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

March 27, 2012

Mr. David A. Heacock
President and Chief Nuclear Officer
Dominion Nuclear Connecticut, Inc.
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: MILLSTONE POWER STATION, UNIT NO. 2 – ISSUANCE OF RELIEF REQUEST RR-04-11 REGARDING RISK-INFORMED INSERVICE INSPECTION PROGRAM (TAC. NO. ME5962)

Dear Mr. Heacock:

By letter dated March 30, 2011,[1] as supplemented by letters dated June 23, 2011, and January 12, 2012,[2] Dominion Nuclear Connecticut, Inc. (DNC or the licensee), requested authorization to implement a risk-informed inservice inspection (RI-ISI) program for Millstone Power Station, Unit No. 2 (MSP2) during the fourth 10-year inservice inspection (ISI) interval. DNC proposed the use of the risk-informed / safety-based inservice inspection (RIS_B) process for the ISI of American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code) Class 1 and Class 2 piping, Examination Categories B-F, B-J, C-F-1, and C-F-2 piping welds. DNC's request is based, in part, on ASME Code Case N-716, "Alternative Piping Classification and Examination Requirements, Section XI Division 1." Code Case N-716 is not approved for use by the U.S. Nuclear Regulatory Commission (NRC).

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(i), the licensee requested authorization to implement a RI-ISI program in lieu of the ASME Code required inspection program on the basis that the RI-ISI program provides an acceptable level of quality and safety.

The NRC staff has reviewed the subject request, and concludes that the licensee's proposed RIS_B program will provide an acceptable level of quality and safety for the piping ISI requirements with regard to (1) the number of locations, (2) the locations of inspections, and (3) the methods of inspection. Therefore, the NRC staff authorizes the proposed RI-ISI in accordance with 10 CFR 50.55a (a)(3)(i) for the MSP2 fourth 10-year inservice inspection interval. The NRC staff's approval of the licensee's RIS_B program does not constitute approval of Code Case N-716.

[1] Agencywide Document Access and Management System (ADAMS) Accession No. ML110900670
[2] ADAMS Accession Nos. ML11179A025 and ML12020A243, respectively

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 question, please contact the Project Manager, Carleen Sanders, at 301-415-1603.

Sincerely,

Meena Khanna, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-336

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST RR-04-11

RISK-INFORMED INSERVICE INSPECTION PROGRAM

DOMINION NUCLEAR CONNECTICUT, INC.

MILLSTONE POWER STATION, UNIT NO. 2

DOCKET NUMBER 50-336

1.0 INTRODUCTION

By letter dated March 30, 2011,[1] as supplemented by letters dated June 23, 2011, and January 12, 2012,[2] Dominion Nuclear Connecticut, Inc. (DNC or the licensee), requested authorization to implement a risk-informed inservice inspection (RI-ISI) program plan for Millstone Power Station, Unit No. 2 (MSP2) during the fourth 10-year inservice inspection (ISI) interval. DNC proposed the use of the risk-informed / safety-based inservice inspection (RIS_B) process for the ISI of American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code) Class 1 and Class 2 piping, Examination Categories B-F, B-J, C-F-1, and C-F-2 piping welds.

DNC requests to implement a RIS_B program based, in part, on ASME Code Case N-716, "Alternative Piping Classification and Examination Requirements, Section XI Division 1" (N-716 or code case). The ASME Code developed the provisions of N-716 to be used in lieu of the requirements of ASME Code Article IWB-2420, Article IWB-2430, Table IWB-2500-1 (Examination Categories B-F and B-J), Article IWC-2420, Article IWC-2430, and Table IWC-2500-1 (Examination Categories C-F-1 and C-F-2) for inservice inspection of Class 1 or 2 piping. It was also developed to be used in lieu of Articles IWB-2200 and IWC-2200 for preservice inspection of Class 1 or 2 piping, and to establish additional requirements for Class 3 piping or Non-Class piping. The N-716 requirements are expected to reduce the number of inspections required but may also define additional requirements for Class 3 or Non-Class piping.

