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

August 27, 2014

Karen D. Fili
Site Vice-President
Northern States Power Company – Minnesota
Monticello Nuclear Generating Plant
2807 West County Road 75
Monticello, MN 55362-9637

SUBJECT: MONTICELLO NUCLEAR GENERATING PLANT – RISK-INFORMED/SAFETY-BASED INSERVICE INSPECTION PROGRAM FOR THE FIFTH 10-YEAR INSERVICE INSPECTION PROGRAM INTERVAL (TAC NO. MF3050)

Dear Mrs. Fili:

By letter dated October 31, 2013, as supplemented by letters dated May 8 and May 19, 2014, Northern States Power Company, a Minnesota corporation (NSPM, the licensee), doing business as Xcel Energy, submitted Relief Request RR-003 to the U.S. Nuclear Regulatory Commission (NRC) for the use of an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, 2007 Edition through the 2008 Addenda, to implement a risk-informed/safety-based (RIS_B) inservice inspection (ISI) program for piping at the Monticello Nuclear Generating Plant (Monticello).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g)(3)(i), NSPM requested to use a RIS_B ISI program for Class 1 and Class 2 piping at Monticello based, in part, on the ASME, Section XI, Code Case N-716.

The NRC staff has reviewed the subject request and determined, as set forth in the enclosed safety evaluation, that the proposed alternative provides an acceptable level of quality and safety. Therefore, the NRC staff authorizes the proposed alternative pursuant to 10 CFR 50.55a(3)(i) for the remainder of the fifth 10-year ISI interval at Monticello. The staff's approval of the licensee's RIS_B ISI program does not constitute approval of Code Case N-716.

If you have any questions, please contact Terry Beltz at (301) 415-3049 or via e-mail at Terry.Beltz@nrc.gov.

Sincerely,

David L. Pelton, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-263

Enclosure:
Staff Evaluation of Relief Request RR-003

cc w/encl: Distribution via ListServ

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE FIFTH 10-YEAR INSERVICE INSPECTION PROGRAM INTERVAL

RELIEF REQUEST RR-003

RISK-INFORMED/SAFETY-BASED INSERVICE INSPECTION ALTERNATIVE

FOR CLASS 1 AND 2 PIPING

MONTICELLO NUCLEAR GENERATING PLANT

NORTHERN STATES POWER COMPANY – MINNESOTA

DOCKET NO. 50-263

1.0 INTRODUCTION

By letter dated October 31, 2013 (Reference 1, hereafter referred to as the submittal), as supplemented by letters dated May 8 and May 19, 2014 (References 2 and 3, respectively), Northern States Power Company, a Minnesota corporation (NSPM, the licensee), doing business as Xcel Energy, submitted Relief Request RR-003, "Request for Authorization of Risk-Informed/Safety-Based Inservice Inspection Alternative for Class 1 and 2 Piping." The request proposed to use a risk-informed/safety based (RIS_B) program as an alternative to the requirements in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, inservice inspection (ISI) program for Class 1 and Class 2 piping at the Monticello Nuclear Generating Plant (MNGP).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i), the licensee requested to use the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety. The proposed RIS_B program is based, in part, on ASME Code Case N-716, "Alternative Piping Classification and Examination Requirements, Section XI Division 1" (Reference 4, Code Case N-716). Code Case N-716 is founded, in large part, on the risk-informed inservice inspection (RI-ISI) process as described in the Electric Power Research Institute (EPRI) Topical Report (TR)-112657, Revision B-A (Reference 5). EPRI TR-112657, Revision B-A, was previously reviewed and approved by the U.S. Nuclear Regulatory Commission (NRC). The provisions of Code Case N-716 define additional requirements for Class 3 or non-Class piping.

Code Case N-716 has not been endorsed for generic use by the NRC. The licensee refers to the methodology described in Code Case N-716 instead of describing the details of the methodology in the relief request. NSPM has, however, modified the methodology described in Code Case N-716 while developing its proposed RIS_B program. When the methodology used

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by the licensee is accurately described in Code Case N-716, this safety evaluation (SE) refers to the details found in Code Case N-716. When the methodology used by the licensee deviates from or expands upon the methodology described in Code Case N-716, this SE refers to details in the relief request. Therefore, Code Case N-716 is incorporated in this SE only as a source for some of the detailed methodology description, as needed, and the NRC staff is not endorsing the use of Code Case N-716 in this SE.

