UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 12, 2019

Mr. Christopher Church
Senior Vice President and Chief
Nuclear Officer
Northern States Power Company - Minnesota
2807 West County Road 75
Monticello, MN 55362-9637

SUBJECT: MONTICELLO NUCLEAR GENERATING PLANT – REQUEST FOR RELIEF FOR COVERAGE OF NOZZLE-TO-VESSEL WELD EXAMINATIONS (EPID L-2018-LLR-0072)

Dear Mr. Church:

By letter dated May 11, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18131A179), Northern States Power Company, Minnesota (NSPM, the licensee) submitted relief request (RR)-012, for relief from examination coverage requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, for certain reactor pressure vessel (RPV) nozzle-to-shell welds at Monticello Nuclear Generating Plant (MNGP). Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief based on its determination that compliance with subject examination coverage requirements is impractical.

As set forth in the enclosed safety evaluation, the U.S. Nuclear Regulatory Commission (NRC) staff determines that compliance with ASME Code, Section XI, requirement for essentially 100 percent volumetric examination of the subject RPV nozzle welds at MNGP is impractical for the licensee. The NRC staff also determines that the licensee's limited-scope volumetric examinations that were already performed on the subject welds for the fifth 10-year inservice inspection (ISI) interval provide reasonable assurance of structural integrity for the subject components. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii), and granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Therefore, the NRC staff grants relief for the limited-scope volumetric examinations of RPV Nozzle Welds N-2E-NV, N-4A-NV, and N-9-NV at MNGP until the end of the fifth 10-year ISI interval on May 31, 2022.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact Robert Kuntz at 301-415-3733 or via e-mail at Robert.Kuntz@nrc.gov.

Sincerely,

Joel S. Wiebe, for

Lisa M. Regner, Acting Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-263

Enclosure:
Safety Evaluation

cc: Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF RR-012

INSERVICE INSPECTION IMPRACTICALITY FOR FIFTH 10-YEAR INTERVAL

NORTHERN STATES POWER COMPANY – MINNESOTA

MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 50-263

1.0 INTRODUCTION

By letter dated May 11, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18131A179), Northern States Power Company, Minnesota (NSPM, the licensee) submitted relief request (RR)-012, for relief from examination coverage requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, for certain reactor pressure vessel (RPV) nozzle-to-shell welds at Monticello Nuclear Generating Plant (MNGP). Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief based on its determination that compliance with subject examination coverage requirements is impractical.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), inservice inspection (ISI) of ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year ISI interval and subsequent intervals comply with the latest edition and addenda of Section XI of the ASME Code that was incorporated by reference in 10 CFR 50.55a(a)(1)(ii), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

Regulation 10 CFR 50.55a(g)(5)(iii) states that if a licensee has determined that conformance with a ASME Code requirement is impractical for its facility, the licensee must notify the U.S. Nuclear Regulatory Commission (NRC or Commission) and submit, as specified in 10 CFR Section 50.4, information to support its determination. Determinations of impracticality in accordance with this section must be based on the demonstrated limitations experienced when attempting to comply with the ASME Code requirements during the ISI interval for which the request is being submitted. Requests for relief made in accordance with this section must be

submitted to the NRC no later than 12 months after the expiration of the initial or subsequent 120-month inspection interval for which relief is sought.

Regulation 10 CFR 50.55a(g)(6)(i) states that the Commission will evaluate determinations under paragraph (g)(5) of Section 50.55a that ASME Code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines are authorized by law, will not endanger life or property or the common defense and security, and are otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Based on the above regulatory requirements, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and the Commission to grant relief and impose such alternative requirements as it determines are authorized by law, will not endanger life or property or the common defense and security, and are otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

3.0 TECHNICAL EVALUATION

3.1 Licensee Relief Request (MNGP Request RR-012)

Applicable Code Edition and Addenda

The Code of Record for the fifth 10-year ISI interval at MNGP is the 2007 Edition with the 2008 Addenda of the ASME Code, Section XI, as conditioned by 10 CFR 50.55a. The fifth 10-Year ISI interval began on September 1, 2012, and is scheduled to end on May 31, 2022.