N-716 has not been endorsed for generic use by the U.S. Nuclear Regulatory Commission (NRC); however the NRC staff's review of the licensee's application of the code case, as described in this safety evaluation (SE), indicates that the application fully complies with the regulatory requirements and safety goals set forth in regulatory guides (RG) 1.174, "*An Approach for Using Probabilistic Risk Assessment In Risk-Informed Decisions On Plant-Specific*

[1] Agencywide Document Access and Management System (ADAMS) Accession No. ML110900670
[2] ADAMS Accession Nos. ML11179A025 and ML12020A243, respectively

Enclosure

Changes to the Licensing Basis,"[3] and RG 1.178, "*An Approach for Plant-Specific Risk-Informed Decisionmaking - Inservice Inspection of Piping,"*[4] for RI-ISI programs. The MSP2 request for relief refers to the methodology described in N-716 instead of describing the details of the methodology. DNC has, however, modified the methodology described in N-716 while developing its proposed RIS_B program. When the methodology used by the licensee is accurately described in N-716, this SE refers to the details found in N-716. When the methodology used by the licensee deviates or expands upon the methodology described in N-716, this SE refers to the licensee's submittals cited above.

2.0 REGULATORY EVALUATION

The ISI of ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as required by 10 CFR 50.55a(g), except where specific relief has been requested by the licensee pursuant to 10 CFR 50.55a(g)(5)(iii) and granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i). The objective of the ISI program, is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary of these components that may impact plant safety. It states in 10 CFR 50.55a(a)(3) that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (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.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 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 interval and subsequent intervals 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, subject to the limitations and modifications listed therein. MSP2 is currently in its fourth 10-year ISI interval which began April 1, 2010 and is scheduled to end March 31, 2020. The ASME Section XI code of record for MSP2's fourth ISI interval is the 2004 Edition with No addenda.

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 all B-F welds and 25 percent of all 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 Categories C-F-1 and C-F-2 piping welds, 7.5 percent of non-exempt welds are selected for volumetric or surface examination, or both. The licensee has proposed to use a RIS_B program for ASME Code Class 1 and Class 2 piping (Examination Categories B-F, B-J, C-F-1 and C-F-2 piping welds), as an alternative to the ASME Code, Section XI requirements. As stated in Section 1.0 of this SE, the provisions of N-716 are

[3] ADAMS Accession Number ML023240437
[4] ADAMS Accession Number ML032510128

expected to reduce the number of required examinations but may also define additional requirements for ASME Code Class 3 or Non-Class piping. The March 30, 2011, letter states that this proposed program will be substituted for the current program in accordance with 10 CFR 50.55a(a)(3)(i) by alternatively providing an acceptable level of quality and safety.

N-716 is founded in large part on the RI-ISI process as described in Electric Power Research Institute (EPRI) Topical Report (TR)-112657 Revision B-A, "*Revised Risk-Informed Inservice Inspection Evaluation Procedure*,"[5] which was previously reviewed and approved by the NRC. The NRC staff has reviewed the development of the proposed RIS_B RI-ISI program using the following documents:

- RG 1.174,
- RG 1.178, and
- RG 1.200, "Revision 1, *An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities.*"[6]

RG 1.174 provides guidance on the use of probabilistic risk analysis (PRA) findings and risk insights in support of licensee requests for changes to a plant's licensing basis. RG 1.178 describes a RI-ISI program as one that incorporates risk insights that can focus inspections on more important locations while at the same time maintaining or improving public health and safety. RG 1.200 describes one acceptable approach for determining whether the quality of the PRA, in total or the parts that are used to support an application, is sufficient to provide confidence in the results, such that the PRA can be used in regulatory decision-making.

3.0 TECHNICAL EVALUATION

As described above, N-716 is founded, in large part, on the RI-ISI process as described in the EPRI TR, which was previously reviewed and approved by the NRC. In general, the licensee simplified the EPRI TR method because it does not evaluate system parts that have been generically identified as high safety-significant (HSS), and uses plant-specific PRA to evaluate in detail only system parts that cannot be screened out as low-safety-significant (LSS).

