



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

November 4, 2008

Mr. Benjamin Waldrep, Vice President
Brunswick Steam Electric Plant
Carolina Power & Light Company
Post Office Box 10429
Southport, North Carolina 28461

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2 – RELIEF REQUEST
ISI-02 REGARDING THE CONTINUED USE OF THE RISK-INFORMED
INSERVICE INSPECTION PROGRAM (TAC NOS. MD7557 AND MD7558)

Dear Mr. Waldrep:

By letter dated December 19, 2007, as supplemented by letter dated June 10, 2008, Carolina Power & Light Company (the licensee) submitted Relief Request ISI-02 for the fourth 10-year inservice inspection (ISI) interval at the Brunswick Steam Electric Plant (BSEP), Units 1 and 2. The licensee proposes to use the risk-informed ISI (RI-ISI) methodology contained in Electric Power Research Institute Topical Report 112657, Revision B-A, as an alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI requirements for the selection and examination of Class 1 piping welds. The relief request extends the previously approved methodology for use in the third ISI interval to the fourth ISI interval.

The U.S. Nuclear Regulatory Commission (NRC) staff has evaluated the licensee's RI-ISI relief request for the fourth 10-year interval. The NRC staff finds that the licensee has satisfactorily demonstrated compliance with risk-informed regulatory guidelines. On the basis of the information submitted, the NRC staff concludes that the proposed RI-ISI program will provide an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3)(i), the NRC authorizes Relief Request ISI-02 for the fourth ISI interval for BSEP, Units 1 and 2.

The bases for the NRC staff's conclusion are contained in the enclosed Safety Evaluation. If you have any questions regarding this issue, please contact Farideh Saba at (301) 415-1447 or farideh.saba@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "T. H. Boyce".

Thomas H. Boyce, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-325 and 50-324

Enclosure: Safety Evaluation

cc w/encl: See next page

Carolina Power & Light Company

**Brunswick Steam Electric Plant,
Units 1 and 2**

cc:

Sandra Spencer, Mayor
City of Southport
201 East Moore Street
Southport, North Carolina 28461

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Enclosure

November 3, 2008

Mr. Benjamin Waldrep, Vice President
Brunswick Steam Electric Plant
Carolina Power & Light Company
Post Office Box 10429
Southport, North Carolina 28461

**SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2 – RELIEF REQUEST
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Sincerely,
/RA/
Thomas H. Boyce, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-325 and 50-324

Enclosure: Safety Evaluation

cc w/encl: See next page

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST RELATED TO THE INSERVICE INSPECTION PROGRAM

FOURTH 10-YEAR INTERVAL

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

DOCKET NUMBERS 50-325 AND 50-324

1.0 INTRODUCTION

By letter dated December 19, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML073620362), as supplemented by letter dated June 10, 2008 (ADAMS Accession No. ML081700074), Carolina Power & Light Company (the licensee) submitted Relief Request ISI-02 (RR ISI-02) for the fourth 10-year inservice inspection (ISI) interval at the Brunswick Steam Electric Plant (BSEP), Units 1 and 2. The licensee proposes to use the risk-informed ISI (RI-ISI) methodology contained in Electric Power Research Institute Topical Report 112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation" (EPRI TR-112657) (ADAMS Accession No. ML013470102), as an alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirements for the selection and examination of Class 1, Categories B-F and B-J piping welds.

In a letter dated April 20, 2001 (ADAMS Accession No. ML011170157), and supplemented by letter dated August 31, 2001 (ADAMS Accession No. ML012550180), the licensee submitted the original RI-ISI program for review and approval by the U.S. Nuclear Regulatory Commission (NRC). The licensee developed the original RI-ISI program in accordance with the methodology contained in EPRI TR-112657. In a letter dated November 28, 2001 (ADAMS Accession No. ML013320228), the NRC approved the BSEP RI-ISI program for use during the third 10-year ISI interval. The licensee's current submittal proposes to extend the approved RI-ISI program for use during the fourth 10-year ISI interval.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g) specifies that ISI of nuclear power plant components shall be performed in accordance with the requirements of the ASME Code, Section XI, except where specific written relief has been granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i) or alternatives are authorized pursuant to 10 CFR 50.55a(a)(3).

Section 50.55a(a)(3) of 10 CFR states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that:

- (i) the proposed alternatives would provide an acceptable level of quality and safety, or
- (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Enclosure

The proposed program was developed consistent with the NRC-approved RI-ISI process and methodology delineated in EPRI TR-112657, as approved by the NRC for use at BSEP during the third ISI interval. The ISI program retains the fundamental requirements of the ASME Code, such as inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements.