The licensee requested to implement the RIS_B program during the fifth ISI interval at MNGP, which commenced on September 1, 2012, and will end on May 31, 2022.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements set forth in the ASME Code to the extent practical within the limitations of the design, geometry, and materials of construction of the components. Inservice inspection of ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable addenda, except where specific relief has been granted by the NRC. Paragraph 55a(a)(3) of 10 CFR 50 states that alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the NRC, if (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The regulations in 10 CFR 50.55a(g)(4)(i) - (ii), also require that during the first 10-year ISI interval and during subsequent intervals that the licensee's ISI program comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b), 12 months prior to the start of the 120-month interval and subject to the limitations and modifications listed in 10 CFR 50.55a(b). The applicable edition of Section XI of the ASME Code during the fifth ISI interval at MNGP is the 2007 Edition with the 2008 Addenda of the ASME Section XI Code.

Pursuant to 10 CFR 50.55a(g), a certain percentage of ASME Code Category B-F, B-J, C-F-1, and C-F-2 pressure retaining piping welds must receive ISI during each 10-year ISI interval. The ASME Code requires 100 percent (%) of B-F welds and 25% of B-J welds greater than 1-inch nominal pipe size be selected for volumetric or surface examination, or both, on the basis of existing stress analyses. For Category C-F-1 and C-F-2 piping welds, 7.5% of non-exempt welds are selected for volumetric or surface examination, or both.

The licensee states that Code Case N-716 is founded in large part on the RI-ISI process described in EPRI TR-112657, Revision B-A, which was previously reviewed and approved by the NRC. The licensee further states that the risk-informed application based on Code Case N-716 meets the intent and principles of Regulatory Guide (RG) 1.174 (Reference 6), and RG 1.178 (Reference 7).

The objectives of the licensee's proposed RIS_B program are to identify high safety significant (HSS) piping at the plant, to determine the locations to be inspected within the identified piping, and to identify appropriate inspection methods. The licensee's proposed program will inspect 10% of HSS welds using an inspection method capable of detecting the degradation mechanism(s) of concern and most likely to occur at each location to be inspected.

In general, the licensee simplified the EPRI TR-112657 method because it does not evaluate system parts that have been generically identified as HSS, and uses probabilistic risk assessment (PRA) analyses to search for and identify other system parts that are HSS. The NRC staff reviewed and evaluated the licensee's proposed RIS_B program based on guidance and acceptance criteria provided in the following documents:

- RG 1.174, "An Approach for Using Probabilistic Risk Assessment In Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (Reference 6)
- RG 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping (Reference 7)
- RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" (Reference 8)
- NUREG-0800, Chapter 3.9.8, "Standard Review Plan [SRP] for the Review of Risk-Informed Inservice Inspection of Piping" (SRP Section 3.9.8) (Reference 9)
- EPRI TR-112657, Revision B-A (Reference 5)

As previously discussed, the NRC may authorize alternatives to the requirements of 10 CFR 50.55a(g), if an applicant or licensee demonstrates that proposed alternatives would provide an acceptable level of quality and safety, or that compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. As such, the NRC staff finds that a regulatory basis exists for the licensee to request and the NRC staff to authorize this alternative. The information provided by the licensee in support of this request has been evaluated by the NRC staff and the bases for disposition are documented below.

3.0 TECHNICAL EVALUATION

3.1 Background

Regulatory Guide 1.174 provides guidance on the use of PRA findings and risk insights in support of licensee request for changes to a plant's licensing basis. Regulatory Guide 1.178 describes an RI-ISI program as one that incorporates risk insights that can focus inspections on risk significant locations. EPRI TR-112657 provides a detailed methodology that the NRC staff has previously concluded will result in an acceptable RI-ISI program. The RIS_B program proposed for MNGP also incorporates risk insights to focus inspection on more important locations although the methodology differs in several respects from the methodology in EPRI TR-112657. This safety evaluation describes the differences between the endorsed methodology in EPRI TR-112657 and the proposed RIS_B methodology to reach a conclusion about the acceptability of the proposed method.

An acceptable RI-ISI program replaces the number and locations of non-destructive examination (NDE) inspections based on ASME Code Section XI requirements by the number and locations of these inspections based on the RI-ISI guidelines. The proposed RIS_B program permits alternatives to the requirements of IWB-2420, IWB-2430, and

IWB-2500 (Examination Categories B-F and B-J) and IWC-2420, IWC-2430, and IWC-2500 (Examination Categories C-F-1 and C-F-2), or as additional requirements for Subsection IWD. Also, the proposed RIS_B program may be used for ISI and preservice inspection of Class 1, 2, 3, or non-Class piping. All piping components, regardless of risk classification, will continue to receive ASME Code-required pressure and leak testing as part of the current ASME Code Section XI program. Visual examinations are scheduled in accordance with the MNGP pressure and leak test program, which remains unaffected by the proposed RIS_B program.