An acceptable RI-ISI program replaces the number and locations of nondestructive examination (NDE) inspections based on ASME Code, Section XI requirements with the number and locations of these inspections based on the RI-ISI guidelines as described in RG 1.178. The proposed RIS_B program permits alternatives, in accordance with N-716, 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) for ISI of Class 1 and 2 piping and IWB-2200 and IWC-2200 for preservice inspection of Class 1 or 2 piping, or as additional requirements for Subsection IWD. The proposed RIS_B program may also require ISI and preservice inspection of Class 3, or Non-Class piping. All piping components,

[5] ADAMS Accession Number ML013470102
[6] ADAMS Accession Number ML070240001

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.

The EPRI TR RI-ISI process 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 processes 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 protection of public health and safety. In general, the methodology in N-716 replaces a detailed evaluation of the safety significance of each pipe segment with a generic population of HSS segments, followed by a screening flooding analysis to identify any plant-specific HSS segments. The screening flooding analysis is performed in accordance with the flooding PRA approach that is consistent with Section 4.5.7 of ASME RA-Sb-2005, "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications, Addendum B to ASME RA-S-2002," as endorsed in RG 1.200. As described below, the acceptability of the licensee's proposed RIS_B program is evaluated by comparing the processes it has applied to develop its program with the steps from the EPRI-TR process.

3.1 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. Standard Review Plan (SRP) 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 MSP2'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 section 3.4.2 of the March 20, 2011, letter, one non-class fire protection pipe run was identified in accordance with N-716 for inclusion in the RIS_B program for inspections. RG 1.178 identifies different groupings of plant piping that should be included in a RI-ISI program, and also clarifies that a "full-scope" risk-informed evaluation is acceptable. The scope of the RIS_B program as defined in N-716 and as evaluated by DNC is consistent with the definition of full-scope in RG 1.178. Therefore, the NRC staff concludes that the "full-scope" extent of the piping included in the RIS_B program satisfies the SRP and RG guidelines and is acceptable.

3.2 Consequence Evaluation

The methodology described in RG 1.178 and the EPRI TR 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 the EPRI TR that yield equivalent results. The consequences are used to determine the safety significance of the segments.

In contrast to the EPRI TR methodology, N-716 does not require that the consequence of each segment failure be estimated to determine the safety-significance of piping segments. Instead, 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) in 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, and SRP 3.9.8, and, therefore, the generic results are derived from acceptable analyses. Section 2(a)(5) in N-716 provides guidance that defines additional, plant-specific HSS segments that should be identified using a plant-specific PRA of pressure boundary failures.

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. This is consistent with the guidelines for evaluating pipe failures with PRA described in RG 1.178 and the EPRI TR and is, therefore, acceptable.

3.3 Degradation Mechanism Evaluation

The approaches employed, with respect to the evaluation of degradation mechanisms, by the EPRI TR, N-716, and the DNC's request for relief are generally similar. Based on the general similarity, the NRC accepts the licensee's conceptual approach to this topic. Despite the general similarity between these approaches, there are some significant differences. These are described below.

The EPRI TR and N-716 differ in the number of pipe segments which are evaluated. The EPRI TR requires the evaluation of each pipe segment to determine all applicable degradation mechanisms. This is then used to determine the safety significance of the segment. Alternatively, the code case identifies a generic population of piping segments to be assigned to the HSS category without evaluation, followed by a search for plant-specific HSS welds. The N-716 approach is at least as conservative as the EPRI TR approach because it identifies, as HSS, each piping segment which would have been so identified by the EPRI TR and it may identify additional piping segments as HSS. Based on this conservatism, the NRC finds the use of the degradation mechanism evaluation aspect of N-716 acceptable.

In lieu of conducting a degradation mechanism evaluation for all the LSS piping, all locations were conservatively assigned to the medium-failure potential. This was done for the purpose of assigning a failure frequency to be used to calculate the change in risk. This results in an equal or greater estimated increase in risk from discontinued inspections because the failure frequencies would always be equal to or less than those used in the licensee's analysis if the susceptibility of all LSS welds to all degradation mechanisms was determined. The NRC finds this approach of N-716 and the licensee's alternative acceptable because the assumed degradation mechanism will always result in the assignment of a failure probability at least as high as the complete analysis required by the EPRI TR methodology.

