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

January 4, 2013

Vice President, Operations
Entergy Nuclear Operations, Inc.
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, NY 10511-0249

SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NO. 3 - RELIEF REQUEST IP3-ISI-RR-05 FOR THE FOURTH TEN-YEAR INSERVICE INSPECTION INTERVAL (TAC NO. ME7940)

Dear Sir or Madam:

By letter dated January 30, 2012, as supplemented on August 16, 2012, Entergy Nuclear Operations, Inc., the licensee, submitted relief request IP3-ISI-RR-05 for Nuclear Regulatory Commission (NRC) approval pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR). The relief request would implement a risk-informed, safety-based (RIS_B) inservice inspection (ISI) program for piping at Indian Point Nuclear Generating Unit No. 3, for the fourth 10-year ISI interval. The licensee proposes use of the 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.

The NRC staff concludes that the licensee's proposed RIS_B program will provide an acceptable level of quality and safety 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, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC authorizes the proposed RIS_B program for the fourth 10-year ISI inspection interval on the basis that this alternative will provide an acceptable level of quality and safety.

Sincerely,

George A. Wilson, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-286

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

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

RISK-INFORMED, SAFETY-BASED INSERVICE INSPECTION PROGRAM

REQUEST FOR ALTERNATIVE IP3-ISI-RR-05

ENTERGY NUCLEAR OPERATIONS, INC.

INDIAN POINT NUCLEAR GENERATING UNIT NO. 3

DOCKET NO. 50-286

1.0 INTRODUCTION

By letter dated January 30, 2012, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12039A253), as supplemented on August 16, 2012 (ADAMS ML12234A095), Entergy Nuclear Operations, Inc., the licensee, submitted relief request IP3-ISI-RR-05 for Nuclear Regulatory Commission (NRC) approval pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR). The relief request would implement a risk-informed, safety-based (RIS_B) inservice inspection (ISI) program for piping at Indian Point Nuclear Generating Unit No. 3 (IP3), for the fourth 10-year ISI interval. The licensee proposed the use of the 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.

The licensee requests to implement an RIS_B program based, in part, on ASME Code Case N-716, "Alternative Piping Classification and Examination Requirements, Section XI Division 1" (Code Case N-716). The licensee proposed to use the provisions of Code Case N-716 in lieu of the requirements of IWB-2420, IWB-2430, Table IWB-2500-1 (Examination Categories B-F and B-J), IWC-2420, IWC-2430, and Table IWC-2500-1 (Examination Categories C-F-1 and C-F-2) for ISI of Class 1 or 2 piping and IWB-2200 and IWC-2200 for preservice inspection of Class 1 or 2 piping, or as additional requirements for Class 3 piping or non-class piping. The Code Case N-716 requirements are expected to reduce the number of inspections required but also define additional requirements for Class 3 piping or non-class piping.

Code Case N-716 has not been approved for generic use by the NRC. The licensee's relief request refers to the methodology described in Code Case N-716 instead of describing the details of the methodology in the relief request. The licensee has, however, modified the methodology described in Code Case N-716 while developing its proposed RIS_B program. When the methodology used by the licensee is accurately described in and consistent with

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Code Case N-716, this safety evaluation (SE) refers to the details in Code Case N-716. When the methodology used by the licensee deviates or expands upon the methodology described in Code Case N-716, this SE refers to the licensee's submittals cited above. Therefore, Code Case 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 Code Case N-716.

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, "except design and access provisions and preservice examination 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 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, that the licensee's ISI program complies 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 conditions listed therein. IP3 is in its fourth 10-year ISI interval which started on July 21, 2009.

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. 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. As stated in Section 1.0 of this SE, the provisions of N-716 are expected to reduce the number of required examinations but may also define additional requirements for Class 3 piping or non-class piping. The application 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.

