September 28, 2007

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SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2 - RISK-INFORMED SAFETY-BASED INSERVICE INSPECTION PROGRAM FOR CLASS 1 AND 2 PIPING WELDS (TAC NOS. MD3137 AND MD3138)

By letter dated September 29, 2006, as supplemented by letters dated September 5 and September 18, 2007, Indiana Michigan Power Company (the licensee) requested approval of a risk-informed/safety-based inservice inspection (ISI) program for piping at the Donald C. Cook Nuclear Plant, Units 1 and 2. The proposed program is based, in part, on the American Society of Mechanical Engineering Boiler and Pressure Vessel Code, Section XI, Code Case N-716.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request, and concludes that the licensee's proposed alternative provides an acceptable level of quality and safety. Therefore, the NRC staff authorizes the proposed alternative in accordance with Title 10 of the *Code of Federal Regulations* 50.55a(a)(3)(i) for the third period of the third 10-year ISI interval (that began on July 1, 1996) on the basis that this alternative will provide an acceptable level of quality and safety. Details of the NRC staff's review are contained in the enclosed safety evaluation. However, the NRC staff's approval of the licensee's risk-informed safety-based program does not constitute approval of Code Case N-716.

Sincerely,

/RA/

Travis L. Tate, Acting Branch Chief
Plant Licensing Branch 3-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-315 and 50-316

Enclosure:
Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

APPROVAL OF RISK-INFORMED/SAFETY BASED

INSERVICE INSPECTION PROGRAM FOR CLASS 1 AND 2 PIPING WELDS AT

DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2 (DCCNP-1 AND DCCNP-2)

1.0 INTRODUCTION

By letter dated September 29, 2006 (Accession No. ML062850540), as supplemented by letters dated September 5, (Accession No. ML072560014), and September 18, 2007 (Accession No. ML072690424, Indiana Michigan Power Company (I&M, the licensee) submitted a relief request, proposing a risk-informed/safety-based inservice inspection (RIS_B) program as an alternative to a portion of its current inservice inspection (ISI) program for DCCNP-1 and DCCNP-2. I&M proposed the use of the RIS_B process for the inservice inspection 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. I&M 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" (CC N-716). The provisions of CC N-716 define additional requirements for Class 3 piping or non-Class piping.

CC 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, which was previously reviewed and approved by the U.S. Nuclear Regulatory Commission (NRC). The licensee proposed the RIS_B program as an alternative to the requirements in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i). The licensee requested implementation of this alternative during the third period of the third 10-year ISI interval that began on July 1, 1996.

CC N-716 has not been endorsed for generic use by the NRC. I&M's relief request refers to the methodology described in CC N-716 instead of describing the details of the methodology in the relief request. I&M has, however, modified the methodology described in CC N-716 while developing its proposed RIS_B program. When the methodology used by the licensee is accurately described in CC N-716, this safety evaluation (SE) refers to the details found in CC N-716. When the methodology used by the licensee deviates or expands upon the methodology described in CC N-716, this SE refers to the licensee's submittals cited above. Therefore, CC N-716 is incorporated in this SE only as a source for some of the detailed methodology descriptions as needed and the NRC staff is not endorsing the use of CC N-716.

ENCLOSURE

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 Code to the extent practical within the limitations of design, geometry, and materials of construction of the components. Paragraph 10 CFR 50.55a(g) also states that ISI of the 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 written relief has been granted by the NRC. The objective of the ISI program, as described in Section XI of the ASME Code and applicable addenda, 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.

The regulations also require, during the first 10-year ISI interval and during subsequent intervals, 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 into 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The DCCNP units are in the third period of the second 10-year ISI interval. The applicable edition of Section XI of the ASME Code for DCCNP for the second 10-year ISI interval is the 1989 Edition.

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. ASME Code requires 100 percent of all B-F welds, 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. As discussed in Reference 5, the selection of welds in the ASME program is based on design stress reports. These analyses are typically very conservative and may not provide an accurate representation of failure potential. Industry experience has shown that pipe failures, while rarely occurring, are due primarily to corrosion or fatigue type failure mechanisms and typically occur in locations not addressed in the plant's ASME ISI program. While the use of conservative assumptions is appropriate in the design of piping systems to achieve high levels of reliability, insights supported by operating experience indicate that it provides misleading expectations regarding the effectiveness of piping inspection programs.

According to 10 CFR 50.55a(a)(3), the NRC may authorize alternatives to the requirements of 10 CFR 50.55a(g), if an applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety, or that compliance with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee has proposed to use an 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. The provisions of CC N-716 define additional requirements for Class 3 piping or non-Class piping. The licensee asserts that this proposed program provides an acceptable level of quality and safety and, therefore, satisfies the requirements of 10 CFR 50.55a(a)(3)(i).

