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February 15, 2024

L-MT-24-007 10 CFR 50.55a(z)

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

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

<u>Response to NRC Request for Additional Information on Proposed Inservice Inspection</u> <u>Alternative RR-002 for the Sixth Ten-Year ISI Interval (EPID L-2023-LLR-0036)</u>

- References: 1) NSPM letter to NRC, "10 CFR 50.55a(z)(1) Request Associated with the Monticello Sixth Inservice Inspection (ISI) Interval, RR-002," (L-MT-23-024) dated July 11, 2023 (ADAMS Accession No. ML23193A799)
  - NRC email to NSPM, "Monticello Request for Additional Information re: ISI RR-002 Alternative to Use IWB-2500(f) (EPID L-2023-LLR-0036)," dated January 20, 2024

Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM") submitted a 10 CFR 50.55a(z)(1) request associated with the Monticello Nuclear Generating Plant (MNGP) 6<sup>th</sup> 10-Year Inservice Inspection (ISI) Interval on July 11, 2023 (Reference 1). In that request, NSPM proposed an alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI, 2019 Edition, IWB-2500(f)(8) and IWB-2500(f)(9) that would allow reducing the number of volumetric inspections planned for MNGP reactor pressure vessel (RPV) nozzle-to-vessel welds and nozzle inner blend radius locations. This alternative would be in use during the 6<sup>th</sup> 10-Year ISI interval through September 8, 2030, the end of the current renewed license for MNGP.

On January 20, 2024, the NRC identified the need for additional information (Reference 2). The enclosure to this letter provides NSPM's response to Reference 2.

Please contact Mr. Ron Jacobson at 612-330-6542 or ronald.g.jacobson@xcelenergy.com if there are any questions or if further additional information is needed.

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#### Summary of Commitments

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

Gregory D. Brown

Plant Manager, Monticello Nuclear Generating Plant Northern States Power Company – Minnesota

Enclosure

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

#### RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI) ON PROPOSED INSERVICE INSPECTION ALTERNATIVE RR-002 FOR THE SIXTH TEN-YEAR ISI INTERVAL

## 1.0 BACKGROUND

Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM") submitted a 10 CFR 50.55a(z)(1) request associated with the Monticello Nuclear Generating Plant (MNGP) 6<sup>th</sup> 10-Year Inservice Inspection (ISI) Interval on July 11, 2023 (Reference 1). In that request, NSPM proposed an alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI, 2019 Edition, IWB-2500(f)(8) and IWB-2500(f)(9) that would allow reducing the number of volumetric inspections planned for MNGP reactor pressure vessel (RPV) nozzle-to-vessel (NV) welds and nozzle inner blend radius (IR) locations. This alternative would be in use during the 6<sup>th</sup> 10-Year ISI interval through September 8, 2030, the end of the current renewed license for MNGP.

On January 20, 2024, the NRC identified the need for additional information (Reference 2). This enclosure provides NSPM's response to Reference 2.

## 2.0 RESPONSES TO REQUESTS FOR ADDITIONAL INFORMATION

The NRC request information is repeated below in italics.

## RAI #RR-002-1

<u>Basis for Request</u>: The incoming web-based RR-002 request (for 6<sup>th</sup> 10-Year ISI interval) does not provide any information regarding the inspection results of past volumetric inspections that were performed on the nozzle-to-vessel welds and nozzle inner blend radius sections of the RPV N2 recirculation inlet nozzles, N3 main steam line nozzles, N5 core spray nozzles, N6 upper closure head spare nozzles, and N8 jet pump instrumentation nozzles during the 5th 10-Year ISI interval.

## Request, Part 1:

(a) Provide a summary of the past inspection results of all volumetric inspections performed on the nozzle-to-vessel welds and nozzle inner blend radius sections of the RPV N2 recirculation inlet nozzles, N3 main steam line nozzles, N5 core spray nozzles, N6 upper closure head spare nozzles, and N8 jet pump instrumentation nozzles during the 5<sup>th</sup> 10-Year ISI interval.

