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

June 30, 2010

Vice President, Operations
Entergy Operations, Inc.
River Bend Station
5485 US Highway 61N
St. Francisville, LA 70775

SUBJECT: RIVER BEND STATION, UNIT 1 – RELIEF FOR ALTERNATIVE RBS-ISI-013, USE OF A RISK-INFORMED, SAFETY-BASED INSERVICE INSPECTION PROGRAM (TAC NO. ME1507)

Dear Sir or Madam:

By letter dated June 16, 2009, as supplemented by letters dated August 11, 2009, and March 12 and May 14, 2010, Entergy Operations, Inc. (Entergy, the licensee), submitted request for alternative RBS-ISI-013 for the third 10-year inservice inspection (ISI) interval program at the River Bend Station, Unit 1 (RBS). The licensee requested to implement a risk-informed, safety-based inservice inspection (RIS_B) program for the 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 at RBS. The proposed RIS_B program is based, in part, on the ASME Code, Section XI, Code Case N-716, "Alternative Piping Classification and Examination Requirements, Section XI Division 1." The proposed alternative is applicable to RBS's third 10-year ISI interval which started on following completion of the refueling outage 15 in the fall of 2009.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request, and concludes that the proposed alternative, with the commitments made in the supplemental letter dated May 14, 2010, provides an acceptable level of quality and safety. Therefore, the staff authorizes the proposed alternative in accordance with paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* for RBS's third 10-year ISI interval. The staff's approval of the licensee's RIS_B program does not constitute approval of ASME Code Case N-716.

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.

The NRC staff's safety evaluation is enclosed. If you have any questions, please contact Alan Wang at 301-415-1445 or via e-mail at alan.wang@nrc.gov.

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-458

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 RBS-ISI-013

ENTERGY OPERATIONS, INC.

RIVER BEND STATION, UNIT 1

DOCKET NO. 50-458

1.0 INTRODUCTION

By letter dated June 16, 2009 (Reference 1), as supplemented by letters dated August 11, 2009 (Reference 2), and March 12 and May 14, 2010 (References 3 and 4, respectively), Entergy Operations, Inc. (Entergy, the licensee), pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), submitted request for alternative RBS-ISI-013. The relief request would implement a risk-informed, safety-based (RIS_B) inservice inspection (ISI) program for piping at Entergy's River Bend Station, Unit 1 (RBS), for the third 10-year ISI interval. Entergy 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.

Entergy 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) (Reference 5). The provisions of Code Case 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 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, for plants issued an initial operating license prior to December 31, 2000. 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 endorsed for generic use by the U.S. Nuclear Regulatory Commission (NRC). Entergy'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. Entergy 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 Code Case N-716, this safety evaluation (SE) refers to the details found in Code Case N-716. When the methodology used by the licensee deviates or expands upon the methodology described in Code Case N-716, this SE refers to the licensee's submittals cited above.

Enclosure

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. The regulations in 10 CFR 50.55a(g) also state 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. RBS is in its third 10-year ISI interval which started on following completion of refueling outage 15 in the fall of 2009.

In Reference 1, 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" (Reference 6), which was previously reviewed and approved by the NRC. The 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" (Reference 7),

- Regulatory Guide 1.178 (RG 1.178), "An Approach for Plant-Specific Risk-Informed Decisionmaking - Inservice Inspection of Piping" (Reference 8), 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 (Reference 9).

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 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. RG 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 based, in large part, on the RI-ISI process as described in Reference 6, 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, IWB3-2430, and IWB-2500 (Examination Categories B-F and B-J) and IWC-2420, IWC-2430, and IWC-2500 (Examination Categories C-F-1 and C-F-2), or as additional requirements for Subsection IWD, and may be used for ISI and preservice inspection of Class 1, 2, 3, or non-class piping. All piping components, regardless of risk classification, will continue to receive ASME Code-required pressure and leak testing, as part of the current ASME Code, Section XI program.