The licensee states that CC 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. The licensee further states that the risk-informed application based upon CC N-716 meets the intent and principles of Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment In

Risk-Informed Decisions On Plant-Specific Changes to the Licensing Basis," and RG 1.178, "An Approach For Plant-Specific Risk-Informed Decisionmaking - Inservice Inspection of Piping."

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 screening probabilistic risk analysis (PRA) to evaluate in detail only system parts that cannot be screened out as low-safety-significant (LSS). The NRC staff has 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"

RG 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping"

NRC report NUREG-0800, Chapter 3.9.8, "Standard Review Plan For the Review of Risk-Informed Inservice Inspection of Piping"

EPRI TR-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure"

Since the issuance of the SE on the EPRI TR, several instances of primary water stress corrosion cracking (PWSCC) of alloy 82/182 dissimilar metal welds have occurred at pressurized-water reactors (PWRs). This has prompted the NRC to send a letter (Reference 9) to the Chairman of the ASME Subcommittee on Nuclear Inservice Inspection, stating that the operating experience with leakage and flaws caused by PWSCC at PWRs supports a position that current ASME Code inspection requirements are not sufficient for managing PWSCC-susceptible butt welds in the reactor coolant pressure boundary of PWRs. This letter represents a departure from the NRC staff's conclusions about PWSCC in the EPRI TR's SER. The NRC staff is including this information to demonstrate that, as issues arise, modifications to RI-ISI programs may be warranted as required in the NRC approval of the RIS_B program. The nuclear power industry, through the Materials Reliability Program (MRP), developed guidance for inspection and evaluation of primary system piping butt welds in MRP-139 (Reference 10). The licensee states that it will follow the inspection schedule in MRP-139.

3.0 TECHNICAL EVALUATION

RG 1.174 provides guidance on the use of 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. The EPRI TR provides a detailed methodology that the NRC staff has previously concluded will result in an acceptable RI-ISI program. The RIS_B program proposed by the licensee also incorporates risk insights to focus inspection on more important locations, although the methodology differs in several respects from the EPRI TR methodology. This SE describes and evaluates the differences between the endorsed EPRI TR methodology 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 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. The proposed RIS_B program permits alternatives to the requirements of IWB-2420, IWB3-2430, 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, and 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 (VT-2) are scheduled in accordance with the DCCNP pressure and leak test program, which remains unaffected by the proposed RIS_B 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. 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 these steps.

3.1 Scope Definition

The scope of evaluation to support RIS_B program development, and of the proposed changes, in CC N-716 and the licensee's submittals 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 DCCNP's evaluation included all 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. The change in risk is used by the licensee to demonstrate that risk increases are small and, therefore, acceptable according to RG 1.174. RG 1.178 clarifies that a "full-scope" risk-informed evaluation is acceptable, where the definition of full-scope is consistent with the scope as defined in CC N-716. Therefore, the NRC staff concludes that the "full-scope" extent of the piping included in the RIS_B program changes satisfies the SRP and RG guidelines and is acceptable.

3.2 Consequence Evaluation

The methodology described in RG 1.178 and the EPRI TR divide 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, CC N-716 does not require that the consequence of each segment failure be estimated to determine the safety-significance of piping segments. Instead, CC 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 CC 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 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 CC 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 stated that it used its PRA of pressure boundary failures (flooding analysis) to search for additional plant-specific HSS segments. The licensee described its flooding analysis in Reference 3. Consistent with CC N-716, the licensee's flooding analysis does not require an estimate of the CCDP and CLERP of each length of pipe. Instead, the analysis describes a systematic process that defines flood zones, identification of flood zone contents (e.g., important equipment), identifies potential flood sources and propagation pathways, and then uses qualitative and quantitative screening to identify potentially important flood scenarios. The CDF and LERF contributions from the significant flood events are quantified. The licensee's September 18, 2007, letter, describes its flooding analysis. The flooding analysis considers both the direct and indirect effects of pressure boundary failure and the different failure modes of the 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.

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 SRP 3.9.8 and is, therefore, acceptable.

3.3 Degradation Mechanism Evaluation

The EPRI TR requires a determination of the 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 the EPRI TR. This information is used to support the safety significance determination for all segments, to target inspections toward the locations with damage mechanisms in the segments that require inspections, and to provide estimates of weld failure frequencies to support the change in risk calculation. Once a segment is placed in the LSS category, the degradation mechanisms at the welds in that segment are not further used in the development of an EPRI RI-ISI program because inspections are not required in LSS segments and the discontinued inspections in LSS segments are not included in the change in risk estimate.

