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September 14, 2016

L-MT-16-041
10 CFR 50.90

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

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

License Amendment Request for AREVA Extended Flow Window
Supplement to Address Power Distribution Uncertainties (TAC No. MF5002)

References: 1) Letter from Karen D. Fili (NSPM), to Document Control Desk (NRC), "License Amendment Request for AREVA Extended Flow Window," L-MT-14-044, dated October 3, 2014 (ADAMS Accession No. ML14283A125)

In Reference 1, Northern States Power Company, a Minnesota corporation (NSPM) doing business as Xcel Energy, requested approval of an amendment to the Monticello Nuclear Generating Plant (MNGP) Renewed Operating License (OL) and Technical Specifications (TS). The proposed change would revise MNGP TS and would approve certain analytical methods that together would support operation in the expanded power-flow operating domain described as the Extended Flow Window (EFW). The purpose of the requested amendment is to transition from the General Electric methodology called Maximum Extended Load Line Limit Analysis Plus (MELLLA+) to the AREVA methodology called EFW.

In a series of discussions with Xcel Energy, NRC Staff requested resolution of two topics related to power distribution uncertainties. These two topics derive from the Conditions and Limitations in a General Electric – Hitachi (GEH) topical licensing report for safety analysis of operations in the extended operating domain (e.g., Maximum Extended Load Line Limit Plus). The purpose of this letter is to provide resolution of these two Limitations (designated 9.5 and 9.23) and propose associated revision to the TS.

Enclosure 1 provides proposed resolution of Limitations 9.5 and 9.23.

Enclosure 2 provides description and justification of the proposed TS changes associated with the resolution of Limitation 9.5.

Enclosure 3 provides a markup of TS Safety Limit 2.1.1 to describe the TS changes associated with the resolution of Limitation 9.5.

Enclosure 4 provides a markup of TS Bases 2.1.1 for information only.

The information offered herein does not affect the conclusions of the No Significant Hazards Consideration and the Environmental Consideration evaluations provided in the Reference 1 license amendment request.

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

If there are any questions or if additional information is needed, please contact Glenn Adams at 612-330-6777.

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: September 14, 2016

Peter A. Gardner
Site Vice President, Monticello Nuclear Generating Plant
Northern States Power Company-Minnesota

Enclosures (4)

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

ENCLOSURE 1

RESOLUTION OF LIMITATIONS 9.5 AND 9.23

Background:

To support Monticello Nuclear Generating Plant (MNGP) operation in the extended power-flow operating domain that is called Maximum Extended Load Line Limit Analysis – Plus (MELLLA+), MNGP license amendment 180 applied the methodologies of the approved licensing topical report (LTR) NEDC-33173 and the Limitations and Conditions (hereafter, "Limitations") described in the associated NRC Safety Evaluation (SE) (Reference 1). Insofar as that LTR and SE provide a framework that may be applied to the Extended Flow Window (EFW) and AREVA methods, Xcel Energy described the applicability of the Limitations in a letter to NRC dated August 26, 2015 (Reference 2). The applicability of two specific Limitations (9.5 and 9.23) is revised in the discussion below.

Limitation 9.5 states: For operation at MELLLA+, including operation at the EPU [Extended Power Uprate] power levels at the achievable core flow statepoint, a 0.03 value shall be added to the cycle-specific SLMCPR [Safety Limit Minimum Critical Power Ratio] value.

Revised Evaluation of Applicability: Insofar as this adder was based on the uncertainty associated with core dynamics created at power-flow ratios in the extended operating domain (i.e., power-flow ratio exceeding 42 MWt/Mlb/hr), and the penalty of 0.03 would limit operations in the second half of MNGP operating cycles with AREVA fuel, Xcel Energy is proposing a Technical Specification (TS) revision to apply the penalty only when the power-flow ratio exceeds the prescribed threshold in the Extended Flow Window (EFW) domain. This proposed TS revision is described in Enclosure 2 of this submittal. The proposed power-flow ratio threshold is supported by Reference 6.

