Xcel Energy®

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

May 16, 2013

L-MT-13-046
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

License Amendment Request for Fuel Storage Changes
Supplement to Respond to NRC Staff Requests for Additional Information (TAC ME9893)

References:
1) Letter from M A Schimmel (NSPM) to Document Control Desk (NRC), "License Amendment Request For Fuel Storage Changes," L-MT-12-076, dated October 30, 2012 (ADAMS Accession No. ML12307A433).
2) Email from T A Beltz (NRC) to G D Adams (NSPM), "Monticello Nuclear Generating Plant – Requests for Additional Information Re: License Amendment Request to Support Fuel Storage Changes (TAC No. ME9893)", dated April 22, 2013 (ADAMS Accession No. ML13113A420).

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 reflect fuel storage system changes and a revised criticality safety analysis that addresses the legacy fuel types in addition to the new AREVA ATRIUM™ 10XM fuel design.

In Reference 2, the NRC sent a request for additional information (RAI) concerning the letter sent by NSPM in Reference 1.

The enclosure to this letter provides the NSPM response to the NRC RAIs.

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.

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 contains two new commitments:

Commitment	Due Date
1. Perform a neutron attenuation test of Spent Fuel Pool (SFP) Coupon Set 7 to demonstrate that the minimum boron-10 areal density assumed in the criticality analysis is available in the SFP storage racks.	12/31/2015
2. Implement a SFP Boral performance program document that requires dimensional / visual examination and neutron attenuation testing on Coupon Set 7 on an interval not to exceed 10 years.	12/31/2015

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

Executed on: May 16, 2013

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

Enclosure

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

ENCLOSURE

MONTICELLO NUCLEAR GENERATING PLANT

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION FROM THE STEAM GENERATOR TUBE INTEGRITY AND CHEMICAL ENGINEERING BRANCH (ESGB)

This enclosure provides responses from the Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy, to a request for additional information (RAI) provided by the Nuclear Regulatory Commission (NRC) on April 22, 2013.

The NRC questions are provided below in *italic font* and the NSPM response is provided in the normal font.

Xcel Energy states in its application that a uniform 0.055 inch void region is used in the criticality safety analysis as a conservative model for potential blistering of Boral. Please provide a response to the following:

1. *Provide justification for why a uniform 0.055 inch void region is conservative.*

   NSPM Response

   The effect of a uniform 0.055" void region has been represented in the final value of neutron multiplication factor ($k_{95/95}$) for the Monticello spent fuel storage system. Application of this void displaces absorber in the calculation with a net increase in reactivity of 0.004 +/- 0.001 Δk. The application of this uniform void to the final $k_{95/95}$ value is considered conservative for current pool conditions because Monticello's Boral coupon inspections to date have indicated no blistering for stainless steel clad Boral. (See Reference 1-1 response RAI 3.5.2.1.15-1).

   As indicated in the footnote in Section 7.4.3 of the criticality analysis (Enclosure 3 of Reference 1-2) the assumed uniform void represents a larger void region than would exist if every 1.25" x 1.25" unit cell on one side of the Boral plate contained a 1.25 inch diameter blister protruding 1/8 inch high. The blister size was chosen as the largest typical blister size identified by the manufacturer (page 13 of Reference 1-3). A larger-than-expected blister population (compared to the representative distribution for 1970 vintage Boral shown in Figure 3-10 of Reference 1-4) and its application to all Boral plates in the spent fuel pool are further conservatisms used in the generation of this penalty.

References:

1-1 L-MT-05-114, Supplement to Responses to Requests for Additional Information Regarding the Monticello Nuclear Generating Plant License Renewal Application (TAC No. MC6440), November 17, 2005, (ADAMS Accession No. ML053250099).

1-2 L-MT-12-076, Monticello Nuclear Generating Plant Docket 50-263, Licensing Amendment Request for Fuel Storage Changes, October 30, 2012, (ADAMS Accession No. ML12307A433).

1-3 AAR Report 1829 Revision 0, Topical Report, Credit for 90% of the ^{10}B in BORAL, October 27, 2004 (ADAMS Accession No. ML043380351).

1-4 EPRI TR-1025204, Strategy for Managing the Long Term Use of Boral in Spent Fuel Storage Pools, July 2012.