#### RESPONSE

Attachment 1 provides the component identification, system, examination year, and the result of those 5<sup>th</sup> 10-Year ISI interval examinations. There were no relevant indications or flaws identified in the B3.100 examinations performed during the 5<sup>th</sup> 10-Year ISI interval. One B3.90

relevant indication (RI) was evaluated for the N3C NV weld that was accepted per IWB-3512-1 of the 2007 Edition with 2008 Addenda ASME Section XI for the 5<sup>th</sup> ISI Interval.

(b) Provide quantitative data (as applicable) regarding detected flaw sizes (e.g., individual flaw length and depth data and, for probabilistic fracture mechanics (PFM) analysis objectives, number of flaws of specified flaw sizes falling within a particular PFM analysis flaw size range for the applicable PFM flaw distribution analysis).

#### <u>RESPONSE</u>

PFM flaw analysis of the N3C NV relevant indication is not required due to no relevant flaw conditions.

(c) Provide ASME-defined allowable flaw sizes for any relevant flaw conditions that were detected and recorded as part of the past volumetric inspections performed during the *5*<sup>th</sup> 10-Year ISI interval.

#### <u>RESPONSE</u>

No relevant flaw conditions were detected and recorded.

<u>Request, Part 2</u>: The NRC staff notes that RPV N1 recirculation outlet nozzles are not part of the RR-002, as the N1 recirculation outlet nozzles should be volumetrically inspected at a 100% accessible population basis. However, the inspection results of 5<sup>th</sup> interval inspections performed on both the N1 recirculation outlet nozzles and the N2 recirculation inlet nozzles would provide relevant information for the probabilistic flaw distribution integrity assessment of RPV nozzles covered in RR-002. As such, the NRC staff requests the following information regarding the past 5th interval inspections performed on N1 and N2 nozzle-to-vessel welds and nozzle inner blend radii locations.

(a) If flaws were detected in any of the specified N1 or N2 nozzle locations during the 5<sup>th</sup> interval inspections, demonstrate that the number of flaws and flaw sizes associated with the recordable indications in the applicable nozzle-to-vessel welds or nozzle inner blend radius locations are consistent with or bounded by the flaw distribution assumptions of the past PFM flaw distribution analysis that was performed as part of the Structural Integrity Associates (SIA) Calculation No. 1101463.301 basis.

## <u>RESPONSE</u>

No flaws were detected in any of the N1 or N2 nozzles during the 5<sup>th</sup> 10-Year ISI interval inspections.

(b) As part of this request, provide the flaw distribution data (i.e., size range data for analyzed flaw size ranges and maximum allowable number of flaws of particular sizes falling within the specified flaw size ranges) of the VIPERNOZ PFM flaw distribution analysis that was performed as part of the analysis bases for SIA Calculation No. 1101463.301.

The staff emphasizes that a response to Part 2 will only be necessary if relevant flaw indications were detected and recorded in any of the nozzle-to-vessel welds or nozzle inner blend radius sections of the set (i.e., reduced population) of the N1 recirculation outlet nozzles or the N2 recirculation inlet nozzles that were inspected during the past 5<sup>th</sup> 10-Year ISI interval.

## **RESPONSE**

No relevant flaw indications were detected during the 5<sup>th</sup> 10-Year ISI interval.

#### Request, Part 3

(a) Identify which PFM flaw distribution analysis is being applied to the flaws detected in the nozzle-to-vessel welds or nozzle inner blend radius sections of the specified RPV N3 main steam line nozzle, N5 core spray nozzle, N6 upper closure head spare nozzle, or N8 jet pump instrumentation nozzle type (i.e., if relevant flaw indications were detected in the weld or inner blend radius locations of the specified nozzle type during the inspections performed in the 5th 10-Year ISI interval).

