailed information regarding the minimum temperature requirements for bolt-up temperature and hydrotest temperature.)

(7) The PTLR methodology describes how the data from multiple surveillance capsules are used in the ART calculation (Appendix A of the MNGP PTLR.)

Hence, the NRC staff found that implementation of the MNGP PTLR was acceptable.

Finally, the NRC concluded that the proposed MNGP PTLR meets the implementation guidance as specified in GL 96-03 and, therefore, is approved as part of the MNGP licensing basis. The MNGP RPV P-T limits are based on an acceptable methodology documented in the SIR-05-044-A report. The NRC staff performed independent evaluations and verified that the P-T limits were developed appropriately using the SIR-05-044-A methodology, and that the proposed P-T limits for 54 EFPY satisfy the requirements of Appendix G to Section XI of the ASME Code and Appendix G to 10 CFR Part 50.

Discussion

A fluence calculation was performed in accordance with RG 1.190 to determine the effects of the flux profile on the reactor vessel and its internals. The fluence calculation determined the projected fluence accumulation for the reactor vessel considering EPU power level (2004 MWt) to the end of the current operating license (54 EFPY /2030). The fluence calculation also considered EPU power levels with MELLLA+ operation to the end of the current operating license at 2004 MWt. Since the calculation was developed in accordance with RG 1.190, the fluence values for components used to determine adjusted reference temperature and related pressure-temperature limits and curves were compared in the fluence calculation and the most conservative value was used. For all components, the EPU-only fluence values were more conservative than the EPU/MELLLA+ fluence values and the EPU-only fluence values were used in the determination of the pressure-temperature limits and curves in the PTLR.

The use of a 1.3 multiplier on projected fluence is a conservative assumption of fluence for subsequent cycle operation. Additional conservatism is provided in that the EPU operation (and thus increased fluence level) was assumed to begin after the 2011 outage. Currently power ascension to full EPU operation has not occurred and can only be estimated to begin after approval of the EPU and MELLLA+ LARs which may occur at the earliest on or about October 2013.

From the fluence calculation, NSPM applied the SIA methodology report No. SIR-05-044-A, (Reference 9) for development of the P-T curves and the PTLR. SIR-05-044-A is an NRC approved methodology. In the SE for LA 172, the NRC found that NSPM implementation of the P-T curves and the PTLR was consistent with the NRC approved SIA methodology and met the requirements of RG 1.99, Revision 2.

Based on the use of approved methodologies for development of fluence values, the application of the methods to applicable regions of the vessel, the use of conservative inputs that bound EPU and MELLLA+ operation and the application of approved methodologies for development of the P-T curves and the PTLR, the NRC approved LA 172.

Conclusion

LA 172 supersedes the fluence and P-T limits discussion in the EPU and MELLLA+ LARs (and associated RAI responses). Since this LAR was developed later and addresses the MNGP specific criteria, NSPM has determined that this LA should be applicable to the EPU and MELLLA+ LARs. NSPM therefore, requests the NRC consider the calculations, analyses and supporting documentation used in development of the PTLR LAR as applicable to both the EPU and MELLLA+ LARs and cites the LA 172 approval as the P-T curve design and licensing bases for MNGP. Based on this conclusion the EPU and MELLLA+ license amendments should reference LA 172 as the basis for the MNGP P-T limits.

References

1. Letter from T A Beltz (NRC) to M A Schimmel (NSPM), "Subject: Monticello Nuclear Generating Plant – Issuance of Amendment to Revise and Relocate Pressure Temperature Curves to a Pressure Temperature Limits Report (TAC No. ME7930)," dated February 27, 2013. (ADAMS Accession No. ML13025A155)
2. Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "License Amendment Request: Extended Power Uprate (TAC MD9990)," L-MT-08-052, dated November 5, 2008. (ADAMS Accession No. ML083230111)
3. Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "License Amendment Request: Maximum Extended Load Line Limit Analysis Plus," TAC ME3145, L-MT-10-003, dated January 21, 2010. (ADAMS Accession No. ML100280558)
4. Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "Xcel Energy Request for NRC Concurrent Review of Monticello Nuclear Generating Plan Maximum Extended Load Line Limit Analysis Plus (MELLLA+) License Amendment Request (LAR) with MNGP Extended Power Uprate (EPU) LAR Review Delay," L-MT-09-100, dated October 28, 2009. (ADAMS Accession No. ML093030035)
5. Letter from J G Giitter (NRC) to T J O'Connor (NSPM), "Subject: Monticello Nuclear Generating Plant – Linking of the Proposed Extended Power Uprate Amendment and the MELLLA+ Amendment (TAC Nos. MD9990 and ME2449)," dated November 23, 2009. (ADAMS Accession No. ML093160816)
6. Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "License Amendment Request: Revise and Relocate Pressure Temperature Curves to a Pressure Temperature Limits Report," L-MT-12-002, dated January 20, 2012. (ADAMS Accession No. ML12033A175)
7. U.S. NRC Generic Letter 96-03, "Relocation of the Pressure Temperature Limit Curves and Low Temperature Overpressure Protection System Limits," dated January 31, 1996.
8. TSTF-419-A, "Revise PTLR Definition and References in ISTS [Improved Standard Technical Specifications] 5.6.6, RCS [Reactor Coolant System] PTLR."
9. SIR-05-044-A, "Pressure-Temperature Limits Report Methodology for Boiling Water Reactors," dated April 2007.
10. Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "Subject: Monticello MELLLA+: Supplemental Information Needed to Complete The Acceptance Review, (TAC ME3145)," L-MT-10-017, dated March 4, 2010. (ADAMS Accession No. ML100710445)