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 HSS segments, followed by a screening flooding analysis to identify any plant-specific HSS segments. The screening flooding analysis is performed in accordance with the flooding PRA approach 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 (Reference 10), 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. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," (SRP) Section 3.9.8, "ASME Code Class 1, 2, and 3 Components, and Component Supports, and Core Support Structures," 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 RBS'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 an 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 Reference 1 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 divides all piping within the scope of the proposed EPRI RI-ISI program into piping segments. The consequence of each segment's 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, coupled with the degradation mechanism, are used to determine the safety significance of the segments.

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

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

Section 2(a)(5) in Code Case N-716 provides guidance that defines additional, plant-specific HSS segments that should be identified using a plant-specific PRA of pressure boundary failures. Adequate identification of plant-specific HSS segments requires the use of a technically adequate PRA, and a flooding analysis that considers both direct and indirect effects of pressure failure and the different failure modes of piping. The technical adequacy of the PRA is addressed in Section 3.7 of this SE. In Reference 2, Entergy compared its flooding analysis to the internal flooding (IF) element supporting requirement (SR) IF-C3 in ASME RA-Sb-2005. Entergy concluded that its analysis meets capability category III in the ASME standard which considers both direct and indirect affects of pressure failure and the different failure modes of piping. The NRC staff agrees with this conclusion.

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 is, therefore, acceptable.

3.3 Degradation Mechanism Evaluation

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

Code Case N-716 identifies a generic population of HSS welds, followed by a search for plant-specific HSS welds. Code Case 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 Code Case N-716 are consistent with those identified in the EPRI TR which the NRC staff has concluded previously is a sufficiently comprehensive list of the applicable mechanisms.

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. The licensee reviewed the LSS piping to verify that it was not susceptible to flow-accelerated corrosion (FAC) or water hammer which would require a higher failure frequency estimate. 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 staff concludes that the bounding analysis for specific welds, where inspections will be added or discontinued, is acceptable because the process fulfills the requirements for identifying

locations that should be inspected (i.e., identifying plant-specific HSS segments) and develops a bounding estimate for the change in risk.

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. RG 1.178 states, for example, that the analysis and definition of a piping segment must be consistent and technically sound.

The primary purpose of segments is to group welds so that consequence analyses can be done for the smaller number of segments instead of for each weld. Sections 2(a)(1) to 2(a)(4) in Code Case N-716 identify system parts (segments and groups of segments) that are generically assigned HSS without requiring a plant-specific consequence determination and any subdivision of these system parts is unnecessary. Section 2(a)(5) in Code Case N-716 uses a PRA to identify plant-specific piping that might be assigned HSS. A flooding PRA consistent with ASME RA-Sb-2005 searches for plant-specific HSS piping by first identifying zones that may be sensitive to flooding, and then evaluating the failure potential of piping in these zones. Lengths of piping whose failure impacts the same plant equipment within each zone are equivalent to piping segments. Therefore, piping segments are either not needed to reduce the number of consequence analyses required (for the generic HSS piping) or, when needed during the plant-specific analysis, the length of pipe included in the analysis is consistent with the definition of a segment in RG 1.178.

An additional purpose of piping segments in the EPRI TR is as an accounting/tracking tool. In the EPRI methodology, all parts of all systems within the selected scope of the RI-ISI program are placed in segments and the safety significance of each segment is developed. For each safety significant classification, a fixed percentage of welds within all the segments of that class are selected. Additional selection guidelines ensure that this fixed percentage of inspections is distributed throughout the segments to ensure that all damage mechanisms are targeted and all piping systems continue to be inspected. 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 must be 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 as used as an accounting tool is not needed within the generic population of HSS welds. A flooding PRA, consistent with ASME RA-Sb-2005, utilizes lengths of piping consistent with the segment definition in RG 1.178 whenever a consequence evaluation is needed. Therefore, the proposed method accomplishes the same objective as the approved methods without requiring that segments be identified and defined for all piping within the scope of the RIS_B program.

3.5 Risk Categorization

Sections 2(a)(1) through 2(a)(4) in Code Case N-716 identify the portions of systems that should be generically classified as HSS, and Section 2(a)(5) requires a search for plant-specific HSS segments. Application of the guideline in Section 2(a)(5) in Code Case N-716 identifies plant-specific piping segments that are not assigned to the generic HSS category but that are risk-significant at a particular plant. Code Case N-716 requires that any segment with a total estimated CDF greater than 1E-6/year be assigned the HSS category. The licensee augmented this Code Case 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. The licensee reviewed the results of its flooding analysis and did not identify any segments 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 were added as a defense-in-depth measure to provide a method of ensuring that any plant-specific locations that are important to safety are identified. All piping that has inspections added or removed per Code Case N-716 are 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) of Code Case N-716.

