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

January 18, 2012

Mr. M. J. Ajluni
Nuclear Licensing Director
Southern Nuclear Operating Company, Inc
40 Inverness Center Parkway
Post Office Box 1295, Bin - 038
Birmingham, Alabama 35201

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2 - RISK-INFORMED SAFETY-BASED INSERVICE INSPECTION ALTERNATIVE FOR CLASS 1 AND CLASS 2 PIPING WELDS (TAC NOS. ME5273 AND ME5274)

Dear Mr. Ajluni:

By letter dated January 5, 2011, as supplemented by letters dated May 27, 2011, and November 16, 2011, Southern Nuclear Operating Company (SNC), pursuant to Title 10 of the *Code of Federal Regulations,* (10 CFR), Part 50, Section 50.55a(a)(3)(i), submitted Relief Request FNP-ISI-ALT-12, Version 2.0, for the Joseph M. Farley Nuclear Plant, Units 1 and 2 (FNP). The request for relief would implement a risk-informed, safety based inservice inspection (ISI) program for piping at FNP. 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, "Alternative Piping Classification and Examination Requirements."

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request, and concludes that the proposed alternative provides an acceptable level of quality and safety. Therefore, the NRC staff authorizes the proposed alternative in accordance with 10 CFR 50.55a (a)(3)(i) for the FNP fourth 10-year ISI interval. The NRC staff's approval of the FNP risk-informed / safety-based inservice inspection (RIS_B) program does not constitute approval of Code Case N-716.

The NRC staff's safety evaluation is enclosed.

Sincerely,

for

Nancy Salgado, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RISK-INFORMED INSERVICE INSPECTION PROGRAM

FOURTH TEN-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN

SOUTHERN NUCLEAR OPERATING COMPANY

JOSEPH M. FARLEY NUCLEAR PLANT UNITS, 1 AND 2

DOCKET NUMBERS 50-348 AND 50-364

1.0 INTRODUCTION

By letter dated January 5, 2011 (Reference 1), as supplemented by letters dated May 27, 2011 (Reference 2), and November 16, 2011 (Reference 3), Southern Nuclear Operating Company (SNC, licensee), requested the U.S. Nuclear Regulatory Commission (NRC) authorization to implement a risk-informed inservice inspection (RI-ISI) program plan for Joseph M. Farley Nuclear Plant (FNP), Units 1 and 2 for the fourth 10-year inservice inspection (ISI) interval. FNP 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. The licensee requested implementation of this alternative during the fourth10-year interval.

SNC requests to implement a risk-informed/safety-based inservice inspection (RIS_B) program based, in part, on ASME Code Case N-716, "Alternative Piping Classification and Examination Requirements, Section XI Division 1" (Reference 4, N-716). The provisions of N-716 may be used 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 inservice inspection 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, for plants issued an initial operating license prior to December 31, 2000. The NRC staff expects that the N-716 requirements may result in reducing the number of inspections for Class 1 or Class 2 piping, but not for Class 3 piping. However, the N-716 requirements may also result in defining additional requirements for Class 3 or non-Class piping.

N-716 has not been endorsed for generic use by the NRC; however the staff's review of the code case, as described in this safety evaluation, indicates that it fully complies with the regulatory requirements and safety goals set forth in regulatory guides 1.178 and 1.174 for risk informed inservice inspection programs. FNP's relief request refers to the methodology described in N-716 instead of describing the details of the methodology in the relief request. FNP has, however, modified the methodology described in N-716 while developing its proposed

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RIS_B program. When the methodology used by the licensee is accurately described in N-716, this safety evaluation (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. Therefore, 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 title 10 of the *Code of Federal Regulations* (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 limitations and modifications listed therein. FNP is currently in its fourth 10-year ISI interval which began December 1, 2007. The ASME Section XI code of record for FNP's fourth ISI interval is the 2001 Edition through the 2003 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. 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 safety evaluation, the provisions of N-716 are expected to reduce the number of required examinations but may also define additional requirements for Class 3 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.