The process described in EPRI TR-112657 includes the following steps which, when successfully applied, satisfy the guidance provided in RGs 1.174 and 1.178:

- Scope Definition
- Consequence Evaluation
- Degradation Mechanism Evaluation
- Piping Segment Definition
- Risk Categorization
- Inspection/NDE Selection
- Risk Impact Assessment
- Implementation Monitoring and Feedback

These steps result in a program consistent with the concept that, by focusing inspections on the most safety-significant welds, the number of inspections can be reduced while at the same time maintaining adequate protection of public health and safety. In general, the methodology in Code Case N-716 replaces a detailed evaluation of the safety significance of each pipe segment with a generic population of HSS segments, followed by a flooding analysis to identify any plant-specific HSS segments. The quality of the flooding analysis was evaluated using Part 3 of ASME/American Nuclear Society (ANS) RA-Sa-2009 (Reference 11), as endorsed in RG 1.200 (Reference 8). As described below, the acceptability of the licensee's proposed RIS_B program is evaluated by comparing the processes the licensee has applied to develop its program with the steps from EPRI TR-112657.

3.2 Scope Definition

The scope of evaluation to support RIS_B program development and of the proposed changes includes ASME Code Class 1, 2, 3, and Non-Class piping welds, and SRP Section 3.9.8 and RG 1.178 address scope issues. The primary acceptance guideline in the SRP is that the selected scope needs to support the demonstration that any proposed increase in core damage frequency (CDF) and risk are small. The scope of MNGP's evaluation included all Class 1 and 2 piping where ASME inspections could be discontinued, providing assurance that the change-in-risk estimate would, as a minimum, capture the risk increase associated with implementing the RIS_B program in lieu of the ASME program. Also, as noted in October 31, 2013 letter, no Class 3 or non-Class piping was identified in accordance with Code Case N-716 for inclusion in the RIS_B program for inspections. RG 1.178 identifies different grouping of plant piping that should be included in a RIS_B program, and also clarifies that a "full-scope" risk-informed evaluation is acceptable. The scope of the RIS_B program as defined in Code Case N-716 and as evaluated by the licensee is consistent with the definition of full-scope in RG 1.178.

Based on the above, the NRC staff concludes that the "full-scope" extent of the piping included in the RIS_B program changes satisfies the guidelines in SRP Section 3.9.8 and RG 1.178 and is, therefore, acceptable.

3.3 Consequence Evaluation

The methodology described in RG 1.178 and EPRI TR-112657 divides all piping within the scope of the proposed EPRI RI-ISI program into piping segments. The consequence of each segment failure must be estimated as a conditional core damage probability (CCDP) and conditional large early release probability (CLERP) or by using a set of tables in EPRI TR-112657 that yield equivalent results. The consequences are used to determine the safety significance of the segments.

In contrast to EPRI TR-112657 methodology, Code Case N-716 does not require that the consequence of each segment failure be estimated to determine the safety-significance of piping segments. Instead, Code Case N-716 identifies portions of systems that should be generically classified as HSS at all plants. A consequence analysis is not required for system parts generically classified as HSS because there is no higher safety significance category to which the system part can be assigned and degradation mechanisms, not consequence, are used to select inspection locations in the HSS weld population. The licensee's PRA is subsequently used to search for any additional, plant-specific HSS segments that are not included in the generic HSS population.

Sections 2(a)(1) through 2(a)(4) of Code Case N-716 provide guidance that identifies the portions of systems that should be generically classified as HSS based on a review of almost 50 RI-ISI programs. These previous RI-ISI programs were all developed by considering both direct and indirect effects of piping pressure boundary failures and the different failure modes of piping. This is consistent with the guidelines for evaluating pipe failures with PRA described in RG 1.178, the EPRI TR-112657, and SRP 3.9.8. Therefore, the generic results are derived from acceptable analyses.

Section 2(a)(5) in Code Case N-716 provides guidance that defines additional, plant-specific HSS segments that should be identified using a plant-specific PRA of pressure boundary failures. The licensee should use its PRA of pressure boundary failures (flooding analysis) to identify additional plant-specific HSS segments and that the flooding analysis considered both the direct and indirect effects of pressure boundary failures and the different failure modes of piping. This is consistent with the guidelines for evaluating pipe failures with PRA described in RG 1.178, EPRI TR-112657, and SRP 3.9.8.

The safety evaluation report (SER) for EPRI TR-112657 states that EPRI TR-112657 does not include a detailed discussion of the specific assumptions to be used to guide the assessment of the direct and indirect effects of segment failures. The SER states that specific assumptions regarding the direct and indirect effects of pipe segment failure should be developed by the individual licensees and should form part of the onsite documentation. In its response to the NRC staff's request for additional information (RAI), dated May 19, 2014 (Reference 3), the licensee stated that a qualitative assessment of flood failure mechanisms was performed and provided assumptions for failure mechanisms. In addition, the NRC staff requested clarification whether the loss of mitigating ability (segment failures that only cause failure of mitigating functions but do not cause a plant trip) is considered in consequence evaluations. The licensee

stated in response to the RAI that MNGP PRA model includes all flooding sources which could lead to an automatic plant trip or a Technical Specification required manual shutdown of the plant (mitigating impact, but no automatic plant trip). Each of the licensee's consequence evaluations (the generic and the plant-specific flooding analysis) considers both direct and indirect effects of piping pressure boundary failures and the different piping failure modes to systematically use risk insights and PRA results to characterize the consequences of piping failure.