The NRC staff agrees 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. Any evaluation that categorizes the safety significance of structures, systems, and components requires metrics and guideline values, such as the Fussel-Vessley and risk achievement worth guidelines endorsed in Regulatory Guide 1.201, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to Their Safety Significance" (Reference 11). Such metrics are subordinate to the change in risk metrics in RG 1.174 which are used to determine whether the increase in risk associated with a proposed change is small and consistent with the intent of the Commission's Safety Goal Policy Statement.

Satisfying the guidelines in Section 2(a)(5) requires confidence that the flooding PRA is capable of successfully identifying all, or most, of the significant flooding contributors to risk that are not included in the generic results. RG 1.200 states that meeting the attributes of an NRC-endorsed industry PRA standard may be used to demonstrate that a PRA is adequate to support a risk-informed application. RG 1.200 further states that an acceptable approach that can be used to ensure technical adequacy is to perform a peer review of the PRA. As discussed in Section 3.7 of this SE, the NRC staff concludes that Entergy has demonstrated adequately that the RBS PRA is sufficiently consistent with the guidelines in RG 1.200 to authorize the implementation of the RIS_B program in conjunction with the licensee's commitment to complete PRA Revision 5 and determine the impact of the ongoing PRA Revision 5 on the RIS_B program by December 15, 2011 (see Section 4.0 of this SE).

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

The NRC staff concludes that the risk categorization performed at RBS provides confidence that HSS segments have been identified. Sections 2(a)(1) through 2(a)(4) in Code Case N-716 which identify generic HSS portions of systems were applied to RBS 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 ASME RA-Sb-2005. The licensee also made a commitment to review the impact of the completion of Revision 5 of its PRA on the RI-ISI program by December 15, 2011.

3.6 Inspection/NDE Selection

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

Consistent with the EPRI TR, Category A welds in the RBS augmented inspection program for intergranular stress-corrosion cracking (IGSCC) in response to NRC Generic Letter 88-01, "NRC Position on IGSCC in BWR [Boiling-Water Reactor] Austenitic Stainless Steel Piping" (Reference 12), are subsumed into the proposed alternative RIS_B program. The existing RBS augmented program for Categories B through G welds remains unchanged.

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" (Reference 13). RBS's FAC program is relied upon to manage this damage mechanism but is not otherwise affected or changed by the RIS_B program.

The original RBS augmented inspection programs for high-energy line breaks in Class 1 and 2 piping were revised in accordance with EPRI TR-1006937, "Extension of the EPRI Risk Informed ISI Methodology to the Break Exclusion Region [BER] Programs" (Reference 14). The results of this EPRI risk-informed BER application demonstrated that the volumetric examination requirement for this scope of piping could be reduced from 100 percent to approximately 15 percent. As a result, 15 percent of the BER population will continue to be examined which exceeds the 10 percent requirement imposed by Code Case N-716.

Section 4 in Code Case N-716 requires that 10 percent of HSS welds shall be selected for examination including, at a minimum, 10 percent of all Class 1 welds. Sections 4(b)(1) through 4(b)(3) in Code Case N-716 describe how the inspection locations will be selected. The selection process includes guidance that ensures that inspection locations are distributed physically throughout the HSS piping systems and that all degradation mechanisms will be represented in the selected locations. The guidance provides some flexibility in the distribution

of locations to satisfy all the guidelines but the number of inspections must be increased beyond 10 percent, if necessary, to meet the quantitative risk acceptance guidelines in Section 5(b).