The licensee states that N-716 is founded in large part on the risk-informed inservice inspection (RI-ISI) process as described in Electric Power Research Institute TR-112657 Revision B-A, "*Revised Risk-Informed Inservice Inspection Evaluation Procedure*," (EPRI TR), February 10, 2000, as previously reviewed and approved by the NRC staff (See Agencywide Documents Access and Management System (ADAMS) Accession Number ML013470102). The staff has reviewed the development of the proposed RIS_B RI-ISI program using the following documents.

Regulatory Guide (RG) 1.174, "*An Approach for Using Probabilistic Risk Assessment In Risk-Informed Decisions On Plant-Specific Changes to the Licensing Basis*" (ADAMS Accession Number ML023240437),

RG 1.178, "*An Approach For Plant-Specific Risk-Informed Decisionmaking - Inservice Inspection of Piping*" (ADAMS Accession Number ML032510128), and

RG 1.200, Revision 2, *An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities* (ADAMS Accession Number ML090410014).

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

N-716 is founded, in large part, on the risk-informed inservice inspection (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. The proposed RIS_B program permits alternatives, based on the provisions of 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 inservice inspection 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, for plants issued an initial operating license prior to December 31, 2000. The NRC staff expects that the N-716 requirements may result in reducing the number of inspections for Class 1 or Class 2 piping, but not for Class 3 piping. However, the N-716 requirements may also result in defining additional requirements for Class 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 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 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 that is consistent with Section 3-5 of ASME RA-Sa-2009, Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications, Addenda to ASME/ANS RA-S-2008 (Reference 5), as endorsed in RG 1.200, Revision 2. 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 Reference 6 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 FNP'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. 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 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 changes satisfies the SRP and RG guidelines and is acceptable.

A group of six welds per unit that are susceptible to primary water stress corrosion cracking (PWSCC) will be inspected in a program separate from the RIS_B program, as discussed in Section 3.3 below.

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 EPRI TR addresses the identification and evaluation of degradation mechanisms for each piping segment of a RI-ISI program. The EPRI TR notes that there is no correlation between design stresses and piping failures. It further notes that most piping failures are the result of active degradation mechanisms in concert with loading conditions. The EPRI TR, therefore, places significant emphasis on identifying all applicable degradation mechanisms for all piping segments and appropriately addressing their significance. The EPRI TR fundamentally provides a three step process to identify and evaluate degradation mechanisms:

a) based on industry experience, identify all possible degradation mechanisms

b) based on plant operating experience, assign degradation mechanisms to piping segments

c) based on the degradation mechanisms present assign pipe rupture potential and expected leak conditions to each pipe segment.

The EPRI TR identifies, and contains a description of the conditions required for, all applicable degradation mechanisms. The section also characterizes pipe rupture potential as high, medium or low and the expected leak conditions as large, small, or none. These classifications are used to assign pipe failure probabilities which are used in determining the pipe failure frequency. The EPRI TR admonishes the user to pay particular attention to the subject of water hammer during the plant operating experience review. Two reasons are cited: first, the occurrence of water hammer is highly plant-specific; and second, the presence of water hammer may necessitate changing the rupture potential category of a given pipe segment from medium to high.

The approaches employed by the EPRI TR, the code case, 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. 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 the EPRI TR which the staff has previously concluded is a comprehensive list of the applicable mechanisms. The CC N-716 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 this 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 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 PWSCC. In its relief request, the licensee considers all of these mechanisms except PWSCC. The licensee stated that PWSCC is addressed through a separate augmented inspection program designed to specifically address welds which are susceptible to PWSCC. The basis for this program is contained in MRP 139 (Reference 6).

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. In Reference 3 SNC indicated the six welds per unit susceptible to PWSCC would 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.

The relief 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. This method has been previously reviewed and accepted by the staff and will not be considered further here.