2. *What acceptance criterion will be used to determine if the blistered volume of a Boral panel meets or exceeds a uniform 0.055 inch void region?*

NSPM Response

Dimensional examinations will be performed on the stainless steel clad coupons which are representative of the actual rack design. The measurement will be performed to ensure that average coupon thickness does not exceed the nominal design thickness of the coupon plus the 0.055-inch dimension. SFP storage rack design and coupon design make no provision for space between the Boral panel and the surrounding stainless steel. Therefore, any blister formation would be directly manifest as a thicker dimension of the coupon.

3. *Describe how Xcel Energy will determine if this acceptance criterion is being met?*

NSPM Response

The acceptance criterion will be checked during scheduled dimensional checks at a frequency determined by program trends. The dimensional examinations will be taken at locations to be prescribed in the program document. The locations will cover the representative part of the coupon (i.e., over the stainless steel cladding and Boral) using a calibrated micrometer and/or caliper.

4. *If the acceptance criterion is not met, describe what additional actions may be taken.*

NSPM Response

Any clad coupon exhibiting a thickness measurement averaged over the prescribed locations of the coupon area that exceeds the acceptance criterion (described in reply to Question 2 above) will result in a failed test that will be identified in the Corrective Action Program (CAP). Corrective actions may include the cessation of fuel movement into a SFP storage rack until the condition is addressed in the CAP.

The coupon may also be reviewed in a more comprehensive manner, using measurement of actual blisters on the coupon (height, diameter, and distribution) to ensure that the measured condition is bounded by the blister height, diameter, and distribution described in the criticality analysis. An acceptable condition may be demonstrated by completion of neutron attenuation testing performed on the coupon which demonstrates a B-10 areal density that exceeds the value assumed in the criticality analysis.

The NRC staff requests the following information:

5. *When was the last time a neutron attenuation test was performed (in-situ or coupon) for the Boral in the MNGP spent fuel pool?*

   NSPM Response

   As described in Reference 5-1 (in Enclosure 1, page 7 of that letter), neutron attenuation testing was last performed on Coupon Set 6, which was removed in August 2000. A review of plant documents indicates that no in-situ neutron attenuation test has ever been performed.

   References:
   5-1 L-MT-05-099, Response to Three Requests for Additional Information Regarding the Monticello License Renewal Application (TAC No. MC6440), dated September 16, 2005 (ADAMS Accession No. ML052630320).

6. *When is the next planned neutron attenuation test at MNGP?*

   NSPM Response

   In Reference 1-1 (in response to RAI 3.5.2.1), it was stated that MNGP would test the remaining coupons sometime during the period of extended operation. Accordingly, the applicable implementing procedure suggested the testing be performed in April, 2020.

   However, to be responsive to increasing regulatory concerns about Boral integrity, the next neutron attenuation test will be performed prior to December 31, 2015. This examination and test will be performed on the remaining coupon set (Coupon Set 7).

7. *Your application states that Boral integrity is managed using the Water Chemistry Aging Management Program and One-time Inspection Program as described in NUREG-1865. While the use of Industry and historical plant operating experience is useful for informing a neutron absorbing material aging management program, it is not an adequate replacement for physical testing. Additionally, your Water Chemistry Aging Management Program does not include neutron attenuation testing. The concern is how MNGP will continue to monitor and mitigate any*

degradation or deformation of your Boral so that it will not reduce the neutron attenuation capability of the material in the future.

a. *Discuss whether you plan on performing in-situ neutron attenuation testing on the Boral panels installed in the spent fuel pool? If so, provide the frequency, acceptance criteria, and proposed corrective actions should the acceptance criteria not be met after a given test.*

NSPM Response

NSPM has no plan to implement in-situ neutron attenuation testing. Based on more than 32 years of satisfactory operating experience of the MNGP storage racks and the favorable examination / test results on representative coupon sets (as documented in References 1-1 and 5-1), the MNGP Boral program will continue to use its remaining coupon set to monitor site-specific Boral integrity. This program will include neutron attenuation testing at an appropriate interval determined by the program, but not to exceed 10 years.

b. *Alternatively, if in-situ testing will not be performed, describe the method you will use to detect any degradation, deformation, or reduction in neutron attenuation capability of your Boral, and what actions will be taken to monitor and mitigate future degradation, deformation, or reduction in neutron attenuation capability.*

NSPM Response

The Boral performance program will continue to use the remaining coupon set to monitor the SFP rack Boral for degradation, deformation, or reduction in neutron attenuation capability. These tests will be non-intrusive such that the integrity of the coupon set as a representative surrogate for the racks' Boral will not be compromised. The program documents are being generated or revised to include inspection and testing specifications. The following elements will be performed at an interval not to exceed 10 years:

1. **Measurement of coupon dimensions, including thickness.** Each coupon in the set will be measured for overall dimensions and thickness, and compared to a baseline. As discussed above (in reply to Question 2), the acceptance criterion of 0.055 inch plus nominal cladding thickness will be applied to the stainless steel-clad coupons. In addition, all coupons will be measured and data recorded for trending purposes and evaluation. Any significant trend in thickness changes will be evaluated in accordance with the Corrective Action Program. If these measured dimensions do not change significantly, they are a strong indicator that Boral is intact and providing its design basis neutron attenuation capability.
2. **Visual examination of coupon surface for blemishes and blisters.** The exposed surfaces of each coupon in the set will be visually examined for blemishes and blisters. Blemishes such as corrosion pits could be indication

of material loss that could lead to reduced neutron attenuation. Also, the character of any blister formation would be recorded and reconciled with that assumed in the criticality analysis. Any significant blemishes would be characterized and evaluated in accordance with the Corrective Action Program.

3. **Neutron attenuation testing.** Each coupon in the set will be subjected to neutron attenuation testing at a qualified laboratory to determine the boron-10 areal density. The acceptance criterion for minimum areal density will be that value assumed in the criticality analysis (0.013 gm/cm^2). Any coupon that did not meet this acceptance criterion would be evaluated in accordance with the Corrective Action Program to determine if there is any impact on the SFP rack neutron attenuation capability.
4. **Weight.** Each coupon in the set will be weighed and compared to the nominal coupon weight and any previous measurement. This weight measurement would help to identify any material loss that might be occurring under the stainless steel cladding. NSPM expects this measurement to be rather inaccurate (subject to the varying degrees of dryness that can be achieved without baking the coupons), and secondary to neutron attenuation testing as an indication of boron loss. Therefore, this parameter will be trended, but no acceptance criterion will be established. Any significant trend in weight reduction would be evaluated in accordance with the Corrective Action Program to determine if there is any impact on the neutron attenuation capability.

NSPM expects that the coupon set will be removed from the SFP for up to an 8-week period in the course of each testing campaign. This campaign will not make the coupon set unrepresentative in any way, as discussed below for each of the postulated drivers of degradation:

- **Neutron radiation.** The applicable literature does not identify neutron radiation as a potential degradation mechanism for Boral. Furthermore, based on the small amount of neutrons generated in a subcritical environment, there is insufficient neutron flux to postulate any credible depletion of the boron-10 in the racks' Boral. Even if the neutron flux were considered credible, the 8-week period of flux that the coupon set missed while in the laboratory would be insignificant compared to the depletion that it has already experienced over its 32 years of service (more than 1600 weeks).
- **Gamma radiation.** The applicable literature does not identify gamma radiation as a potential degradation mechanism for Boral. Even if the gamma flux were considered credible, the 8-week period of flux that the coupon set missed while in the laboratory would be insignificant compared to the flux that it has already experienced over its 32 years of service (more than 1600 weeks).
- **Corrosion.** After initial passivation of Boral, the principal drivers for subsequent corrosion would be an adverse change to SFP chemistry,

exposure to contaminants in the SFP, or exposure to air. Based on the ongoing SFP water chemistry program and limits on SFP water levels, none of these mechanisms will have significant effect on SFP materials in that short timeframe when the coupons are removed. More likely, the process of removing the coupon set from the SFP, drying it, and exposing it to air will artificially accelerate any corrosion mechanism beyond that which the SFP racks will experience. Therefore, the coupon sets will be conservatively representative of corrosion following the testing campaign.

- **Blistering.** As described in NUREG-1865, blistering / bulging was experienced in the first racks installed at MNGP until modifications to the stainless steel wrappers allowed the passivation gases to escape. After modification, no bulging has occurred in rack walls and no blistering has been witnessed in the examination of the first six SS-clad coupon sets. Therefore, there is no ongoing driver to blistering that Coupon Set 7 would be missing during the period of the testing campaign. The process of removing the coupon set from the SFP, drying it, and exposing it to air will artificially accelerate any blistering mechanism beyond that which the SFP racks will experience. Therefore, the coupon sets will be conservatively representative of blistering following the testing campaign.

In summary, the enhanced performance program will continue to re-use Coupon Set 7. As discussed above, it will be in the licensee's interest to perform this testing with minimal stress on the coupons. For example, any process to dry the coupons (to satisfy shipping requirements) will be performed in a slow and deliberate manner. These processes and the short time of the campaign will serve to keep the coupon set representative of the in-situ racks.