Limitation 9.23 states: In the first plant-specific implementation of MELLLA+, the cycle-specific eigenvalue tracking data will be evaluated and submitted to NRC to establish the performance of nuclear methods under the operation in the new operating domain. The following data will be analyzed:

- Hot critical eigenvalue
- Cold critical eigenvalue
- Nodal power distribution (measured and calculated TIP [Traversing Incore Probe] comparison)
- Bundle power distribution (measured and calculated TIP comparison)
- Thermal margin

- Core flow and pressure drop uncertainties, and
- The MIP [MCPR Importance Parameter] Criterion (e.g., determine if core and fuel design selected is expected to produce a plant response outside the prior experience base).

Provision of evaluation of the core-tracking data will provide the NRC staff with bases to establish if operation at the expanded operating domain indicates: (1) changes in the performance of nuclear methods outside the Extended Power Uprate (EPU) experience base; (2) changes in the available thermal margins; (3) need for changes in the uncertainties and NRC-approved criterion used in the SLMCPR methodology; or (4) any anomaly that may require corrective actions.

Revised Evaluation of Applicability: This Limitation requests the first reactor plant to implement the extended operating domain to evaluate and submit cycle-specific eigenvalue data. The requirements of this Limitation should not be applied to MNGP EFW operation for the same reasons that they were not applied to MNGP MELLLA+ operation. The two predominant reasons are described in Reference 5 and are unaffected by the change in fuel design and the fact that EFW implementation has no effect on reactor output and TIP measurement function. Due to its low power density and low power-flow ratio (both of which are unaffected by the AREVA fuel transition), the MNGP reactor does not provide meaningful information for the eigenvalue tracking required by Limitation 9.23. At EPU conditions, MNGP has a lower power density (i.e., 48.3 kilowatts/liter) compared to other boiling water reactors, per Reference 1. Furthermore, at the extreme of the EFW operating domain (at 100% power), MNGP also has a comparatively low power-to-flow ratio of 43.5 MWt/Mlb/hr. Typical MNGP operation (85%-95% flow) results in power-to-flow ratios of 36.6 - 40.9 MWt/Mlb/hr.

References:

1. GE-Hitachi, Final SE for NEDC-33173P, "Applicability of GE Methods to Expanded Operating Domains," dated July 21, 2009 (ADAMS Accession No. ML083520464). This SE is an enclosure to NEDC-33173 Revision 4
2. Letter from Peter A. Gardner (NSPM) to Document Control Desk (NRC), "License Amendment Request for AREVA Extended Flow Window Supplement to Respond to NRC Staff Questions (TAC No. MF5002)," dated August 26, 2015 (ADAMS Accession No. ML15348A221)
3. EMF-2158(P)(A), October 1999, "Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2"
4. Not used
5. General Electric – Hitachi letter MFN 15-066 dated August 26, 2015 (ML15238A687)
6. NRC letter to General Electric - Hitachi, Final Safety Evaluation for GE Hitachi Nuclear Energy Americas Topical Report NEDC-33173P, Revision 2 and Supplement 2, Parts 1-3, "Analysis of Gamma Scan Data and Removal of Safety

Limit Minimum Critical Power Ratio (SLMCPR) Margin" (TAC No. ME1891), ADAMS Accession No. ML113340215

ENCLOSURE 2

DESCRIPTION AND JUSTIFICATION OF PROPOSED TS REVISION

1.0 Detailed Description of Proposed Change to TS 2.1.1, Reactor Core SLs:

The proposed change to TS 2.1.1 increases the value of Safety Limit Minimum Critical Power Ratio (SLMCPR) for AREVA analysis methods when the ratio of core power to core flow equals or exceeds 42 megawatts thermal per million pounds per hour (MWt/Mlb/hr) in the Extended Flow Window (EFW) operating domain. To make this change, TS 2.1.1.2 was divided into two separate sections (2.1.1.2 and 2.1.1.3) to improve clarity. Specific changes are described as follows:

- Proposed TS 2.1.1.2 was modified to be dedicated solely to the safety limit that applies for GEH methods. The content of this specification is unchanged.
- Proposed TS 2.1.1.3.a is dedicated to explaining the safety limit that applies for AREVA methods at operations not in the EFW domain.
- Proposed TS 2.1.1.3.b is dedicated to explaining the safety limit that applies for AREVA methods below the 42 MWt/Mlb/hr threshold.
- Proposed TS 2.1.1.3.c is dedicated to explaining the safety limit that applies for AREVA methods at or above the 42 MWt/Mlb/hr threshold.
- Proposed TS 2.1.1.4 is current TS 2.1.1.3, renumbered. The content of this specification is unchanged.