#### RESPONSE

No relevant flaw indications were detected during the 5<sup>th</sup> 10-Year ISI interval.

(b) As part of the response, include considerations on whether a new, component-specific *PFM* flaw distribution analysis will need to be performed and docketed as part of RR-002 for a specified RPV N3, N5, N6, or N8 nozzle type if relevant flaw indications were detected in the nozzle-to-vessel welds or inner blend radius sections of the specified N3, N5, N6, or N8 nozzle type.

## <u>RESPONSE</u>

No relevant flaw indications were detected during the 5<sup>th</sup> 10-Year ISI interval. No additional PFM flaw distribution analysis is required since calculation 1101463.301 bounds the N3, N5, N6, and N8 nozzles for the period of extended operation.

(c) For detected flaw indications in the nozzle-to-vessel welds or nozzle inner blend radius locations of the RPV N3, N5, N6, or N8 nozzles, demonstrate that the number of flaws and flaw sizes associated with the recordable flaw indications are consistent with or bounded by the flaw distribution assumptions (i.e., data for analyzed flaw size ranges and allowable number of flaws of particular sizes falling within the specified <u>flaw</u> size ranges) of the PFM flaw distribution analysis used for the nozzle-to-vessel welds or nozzle inner blend radius sections of the specified nozzle type(s).

The staff emphasizes that a response to this RAI part will only be necessary if relevant flaw indications were detected and recorded in any of the nozzle-to-vessel welds or nozzle inner blend radius sections of the set (i.e., reduced population) of RPV N3, N5, N6, or N8 nozzles that were inspected during the past 5<sup>th</sup> 10-Year ISI interval.

#### <u>RESPONSE</u>

No relevant flaw indications were detected during the 5<sup>th</sup> 10-Year ISI interval.

## RAI #RR-002-2

<u>Basis for Request</u>: The RR-002 request (for 6<sup>th</sup> 10-Year ISI interval) does not clearly define whether additional information docketed with the prior RR-002 alternative for the 5<sup>th</sup> 10-Year ISI interval is applicable to, part of, and valid for the new RR-002 ISI alternative request for the 6<sup>th</sup> 10-Year ISI interval (i.e., references to the prior submittal records does not achieve this objective).

<u>Request Part 1</u>. In Section 17, "Applicable ASME Code Components and/or System Description," of RR-002, the licensee identifies that the scope of RR-002 for the MNGP 6<sup>th</sup> 10-Year ISI interval applies to the ASME Code Class 1 "N2, N3, N5, N6, and N8 Nozzle-to-shell welds and associated inner radius sections". However, the RR-002 alternative does not specify which types of RPV nozzles correlate to the N2, N3, N5, N6 and N8 nozzle designations. Attachment 1 of the previous RR-002 request for the 5<sup>th</sup> 10-Year ISI interval (i.e., in Attachment 1 of Xcel Energy Letter dated September 23, 2011; ML112720147) provided more detailed component scoping information by identifying that the applicable Class 1 nozzleto-vessel welds and associated inner blend radius sections are those associated with the following RPV nozzle types:

- The ten (10) RPV N2 recirculation inlet nozzles Component IDs N2A, N2B, N2C, N2D, N2E, N2F, N2G, N2H, N2J, and N2K
- The four RPV N3 main steam line nozzles Component IDs N3A, N3B, N3C, and N3D
- The two RPV N5 core spray nozzles Component IDs N5A and N5B
- The two RPV N6 closure head spare nozzles Component IDs N6A and N6B
- The two RPV jet pump instrumentation nozzles Component IDs N8A and N8B

Confirm whether the information regarding the prior nozzle descriptions, nozzle ID numbers, and nozzle populations provided in Attachment 1 of Xcel Energy Serial Letter No. L-MT-11-056 (ML112720147) is applicable to, part of, and valid for the new RR-002 alternative request for the 6<sup>th</sup> 10-Year ISI interval.