Based on the above, the NRC staff finds this consequence evaluation to be consistent with the guidelines for evaluating pipe failures with PRA described in RG 1.178 and EPRI TR-112657 and is, therefore, acceptable.

3.4 Degradation Mechanism Evaluation

EPRI TR-112657 requires a determination of susceptibility to all degradation mechanisms of every weld within the scope of the proposed program. The degradation mechanisms which should be identified are described in EPRI TR-112657. This information is used to support the safety significance determination for all segments, to target inspections toward the locations with degradation mechanisms in the segments that require inspections, and to provide estimates of weld failure frequencies to support the change in risk evaluation. Once a segment is placed in the low safety significant (LSS) category, the degradation mechanisms at the welds in that segment are not further used in the development of the EPRI TR-112657 RI-ISI program because no inspections are required in LSS segments and the discontinued inspections in LSS segments are not included in the change in risk estimate.

Code Case N-716 identifies a generic population of HSS welds, followed by a search for plant-specific HSS welds and requires a determination of the susceptibility to all degradation mechanisms of all welds assigned generically as HSS. The degradation mechanisms considered in Code Case N-716 are consistent with those identified in EPRI TR-112657, which the NRC staff has previously concluded is a sufficiently comprehensive list of the applicable degradation mechanisms.

Pipe failure frequencies are used in the screening analysis searching for plant-specific HSS welds described in Section 3.2 of this SER, and then in the change in risk estimate. If welds are exposed to any degradation mechanism, aside from flow-accelerated corrosion (FAC) and water hammer, a medium failure frequency is assigned to those welds. If welds are exposed to FAC or water hammer, a high failure frequency is assigned. Finally, if there are no damage mechanisms, a low failure frequency is assigned. This is consistent with the approved methodology in EPRI TR-112657.

The licensee stated in Section 3.4.1 of Reference 1 that the presence of FAC was adjusted for in the quantitative analysis by excluding its impact on the failure potential rank. The exclusion of the impact of FAC was performed because the licensee manages this damage mechanism through the plant augmented inspection program for FAC per Generic Letter (GL) 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning." EPRI TR-112657 notes that the plant's existing FAC program in response to GL 89-08 would not be affected by the RI-ISI program. The NRC staff found this to be acceptable, as documented in Section 3.2.1 of Reference 10.

The approach proposed by the licensee used failure frequency estimates that reflected applicable degradation mechanisms while searching for plant-specific HSS piping. Failure frequency estimates are further refined for use in the change in risk estimate by identifying degradation mechanisms at all generic HSS welds and in LSS segments with potential high-failure frequency (i.e., susceptible to FAC or water hammer). The screening evaluation relies on a plant-specific update of generic failure frequencies, followed by a bounding analysis for specific welds where inspections will be added or discontinued.

Based on the above, the NRC staff finds the degradation mechanism evaluation to be acceptable because the process fulfills the requirements for identifying locations that should be inspected (i.e., identifying plant-specific HSS segments) and develops a bounding estimate for the change in risk, respectively.

3.5 Piping Segment Definition

Previous guidance on risk-informed inservice inspection including RG 1.178 and EPRI TR-112657 centered on defining and using piping segments. RG 1.178 states, for example, that the analysis and definition of a piping segment must be consistent and technically sound. The primary purpose of segments is to group welds so that consequence analyses can be done for the smaller number of segments instead of for each weld. Sections 2(a)(1) to 2(a)(4) in Code Case N-716 identify system parts (segments and groups of segments) that are generically assigned HSS without requiring a plant-specific consequence determination and any subdivision of these system parts is unnecessary. Section 2(a)(5) in CC N-716 uses a PRA to identify plant-specific piping that might be assigned HSS. A flooding PRA consistent with the ASME PRA Standard searches for plant-specific HSS piping by first identifying zones that may be sensitive to flooding, and then evaluating the failure potential of piping in these zones. Lengths of piping whose failure impacts the same plant equipment within each zone are equivalent to piping segments. Therefore, piping segments are either not needed to reduce the number of consequence analyses required (for the generic HSS piping) or, when needed during the plant-specific analysis, a length of pipe included in the analysis is consistent with the definition of a segment in RG 1.178 and SRP 3.9.8.