CC N-716 identifies a generic population of HSS welds, followed by a search for plant-specific HSS welds. CC N-716 requires a determination of the susceptibility to all degradation mechanisms of all welds assigned to the HSS category. The degradation mechanisms to be considered in the CC N-716 are consistent with those identified in the EPRI TR report which the staff has previously concluded is a sufficiently comprehensive list of the applicable mechanisms except for PWSCC at PWR units as stated earlier in this SE.

As described above, CC N-716 augments the generic HSS welds with a search for plant-specific HSS welds based on the flooding analysis. The flooding analysis first identifies areas that may be sensitive to floods (i.e., potential HSS areas) and then used qualitative and quantitative screening to identify safety-significant flood events. The licensee stated that, during its initial screening, failure potential calculations were performed using flooding frequencies calculated using the methodology in EPRI TR-102266, “Pipe Failure Study Update.” This methodology provides piping failure frequencies based on pipe size and degradation mechanism (e.g., erosion/corrosion) and is, therefore, consistent with the EPRI RI-ISI methodology. During the final calculations, the license stated that it used ERPI TR-1012302, “Piping Rupture Frequencies for Internal Flooding PRAs - Revision 1.” This document also provides frequencies for different pipe sizes and, when applied to the systems as defined in the report, includes the general characteristics of the fluid systems (i.e., river water source, lake water source, and sea water source). Therefore, the effect of degradation mechanisms associated with these characteristics is included in the failure frequencies consistent with the requirements in the EPRI TR methodology.

The licensee stated that a review was conducted to verify that LSS piping was not susceptible to flow accelerated corrosion (FAC) or water hammer, the two degradation mechanisms that would assign a high failure frequency to a weld. In lieu of conducting a degradation mechanism evaluation for all the LSS piping, all locations were conservatively assigned to the medium failure potential 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 mechanism was determined.

The approach proposed by the licensee identifies degradation mechanisms at all HSS welds and in LSS segments with potential high failure frequency (i.e., susceptible to FAC or water hammer). The licensee used failure frequency estimates that reflected applicable degradation mechanisms while searching for plant-specific HSS welds. Therefore, the NRC staff concurs that limiting the search for degradation mechanisms compared to the search required by the EPRI TR is acceptable because the licensee’s method fulfills the requirements for identifying locations that should be inspected, identifying additional plant-specific HSS segments, and developing a bounding estimate for the change in risk respectively.

3.4 Piping Segment Definition

Previous guidance on RI-ISI including RG 1.178, SRP 3.9.8, and both approved industry methodologies 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 CC 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. The process described by the licensee to search for plant-specific HSS piping first identifies zones that may be sensitive to flooding, and then evaluates 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 and SRP 3.9.8.

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 category, 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. CC 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 CC N-716 process yields a well defined population of HSS welds from which inspections must be selected. This accomplishes the same objective as accounting for each weld throughout the analysis by using segments. CC N-716, as applied by the licensee, 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.

3.5 Risk Categorization

Sections 2(a)(1) through 2(a)(4) in CC 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 CC 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. CC N-716 requires that any segment with a total estimated CDF greater than 1E-6/year be assigned the HSS category. The licensee augmented this CC N-716 metric on CDF with the requirement to assign the HSS category to any segment with a total estimated 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 RG 1.174. The licensee further argues that allocating resources (i.e., NDE) to components below this guideline will provide negligible risk benefit while expending unnecessary worker dose and radwaste.

The licensee, in a letter dated September 5, 2007, 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. Any piping that has inspections added or removed per CC 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 criteria. 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 provides 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. Any evaluation that categorizes the safety significance of structures, systems and components (SSCs) requires metrics and guideline values, such as the Fussel-Vessley and risk achievement worth guidelines endorsed in RG 1.201, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to Their Safety Significance." Such metrics are subordinate to the change in risk metrics in RG 1.174 which are used to determine whether the increase in risk associated with a proposed change is small and consistent with the intent of the Commission's Safety Goal Policy Statement.

Satisfying the guidelines in Sections 2(a)(5) 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. The licensee stated that it performed its flooding analysis consistent with the draft ASME Standard RA-Sa-2003, Appendix B[1] and described the analysis in its letter dated September 18, 2007. The flooding analysis described in this letter is consistent with the flooding analysis described in the ASME Standard RA-Sb-2005. RG 1.200 states that compliance with the requirements in ASME RA-Sb-2005 may be used to demonstrate that a PRA analysis is adequate to support a risk-informed application and the NRC staff finds that the flooding analysis, as described, should identify risk significant areas and piping failures.