By letter dated January 30, 2012, the licensee states that Code Case N-716 is founded in large part on the risk-informed inservice inspection (RI-ISI) process as described in the Electric Power Research Institute (EPRI) Topical Report (TR)-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure (PWRMRP-05)," (ADAMS Accession No. ML013470102), which was previously reviewed and approved by the NRC. The NRC staff has reviewed the development of the proposed RIS_B and RI-ISI programs using the following documents:

Regulatory Guide 1.174 (RG 1.174), "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (ADAMS Accession No. ML023240437),

Regulatory Guide 1.178 (RG 1.178), "An Approach for Plant-Specific Risk-Informed Decisionmaking - Inservice Inspection of Piping" (ADAMS Accession No. ML032510128), and

Regulatory Guide 1.200 (RG 1.200), Revision 1, An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities (ADAMS Accession No. ML070240001).

Regulatory Guide 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. Regulatory Guide 1.178 describes an 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. Regulatory Guide 1.200 describes an 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

Code Case 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 screening 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. The proposed RIS_B program permits alternatives to the requirements of IWB-2420, IWB-2430, and IWB-2500 (Examination Categories B-F and B-J) and IWC-2420, IWC-2430, and IWC-2500 (Examination Categories C-F-1 and C-F-2), or as additional requirements for Subsection IWD, 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.

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 the protection of public health and safety. In general, the methodology in Code Case N-716 replaces a detailed evaluation of the safety significance of each pipe segment with a generic population of high safety-significant segments, followed by a screening flooding analysis to identify any plant-specific high safety-significant segments. The screening flooding analysis is performed in accordance with the flooding PRA approach described in 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 the risk evaluation to support RIS_B program development includes ASME Code Class 1, 2, and 3 and non-class piping welds. Standard Review Plan (SRP) Section 3.9.8, "Risk-Informed Inservice Inspection of Piping," and RG 1.178 addresses the scope issues. The primary acceptance guideline in the SRP and RG 1.178 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 IP3'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. Regulatory Guide 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 Code Case N-716 is consistent with the definition of full-scope in RG 1.178. The licensee confirmed in letter dated January 30, 2012, that the safety significance determination based on the PRA results may include Class 3 or non-class piping. 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 1.178 guidelines and is, therefore, 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 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 by the EPRI TR, N-716, and the relief request with respect to the evaluation of degradation mechanisms 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 code case 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 code case approach is at least as conservative as the EPRI TR approach because it identifies as high safety significance each piping segment which would have been so identified by the EPRI TR and because it may identify additional piping segments as being of high safety significance. Based on this conservatism, the NRC finds the use of the degradation mechanism evaluation aspect of the code case acceptable.

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 NRC finds this approach of

N-716 and the licensee's proposed 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 code case 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 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 other degradation mechanisms these mechanisms should be considered in the RIS_B program.

The relief request differs from the EPRI TR in the manner in which thermal stratification, cycling, and striping 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.

The relief request and the EPRI TR 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. Code Case N-716 requires evaluation of all piping segments not specified as HSS to determine whether water hammer is present. If water hammer is present in a piping segment, that segment is assigned a high failure potential in accordance with Table 3 of N-716 because, as stated above, LSS segments are assumed to have a medium failure potential initially. The NRC staff finds this approach acceptable as it is consistent with the EPRI TR for those segments considered and it is at least as conservative as the EPRI TR for those segments not fully evaluated as these segments were assumed to be of high safety significance.

3.4 Piping Segment Definition

Previous guidance on RI-ISI, including RG 1.178 and the EPRI TR, centered on defining and using piping segments. Regulatory Guide 1.178 states, for example, that the analysis and definition of a piping segment must be consistent and technically sound.