The NRC staff reviewed the proposed RI-ISI program based on guidance and acceptance criteria provided in the following documents:

- EPRI TR-112657, Revision B-A, "*Revised Risk-Informed Inservice Inspection Evaluation Procedure*," Final Report, December 1999 (EPRI TR-112657) (ADAMS Accession No. ML013470102).
- 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*," U.S. NRC, November 2002 (RG 1.174) (ADAMS Accession No. ML023240437).
- NRC Regulatory Guide 1.178, Revision 1, "*An Approach for, Plant-Specific, Risk-Informed Decisionmaking for Inservice Inspection of Piping*," U.S. NRC, September 2003 (RG 1.178) (ADAMS Accession No. ML032510128).
- NUREG-0800, Section 3.9.8, "*Standard Review Plan for the Review of Risk-Informed Inservice Inspection of Piping*," U.S. NRC, September 2003 (SRP Chapter 3.9.8) (ADAMS Accession No. ML032510135).

3.0 TECHNICAL EVALUATION

3.1 Proposed Relief Request ISI-02

3.1.1 ASME Code Components Affected

Code Class: Class 1

Category: B-J and B-F

Affected Components: Pressure Retaining Piping

3.1.2. Applicable Code Edition and Addenda

The ASME Code of Record for the fourth 10-year ISI interval at BSEP, Units 1 and 2, is the ASME Code, Section XI, 2001 Edition through 2003 Addenda.

3.1.3. Applicable Code Requirements (as stated by the licensee)

The following code requirements are paraphrased from the 2001 Edition through the 2003 Addenda of the ASME Code, Section XI:

Table IWB-2500-1, Examination Category B-F, requires volumetric and surface examinations on all welds for Items B5.10. Table IWB-2500-1, Examination Category B-J,

requires volumetric and/or surface examinations on a sample of welds for Items B9.11, B9.21, B9.31, B9.32, and B9.40. The weld population selected for inspection includes the following:

1. All terminal ends in each pipe or branch run connected to vessels.
2. All terminal ends and joints in each pipe or branch run connected to other components where the stress levels exceed either of the following limits under loads associated with specific seismic events and operational conditions: (a) primary plus secondary stress intensity range of $2.4S_m$ for ferritic steel and austenitic steel or (b) a cumulative usage factor of 0.4.
3. All dissimilar metal welds not covered under Category B-F.
4. Additional piping welds so that the total number of circumferential butt welds, branch connections, or socket welds selected for examination equals 25 percent of the circumferential butt welds, branch connections, or socket welds in the reactor coolant piping system. This total does not include welds exempted by IWB-1220 or welds in Item No. B9.22.

3.1.4. Proposed Alternative and Basis for Use

In accordance with 10 CFR 50.55a(a)(3)(i), the licensee requested NRC approval of the BSEP RI-ISI program as an alternative to the ASME Code, Section XI, 2001 Edition with 2003 Addenda inspection requirements for Class 1 Examination Category B-J and B-F pressure retaining welds. Examination of these welds will be in accordance with the applicable requirements of the Performance Demonstration Initiative (PDI) Program and the applicable modifications and limitations specified in 10 CFR 50.55a.

According to the licensee's December 19, 2007, letter:

The current BSEP RI-ISI program was developed in accordance with the EPRI methodology contained in EPRI TR-112657. The current BSEP RI-ISI program was approved by NRC letter dated November 28, 2001, for use during the second and third periods of the third 10-year inspection interval.

The fourth interval RI-ISI program will be a continuation of the current application and has been updated consistent with the intent of Nuclear Energy Institute (NEI) document, NEI 04-05, "Living Program Guidance to Maintain Risk-Informed Inservice Inspection Programs for Nuclear Plant Piping Systems" (ADAMS Accession No. ML041480432), and continues to meet EPRI TR-112657 and RG 1.174 risk acceptance criteria.

In addition to the risk-informed evaluation, selection, and examination procedure, all ASME Code, Section XI components, regardless of risk classification, will continue to receive code-required pressure testing as part of the current ASME Code, Section XI program. Visual examinations (i.e., VT-2) are implemented in accordance with the BSEP pressure testing program, which remains unaffected by the RI-ISI program.

3.1.5. Duration of the Proposed Alternative

RR ISI-02 is proposed for the fourth 10-year ISI interval at BSEP, which began on May 11, 2008, and will conclude on May 10, 2018.

3.2 Engineering Evaluation

The NRC approved the original RI-ISI program for the third 10-year ISI interval at BSEP, Units 1 and 2, in a safety evaluation dated November 28, 2001. That safety evaluation discusses the NRC's detailed review of the original RI-ISI program based on guidance and acceptance criteria found in the documents listed in Section 2.0 of this safety evaluation.

In its November 28, 2001, safety evaluation, the NRC staff concluded that the original RI-ISI program was developed consistent with the NRC-approved RI-ISI process and methodology delineated in EPRI TR-112657. The staff further concluded that the ISI program retained the fundamental requirements of the ASME Code, such as: inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements.

With regard to BSEP RR ISI-02, the staff will not repeat the same evaluation as documented in the November 28, 2001, safety evaluation because the licensee proposed to extend the already approved RI-ISI program from the third interval to the fourth interval. Instead, the staff evaluated the differences and changes, if any, to the RI-ISI program from the third interval to the fourth interval. The relevant issues are discussed below.