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

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

3.7 Risk Impact Assessment

Section 5 in Code Case N-716 requires that any piping that has NDE inspections[1] added or removed per Code Case N-716 be included in the change in risk assessment. Acceptance criteria provided in Section 5(d) in Code Case 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 assessment (and the Risk Categorization in Section 3.5 of this SE) should be performed using a technically adequate PRA. In Reference 1, the licensee stated that its PRA has been reviewed as part of the Boiling Water Reactor Owners Group (BWROG) Peer Review process in 1998. A self-assessment gap analysis of the current PRA model using RG 1.200 was conducted in the fall 2008. Differences between a PRA's characteristics and the characteristic described in capability category II in the ASME standard, are identified as "gaps" in RG 1.200. In Reference 1, the licensee stated that the reviews had identified 102 gaps, of which 72 where the supporting requirement (SR) had not been met, and 30 where the licensee's analysis was

[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 concluded 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.

consistent with only the minimum characteristics in capability category I. The NRC staff noted that there were more gaps associated with the RBS PRA than most RIS_B submittals. The NRC staff performed an audit at Entergy Headquarters in Jackson, Mississippi, to gain a better understanding on how Entergy reached its conclusion that the PRA was suitable for use in developing its RIS_B program. The results of the audit are provided in Reference 15.

The NRC audit was conducted by discussing each of 67 SRs that had been identified as either Not-Met or as capability category I during the Gap Analysis. Thirty-five additional SRs identified as either Not-Met or a capability category I during the Gap Analysis were not individually discussed during the audit because the SRs 1) solely addressed the "documentation" high-level requirements, or 2) were identified as capability category I for the large early release SRs. Failure to meet a documentation SR is not judged in itself to result in unacceptable PRA results. Meeting LERF SRs with capability category I is generally conservative and judged to be acceptable based on the absolute binning used in the Code Case N-716 process. LERF SRs assigned a Not-Met were evaluated as part of the 67 SRs.

All 67 SRs that were discussed during the audit were dispositioned as described in Table 1 of the audit report (Reference 15). As indicated in Table 1, six SRs were identified that might, individually, affect the RIS_B results and for which further information was required before the NRC staff could conclude its review of the relief request. The NRC staff concluded that the licensee's preliminary determination that the cumulative affect of resolving the other 61 gaps is not expected to affect the RIS_B program. In its letter dated March 12, 2010, the licensee described, in detail, its evaluation of the six SRs that might individually affect the RIS_B results. The licensee explored the potential change to the PRA that might need to be made to address the issues discussed in the SRs and estimated the potential impact of making the change. Based on these descriptions, the NRC staff agrees with the licensee's conclusion that these six SRs do not cause major errors in the PRA that might affect the PRA results to the extent that LSS segments could be expected to become HSS.

Although possible to reasonably evaluate the affects of not meeting individual SRs at capability category II, synergistic affects between numerous unrelated or tangentially related changes to the complex models in PRA can only be included in the results with certainty by changing the PRA model. As described in its letter dated March 12, 2010, the licensee is in the process of revising the PRA model, which will become Revision 5 when completed. Revision 5 is currently scheduled for completion by December 2010. After completing Revision 5, the licensee further stated in the letter that it plans a peer review of Revision 5 against Nuclear Energy Institute (NEI) 05-04, "Process for Performing Follow-on PRA Peer Reviews Using the ASME PRA Standard," (Reference 16), that will be conducted during 2011. This schedule for completing the update of the PRA, and the peer review of the update will not be complete by December 2010, the date the licensee stated it needs to have an authorized RIS_B program in order to properly integrate the RIS_B program into its next refueling outage (16) planning.

Delaying authorization of the RIS_B program would require the licensee to inspect a greater number of welds than a risk-informed process indicates is necessary. Requiring the licensee to accelerate the update and review schedules was considered unnecessary because the NRC staff agrees that changes to the PRA from this process are likely to have a minimal effect, if any, on the proposed RIS_B program. Minor program changes following periodic PRA revisions are part of the living PRA aspects of a risk-informed ISI program. Therefore, based on the

licensee's gap resolution evaluation provided in References 2 and 3, the results of the NRC staff's audit reported in Reference 15, and the licensee's commitment made in Reference 3 to reevaluate its RIS_B program using the completed, peer reviewed Revision 5 of the PRA. The NRC staff concludes that the RIS_B program is based on a PRA with sufficient technical adequacy to provide confidence that the program will focus on the appropriate risk significant welds during the third 10-year ISI interval.