The primary purpose of piping segments is to group welds so that consequence analyses can be done for the smaller number of segments instead of for each weld. Sections 2(a)(1) to 2(a)(4) in Code Case N-716 identify system parts (segments and groups of segments) that are generically assigned HSS without requiring a plant-specific consequence determination and any subdivision of these system parts is unnecessary. Section 2(a)(5) in Code Case N-716 uses PRA to identify plant-specific piping that might be assigned HSS. A flooding PRA consistent with ASME RA-Sb-2009 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 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. Code Case N-716 generically defines a large population of welds as HSS. An additional population of welds may be added based on the risk-informed search for plant-specific HSS segments. When complete, the Code Case N-716 process yields a well-defined population of HSS welds from which inspections are selected accomplishing the same objective as accounting for each weld throughout the analysis by using segments. Code Case 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 used as an accounting tool is not needed within the generic population of HSS welds. A flooding PRA, consistent with ASME RA-Sb-2009, 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 the HSS category. A review of the internal flood PRA was performed to identify any piping whose failure could cause flooding that could significantly impact safety significant components. During the review, the licensee identified some piping in the Residual Heat Removal (RHR) and Safety Injection (SI) systems located outside of containment with a CCDP greater than 1 E-4/year. As a result, all LSS welds in these systems were conservatively assigned CCDP/CLERP equal to 1.2E-2/1.2E-3. The licensee assigned failure potentials to the LSS welds using Table 3 of the N-716 guidance. Only those locations that were susceptible to FAC were assigned a high failure potential. However, this is covered under the licensee's FAC program. To conservatively bound the RHR and SI, the licensee assigned all the LSS piping to a medium failure potential to the change-in-risk assessment. The licensee finds that the flood risk will be reduced to less than 1E-6/year and that the piping segments can be removed from the RIS_B scope. The licensee has reviewed the results of its flooding analysis and did not identify any segments other than the RHR and SI segments that had a CDF greater than 1E-6/year.

In the application, the licensee states that the Indian Point Probabilistic Safety Assessment (PSA) model underwent a formal industry peer review in 2010 against the ASME PRA standard RA-Sb-2009 and RG 1.200 Rev 2. In response to the NRC staff's request for additional information, the licensee confirmed that a self-assessment was unnecessary as the peer review was performed to the ASME 2009 (as endorsed by the Regulatory Guide 1.200 revision 2) standard.

Findings from the peer review indicate 11 "not-met" supporting requirements (SR) to Capability Category II. Of those findings, the licensee considered all but three of them to be resolved with one of the unresolved findings having a minor impact. The vast majorities of these findings are considered documentation and/or minor plant and model change or model error related and have no technical impact on the Human Reliability Analysis model. The findings and observations in relation to Internal Flooding as well as the licensee's explanations and changes were reviewed by staff and found to be acceptable. Most of the resolutions to the findings and observations were complied with by the licensee. The open findings and the licensee's dispositions are listed below:

Finding 3 (3-7) SR IFQU-A6 (Open-Minor Impact (Increase)): The effects of floods on performance shaping factors were not addressed in the PRA. The methodology the licensee used to disposition this finding is conservative due to their non-credit of short-term isolation by the operators.

Finding 4 (4-14) SR DA-A2 (Open-No Significant Impact): Plant specific features need to be considered for boundary definitions due to component boundaries not being consistent among failure rate, Common Cause Failure and unavailability data. This is a conservative treatment of failure rate with risk numbers not posing a significant change.

Finding 5 (1-15) SR IE-C5 (Open-No Significant Impact): The initiating event frequencies are not weighted by the fraction of time the plant is at power. This use of this method is more conservative as the term "calendar years" may exclude unusual periods of non-operation.

In response to the staff's concerns regarding finding 6-11 over the inclusion of the internal flooding sources in the "final update report," the licensee's letter dated August 16, 2012, stated that the table has been added to the updated report. In response to the NRC staff's other concern regarding finding 6-11 over the discrepancy between information in the licensee's documentation and in the Modular Accident Analysis Program (MAAP) for the Condensate Storage Tank (CST) inventory to support 24 hour Auxiliary Feed water System (AFW) operation, the licensee stated that a conservative margin is built into the Westinghouse Commercial Atomic Power analysis to support concluding that the CST volume is sufficient to meet the AFW 24 hour mission time in the PSA update model. The licensee further stated that the PSA Update report has been revised to reflect the above information and reference.

Along with the peer review team findings, the licensee also identified ten additional flood sources and impacts. The CDF and LERF (large early release frequency) values were also found to be in the acceptable range for these. The NRC staff concurs that the licensee provided sufficient resolution for each of the outstanding SRs to verify that they do not impact the ISI 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 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 the licensee 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 Indian Point 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.

Code Case 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.