#### <u>RESPONSE</u>

The data set provided in Enclosure 1, Attachment 1 of the 5<sup>th</sup> 10-Year ISI interval request L-MT-11-056 (Reference 3) is applicable, part of, and valid for the 6<sup>th</sup> 10-Year ISI interval.

<u>Request Part 2</u>. The information in incoming web-based RR-002 does not specify how many (by number of nozzle locations) of the nozzle-to-shell welds and associated inner blend radius sections in the RPV N2, N3, N5, N6, and N8 nozzle types will be inspected during the portion of the 6<sup>th</sup> 10-Year ISI interval. The licensee provided this information in Table 5-1 of Enclosure 1 in the prior Xcel Energy L-MT-11-056 transmittal letter for the 5<sup>th</sup> 10-Year ISI interval (letter dated September 28, 2011; ML112720147). Confirm whether the total number of nozzle

inspections, as provided and identified in Table 5-1 of Enclosure 1 in the Xcel Energy Serial Letter No. L-MT-11-056 is still being applied to (i.e., applicable to, part of, and valid for) the new RR-002 alternative request for the 6<sup>th</sup> 10-Year ISI interval.

#### <u>RESPONSE</u>

The total number of nozzle inspections, as provided and identified in Table 5-1 of Enclosure 1 of Reference 3 will still be applied to the 6th 10-Year ISI interval RR-002.

<u>Request, Part 3</u>: The criteria in BWRVIP-108-A, "BWR Vessel and Internals Project, Technical Basis for Reduction of Inspection Requirements for Boiling Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Blend Radii" (ML19297F808 [non-public, proprietary version]; ML19297F806 [redacted, publicly available version]), specify that the risk-informed alternatives for reducing BWR RPV nozzle inspections be accompanied with a plant-specific PFM analysis that includes a probability of failure analysis for the applicable RPV nozzle types (covering the applicable nozzle-to-vessel welds and associate nozzle inner blend radius locations). For the prior RR-002 request that applied to the 5<sup>th</sup> 10-Year ISI interval, the licensee submitted the applicable PFM analysis as shown in SIA Calculation No. 1101463.301, "Monticello N2 Nozzle Code Case N-702 Relief Request," (ML12230A098) which was supplemented and included as an enclosure in the Xcel Energy email dated August 10, 2012 (ML12230A091).

(a) Confirm whether the PFM analysis in the docketed SIA No. 1101463.301 calculation is applicable to, part of, and valid for the new RR-002 ISI alternative request that applies to the 6<sup>th</sup> 10-Year ISI interval of the unit. If the SIA calculation is applicable, discuss the reason (with sufficient technical details) why the PFM analysis basis in the SIA No. 1101463.301 calculation is considered to be valid for the nozzle population in the current RR-002.

## <u>RESPONSE</u>

Yes, the PFM analysis in the docketed SIA No. 1101463.301 (Reference 4) is applicable to and valid for the 6<sup>th</sup> 10-Year ISI interval timeframe requested in Reference 1. The PFM analysis provided a justification of the reduction of in-service inspection of the nozzle-to-shell weld and the nozzle blend radii through the period of the MNGP renewed license, which ends on September 8, 2030 (through 54 Effective Full-Power Years [EFPY]/60 years). Design inputs for this justification provided in PFM Section 3.0, and the Assumptions of Section 4.0, remain valid. Additionally, verified in the 5th 10-Year ISI interval:

- No flaws found in the conduct of ISI program examinations on applicable B3.90 and B3.100 ASME code components.
- The End of Life Fluence input in the PFM Section 3 is more conservative than the updated 72EFPY/80 years estimate of 7.08x10<sup>17</sup> n/cm2 that has been determined in support of the ongoing MNGP Subsequent License Renewal
- As of June 2023, MNGP has done 156 start/shutdown cycles and is projected to do 176 by the end of the current renewed license, below the assumed 288 heat/shutdown cycles in the PFM Section 7.0