Markups of the Technical Specifications are provided in Enclosure 3 to this submittal.

2.0 Justification for Proposed Changes:

- The uncertainties in monitoring the core operating state and the procedures used to calculate critical power are used to establish the SLMCPR. In the proposed site-specific TS change (TS 2.1.1.3.b and 2.1.1.3.c), a core power / core flow ratio of 42 MWt/Mlb/hr (in the EFW domain) serves as the threshold above which the penalty provided in Reference 4.1 must be added to the SLMCPR that is otherwise supported by AREVA analysis methods. That report confirmed validity of this threshold based on boiling water reactor gamma scan data and invoked this threshold in revised Limitation 9.5 of the Safety Evaluation. This threshold is appropriate for MNGP because it represents a sufficiently high power / flow ratio that is outside the normal

range of plant maneuvering. In this way, the SLMCPR adder will not normally affect full power operation.

- In the proposed site-specific TS change (TS 2.1.1.3.b), the SLMCPR for operation (1.15) that is prescribed for operation below the power / flow threshold reflects the MCPR value calculated for the representative transition core and does not include any additional penalty for power distribution uncertainties beyond those inherent in the AREVA safety analysis methodology. This is justified because of confidence in power distribution errors at lower power-flow ratios, particularly for low power-density plants (such as MNGP). While determining the effect of power distribution uncertainties (using gamma scan information from higher power density plants), Reference 4.1 found that the need for a penalty was reduced below the power / flow ratio (42 MWt/Mlb/hr). Whereas Reference 4.1 imposed a generic adder of 0.01 (to General Electric – Hitachi methods) in this regime, that adder was based on gamma scan data from reactors with much higher power density cores. Furthermore, in MNGP License Amendment 188 (transition to AREVA fuel operating at EPU conditions), it was shown that no penalty/adder was required at power-flow ratios representative of Extended Power Uprate (EPU).

- In the proposed site-specific TS change (TS 2.1.1.3.c), the SLMCPR (1.19) that is prescribed for operation above the power-flow threshold in the EFW region reflects the MCPR value calculated for the representative transition core with an additional penalty of 0.03 for power distribution uncertainties beyond those inherent in the AREVA safety analysis methodology. This adder is an appropriate value based on Reference 4.2, and provides additional margin beyond that in Reference 4.1.

- In the proposed site-specific TS change (TS 2.1.1.3.a), the SLMCPR for single-loop operation (1.20) in the MELLLA region reflects the MCPR value calculated for the representative transition core and does not include any additional penalty for power distribution uncertainties beyond those inherent in the AREVA safety analysis methodology because single-loop operation is prohibited in that TS region where the adder would otherwise apply (i.e., in the EFW domain).

The proposed change may be implemented through the power and flow dependent Operating Limit MCPRs (OLMCPRs). Power and flow dependent OLMCPRs are established to protect the SLMCPR during normal operation or an anticipated operational occurrence (AOO). OLMCPRs are established such that they are greater than or equal to the sum of the SLMCPR and the largest change in CPR for any AOO. With the proposed change, the SLMCPR will have a different value depending on where the plant is operating on the power/flow map. OLMCPRs are established to protect the SLMCPR applicable to the steady state

conditions prior to the AOO or to protect the SLMCPR applicable to the steady state conditions after the AOO, whichever SLMCPR is larger. For AOOs which result in a scram, the SLMCPR applicable to the steady state conditions prior to the AOO is added to the change in CPR during the AOO.

3.0 Regulatory Evaluation:

10 CFR 50.36(c)(1) requires TS to include Safety Limits, and precedent has clearly established MCPR as an appropriate Safety Limit for boiling water reactors. Creating a Power-Flow ratio threshold to define the applicability of a penalty / adder to that SL is thereby appropriate TS content as well. Therefore, the proposed TS change comports with the regulatory requirements of 10 CFR 50.36.