An additional purpose of piping segments in EPRI TR-112657 is as an accounting/tracking tool. In the EPRI methodology, all parts of all systems within the selected scope of the RI-ISI program are placed in segments and the safety significance of each segment is developed. For each safety significant classification, a fixed percentage of welds within all the segments of that class are selected. Additional selection guidelines ensure that this fixed percentage of inspections is distributed throughout the segments to ensure that all damage mechanisms are targeted and all piping systems continue to be inspected. Case Code N-716 generically defines a large population of welds as HSS. An additional population of welds may be added based on the risk-informed search for plant-specific HSS segments. When complete, the Code Case N-716 process yields a well-defined population of HSS welds accomplishing the same objective as accounting for each weld throughout the analysis by using segments. Case Code N-716 provides additional guidelines to ensure that this fixed percentage is appropriately distributed throughout the population of welds subject to inspection, all damage mechanisms are targeted, and all piping systems continue to be inspected.

The NRC staff concludes that the segment identification in RG 1.178, as used as an accounting tool, is not needed within the generic population of HSS welds. The risk-informed search for

HSS segments based on a flooding PRA divides up piping systems into segments based on consequences, which is consistent with the segment definition in RG 1.178.

Therefore, the licensee's proposed method accomplishes the same objective as the approved methods without requiring that segments be identified and defined for all piping within the scope of the RIS_B program and accordingly is acceptable to the NRC staff.

3.6 Risk Categorization

Sections 2(a)(1) through 2(a)(4) in Code Case N-716 identify the portions of systems that should be generically classified as HSS, and Section 2(a)(5) requires a search for plant-specific HSS segments. Application of the guideline in Section 2(a)(5) in Code Case N-716 identifies plant-specific piping segments that are not assigned to the generic HSS category but that are risk-significant at a particular plant. Code Case N-716 requires that any segment with a total estimated CDF greater than 1×10^{-6} per year be assigned to the HSS category. The licensee augmented this CC N-716 metric on CDF with the requirement to also assign the HSS category to any segment with a total estimated large early release frequency (LERF) greater than 1×10^{-7} per year. The licensee stated that these guideline values are consistent with the decision guidelines for acceptable changes in CDF and LERF found in RG 1.174.

In the October 31, 2013 letter, the licensee clarified that these ancillary metrics were added as a defense-in-depth measure to provide a method of ensuring that any plant-specific locations that are important to safety are identified. All piping that has inspections added or removed per Code Case N-716 is required to be included in the change-in-risk assessment and an acceptable change-in-risk estimate is used to demonstrate compliance with the acceptance guidelines in RG 1.174. The ancillary metrics and guidelines on CDF and LERF are only used to add HSS segments and not, for example, to remove system parts generically assigned to the HSS in Section 2(a)(1) through 2(a)(4) of CC N-716.

The NRC staff concurs that a plant-specific analysis to identify plant-specific locations that are important to safety is a necessary element of RI-ISI program development. The results of the plant-specific risk categorization analysis provide confidence that the goal of inspecting the more risk-significant locations is met while permitting the use of generic HSS system parts to simplify and standardize the evaluation. Satisfying the guidelines in Section 2(a)(5) in Code Case N-716 requires confidence that the flooding PRA is capable of successfully identifying all, or most, of the significant flooding contributors to risk that are not included in the generic results. RG 1.200 states that meeting the attributes of an NRC-endorsed industry PRA standard may be used to demonstrate that a PRA is adequate to support a risk-informed application. RG 1.200 further states that an acceptable approach that can be used to ensure technical adequacy is to perform a peer review of the PRA.

In the October 31, 2013 submittal, the licensee states that in April 2013 the MNGP PRA internal events model, which was upgraded in 2013, underwent a formal BWROG [Boiling Water Reactor Owners' Group]-sponsored industry peer review against ASME/ANS RA-Sa-2009 and RG 1.200, Revision 1. In its May 19, 2014 response to NRC staff's RAIs, the licensee identified two typographical errors in the original submittal and stated that the peer-review was performed against RG 1.200, Revision 2. The licensee described the resolution of 22 findings identified by the peer review team. The NRC staff agrees that the licensee's discussion of the resolution of the peer review findings addresses those findings, and that the MNGP PRA should identify risk

significant areas and piping failures. The licensee also reported a qualitative assessment to identify any piping whose failure could cause flooding that could significantly impact safety significant components.

The NRC staff concludes that the CDF and LERF metrics proposed by the licensee are acceptable because they address the risk elements that form the basis for risk-informed applications (i.e., core damage and large early release). The NRC staff accepts the proposed guideline values because these ancillary guidelines are applied in addition to the change-in-risk acceptance guidelines in RG 1.174, and only add plant-specific HSS segments to the RIS_B program (i.e., they may not be used to reassign any generic HSS segment into the LSS category).