RPV Welds Addressed in MNGP RR-012

The following table lists the ASME Code, Section XI, Class 1 RPV nozzle welds and associated limited examination coverages that are addressed in RR-012. The welds are listed based on the nomenclature in Table IWB-2500-1, "Examination Categories" of the ASME Code, Section XI for ASME Code Class 1 components, and they include the plant-specific component identifications provided in the RR. Limited-scope volumetric examinations were performed using the ultrasonic testing (UT) method.

ASME Code Item, Licensee Component ID	**Description of Items with Limited Coverage**	**Examination Method, Reported Coverage**	**Examination Limitations**
Item No. B3.90, RPV Nozzle Weld N-2E-NV	RPV Recirculation Inlet Nozzle-to-Shell Weld	UT, 83 percent (%)	Nozzle Geometry
Item No. B3.90, RPV Nozzle Weld N-4A-NV	RPV Feedwater Inlet Nozzle-to-Shell Weld	UT, 83%	Nozzle Geometry
Item No. B3.90, RPV Nozzle Weld N-9-NV	RPV CRD-Return (Capped) Nozzle-to-Shell Weld	UT, 85%	Nozzle Geometry

ASME Code Requirements and NRC-Approved Code Case

The ASME Code, Section XI, Table IWB-2500-1, Item No. B3.90, requires volumetric examination of the subject RPV nozzle-to-shell welds using the examination volume specified in Figure IWB-2500-7(b). This figure shows the weld configuration that is applicable to the subject RPV nozzle welds at MNGP. The RR indicated that in performing the subject RPV nozzle weld examinations the reduced examination volume specified in Figure 2 of ASME Code Case (CC) N-613-1 was applied. The RR identified that this CC is acceptable for application in plant ISI programs, per Table 1 of Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 17, August 2014. CC N-613-1 allows for a reduction in the examination volume for UT of Examination Category B-D RPV nozzle welds from the volumes specified in Figures IWB-2500-7(a), (b), and (c), as applicable to the nozzle weld configuration, to the examination volumes specified in CC N-613-1 Figures 1, 2, and 3, respectively. It should be noted that, as per Revision 18 of RG 1.147, which is the latest revision of the RG incorporated by reference into 10 CFR 50.55a, ASME CC N-613-1 has been superseded by CC N-613-2. However, the reduced examination volume specified in Figure 2 of CC N-613-2 is the same as that in Figure 2 of CC N-613-1 for the subject RPV nozzle weld examinations.

The RR also cited ASME Code, Paragraph IWA-2200(c), which specifies that when performing UT on a component with a defined examination volume, "essentially 100%" of the required volume shall be examined. The RR identified that the ASME Code paragraph states that "essentially 100%" coverage is achieved when the applicable examination coverage is greater than 90 percent; however, in no case shall the examination be terminated when greater than 90 percent coverage is achieved if additional coverage of the required volume is practical.

Licensee's Reported Impracticality and Burden Caused by Compliance

The licensee determined that compliance with the ASME Code, Section XI, requirement for achieving essentially 100 percent coverage of the examination volume specified in Figure 2 of ASME CC N-613-1 for the subject welds is impractical, considering the limitations experienced when attempting to comply with this requirement. Therefore, in accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested that the NRC grant relief for the subject welds based on its determination that achieving the required examination coverage is impractical due to physical limitations imposed by component geometry.

The RR stated that the MNGP construction permit was issued in 1967 and the MNGP systems and components were designed for construction before the ISI requirements of the ASME Code, Section XI, were formalized and published. Since MNGP components were not specifically designed to meet these requirements, the RR states that full compliance is not feasible or practical within the limits of the plant design.

The RR identified that 10 CFR 50.55a recognizes the limitations to performance of ISI of components in accordance with the ASME Code, Section XI, due to the earlier plant design and construction code requirements. The RR cited the following 10 CFR 50.55a requirements regarding limitations to performance of ISI for plants whose construction permits (CPs) predate the effective implementation date for ISI in accordance with the ASME Code, Section XI:

- 10 CFR 50.55a(g)(1), *Inservice inspection requirements for older plants (pre-1971 CPs)*, states "for a boiling or pressurized water-cooled nuclear power facility whose

construction permit was issued before January 1, 1971, components (including supports) must meet the requirements of paragraphs (g)(4) and (g)(5) of this section to the extent practical."