Code Case N-770-1 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. The licensee stated in their request that the RIS_B Program will not be used to eliminate any regulatory requirements. 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, the degradation mechanisms should still be considered in the RI-ISI program for examinations. The 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, 3 piping
- 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
- Reinspection sample size

In its relief request, the licensee based its selection of pipe segments on Code Case N-716. The code case has adopted a pipe selection procedure which differs from that in the EPRI TR. While the approach adopted by the code case may or may not be more conservative than that adopted by the EPRI TR, the change in risk evaluation required by the code case, and described elsewhere in this SE, mandates that the increase in risk (CDF and LERF), as compared to the current code requirements, for any given system cannot exceed 1×10^{-7} and 1×10^{-8} per year and that the total increase in CDF and LERF may not exceed 1×10^{-6} and 1×10^{-7} per year. The NRC staff finds the approach used in the code case 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
- Physical access to element

The code case also contains additional information for consideration in weld selection. This list includes:

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

Additionally, the code case 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 the code case.

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

3.7 Risk Impact Assessment

The licensee uses a change in the risk estimation process approved by the NRC staff in the EPRI TR. The change in the risk assessment to 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. Code Case N-716 also includes both alternatives, and the bounding values to be used in the bounding analysis are the same as those approved for use in 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 and corresponding types of feedwater and steam piping breaks. Conservative CCDP estimates were based on pipe break locations. 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 so limiting the consequence evaluation to segments that are inspected is acceptable.

Section 5 in N-716 requires that any piping that has NDE inspections[1] added or removed per N-716 be included in the change in risk assessment. The licensee used nominally 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 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. 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 N-716 includes the risk increase from discontinued inspection in LSS locations. CCDP and CLERP values equal to 1.2E-2 and 1.2E-3 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

[1]Code Case N-716 requires no estimated risk increase for discontinuing surface examinations at locations that are not susceptible to outside diameter attack [e.g., external chloride stress-corrosion cracking]. The NRC staff determined during the review and approval of 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.

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 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 Code, Inspection Program B. The corrective action category requires a corrective action program that is consistent with the requirements of Section XI of the Code for both Code class and non-code class piping.

Information concerning this topic was obtained from the relief request itself and from Sections 6 and 7 of the code case. The code case information was used by the NRC in this review based on the licensee's statement that it would develop implementation procedures for its program in accordance with the code case. 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 Code or more frequently as directed by the NRC, or industry or plant specific feedback. Sections 6 and 7 of the code case address both inspection frequency and program updates. These sections indicate that inspection frequencies should normally be in accordance with Code requirements and that updates should be made on a 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 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 Code concerning the manner in which the examination is conducted and the acceptance standard.

The code case addresses the issue of degradation mechanism/inspection technique in Table 1. Like Table 4.1 of the EPRI TR, Table 1 of the code case lists degradation mechanism and corresponding inspection techniques. This table also provides references to the Code concerning the manner in which the examination is conduced and the acceptance standard.

In its relief request, 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 the code case). 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

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 fourth 10-year ISI inspection 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.

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

Principal Contributors: Margaret Audrain
Jonathan Evans

Date: January 4, 2013

January 4, 2013

Vice President, Operations
Entergy Nuclear Operations, Inc.
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
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SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NO. 3 - RELIEF REQUEST IP3-ISI-RR-05 FOR THE FOURTH TEN-YEAR INSERVICE INSPECTION INTERVAL (TAC NO. ME7940)

Dear Sir or Madam:

By letter dated January 30, 2012, as supplemented on August 16, 2012, Entergy Nuclear Operations, Inc., the licensee, submitted relief request IP3-ISI-RR-05 for Nuclear Regulatory Commission (NRC) approval pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR). The relief request would implement a risk-informed, safety-based (RIS_B) inservice inspection (ISI) program for piping at Indian Point Nuclear Generating Unit No. 3, for the fourth 10-year ISI interval. The licensee proposes use of the 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.

The NRC staff concludes that the licensee's proposed RIS_B program will provide an acceptable level of quality and safety 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, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC authorizes the proposed RIS_B program for the fourth 10-year ISI inspection interval on the basis that this alternative will provide an acceptable level of quality and safety.

Sincerely,
/RA/
George A. Wilson, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-286
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