The EPRI TR and the N-716 both consider a long and identical list of degradation mechanisms. Both of these lists include primary water stress corrosion cracking (PWSCC). In its relief request, the licensee considers all of these mechanisms including PWSCC. The licensee stated that Alloy 600/82/182 inspections are addressed through a separate augmented inspection program in accordance with ASME Code Case N-722 as required by 10 CFR 50.55a. The licensee stated that the RIS_B application does not take credit for these augmented examinations. However, the NRC issued rulemaking on June 21, 2011, which mandated the implementation of ASME Code Case N-770-1, applicable to Alloy 600 dissimilar metal butt welds susceptible to PWSCC. The NRC finds that these Alloy 600 butt welds susceptible to PWSCC should be removed from the RIS_B program and examined in accordance with N-770-1 and 10 CFR 50.55a(g)(6)(ii)(F). The NRC staff finds that the exclusion of welds susceptible to PWSCC from this RI-ISI program and inclusion of these welds in a plant augmented inspection program designed to meet the requirements of N-770-1 is acceptable because these welds will be adequately inspected under the augmented program. If these welds are susceptible to degradation mechanisms other than PWSCC, these mechanisms should be considered in the RIS_B program.

DNC's request differs from the EPRI TR in the manner in which thermal stratification, cycling, and striping (TASCS) is addressed. The method contained in the EPRI TR does not allow for the consideration of the severity of fatigue cycles. The method proposed by the licensee does. Therefore, the method proposed by the licensee provides a more accurate prediction of this degradation mechanism and the NRC staff finds the method to be acceptable.

DNC's request and the EPRI TR also differ on the number of pipe segments evaluated for flow accelerated corrosion (FAC) and water hammer. The EPRI TR states that all pipe segments are to be evaluated for FAC and water hammer as the presence of these degradation mechanisms may affect the failure potential for the piping segment. N-716 requires evaluation of all piping segments not specified as HSS by the code case to determine whether water hammer is present. If water hammer is present in a piping segment then, that segment is assigned a high failure potential in accordance with Table 3 of N-716 because, as stated above, LSS segments are initially assumed to have a medium failure potential. The NRC staff finds this approach acceptable as it is consistent with the EPRI TR for those segments considered, and for those segments not fully evaluated, it conservatively assumes these segments to be of HSS.

3.4 Piping Segment Definition

Previous guidance on risk-informed inservice inspection including RG 1.178 and the EPRI-TR 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 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 N-716 uses a PRA to identify plant specific piping that might be assigned HSS. A flooding PRA consistent with ASME RA-Sb-2005 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, the length of pipe included in the analysis is consistent with the definition of a segment in RG 1.178.

An additional purpose of piping segments in the EPRI-TR 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. 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 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. 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. A flooding PRA consistent with ASME RA-Sb-2005 utilizes lengths of piping consistent with the segment definition in RG 1.178 whenever a consequence evaluation is needed. Therefore, the 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.

3.5 Risk Categorization

Sections 2(a)(1) through 2(a)(4) in 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 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. N-716 requires that any segment with a total estimated CDF greater than 1E-6/year be assigned to the HSS category. The licensee augmented this 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 1E-7/year. The licensee stated that these guideline values are suitably small and consistent with the decision guidelines for acceptable changes in CDF and LERF found in the EPRI TR.

A review of the flooding PRA was performed to identify any piping whose failure could cause flooding that could significantly impact safety significant components. During the review, it was determined by the licensee that one pipe run contributed to a CDF greater than 1E-06/yr due to flooding in an electrical room. This non-class pipe is a portion of the fire protection system that runs through the East DC Switchgear Room and was designated as HSS. Localized corrosion in the form of micro-biologically induced corrosion and pitting was determined a concern for pipe failure and twenty-five percent of the component areas were selected for examination over the interval. In addition, by letter dated January 12, 2012, the licensee submitted supplemental information that identified additional fire protection piping to be designated as HSS. This piping is part of the fire suppression system in the auxiliary building cable vault and will be conservatively included in the RI-ISI program until a flow rate analysis and PRA model update are performed. Another fire protection piping segment located in the turbine building cable vault was also identified; however, the licensee determined that a flooding event resulting from a failure of this piping segment would not contribute significantly to CDF or LERF because there would be adequate time for operators to mitigate the flood from this source. The licensee performed a walkdown of plant areas that, if flooded, would result in a HSS flood scenario. The internal flooding model was then reviewed to verify these flooding scenarios were included. The licensee reviewed the results of its flooding analysis and did not identify any segments other than the fire protection piping that had a CDF greater than 1E-6/year or a LERF greater than 1E-7/year.