The licensee reviewed the results of its flooding analysis to identify any segments that may have a CDF of LERF greater than 1E-6/year or 1E-7/year respectively. In its September 5, 2007, letter, the licensee reported two scenarios that exceeded the metrics, further indicating that the flooding analysis is capable of identifying such scenarios. One scenario was reduced below the guideline values by reflecting a plant change in the analysis. The second scenario was reduced below the guideline values based on a more detailed analysis of the human error probabilities associated with the scenario.

The NRC staff concurs 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.

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[1]The referenced document is a draft ASME document that includes proposed changes to the previously published ASME RA-Sa-2003 standard. The final version of this document is the ASME RA-Sb-2005 standard that is endorsed, with comments, in RG 1.200.

3.6 Inspection/NDE selection

The licensee's submittals discuss the impact of the proposed RIS_B application on the various augmented inspection programs. CC N-716 contains no provisions for reducing the number of inspections in the inspection program for high energy line breaks (HELB) outside containment, implemented in response to Updated Final Safety Analysis Report (UFSAR) Section 6.6.8, "Augmented Inservice Inspection to Protect against Postulated Piping Failures." However, CC N-716 does include a provision to increase the number of HELB inspections if the HELB program is inspecting less than 10 percent of the welds in this region. Changes to the HELB program may be made as authorized by EPRI TR-1006937, "Extension of the EPRI Risk Informed ISI Methodology to the Break Exclusion Region Programs," or by another process found acceptable by the NRC staff.

CC 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."

MRP-139 will be used as an augmented inspection program for the inspection and management of PWSCC susceptible dissimilar metal welds and will supplement the RI-ISI program.

Section 4 in CC N-716 requires that 10 percent of HSS welds shall be selected for examination. The licensee, in the letter dated September 5, 2007, clarified that the population of welds for which 10 percent must be inspected includes all butt welds and socket welds categorized as HSS. The licensee further clarified that all inspections shall be volumetric inspections.

Sections 4(b)(1) through 4(b)(3) in CC N-716 describe how the inspection locations will be selected. The selection process includes guidance that ensures that inspection locations are distributed physically throughout the HSS piping systems and that all degradation mechanisms will be represented in the selected locations. The guidance provides some flexibility in the distribution of locations to satisfy all the guidelines but the number of inspection must be increased beyond 10 percent, if necessary, to meet the quantitative risk acceptance guidelines in Section 5(b).

In contrast to the EPRI TR which only changed the types of ISI inspections and the locations of inspections, CC N-716 also discontinues preservice inspection requirements for LSS welds. These preservice examinations are performed to obtain a baseline inspection using the examination method that will be used for subsequent ISI examinations. Similar to the ASME Code which requires preservice examination of all Class 1 welds, CC N-716 requires preservice examination of all HSS welds. Preservice examinations are performed on ASME Code Class 2 welds that are initially selected for ISI, which is 7.5 percent of Class 2 piping welds. Any Class 2, Class 3 or non-code welds that are selected for inspection in the RIS_B program will be HSS welds. Therefore, preservice examinations will continue to be performed on all welds selected for examination using CC N-716 to obtain a baseline inspection using the examination method that will be used for subsequent ISI examinations.

In addition to the preservice exams as required, repair/replacement activities involving welding or brazing areas and welded joints made for installation of items shall be examined in accordance with the Construction Code identified in the licensee's Repair/Replacement Plan. The licensee's use of CC N-716 does not affect the examinations required to verify the integrity of welds associated with repair/replacement activities. Therefore, the NRC staff finds that there is no effect on the change in risk calculations associates with repair activities under the RIS_B program because the examinations required to verify the integrity of repaired or replaced welds are not affected and will continue to be performed.

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 bin. CC 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), isolable LOCAs, potential LOCAs, and corresponding types of feedwater and steam piping breaks. Conservative CCDP and CLERP estimates were developed from the PRA based on 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 concurs that the scenarios described are reasonable because they identify the appropriate equipment failure modes that cause a sequence to progress, and the licensee uses generally acceptable values for those failure modes. Based on these estimated CCDPs and CLERPs, welds whose failure would cause each type of transient 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. 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. As discussed above, the licensee stated that it performed its flooding analysis consistent with the draft ASME Standard RA-Sa-2003, Appendix B, and summarized its analysis in Reference 2. The licensee stated that its flooding analysis did not identify any high consequence segments (lower bound CCDP and CLERP of 1E-4 and 1E-5, respectively) for LSS Class 2 piping that was being inspected under the ASME ISI program. Instead of performing additional screening analysis to identify medium (as opposed to low) risk contributors, the licensee placed all previously inspected LSS Class 2 piping into the medium consequence bin and used the bounding CCDPs and CLERPs (CCDP and CLERP of 1E-4 and 1E-5, respectively) to estimate the risk increase for all discontinued inspections in this piping.