(b) Discuss why the selected lower bound  $K_{lc}$  fracture toughness value of 200 ksi $\sqrt{inch}$ , as shown in Section 4 of the SIA calculation, is considered to be a valid lower bound value for the PFM analysis, as this is based on the unirradiated material assumption in BWRVIP-108-A that the assessed BWR RPV nozzles will not have neutron fluence exposures in excess of 1.0 x  $10^{17}$  n/cm2 (E > 1.0 MeV) at the end of the period of interest. Confirm that use of the unirradiated  $K_{lc}$  value of 200 ksi $\sqrt{inch}$  is valid and can applied as the  $K_{lc}$  value for the nozzles in the current RR-002 in the licensee's PFM analysis. However, in contrast to this BWRVIP-108-A assumption, the N2 inlet nozzles are projected to have a limiting inside surface fluence exposure high enough as shown in Section 3 of the SIA calculation (i.e., 1.01 x 10<sup>18</sup> n/cm2 at 54 effective full power years) that could potentially challenge the selection, validity, and use of the 200 ksi $\sqrt{in}$  K<sub>lc</sub> value specified in SIA Calculation.

# <u>RESPONSE</u>

Adjusted Reference Temperature is an input to  $K_{IC}$  and the Adjusted Reference Temperature equations are taken from Regulatory Guide 1.99, "Radiation Embrittlement of Reactor Vessel Materials," Revision 2, which has fluence as an input. Therefore, the fracture toughness values used in the PFM are adjusted based on fluence levels. KIC values less than 200 ksi $\sqrt{nch}$  are used for calculation runs with higher fluence values in the PFM.

Request, Part 4: The criteria in BWRVIP-108-A include five criteria that, if met, would provide proper demonstration that PFM analyses of RPV recirculation inlet and outlet nozzle locations are bounding for the PFM analyses of other nozzles adjoined to the RPV such that PFM analysis considerations of the other RPV nozzle locations would not be necessary. For the prior RR-002 request that applied to the 5<sup>th</sup> 10-Year ISI interval, the licensee included the five appropriate criterion assessments in Attachment 2 of the Xcel Energy L-MT-11-056 letter dated September 28, 2011 (ML112720147). Additionally, the prior RR-002 request for the 5th 10-Year ISI interval did not include the N1 RPV recirculation outlet nozzles because the prior BWRVIP-108-A deterministic screening criteria assessments applied to the RPV recirculation outlet nozzles in the licensee's Letter No. L-MT-11-056 did not pass Screening Criterion 4 for the RPV recirculation outlet nozzles which required the calculated "(p\*r/t)/C<sub>RPV</sub>" parameter value < 1.15. For the 5<sup>th</sup> 10-Year ISI interval, the RPV recirculation outlet nozzle-to-vessel welds and inner blend radius sections were required to be inspected in accordance with the volumetric inspection requirements including 100% population and 10-year frequency criteria specified in ASME Section XI, Table IWB-2500-1, Examination Category B-D, Inspection Items B3.90 and B3.100.

(a) In relation to these Criteria assessments, confirm whether the previous five Criteria assessments in Attachment 2 of the licensee's L-MT-11-056 letter are still applicable to, part of, and valid for the new RR-002 that applies to the 6<sup>th</sup> 10-Year ISI interval.

## <u>RESPONSE</u>

The five criteria identified in Attachment 2 of the Reference 3 Enclosure 1 are valid for this relief request as required by IWB-2500(f). The 5<sup>th</sup> 10-Year ISI interval request L-MT-11-056 (Reference 3) and the SIA PFM analysis as shown in SIA Calculation No. 1101463.301 were

for the application of ASME Code Case N-702. That code case is now incorporated in the ASME BPV Section XI code, 2019 edition as IWB-2500(f):