In the March 30, 2011, letter the licensee clarified that these ancillary metrics, as described above, 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 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 RG 1.174 acceptance guidelines. 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 Sections 2(a)(1) through 2(a)(4).

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 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 (ASME RA-Sb-2005 at the time of the application) 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 March 30th letter, the licensee states that the MSP2 Probabilistic Safety Assessment model underwent a formal industry peer review in 2006. In October 2007, a self assessment was performed against the ASME PRA standard RA-Sb-2005 and RG 1.200, Revision 1. In January 2011, the MPS2 PRA model was updated to meet capability category II supporting requirements for internal events and internal flooding of the ASME/ANS Combined PRA Standard and RG 1.200, Revision 2.

Findings from the self assessment review indicate 42 "not-met" supporting requirements (SR) to capability category II. The vast majority of these findings are considered documentation related and have no technical impact on the PRA model. In the June 23, 2011, letter the licensee clarified its resolution of IFPP-A3 by stating that multi-unit flood areas and scenarios are not relevant for MPS2 because MPS2 and Millstone Power Station, Unit No. 3 (MPS3) are physically separate and do not share any buildings pertinent to the internal flooding PRA. The only fluid systems that connect MPS2 and MPS3 are the instrument air crosstie and condensate polishing systems. Both of these systems have minimal impact on the ISI program. The licensee provided sufficient resolution for each of the outstanding SRs to verify that they do not impact the ISI application. The NRC staff agrees that each of these SRs would have a minimal or conservative impact on the risk-insights for this application.

The NRC staff finds 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).

The NRC staff finds that the risk categorization performed by MSP2 provides confidence that HSS segments have been identified. Sections 2(a)(1) through 2(a)(4) in N-716 which identify generic HSS portions of systems were applied to MSP2 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.

3.6 Inspection/NDE Selection

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

N-716 contains no provisions for changing the FAC augmented program developed in response to NRC Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning." The licensee's

FAC program is relied upon to manage this damage mechanism but is not otherwise affected or changed by the RIS_B program.

The licensee's augmented inspection program to inspect Alloy 600/82/182 locations in accordance with ASME Code Case N-722-1, "Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated With Alloy 600/82/182 Materials, Section XI Division 1," is unaffected by the RIS_B program.

The licensee stated in the March 30th letter that the analysis for PWSCC was performed in accordance with N-716 and selections were made to meet the criteria of the code case. Section 3.3.1 of the March 30, 2011, letter further describes examinations of welds mitigated for PWSCC that would be examined in accordance with Relief Request RR-04-07[7] that had been submitted to the NRC for approval. DNC goes on to state that they anticipated the next revision of 10 CFR 50.55a would address these welds and at that time the licensee would incorporate the new regulatory requirements.

Subsequent to the licensee's submittal, in a Final Rule issued in the *Federal Register*, dated June 21, 2011 (76 FR 36232), the NRC added a new paragraph to 10 CFR 50.55a(g)(6)(ii)(F) requiring licensees to implement ASME Code Case N-770-1, "Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated with UNS N06082 or UNS W86182 Weld Filler Materials With or Without the Application of Listed Mitigation Activities, Section XI, Division 1," subject to the conditions specified in paragraphs (g)(6)(ii)(F)(2) through (g)(6)(ii)(F)(16). In addition, the NRC held a public meeting to discuss the June rulemaking and the implementation of Code Case N-770-1 on July 12, 2011.[8] The NRC indicated that the Alloy 600 welds susceptible to PWSCC should not be included in the RIS_B program but should be addressed in an augmented inspection program. However, in those cases where the RI-ISI program identifies degradation mechanisms other than PWSCC that could affect either unmitigated or mitigated welds, those degradation mechanisms should still be considered in the RI-ISI program for examinations. The rule became effective on July 21, 2011. Consequently, by letter dated July 28, 2011,[9] DNC withdrew Relief Request RR-04-07 because it is no longer needed.