- 10 CFR 50.55a(g)(4), *Inservice inspection standards requirement for operating plants*, states "throughout the service life of a boiling or pressurized water-cooled nuclear power facility, components (including supports) that are classified as ASME Code Class 1, Class 2, and Class 3 must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI of editions and addenda of the ASME Code . . . . to the extent practical within the limitations of design, geometry, and materials of construction of the components."

- 10 CFR 50.55a(g)(5)(iii), *ISI program update: Notification of impractical ISI Code requirements*, states "if the licensee has determined that conformance with a Code requirement is impractical for its facility the licensee must notify the NRC and submit, as specified in 10 CFR 50.4, information to support the determinations."

The RR states that the examination limitations for the subject welds are due to inherent geometric contours associated with the nozzle design, as illustrated in attachments to its submittal. The RR reports that its limited coverage examinations were conducted to the extent practical within the design constraints of the subject components. The RR states that compliance with the examination coverage requirements of the ASME Code, Section XI (as modified by the CC), would require modification or replacement of these components where geometric contour is inherent to the component design.

Licensee's Proposed Alternative and Basis for Use

Proposed Alternative

The RR states that qualified examinations were performed that achieved the maximum amount of coverage obtainable within the limitations imposed by the design of the components. The RR reports limited examination coverages are shown in the table above. The RR states that there are no detectable indications associated with these limited coverage examinations.

Basis for Use

The RR identifies that UT procedures incorporate inspection techniques that are qualified in accordance Appendix VIII of the ASME Code, Section XI. The RR indicates that the subject weld examinations were performed from the RPV exterior with the transducer in contact with the component surfaces. Limited examination coverages were determined as a percentage of the exam volume specified in Figure 2 of CC N-613-1. The request states that the refracted longitudinal wave mode of propagation was applied for all scans of the examination volume perpendicular to the weld. The refracted longitudinal wave mode of propagation was also applied to the outer 85 percent of the exam volume (relative to the interior stainless steel-clad surface of the nozzle welds) for circumferential scans parallel to the weld. The RR states that the shear wave mode of propagation was applied for each of the transducer and wedge combinations required for the remaining inner 15 percent of the examination volume for scans parallel to the weld, as required by its nondestructive examination procedures and the Electric Power Research Institute (EPRI) computer modeling reports.

The RR states that the subject RPV nozzles received examinations to the extent practical within the limitations of component design. The request reports that one hundred percent coverage was obtained for the inner 15 percent of the examination volume for scans of the subject welds in both the perpendicular and parallel scan directions. The RR identified that the examination limitations for the subject welds were encountered within the outer 85 percent of the examination volume for the perpendicular and parallel scan directions. The request states that satisfactory results were achieved for all limited scope examinations, and no flaw indications were detected.

The RR states that the subject RPV nozzle welds are accessible for examination coverage from the vessel plate side of the weld; however, the curvature of the nozzle forging and its proximity to the weld preclude obtaining full examination coverage within the outer 85 percent of the examination volume. The request provides examination coverage drawings in Attachment 2 of its submittal, which depict the coverage obtained for UT scans perpendicular and parallel to welds as a fraction of the required examination volume specified in Figure 2 of CC N-613-1. The areas of examination coverage, and areas of no examination coverage, are identified on the respective drawings for each nozzle. The RR states that these drawings show how the contour on the exterior surface of the nozzles causes transducer liftoff, which inhibits the ability to maintain adequate coupling necessary to transmit and receive the ultrasonic sound energy. The RR states that additional coverage with meaningful results was not achievable with the implementation of qualified performance-based examination methods without redesigning and modifying the components to allow additional scanning surfaces. The relief identifies that if significant service-induced degradation existed in the subject welds, it would have been identified by the examinations performed.

The RR reports that the examination coverages obtained for the previous (fourth) 10-year ISI interval examinations were substantially similar to those obtained for the current (fifth) ISI interval examinations; however, the percent of full volumetric coverage obtained for Nozzles N-2E and N-4A in the current (fifth) ISI interval is slightly higher than the fourth ISI interval coverage values due to refinement in determination of coverage values.