Based on the above, the NRC staff finds that the risk categorization performed by MNGP provides confidence that HSS segments have been identified. Sections 2(a)(1) through 2(a)(4) in Code Case N-716, which identify generic HSS portions of systems, were applied to MNGP piping. The licensee's PRA used to fulfill the guideline in Section 2(a)(5) was performed using a PRA of adequate technical quality based on consistency between the PRA and the applicable characteristics of the NRC-endorsed industry standard.

3.7 Inspection/NDE Selection

The licensee's submittals discuss the impact of the proposed RIS_B application on the various augmented inspection programs.

The licensee's augmented inspection program for high energy line breaks outside containment has not been revised by this application.

The augmented inspection program for intergranular stress corrosion cracking (IGSCC), as addressed in NRC GL 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping;" NUREG-0313, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," Revision 2; and BWRVIP-75-A, "BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules," have been resolved by MNGP's pipe replacement program, wherein all susceptible material was replaced with resistant material. All welds are therefore classified as IGSCC Category "A" and are considered resistant to IGSCC, and as such are assigned a low failure potential provided no other damage mechanisms are present. Examination criteria for these welds will be in accordance with the RIS_B process.

The plant augmented inspection program for flow accelerated corrosion (FAC) per GL 89-08 is relied upon to manage damage caused by FAC but is not otherwise affected or changed by the RIS_B program.

The NRC staff finds the licensee's approach to the integration of the proposed RI-ISI program with augmented inspection programs as described above acceptable because it is consistent with the EPRI TR.

Additionally, Code Case N-716 contains requirements that inspection locations be divided among the systems under consideration and that certain percentages of inspections will be conducted in specific locations. In its relief request the licensee has addressed these issues.

The NRC staff finds this acceptable because the information provided in the relief request is consistent with that required by the EPRI TR which has been reviewed and approved by the NRC.

In addition, in the additional information provided in the May 8, 2014 supplemental letter, the licensee stated that weld selections will consider whether greater than 90% coverage can be obtained. Weld joint configurations that are favorable to attaining the required coverage were selected for the RIS_B program to the extent practicable. Piping welds with known coverage limitations were not selected for examination in the proposed RIS_B program. In addition, the twenty-one weld exams completed in the 2013 refueling outage all attained the required coverage.

The NRC staff reviewed the tables provided in the licensee's submittal which address degradation mechanisms, failure potential, and the number of welds selected for examination. The NRC staff finds the data contained in these tables, along with the additional information provided in the May 8, 2014, supplemental letter, to be consistent with the requirements of the EPRI TR and is, therefore, acceptable.

3.8 Risk Impact Assessment

The licensee uses a change-in-risk estimation process approved by the NRC staff in EPRI TR-112657. The change-in-risk assessment in the EPRI TR-112657 permits using each segment's CCDP and CLERP or, alternatively, placing each segment into a high-, medium-, or low-consequence "bin" and using a single-bounding CCDP and CLERP for all segments in each consequence bin. Code Case N-716 also includes both alternatives and the bounding values to be used in the bounding analysis are the same as those approved for use in EPRI TR-112657. The licensee uses the alternative of placing each segment into consequence bins and using the associated bounding values for all segments in each bin during the change-in-risk assessment.

In the submittal, the licensee identified the different types of pipe failures that cause major plant transients such as those causing loss-of-coolant accidents (LOCAs), isolable LOCAs, and potential LOCAs. Conservative CCDP estimates were developed from the PRA for these initiating events. When the scenario was not appropriately modeled in the PRA, the licensee developed scenarios based on the PRA results and associated plant-specific equipment failures. The NRC staff concludes that the scenarios described are reasonable because they are modeled in the PRA or include the appropriate equipment failure modes that cause each sequence to progress, and the licensee uses generally accepted values for those failure modes. Based on these estimates, the segments were assigned into the appropriate consequence bin.

The licensee relied on its flooding analysis to identify the appropriate consequence bin for welds whose failure does not cause a major plant transient and for which a consequence estimate is required. As discussed above, the licensee performed its flooding analysis consistent with ASME PRA Standard. Only segments with locations at which an inspection is being discontinued or added need to be included in the change-in-risk calculation. Therefore, LSS Class 2, Class 3, and non-Code piping that were not previously inspected do not require a consequence estimate because they contain no discontinued inspections and inspections are not added to LSS segments. The updated internal flooding PRA review identified some Class 2 piping in the core spray, residual heat removal, reactor core isolation cooling, and high pressure coolant injection torus suction lines to have a CCDP/CLERP greater than 1×10^{-4} and 1×10^{-5}

per year. Instead of performing screening analysis to identify medium (as opposed to low) risk contributors for remaining LSS Class 2 piping, the licensee placed previously inspected LSS Class 2 piping into the medium consequence bin and used the bounding CCDP and CLERP values of 1×10^{-4} and 1×10^{-5} per year, respectively.