4.0 References:

4.1 NRC letter to General Electric - Hitachi, Final Safety Evaluation for GE Hitachi Nuclear Energy Americas Topical Report NEDC-33173P, Revision 2 and Supplement 2, Parts 1-3, “Analysis of Gamma Scan Data and Removal of Safety Limit Minimum Critical Power Ratio (SLMCPR) Margin,” dated March 15, 2012 (TAC No. ME1891), ADAMS Accession Nos. ML113340215, ML113340123, ML113340474, ML113340473

4.2 GE-Hitachi, Final SE for NEDC-33173P, “Applicability of GE Methods to Expanded Operating Domains,” dated July 21, 2009 (ADAMS Accession No. ML083520464). This SE is an enclosure to NEDC-33173 Revision 4

ENCLOSURE 3

MARKUP OF TECHNICAL SPECIFICATIONS

2 page follows

2.0-1
Inserts

2.0 SAFETY LIMITS (SLs)

2.1 SLs

2.1.1 Reactor Core SLs

2.1.1.1 With the reactor steam dome pressure < 686 psig or core flow < 10% rated core flow (GEH methods):

or

With the reactor steam dome pressure < 586 psig or core flow < 10% rated core flow (AREVA methods):

THERMAL POWER shall be ≤ 25% RTP.

~~2.1.1.2~~ ~~With the reactor steam dome pressure ≥ 686 psig and core flow ≥ 10% rated core flow (GEH methods):~~

~~or~~

~~With the reactor steam dome pressure ≥ 586 psig and core flow ≥ 10% rated core flow (AREVA methods):~~

~~MCPR shall be ≥ 1.15 for two recirculation loop operation or ≥ 1.15 for single recirculation loop operation.~~

Insert new sections 2.1.1.2 and 2.1.1.3

~~2.1.1.3~~ Reactor vessel water level shall be greater than the top of active irradiated fuel.

2.1.1.4

2.1.2 Reactor Coolant System Pressure SL

Reactor steam dome pressure shall be ≤ 1332 psig.

2.2 SL VIOLATIONS

With any SL violation, the following actions shall be completed within 2 hours:

2.2.1 Restore compliance with all SLs; and

2.2.2 Insert all insertable control rods.

Insert to TS

2.1.1.2 With the reactor steam dome pressure ≥ 686 psig and core flow ≥ 10% rated core flow (GEH methods) MCPR shall be ≥ 1.15 for two recirculation loop operation or ≥ 1.15 for single recirculation loop operation.

2.1.1.3 With the reactor steam dome pressure ≥ 586 psig, core flow ≥ 10% rated core flow (AREVA methods):

a. For operation not in the EFW domain, MCPR shall be ≥ 1.15 for two recirculation loop operation, or ≥ 1.20 for single recirculation loop operation,

or

b. For operation in the EFW domain and the ratio of power to core flow < 42 MWt/Mlb/hr, MCPR shall be ≥ 1.15,

or

c. For operation in the EFW domain and the ratio of power to core flow ≥ 42 MWt/Mlb/hr, MCPR shall be ≥ 1.19.

ENCLOSURE 4

MARKUP OF TECHNICAL SPECIFICATION BASES

3 pages follow

B2.1.1-4
B2.1.1-6
Inserts

BASES

and 2.1.1.3

APPLICABLE SAFETY ANALYSES (continued)

2.1.1.2 MCPR

The fuel cladding integrity SL is set such that no significant fuel damage is calculated to occur if the limit is not violated. Since the parameters that result in fuel damage are not directly observable during reactor operation, the thermal and hydraulic conditions that result in the onset of transition boiling have been used to mark the beginning of the region in which fuel damage could occur. Although it is recognized that the onset of transition boiling would not result in damage to BWR fuel rods, the critical power at which boiling transition is calculated to occur has been adopted as a convenient limit. However, the uncertainties in monitoring the core operating state and in the procedures used to calculate the critical power result in an uncertainty in the value of the critical power. Therefore, the fuel cladding integrity SL is defined as the critical power ratio in the limiting fuel assembly for which more than 99.9% of the fuel rods in the core are expected to avoid boiling transition, considering the power distribution within the core and all uncertainties.