The RR identifies that the subject pressure-retaining welded joints are fabricated from low alloy steel materials: SA508, Class 2, nozzle forgings are welded to SA533 Grade B, Class 1, RPV shell plate using E8018NM weld filler metal. The request identifies that all low alloy steel pressure-retaining materials have stainless steel cladding on the interior surfaces. The RR states that it implements a hydrogen water chemistry system to reduce the oxidizing potential in the reactor coolant environment. The request also notes that as Class 1 Examination Category B-P components, system pressure testing with VT-2 visual examinations are required every outage prior to startup. The RR reports that no evidence of pressure boundary leakage was identified during the system pressure test.

The RR states that its limited coverage examinations, which were completed to the extent practical with no unacceptable indications, provide reasonable assurance of the structural integrity of the subject welds. Based on these determinations, and pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested that the NRC grant relief from the ASME Code, Section XI, examination requirements for the subject RPV nozzle welds.

3.2 NRC Staff Technical Evaluation

In accordance with 10 CFR 50.55a(g)(6)(i), the NRC staff independently evaluated the licensee's determination under 10 CFR 50.55a(g)(5)(iii) that the ASME Code, Section XI,

volumetric examination requirements are impractical for the subject RPV nozzle welds addressed in RR-012 for MNGP. The NRC staff's review addressed the following information:

(a) information describing examination limitations and figures showing component geometry, which limited UT transducer access for achieving 100 percent examination coverage of the exam volume defined in Figure 2 of ASME CC N-613-1;

(b) reporting of limited-scope examination coverages and figures illustrating UT scan directions and exam coverages for the inner 15 percent and outer 85 percent of the examination volume;

(c) reporting of limited scope examination results (i.e., relevant indications or lack thereof);

(d) component material information and operational experience (OpE) that is relevant to the structural integrity of the welded joints.

Item No. B3.90 of the ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D, requires essentially 100 percent volumetric examination coverage of RPV nozzle welds using examination volumes specified in Figures IWB-2500-7(a), IWB-2500-7(b), or IWB-2500-7(c), as applicable to the nozzle weld configuration. Figure IWB-2500-7(b) shows the configuration for the subject nozzle welds at MNGP. The NRC staff identified that a reduction in the examination volume from that shown in Figure IWB-2500-7(b) to the examination volume shown in Figure 2 of ASME CC N-613-2 is acceptable (without NRC approval) for the subject nozzle weld examinations based on the incorporation of ASME CC N-613-2 into the latest revision (Revision 18) of RG 1.147, which is incorporated by reference into 10 CFR 50.55a. The NRC staff noted that the licensee's citation of CC N-613-1, which has been superseded by CC N-613-2 in Revision 18 of RG 1.147, is inconsequential to the reduction in the required examination volume for the subject welds since the required examination volume defined in Figure 2 is identical between the two code cases. Therefore, the NRC staff finds that the licensee's use of ASME CC N-613-1, Figure 2 for establishing the required examination volume for the subject welds is acceptable.

Volumetric Examination Limitations

The NRC staff reviewed the information provided in the RR related to the limitations in the volumetric examination coverages for the subject RPV nozzle welds, as well as the information and figures in its submittal addressing how compliance with the code requirement for achieving essentially 100 percent volumetric examination coverage is impractical for the subject RPV nozzle welds. The NRC staff noted that the figures provided in Attachment 2 of the RR provide cross-sectional diagrams of the subject welds showing the weld configuration in relation to the required examination volume specified in Figure 2 of ASME CC N-613-1. These figures illustrate the amount of examination coverage that was achieved for the two orthogonal scan directions (perpendicular and parallel to the weld) for both the inner 15 percent and the outer 85 percent of the required examination volume. Based on its review of these figures, the NRC staff was able to verify that UT scans from the nozzle side of the weld would not be able to achieve significant coverage of the examination volume because the surface of the nozzle forgings remains contoured in close proximity to the weld surface and within the required examination volume. The NRC staff noted that if the component surface is significantly contoured, such that the face of the UT transducer (or angle beam wedge) cannot be maintained flush against the component surface, then the gap between the transducer face and component surface would preclude the transmission of adequate sound energy into the

component. Based on review of the figures, the NRC staff verified that UT scans in both orthogonal directions from the RPV shell side of the weld (where the RPV surface is flat) were able to achieve full (100 percent) coverage of the inner 15 percent of the examination volume and a reasonable amount of coverage (about 80 percent) of the outer 85 percent of the examination volume; all examination coverage limitations were restricted to the outer 85 percent of the examination volume. Based on its review of this information, the NRC staff determines that the licensee adequately demonstrated that the geometric contours of the subject welded joints prevented the performance of adequate UT scans from the nozzle side of the welds, thereby, limiting the volumetric examination coverages to 83 percent, 83 percent, and 85 percent of the required examination volume for MNGP RPV nozzle welds N-2E-NV, N-4A-NV, and N-9-NV, respectively.