The change in risk assessment in the EPRI TR permits using each segment's CCDP and CLERP in the change in risk estimate. Alternatively, the EPRI TR permits placing segments 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 permits use of either estimated or bounding consequence values. The bounding values to be used in the bounding analysis are the same as those approved for use in the EPRI TR. In Reference 1, the licensee identified the different types of pipe failures that cause major plant transients such as those causing loss-of-coolant accidents (LOCAs) and unisolated LOCAs. Conservative CCDP estimates were developed from the PRA for breaks in locations that could cause these initiating events. These estimated CCDP/CLERP values were used for all applicable inspection locations. Entergy assigns all other inspection locations the upper bounding CCDP/CLERP for feedwater piping breaks outside of containment, which is slightly higher that the upper-bound CCDP/CLERP for the medium-consequence bin.

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 Code Case N-716 includes the risk increase from discontinued inspection in LSS locations. Based on the detailed analysis of every segment required by the EPRI TR, the NRC staff concludes, in the programs developed according to the ERPR-TR, that there is a high confidence that the total increase in risk from all discontinued inspections in LSS segments would be negligible and does not need to be quantified. The staff also 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 thereby providing confidence that the less detailed analyses of LSS segments required by Code Case N-716 does not result in an unanticipated and potentially unacceptable risk increase and is, therefore, acceptable.

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

3.8 Implementation Monitoring and Feedback

The objective of this element of RG 1.174 and RG 1.178 is to assess performance of the affected piping systems under the proposed RI-ISI program by implementing monitoring strategies that conform to the assumptions and analysis used in developing the RIS_B program. In Reference 1, the licensee states that upon approval of the RIS_B program, procedures that

comply with the guidelines described in Code Case N-716 will be prepared to implement and monitor the program.

The list of possible changes includes all changes at the facility or in the PRA that could affect the evaluation used to develop the RIS_B program and performing the reevaluation every ISI period coincides with the inspection periods in the inspection program requirements contained in ASME Section XI. The NRC staff concludes that the proposed procedures are consistent with the performance monitoring guidelines described in RG 1.178 and are, therefore, acceptable.

3.9 Examination Methods

In accordance with Code Case N-716, LSS welds will be exempt from the volumetric, surface, VT-1 and VT-3 visual examination requirements of ASME Code, Section XI. Ten percent of the HSS welds will be selected for examination as addressed in Section 3.6 of this SE. Section 4 of Code Case N-716 directs users to Table 1 for the examination requirements of the welds selected for examination. The examination method is based on the postulated degradation for the selected weld. 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. Table 1 of Code Case N-716 is consistent with the traditional RI-ISI approach for examination methods as approved in EPRI TR-112657. The examination methods are based on an inspection-for-cause philosophy so that when there is a potential for a certain degradation mechanism, the examination method selected would be one that would be able to detect that type of degradation. This is consistent with the guidelines for inspection strategies described in SRP 3.9.8 and is, therefore, acceptable.

4.0 REGULATORY COMMITMENTS

The cumulative impact of the formal resolution of the gaps identified in the reviews of the PRA is not expected to affect the RIS_B program but this conclusion cannot be confirmed until after the PRA Revision 5 has been completed and updated. In its letter dated March 12, 2010, the licensee made the following regulatory commitment:

> As discussed during the December 2009 NRC audit of the RBS PRA Self-Assessment against the ASME PRA Standard, Entergy commits to review the impact of the ongoing PRA Revision 5 on the RI-ISI program by December 15, 2011.

In a subsequent letter dated May 14, 2010, the licensee made the following commitment:

> Entergy will implement the required changes to the RI-ISI program inspection scope prior to refueling outage (RF) 17 scheduled for early 2013.

As discussed in Section 4 of the submittal, and Section 3.8 of this SE, the RIS_B program is a living program. Changes to the facility or to the PRA are expected to occur and the licensees periodically review these changes to ensure the appropriate identification of HSS piping locations. The changes to the PRA arising from final resolution of the gaps and the subsequent reviews of these changes for the effects on the RIS_B program is no different from the licensees' periodic reviews. The NRC staff concludes that the licensee's current schedule to

systematically and properly complete its PRA update and then its RIS_B program review is reasonable and acceptable.