The MCPR SL is determined using a statistical model that combines all the uncertainties in operating parameters and the procedures used to calculate critical power.

For operating cycles using AREVA safety analysis methods, the probability of the occurrence of boiling transition is determined using the approved AREVA correlations. For such operating cycles, References 8, 9, 10, and 11 describe the uncertainties and methodologies used in determining the MCPR SL.

Insert A (next page)

For operating cycles using GEH safety analysis methods, the probability of the occurrence of boiling transition is determined using the approved General Electric Critical Power correlations. Details of the fuel cladding integrity SL calculation are given in Reference 2. Reference 3 includes a tabulation of the uncertainties used in the determination of the MCPR SL and of the nominal values of the parameters used in the MCPR SL statistical analysis.

2.1.1.4

2.1.1.3 Reactor Vessel Water Level

During MODES 1 and 2 the reactor vessel water level is required to be above the top of the active irradiated fuel to provide core cooling capability. With fuel in the reactor vessel during periods when the reactor is shut down, consideration must be given to water level requirements due to the effect of decay heat. If the water level should drop below the top of the active irradiated fuel during this period, the ability to remove decay heat is reduced. This reduction in cooling capability could lead to elevated cladding temperatures and clad perforation in the event that the

BASES

REFERENCES (continued)

7. Amendment No. 185, “Issuance of Amendment to Reduce the Reactor Steam Dome Pressure Specified in the Reactor Core Safety Limits,” dated November 25, 2014. (ADAMS Accession No. ML14281A318)

8. EMF-2209(P)(A) Revision 3, “SPCB Critical Power Correlation”, AREVA NP, September 2009.

9. EMF-2245(P)(A) Revision 0, “Application of Siemens Power Corporation’s Critical Power Correlations to Co-Resident Fuel,” Siemens Power Corporation, August 2000.

10. ANP-10298P-A Revision 1, “ACE/ATRIUM 10XM Critical Power Correlation,” AREVA, March 2014.

11. ANP-10307PA, Revision 0, “AREVA MCPR Safety Limit Methodology for Boiling Water Reactors,” AREVA NP, June 2011.

12. Amendment No. 188, “Issuance of Amendment to Transition to AREVA ATRIUM 10XM Fuel and AREVA Safety Analysis Methods,” dated June 5, 2015. (ADAMS Accession Nos. ML15072A141, ML15154A477, and ML15072A135)

Insert new references 13 and 14 from attached page.

Insert A to TS Bases:

However, based on reduced confidence in power distribution uncertainties in the extended operating domain (Extended Flow Window), TS Safety Limit 2.1.1.3.c includes a penalty of 0.03 that must be added to the SLMCPR (i.e., the SLMCPR calculated with AREVA methods and uncertainties) when the ratio of core power to core flow equals or exceeds 42 MWt/Mlb/hr in the EFW domain. This threshold is provided in Reference 13, and the basis for the 0.03 penalty is provided in Reference 14. This threshold is appropriate for MNGP because it represents a sufficiently high power-flow ratio that is outside the normal range of plant maneuvering. In this way, the SLMCPR adder (0.03) will not adversely affect full power operation. The adder (0.03) is not imposed on single-loop operation because single-loop operation is prohibited in the EFW region.

Insert New References:

13. NRC letter to General Electric - Hitachi, Final Safety Evaluation for GE Hitachi Nuclear Energy Americas Topical Report NEDC-33173P, Revision 2 and Supplement 2, Parts 1-3, "Analysis of Gamma Scan Data and Removal of Safety Limit Minimum Critical Power Ratio (SLMCPR) Margin" (TAC No. ME1891), ADAMS Accession No. ML113340215
14. GE-Hitachi, Final SE for NEDC-33173P, "Applicability of GE Methods to Expanded Operating Domains," dated July 21, 2009 (ADAMS Accession No. ML083520464). This SE is an enclosure to NEDC-33173 Revision 4