- Criteria 1 [IWB-2500(f)(3)]: the Monticello Pressure and Temperature Limits Report (PTLR) specifies RPV heatup/cooldown rate less than or equal to 100°F per hour
- Criteria 2 [IWB-2500(f)(4)]: remains applicable and met for the recirculation inlet nozzles (N2)
- Criteria 3 [IWB-2500(f)(5)]: remains applicable and met for the recirculation inlet nozzles (N2)
- Criteria 4 [IWB-2500(f)(6)]: is not met for the recirculation outlet nozzles (N1) and these nozzles will remain subject to inspection of 100% of the population
- Criteria 5 [IWB-2500(f)(7)]: is met but will not be needed since IWB-2500(f)(6) is not met for the recirculation outlet nozzles

Specifically, the requirements of IWB-2500(f), using an approved alternative for IWB-2500(f)(8) and IWB-2500(f)(9) as requested in Reference 1, will still be met before applying the 25% minimum examination requirement to the Reference 1 specified population in the 6<sup>th</sup> 10-Year ISI interval.

(b) Additionally, since the RPV N1 recirculation outlet nozzles did not pass the calculation basis for Criterion 4, confirm that the licensee will perform volumetric inspections of 100 % of the N1 RPV recirculation outlet nozzle-to-vessel welds and nozzle inner blend radii sections for essentially 100% of the accessible nozzle location surface areas or volumes (i.e., achieving a minimum 90% coverage of the surface areas or volumes) during the 6<sup>th</sup> 10-Year ISI interval in accordance with the applicable requirements in ASME Section XI, Table IWB-2500-1, Examination Category B-D, Inspection Items B3.90 and B3.100.

## <u>RESPONSE</u>

100% of the RPV N1 recirculation outlet nozzle population will be completed during the  $6^{th}$  10-Year ISI interval.

# 3.0 REFERENCES

- 1. NSPM letter to NRC, "10 CFR 50.55a(z)(1) Request Associated with the Monticello Sixth Inservice Inspection (ISI) Interval, RR-002," (L-MT-23-024) dated July 11, 2023 (ADAMS Accession No. ML23193A799)
- 2. NRC email to NSPM, "Monticello Request for Additional Information re: ISI RR-002 Alternative to Use IWB-2500(f) (EPID L-2023-LLR-0036)," dated January 20, 2024
- 3. NSPM letter to NRC "10CFR50.55a Requests Associated with the 5th Inservice Inspection Ten-Year Interval," dated September 28, 2011 (ADAMS Accession No. ML112720147)
- 4. SIA No. 1101463.301, "Monticello N2 Nozzle Code Case N-702 Relief Request," Revision 2, dated August 7, 2012 (ML12230A098)

# **ATTACHMENT 1**

# Fifth Ten-Year Interval Examinations

<u>Nozzle ID<sup>1</sup></u>	<u>System</u>	<u>Exam Year</u>	<u>Result<sup>2</sup></u>
N2D (NV)	Recirculation (Inlet)	2013	NRI
N2D (IR)	Recirculation (Inlet)	2013	NRI
N2E (NV)	Recirculation (Inlet)	2017	NRI
N2E (IR)	Recirculation (Inlet)	2017	NRI
N2G (NV)	Recirculation (Inlet)	2021	NRI
N2G (IR)	Recirculation (Inlet)	2021	NRI
N3C (NV)	Main Steam	2019	RI
N3C (IR)	Main Steam	2019	NRI
N5B (NV)	Core Spray	2013	NRI
N5B (IR)	Core Spray	2013	NRI
N6A (NV)	Closure Head Spare	2021	NRI
N6A (IR)	Closure Head Spare	2021	NRI
N8A (NV)	Jet Pump Instrumentation	2013	NRI
N8A (IR)	Jet Pump Instrumentation	2013	NRI

<sup>1</sup> Nozzle ID: Nozzle-to-Vessel (NV), Item B3.90 or Inner Radius (IR), Item B3.100

<sup>2</sup> Results: No Relevant Indication (NRI), Relevant Indication (RI)