Section 5 in CC N-716 requires that any piping that has NDE inspections[2] added or removed per CC N-716 be included in the change in risk assessment. Acceptance criteria provided in Section 5(d) in CC N-716 include limits of 1E-7/year and 1E-8/year for increase of CDF and LERF for each system, and limits of 1E-6/year and 1E-7/year for the total increase in CDF and LERF associated with replacing the ASME Code Section XI program with the RIS_B program.

[2]CC 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 topical report 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.

These guidelines and guideline values are consistent with those approved by the NRC staff in the EPRI TR and are, therefore, 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 that change 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 CC N-716 includes the risk increase from discontinued inspection in LSS. Based on the detailed analysis of every segment required by the EPRI TR, the staff concluded that there is a high confidence that the total increase in risk from all discontinued inspections in LSS segments would be negligible. The 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 providing confidence that the less detailed analyses of LSS segments required by CC N-716 does not result in an unanticipated and potentially unacceptable risk increase.

The licensee provided the results of the change in risk calculations in the submittals and noted that all the estimates satisfy both the system level and the total guidelines. Therefore, the NRC staff finds that any increase in risk is small and acceptable.

3.8 Implementation Monitoring and Feedback

The objective of this element of RGs 1.174 and 1.178 is to assess performance of the affected piping systems under the proposed RI-ISI program by implementing monitoring strategies that conform with the assumptions and analysis used in developing the RIS_B program. In Reference 2, the licensee states that it will implement program updates as described in Section 7 of CC N-716. Section 7 states that the examination selections shall be reevaluated on the basis of inspection periods that coincide with the inspection program requirements for Inspection Program A or B of IWA-2431 or IWA-2432, i.e., the currently acceptable interval before each licensee is required to update their ASME program to the latest ASME requirements.

The proposed periodic reevaluation interval meets existing ASME Code requirements and, therefore, should be considered acceptable. The revaluation shall determine if any change to the inspection selections need to be made because of plant design changes, changes in postulated conditions, inspection results, piping failures, and updates to the PRA. This list of possible changes includes all changes at the facility or in the PRA that could affect the evaluation used to develop the RIS_B program and is, therefore, acceptable.

These periodic reevaluations satisfy the guidelines in RG 1.178 that an RI-ISI program should be self correcting as experience dictates because the proposed update interval is consistent with the acceptable AMSE Code update interval, and all the factors that could change the program are included in the reevaluation.

3.9 Examination Methods

In accordance with CC N-716, LSS welds will be exempt from the volumetric, surface, VT-1, and VT-3 visual examination requirements of Section XI. Ten percent of the HSS welds will be selected for examination as addressed in Section 3.6 of this SE. Section 4 of CC N-716 directs users to Table 1 for the examination requirements of the welds selected for examination. The examination method is based on the postulated degradation for the selected weld. Table 1 of CC N-716 is consistent with the traditional RI-ISI approach for examination methods as approved in EPRI TR-112657. The examination methods are based on an inspection-for-cause philosophy so that when there is a potential for a certain degradation mechanism, the examination method selected would be one that would be able to detect that type of degradation.

4.0 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 the licensee demonstrates that the proposed alternatives will provide an acceptable level of quality and safety. In this case, the licensee 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 the EPRI TR methodology, the existing ASME Code performance measurement strategies will remain in place. In addition, the CC N-716 methodology provides for increased inspection volumes for those locations that are included in the NDE portion of the program.

RG 1.174 establishes requirements for risk-informed decisions involving a change to a plant's licensing basis. RG 1.178 establishes requirements for risk-informed decisions involving alternatives to the ISI program requirements of 10 CFR 50.55a(g), and its directive to follow the requirements of the ASME Code, Section XI. The EPRI RI-ISI methodology contains details for developing an acceptable a RI-ISI program. CC 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 in this SE. 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 therefore, 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 pursuant to 10 CFR 50.55a(a)(3)(i) for the proposed alternative to 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 proposed RI-ISI program is authorized for the third period of the third 10-year ISI interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that this alternative will provide an acceptable level of quality and safety.

5.0 REFERENCES

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13. EPRI-TR-1012266, Pipe Failure Study Update, April 1993, Electric Power Research Institute, Palo Alto, California.

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