Limited-Scope Examination Results and Aging Management Operating Experience

The NRC staff noted that the RR states that no relevant indications were observed based on the limited-scope UT examinations of the subject RPV nozzle welds. The NRC staff also noted that the inner 15 percent of the examination volume, for which 100 percent coverage was achieved, has a relatively greater potential for degradation compared to the outer 85 percent (where examination coverage was restricted) since this inner 15 percent is adjacent to the RPV interior cladding and, therefore, in close proximity to the interior wetted surface of the RPV. However, the likelihood of service-induced degradation resulting in new flaw formation is still very low even for the inner 15 percent of the weld volume given that all pressure-retaining materials are low alloy steel. Industry operating experience with ISI of these types of low alloy steel full penetration RPV welds shows that the known material aging mechanisms (generally neutron embrittlement and accumulation of fatigue cycles) are very unlikely to result in the formation of new flaws in the low alloy steel pressure-retaining materials. The NRC staff notes that low alloy steel pressure-retaining RPV welds are not considered to be susceptible to the formation of new flaws by stress corrosion cracking. Cracking due to metal fatigue is also very unlikely since compliance with fatigue cumulative usage factor acceptance criteria, as per the applicable design code, is required for the duration of the licensed operating term of the plant. Therefore, the NRC staff determined that the licensee's reported limited examination coverages for the subject RPV nozzle welds with acceptable results provide reasonable assurance of structural integrity for these components.

NRC Staff Technical Evaluation Summary

Based on the evaluation above, the NRC staff finds that the licensee has adequately demonstrated the impracticality associated with achieving essentially 100 percent examination coverage of the subject welds based on the demonstrated limitations it experienced when attempting to comply with these Code requirements. Further, the NRC staff finds that the licensee's limited-scope volumetric examinations that were already performed on the subject welds for the fifth 10-year ISI interval provide reasonable assurance of structural integrity for the subject components.

4.0 CONCLUSION

As set forth above, the NRC staff determines that compliance with ASME Code, Section XI, requirement for essentially 100 percent volumetric examination of the subject RPV nozzle welds at MNGP is impractical for the licensee. The NRC staff also determines that the licensee's limited-scope volumetric examinations that were already performed on the subject welds for the fifth 10-year ISI interval provide reasonable assurance of structural integrity for the subject

components. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii), and granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Therefore, the NRC staff grants relief for the limited-scope volumetric examinations of RPV nozzle welds N-2E-NV, N-4A-NV, and N-9-NV at MNGP until the end of the fifth 10-year ISI interval on May 31, 2022.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved remain applicable including third-party review by the Authorized Nuclear Inservice Inspector.

Principle Contributor: Christopher R. Sydnor, NRR

Date of issuance: June 12, 2019

SUBJECT: MONTICELLO NUCLEAR GENERATING PLANT – REQUEST FOR RELIEF FOR COVERAGE OF NOZZLE-TO-VESSEL WELD EXAMINATIONS (EPID L-2018-LLR-0072) DATED JUNE 12, 2019

DISTRIBUTION:
PUBLIC
PM File Copy
RidsACRS_MailCTR Resource
RidsNrrDorlLpl3 Resource
RidsNrrPMMonticello Resource
RidsNrrDLMRMVIB Resource
RidsRgn3MailCenter Resource
RidsNrrLASRohrer Resource

ADAMS Accession No. ML19148A694 *e-mail dated

OFFICE	NRR/DORL/LPL3/PM	NRR/DORL/LPL3/LA	NRR/DMLR/MVIB/BC	NRR/DORL/LPL3/BC
NAME	RKuntz	SRohrer	DAlley*	LRegner (A)
DATE	6/6/19	6/5/19	5/23/19	6/12/19 (JWiebe for)

OFFICIAL RECORD COPY