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. In its relief request, the licensee stated that it evaluated all piping segments not specified as HSS by the code case to determine whether water hammer was present. The licensee stated that water hammer was not present in the pipe segments considered. The LSS piping may be susceptible to FAC; however, the examination for FAC is performed per the FAC augmented program. In lieu of conducting a degradation mechanism evaluation for all 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 greater than those used in the licensee's analysis, if the susceptibility of all LSS welds to all degradation mechanism was determined.

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-Sa-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 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. The Code Case 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 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-Sa-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. 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 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 in order to reduce the flooding scenario frequencies due to the postulated rupture of fire protection piping in auxiliary building areas that supplemental visual inspection of the associated fire protection piping is required every quarter. Therefore, without performing the visual examinations, the piping would be classified as high safety significant. In reference 2, the licensee determined that these welds will be reclassified as high safety significant and will be subject to volumetric examination in addition to visual inspections. The licensee has 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 Reference 1, 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/ANS RA-Sa-2009 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 Reference 1, the licensee states that the FNP Probabilistic Safety Assessment (PSA) model underwent a peer review in 2001 under the auspices of the Westinghouse Owners Group. In 2005, a gap analysis was performed against the ASME PRA Standard ASME RA-Sb-2005 and Regulatory Guide (RG) 1.200, Revision 1. Another peer review was conducted against the requirements of the ASME/ANS Combined PRA Standard ASME/ANS RA-Sa-2009 and RG 1.200, Revision 2 in March 2010 for the Unit 1 model.

The Unit 1 internal flooding CDF and LERF results are used for both units. Although, there is no independent Unit 2 internal flooding model, it was judged that for this application, the Unit 1 model is adequate to represent Unit 2 flooding risk based on an evaluation of plant differences. This evaluation was performed using information collected from Unit 1 plant walk-down and review of Unit 2 plant design information related to flooding. The review did not identify any major differences that would adversely impact the flooding analysis result developed for Unit 1. The licensee states that after the Unit 2 internal flooding model is completed, if there are any segments identified with a contribution to CDF greater than 1E-6 or LERF greater than 1E-7 that these segments will be added to the high safety significant scope during the subsequent periodic update.

Findings from the RG 1.200, Rev. 2 PRA peer review, as discussed in Enclosure 1 of Reference 1, indicate there were 17 CDF related "not-met" supporting requirements (SR) and five CDF related SRs that met capability category (CC) I requirements but not CCII requirements. The licensee provided sufficient resolution for each of the outstanding SRs to verify that all have been closed for this application. The findings also included four LERF related SRs that met CCI requirements but not CCII requirements. The staff agrees that each of these SRs would have a minimal and conservative impact on the risk-insights for this application.

The NRC staff finds that the CDF and LERF metrics, as discussed above, 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 staff finds that the risk categorization performed by SNC 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 FNP 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 industry standard ASME/ANS RA-Sa-2009, as endorsed by the NRC in RG 1.200, Revision 2.

3.6 Inspection/NDE Selection

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

In Reference 1, the licensee states that the FNP augmented inspection program for high energy line breaks (HELB) outside containment is not affected or changed by the RIS_B Program. The staff notes that N-716 contains no provisions for reducing the number of inspections in the inspection program for break exclusion region (BER). However, Code Case 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," (ADAMS Accession Number ML021790518) or by another process found acceptable by the NRC staff.

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.

In Reference 3 the licensee indicated the six reactor pressure vessel nozzle welds per unit susceptible to PWSCC will be removed from the RIS_B program. These welds will be examined in accordance with the augmented examination requirements of ASME Code Case N-770-1 and 10 CFR 50.55a(g)(6)(ii)(F).

The FNP augmented inspection program implemented in response to NRC Bulletins 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems," will be subsumed by the RIS_B Program.

The staff finds the licensee's approach to the integration of the proposed RI-ISI program with augmented inspection programs acceptable because it is consistent with EPRI TR 112657-B-A.