The licensee conducted a review and verified that the LSS piping was not susceptible to water hammer. LSS piping may be susceptible to FAC; however, the susceptibility evaluation and examination for FAC is governed by the FAC program. The RIS_B Program credits and relies upon this plant augmented inspection program to manage this damage mechanism. In lieu of conducting a formal degradation mechanism evaluation for all LSS piping (e.g., to determine if thermal fatigue is applicable), the licensee conservatively assigned these locations to the medium failure potential for use in the change-in-risk assessment.

Section 5 in Code Case N-716 requires that any piping that has NDE inspections[1] added or removed per CC N-716 be included in the change-in-risk assessment. The licensee nominally used the upper-bound estimates for CCDP and CLERP. Acceptance criteria provided in Section 5(d) of Code Case N-716 include limits of 1×10^{-7} per year and 1×10^{-8} per year for increase of CDF and LERF for each system, and limits of 1×10^{-6} per year and 1×10^{-7} per year for the total increase in CDF and LERF associated with replacing the ASME Code Section XI program with the RIS_B program. These guidelines and guideline values are consistent with those approved by the NRC staff in EPRI TR-112657 and are, therefore, acceptable.

The change-in-risk evaluation approved in EPRI TR-112657 is a final screening to ensure that a licensee replacing the Section XI program with the risk-informed alternative evaluates the potential change-in-risk resulting from change in method and implements it only upon determining, with reasonable confidence, that any increase in risk is small and acceptable. The licensee's method is consistent with the approved method in EPRI TR-112657 with the exception that the change-in-risk calculation in N-716 includes the risk increase from discontinued inspection in LSS segments.

The NRC staff concludes that the licensee's method described in the submittal is acceptable because the deviation from the approved method in EPRI TR-112657 expands the scope of the calculated change-in-risk providing confidence that the less detailed analyses of LSS segments required by Code Case N-716 do not result in an unanticipated and potentially unacceptable risk increase.

The licensee provided the results of the change-in-risk calculations in the submittal. The results indicate a small and acceptable increase in risk and all the estimates satisfy both the system level and the total CDF and LERF guidelines. Based on the above, the NRC staff finds the change in risk acceptable for this application.

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[1] Code Case N-716 requires no estimated risk increase for discontinuing surface examinations at locations that are not susceptible to outside diameter attack (e.g., external chloride stress-corrosion cracking). The NRC staff determined during the review and approval of EPRI TR-112657 that surface exams do not appreciably contribute to safety and need not be included in the change in risk evaluation and, therefore, exclusion of surface exam from the change in risk evaluations is acceptable.

3.9 Implementation Monitoring and Feedback

The objective of this element in RG 1.174 and RG 1.178 is to assess the performance of affected piping systems under the proposed RI-ISI program by implementing monitoring strategies that conform to the assumptions and analysis used in developing the RIS_B program. In Section 3.5 of Reference 1, the licensee states that upon approval of the RIS_B program, procedures that comply with the guidelines described in Code Case N-716 will be prepared to implement and monitor the program.

The list of possible procedural changes include all changes at the facility or in the PRA that could affect the evaluation used to develop the RIS_B program and performing the reevaluation every ISI period coincides with the inspection periods in the inspection program requirements contained in the ASME Code, Section XI.

Based on the above, the NRC staff finds that the proposed changes are consistent with the performance monitoring guidelines described in RG 1.174 and RG 1.178 and are, therefore, acceptable.

3.10 Examination Methods

Section 4 of the EPRI TR addresses the NDE techniques which must be used in a RI-ISI program. This section emphasizes the concept that the inspection technique utilized must be specific to the degradation mechanism expected. Table 4.1 of the EPRI TR summarizes the degradation mechanisms expected and the examination methods which are appropriate. Specific references are provided to the ASME Code, Section XI concerning the manner in which the examination is conducted and the acceptance standard.

Code Case N-716 addresses the issue of the degradation mechanism/inspection technique in Table 1. Similar to Table 4.1 of the EPRI TR, Table 1 of Code Case N-716 degradation mechanism and corresponding inspection techniques. This table also provides references to ASME Code, Section XI concerning the manner in which the examination is conducted and to the acceptance standard.

In its relief request, the licensee states that the implementation of the RI-ISI program will conform to Code Case N-716, i.e., each HSS piping segment will be assigned to the appropriate item number within Table 1 of Code Case N-716. The NRC staff finds this acceptable because proper assignment of piping segments into Table 1 will ensure that appropriate inspections to detect the degradation mechanism under consideration are conducted. The NRC staff finds this approach acceptable because it is consistent with the EPRI TR which has been reviewed and approved by the NRC and Code Case N-716 includes additional code item numbers to assign NDE requirements to all HSS locations including those segments where no degradation mechanism has been identified.