5.0 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.

RG 1.174 establishes requirements for risk-informed decisions involving a change to a plant's licensing basis. RG 1.178 establishes requirements for risk-informed decisions involving alternatives to the ISI program requirements of 10 CFR 50.55a(g), and its directive to follow the requirements of the ASME Code, Section XI. The EPRI TR 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 TR 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, subject to the licensee completing its commitments made in its letters dated March 10 and May 14, 2010, the proposed RI-ISI program is authorized for the third 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.

6.0 REFERENCES

1. Roberts, J. C., Entergy Operations, Inc., letter to U.S. Nuclear Regulatory Commission, "Request for Alternative – Implementation of a Risk-Informed Inservice Inspection Program Based on ASME Code Case N-716," dated June 16, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML091740306).

2. Roberts, J. C., Entergy Operations, Inc., letter to U.S. Nuclear Regulatory Commission, "Supplement to Request for Alternative – Implementation of a Risk-Informed Inservice Inspection Program Based on ASME Code Case N-716 (RBS-ISI-013)," dated August 11, 2009 (ADAMS Accession No. ML092290106).

3. Lorfing, D. N., Entergy Operations, Inc., letter to U.S. Nuclear Regulatory Commission, "Supplement to Request for Alternative – Implementation of a Risk-Informed Inservice Inspection Program Based on ASME Code Case N-716 (RBS-ISI-013)," dated March 12, 2010 (ADAMS Accession No. ML100740395).

4. Lorfing, D. N., Entergy Operations, Inc., letter to U.S. Nuclear Regulatory Commission "Supplement to Request for Alternative – Implementation of a Risk-Informed Inservice Inspection Program Based on ASME Code Case N-716 (RBS-ISI-013)," dated May 14, 2010 (ADAMS Accession No. ML101410263).

5. ASME Code Case N-716, "Alternative Piping Classification and Examination Requirements, Section XI, Division 1," American Society of Mechanical Engineers, New York, New York, April 19, 2006.

6. Electric Power Research Institute, Topical Report (TR)-112657 Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure (PWRMRP-05)," December 1999 (ADAMS Accession No. ML013470102).

7. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.174, Revision 1, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," November 2002 (ADAMS Accession No. ML023240437).

8. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.178, Revision 1, "An Approach for Plant-Specific Risk-Informed Decisionmaking - Inservice Inspection of Piping," September 2003 (ADAMS Accession No. ML032510128).

9. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.200, Revision 1, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," January 2007 (ADAMS Accession No. ML070240001).

10. ASME RA-Sb-2005, "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," Addendum B to ASME RA-S-2002, ASME, New York, New York, December 30, 2005.

11. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.201, Revision 1, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to Their Safety Significance," May 2006 (ADAMS Accession No. ML061090627).

12. U.S. Nuclear Regulatory Commission, Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," dated January 25, 1988 (ADAMS Accession No. ML031130463).

13. U.S. Nuclear Regulatory Commission, Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning," dated May 2, 1989 (ADAMS Accession No. ML031470660).

14. Holden, C., U.S. Nuclear Regulatory Commission, letter to G. L. Vine, Electric Power Research Institute, and safety evaluation on EPRI Topical Report (TR)-1006937, "Extension of the EPRI Risk Informed ISI Methodology to the Break Exclusion Region Programs," dated June 27, 2002 (ADAMS Accession No. ML021790518).

15. Wang, A. B., U.S. Nuclear Regulatory Commission, letter to Vice President, Operations, Entergy Operations Inc., "River Bend Station, Unit 1 - Audit of the Technical Adequacy of Probabilistic Risk Assessment (TAC No. ME1507)," dated April 30, 2010 (ADAMS Accession No. ML100290384).

16. NEI 05-04, "Process for Performing Follow-on PRA Peer Reviews Using the ASME PRA Standard," Nuclear Energy Institute, Washington, DC, January 2005.

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Date: June 30, 2010

The NRC staff's safety evaluation is enclosed. If you have any questions, please contact Alan Wang at 301-415-1445 or via e-mail at alan.wang@nrc.gov.

Sincerely,

/RA/

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Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-458

Enclosure:
Safety Evaluation

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