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.

Section 3.6 of the EPRI TR addresses the selection of pipe segments for inspection. This section presents the current Code requirements. It also establishes requirements for the RI-ISI program related to:

- Class 1 category BJ welds,
- Class 1, 2, and 3 piping,

[7] ADAMS Accession No. ML102580204
[8] ADAMS Accession No. ML112240818
[9] ADAMS Accession No. ML11209556

- Piping subject to localized corrosion,
- Impact of augmented inspection programs on the selection of pipe segments for RI-ISI Guidance for selecting individual welds for inspection within a group of welds, and
- Reinspection sample size.

In its relief request, the licensee has chosen to base its selection of pipe segments on N-716. N-716 has adopted a pipe selection procedure which differs from that in the EPRI TR. While the approach adopted by the N-716 may or may not be more conservative than that adopted by the EPRI TR, the change in risk evaluation required by N-716, and described elsewhere in this SE, mandates that the increase in risk (CDF and LERF), as compared to the current ASME Code requirements, for any given system cannot exceed 1×10^{-7} and 1×10^{-8} per year, respectively, and that the total increase in CDF and LERF may not exceed 1×10^{-6} and 1×10^{-7} per year, respectively. The NRC staff finds the approach used in the N-716 and by the licensee to be acceptable because the CDF and LERF associated with the piping under consideration is generally lower and in no case is significantly greater than the risk currently accepted when the existing code requirements are used.

In addition to the information regarding the number of welds to be inspected, the EPRI TR contains information concerning additional criteria to be considered when selecting welds for inspection. The EPRI TR states that licensees should consider:

- Plant specific service history,
- Predicted severity of postulated damage mechanisms,
- Configuration/accessibility of element to enable effective examination,
- Radiation exposure,
- Stress concentration, and
- Physical access to element.

N-716 also contains additional information for consideration in weld selection. This list includes:

- Plant specific cracking experience,
- Weld repairs,
- Random selection, and
- Minimization of worker exposure

Additionally, the 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 and N-716.

The NRC staff reviewed the tables provided in the relief request which address degradation mechanisms, failure potential and the number of welds selected for evaluation. The NRC staff finds that the data contained in these tables is consistent with the requirements of the EPRI TR, and therefore is acceptable.

3.7 Risk Impact Assessment

The licensee uses a change in risk estimation process approved by the NRC staff in the EPRI TR. The change in risk assessment in the EPRI TR permits using each segment's CCDP and CLERP or, alternatively, placing each segment into high-, medium-, or low-consequence "bins" and using a single bounding CCDP and CLERP for all segments in each consequence bin. 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 the EPRI TR. 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) and corresponding types of feedwater and steam piping breaks. Conservative CCDP estimates were developed from the PRA for these initiating events. 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.

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 RA-Sa-2009. Only segments with locations at which an inspection is being discontinued need to be included in the change in risk calculation; therefore, limiting the consequence evaluation to segments that are inspected is acceptable.

Section 5 in N-716 requires that any piping that has NDE inspections[10] added or removed per 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) in N-716 include limits of 1E-7/year and 1E-8/year for increase in CDF and LERF, respectively, for each system, and limits of 1E-6/year and 1E-7/year for the total increase in CDF and LERF, respectively, 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 the EPRI TR and are, therefore, acceptable.

[10]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 the EPRI TR that the surface exams do not appreciably contribute to safety and need not be included in the change in risk quantification and, therefore, exclusion of surface examinations from the change in risk evaluations is acceptable.