3.11 Conclusion

Pursuant to 10 CFR 50.55a(a)(3)(i), alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the NRC, if a licensee demonstrates that the proposed alternatives will provide an acceptable level of quality and safety. In this case, the licensee has proposed to use an alternative to the risk-informed process described in NRC-approved EPRI TR-112657.

The implementation strategy is consistent with the RG 1.178 guidelines because the number and location of inspections is a product of a systematic application of the risk-informed process. Other aspects of the licensee's ISI program, such as system pressure tests and visual examination of piping structural elements will continue to be performed on all Class 1, 2, and 3 systems in accordance with ASME Code, Section XI. This provides a measure of continued monitoring of areas that are being eliminated from the NDE portion of the ISI program.

As required by EPRI TR-112657 methodology, the existing ASME Code performance measurement strategies will remain in place. In addition, the Code Case N-716 methodology provides for increased inspection volumes for those locations that are included in the NDE portion of the program.

Regulatory Guide RG 1.174 provides NRC staff recommendations for using risk-informed decisions in support of changes to a plants licensing basis. Regulatory Guide 1.178 provides guidance on acceptable approaches in meeting existing ASME Code Section XI requirements for the scope and frequency of inspection of ISI programs, and for making risk-informed decisions involving alternatives to the ISI program requirements of 10 CFR 50.55a(g) and its directive to follow the requirements of ASME Code Section XI. The EPRI TR-112657 RI-ISI methodology contains details for developing an acceptable RI-ISI program. Code Case N-716, modified as described by the licensee in its submittal, describes a methodology similar to the EPRI TR-112657 methodology but with differences as described in this safety evaluation. The NRC staff has evaluated each of the differences and determined that the licensee's proposed methodology, when applied as described, meets the intent of all the steps endorsed in EPRI TR-112657, is consistent with the guidance provided in RG 1.178, and therefore satisfies the guidelines established in RG 1.174.

Based on the discussion above, the NRC staff concludes that the proposed RIS_B program provides an acceptable level of quality and safety for the alternative to piping ISI requirements with regard to (1) the number of locations, (2) the locations of inspections, and (3) the methods of inspection. Therefore, the proposed RI-ISI program is authorized for the fifth 10-year ISI interval at MNGP pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that this alternative continues to provide an acceptable level of quality and safety.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes relief request RR-003 for MNGP. The relief request is authorized for use during the fifth ISI interval at MNGP which commenced on September 1, 2012, and is scheduled to end 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.

5.0 REFERENCES

1. Letter from Karen D. Fili (NSPM) to the U.S. NRC Document Control Desk (DCD), "Request to Utilize an Alternative to the Requirements of 10 CFR 50.55a(g) for Implementation of a Risk-Informed, Safety-Based Inservice Inspection Program Based on ASME Code Case N-716," dated October 31, 2013 (ADAMS Accession No. ML13308A390).

2. Letter from Karen D. Fili (NSPM) to the U.S. NRC DCD, "Response to NRC Request for Additional Information Regarding Relief Request RR-003, Implementation of a Risk-Informed/Safety-Based Inservice Inspection Program Based on ASME Boiler and Pressure Code Case N-716 for ASME Class 1 and 2 Piping Welds (TAC No. MF3050)," dated May 8, 2014 (ADAMS Accession No. ML14128A319).

3. Letter from Karen D. Fili (NSPM) to the U.S. NRC DCD, "Response to NRC Request for Additional Information Regarding Request RR-003, Implementation of a Risk-Informed/Safety-Based Inservice Inspection Program Based on ASME Boiler and Pressure Code Case N-716 for ASME Class 1 and 2 Piping Welds (TAC No. MF3050)," dated May 19, 2014 (ADAMS Accession No. ML14139A233).

4. ASME Code Case N-716, "Alternative Piping Classification and Examination Requirements, Section XI Division 1," © ASME, New York, New York, dated April 19, 2006.

5. EPRI TR-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," dated December 1999 (ADAMS Accession No. ML013470102).

6. RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," dated May 2011 (ADAMS Accession No. ML100910006).

7. RG 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping," dated September 2003 (ADAMS Accession No. ML032510128).

8. RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," dated January 2007 (ADAMS Accession No. ML070240001).

9. NUREG-0800, Chapter 3.9.8, "Standard Review Plan for the Review of Risk-Informed Inservice Inspection of Piping," dated September 2003 (ADAMS Accession No. ML032510135).

10. NRC Safety Evaluation Report related to "Revised Risk-Informed Inservice Inspection Evaluation Procedure" (EPRI TR-112657, Rev. B, July 1999), dated October 28, 1999 (ADAMS Accession No. ML993190474).

11. ASME/ANS RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," © ASME, New York, New York, dated December 2009.

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Sincerely,

/RA/

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Office of Nuclear Reactor Regulation

Docket No. 50-263

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Staff Evaluation of Relief Request RR-003

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