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 has chosen to base its selection of pipe segments on the code case. This code case is not approved for use. 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 Safety Evaluation, mandates that the increase in risk (CDF and LERF), as compared to the current Code requirements, for any given system cannot exceed 1E-7 and 1E-8 per year and that the total increase in CDF and LERF may not exceed 1E-6 and 1E-7 per year. The 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 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 staff reviewed the tables provided in the 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 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-Sb-2005. The licensee stated that its flooding analysis did identify 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. The review identified some piping in the RHR and CVCS systems located outside of containment with a CCDP greater than 1E-4. As a result, all LSS RHR and CVCS welds were conservatively assigned CCDP/CLERP equal to 2E-3/2E-4. 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

[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.

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 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.

Using the upper-bound CCDP/CLERP will overestimate the risk increase at locations when inspections are discontinued, but will also overestimate the risk decrease at locations where inspections are added. The licensee reported a sensitivity study where risk impact is estimated using upper bound values for CCDP and CLERP in those cases that result in a risk increase and lower bound values for CCDP and CLERP in those cases that result in a risk decrease. The licensee reported that the delta risk impact guidelines are not exceeded in the bounding study.

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

Section 6.2.3 of the EPRI TR addresses implementation, performance monitoring and corrective action strategies. This section does not contain sufficient information to be useful as an evaluation tool. However, this section states that there are no unique aspects of the EPRI method that would suggest a need to depart from any of the requirements of Element 3 of RG 1.178. Element 3 of RG 1.178 will, therefore, be used to evaluate this aspect of the request.

Element 3 of RG 1.178 is divided into three categories: program implementation, performance monitoring, and corrective actions. 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.

Information concerning this topic was obtained from the licensee's relief request 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 ASME Code or more frequently as directed by the NRC, or industry or plant-specific feedback. Sections 6 and 7 of the code case address the inspection frequency and program updates requirements. 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 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.

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 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

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 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 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 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 FNP fourth 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. All requirements, other than for which relief was specifically requested and authorized above, remain applicable, including the third party review by the authorized nuclear in-service inspector.

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J. Patel

Date: January 18, 2012

REFERENCES

1. Letter, Mark J. Ajluni (Southern Nuclear Operating Company, Inc.) To U.S. Nuclear Regulatory Commission containing "Request for Approval of a Risk-Informed/Safety Based Inservice Inspection Alternative for Class 1 and 2 Piping FNP-ISI-ALT-12, Version 2.0, for Joseph M. Farley Nuclear Plant - Units 1 and 2, January 5, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML110060173)

2. Letter, Mark J. Ajluni (Southern Nuclear Operating Company, Inc.) To U.S. Nuclear Regulatory Commission containing "NRC Request for Addition Information for Risk-Informed ISI Alternative FNP-ISI-ALT-12, Version 2.0" May 27, 2011(ADAMS Accession Number ML111470508)

3. Letter, Mark J. Ajluni (Southern Nuclear Operating Company, Inc.) To U.S. Nuclear Regulatory Commission containing "Request for Approval of a Risk-Informed/Safety Based Inservice Inspection Alternative for Class 1 and 2 Piping FNP-ISI-ALT-12, Version 2.0, for Joseph M. Farley Nuclear Plant - Units 1 and 2, November 16, 2011 (ADAMS Accession Number ML113210337)

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

5. ASME/ANS RA-Sa-2009, Addenda to ASME/ANS RA-S-2008 Standard for Level I / Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications, ASME, New York, New York and ANS, Chicago, Illinois.

6. MRP-139, Materials Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guideline, Revision 1, December 2008, Electric Power Research Institute, Palo Alto, California.

The NRC staff's safety evaluation is enclosed.

Sincerely,

/RA/ by VSreenivas Acting for

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Docket Nos. 50-348 and 50-364

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Safety Evaluation

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