The change in risk evaluation approved in the EPRI TR method 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 EPRI TR method with the exception that the change in risk calculation in N-716 includes the risk increase from discontinued inspection in LSS locations. CCDP and CLERP values greater than 1E-4 and 1E-5 were used for LSS welds to bound plant internal flooding study results. These values used for CCDP and CLERP were determined based on results from the plant internal flooding study and are conservatively applied as an upper bound for all LSS welds. In lieu of conducting a formal degradation mechanism evaluation for all LSS piping (e.g., thermal fatigue), these locations were conservatively assigned to the medium failure potential category for use in the change in risk assessment. The high failure potential category is not applicable since a review was conducted to ascertain LSS piping is not susceptible to FAC or water hammer. The NRC staff concludes that the licensee's method described in the submittal is acceptable because the deviation from the approved EPRI TR method expands the scope of the calculated change in risk.

The licensee provided the results of the change in risk calculations in the submittal and noted that most of the results indicate a small and acceptable increase in risk and that all the estimates satisfy both the system level and the total guidelines. Therefore, the NRC staff finds the change in risk acceptable for this application.

3.8 Implementation Monitoring and Feedback

Element 3 of RG 1.178 and SRP 3.9.8 address the implementation, performance monitoring and corrective action strategies which are acceptable.

The program implementation category requires that a licensee's RI-ISI program have a schedule for inspecting all piping segments categorized as safety significant. It further states that the inspection interval will normally be that prescribed by Section XI of the ASME Code but that certain degradation mechanisms may require the interval to be altered. The performance monitoring category requires that a licensee's RI-ISI program be updated based on: changes in plant design features, changes in plant procedures, equipment performance changes, examination results, and plant or industry operating experience. Additionally, a licensee must update its program periodically to correspond to the requirements contained in Section XI of the ASME Code, Inspection Program B. The corrective action category requires a corrective action program that is consistent with the requirements of Section XI of the ASME Code for both Code Class and Non-Code Class piping.

DNC developed implementation procedures for its program in accordance with N-716. In its relief request, the licensee states that it has a corrective action program and that it will review the RI-ISI program periodically as required by the ASME Code or more frequently as directed by the NRC, or industry or plant specific feedback. Sections 6 and 7 of N-716 address inspection frequency and program updates. These sections indicate that inspection frequencies should normally be in accordance with ASME Code requirements and that updates should be made on an ASME Code dictated schedule or more frequently in response to plant and industry events or information.

The NRC finds the licensee's approach to implementing the program to be acceptable because, in accordance with RG 1.178, the licensee indicated that it inspects components on a frequency based on the ASME Code, that it has a corrective action program, and that it updates the program periodically and in response to plant and industry events and information.

3.9 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 concerning the manner in which the examination is conducted and the acceptance standard.

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

In its request for relief, the licensee states that the implementation of the RI-ISI program will conform to the code case, i.e., each HSS piping segment will be assigned to the appropriate item number within Table 1 of 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 finds this approach acceptable because it is consistent with the EPRI TR.

4.0 CONCLUSION

As stated above, the licensee proposed to use an alternative to the risk-informed process described in Code Case N-716 which is based, in large part, on NRC-approved EPRI TR-112657. The implementation strategy is consistent with the EPRI-TR 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 the EPRI TR 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.

The EPRI RI-ISI methodology contains details for developing an acceptable RI-ISI program. Code Case N-716, modified as described by the licensee in its submittals, describes a methodology similar to the EPRI methodology but with several differences as described above. 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 the EPRI TR, is consistent with the guidance provided in RG 1.178, and satisfies the guidelines established in RG 1.174.

The NRC staff concludes that the licensee's proposed RIS_B program will provide an acceptable level of quality and safety for the piping ISI requirements with regard to (1) the number of locations, (2) the locations of inspections, and (3) the methods of inspection. Therefore, the NRC staff authorizes the proposed RI-ISI in accordance with 10 CFR 50.55a (a)(3)(i) for the MSP2 fourth 10-year inservice inspection interval. The NRC staff's approval of the licensee's RIS_B program does not constitute approval of Code Case N-716.

All requirements, other than for which relief was specifically requested and authorized, remain applicable, including the third party review by the Authorized Nuclear Inservice Inspector.

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Date: March 27, 2012

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 question, please contact the Project Manager, Carleen Sanders, at 301-415-1603.

Sincerely,

/ra/

Meena Khanna, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-336

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