In the June 10, 2008, letter, the licensee confirmed that no new welds were added to or removed from the RI-ISI program since approval was obtained for the third inspection interval. This shows that the scope of the RI-ISI program for the fourth interval is the same as that for the third interval.

The fourth interval RI-ISI program will be based on the ASME Code, 2001 Edition through the 2003 Addenda. However, the staff notes that 10 CFR 50.55a(b)(2)(xxiv) in the current regulation prohibits the use of Appendix VIII, the supplements to Appendix VIII, and Article I-3000 of Section XI of the ASME Code, 2002 Addenda through the latest editions and addenda. This condition and limitation are applicable to ultrasonic examinations using the PDI Program.

In the June 10, 2008, letter, the licensee clarified that the reference to the ASME Code, Section XI, 2001 Edition through the 2003 Addenda in BSEP RR ISI-02 was only to identify the ASME Code of Record for the ISI program. The licensee recognized that 10 CFR 50.55a(b)(2)(xxiv) prohibits the use of Appendix VIII, the supplements to Appendix VIII, and Article I-3000 of Section XI of the ASME Code, 2002 Addenda through the latest edition and addenda. During the fourth ISI interval, the licensee stated that it will perform examinations of risk-informed components in accordance with the PDI Program requirements and the applicable 10 CFR 50.55a modifications and limitations pertaining to the use of Appendix VIII. As shown in the licensee's letter dated June 10, 2008, RR ISI-02 has been revised to clarify the requirements for examining weldments within the scope of this request. The staff finds the revised RR ISI-02 acceptable because it will follow the conditions and limitations of 10 CFR 50.55a(b)(2)(xxiv).

In RR ISI-02, the licensee stated that all ASME Code, Section XI piping components, regardless of risk classification, will continue to receive ASME Code-required pressure testing as part of the current ASME Code, Section XI program. In the June 10, 2008, the licensee clarified that as "this relief request only applies to Class 1 components, system pressure tests will be performed in accordance with requirements specified in Examination Category B-P. For repair/replacement activities involving these components, the applicable requirements of Subarticle IWA-4500 will be met. In both cases, the pressure tests and visual (i.e., VT-2) examinations will meet the applicable requirements specified in Articles IWA-5000 and IWB-5000." The NRC staff finds it is acceptable for the licensee to follow the applicable ASME Code requirements while performing pressure tests.

In the proposed relief request, the licensee stated that the RI-ISI program continues to meet RG 1.174, but did not discuss whether RG 1.178 and SRP Chapter 3.9.8 will be satisfied. In its letter dated June 10, 2008, the licensee clarified that "RG 1.178 is structured to follow the general four-element process, and is consistent for risk-informed applications and approaches identified in RG 1.174. Additionally, RG 1.178 focuses on the use of probabilistic risk assessment in support of a RI-ISI program consistent with RG 1.174. SRP Chapter 3.9.8 is consistent with the approach for using probabilistic risk assessment in risk-informed decisions on plant-specific changes to the licensing basis described in RG 1.174 and provides acceptable methods for implementing a RI-ISI program as described in RG 1.178."

The licensee stated that since the RI-ISI program at BSEP meets the applicable requirements of RG 1.174, and was developed in accordance with NRC-approved methodology (i.e., EPRI TR-112657), the proposed RI-ISI program meets the applicable requirements of RG 1.178 and SRP Chapter 3.9.8. The staff reviewed the information contained in the RR ISI-02 submittals, as well as the details contained in the November 28, 2001, safety evaluation of the previous RI-ISI program, and finds that the proposed RI-ISI program meets the applicable requirements of RG 1.178 and SRP Chapter 3.9.8.

With respect to the RI-ISI experience in the third interval, the licensee stated that the RI-ISI program was implemented at BSEP at the beginning of the second period of the third inspection interval. For this reason, the NRC's safety evaluation dated November 28, 2001, stated that BSEP would complete 72.3 percent of the Unit 1, and 91 percent of the Unit 2 risk-informed examinations during the second and third inspection periods of the third 10-year ISI interval.

For Unit 1, the licensee stated that "the required risk-informed examinations have been completed. The results of the examinations were found to be satisfactory. The licensee did not encounter any problems implementing the risk-informed program with Unit 1. To support examination of some of the welds, conditioning was required to obtain better examination coverage. In addition, some welds were considered limited examinations due to the configuration of the weld."

For Unit 2, the licensee stated that "not all of the required risk-informed examinations have been completed. As allowed by paragraph IWA-2430(d) and IWB-2412(b), the third inspection interval and period has been extended for one year. This extension will allow the examination of the remaining seven weldments during the B219R1 refueling outage that is currently scheduled for Spring 2009. The remaining required risk-informed examinations have been completed, and their results were found to be acceptable." The licensee did not encounter any problems during

the implementation of this program for Unit 2. Similar to Unit 1, the licensee stated that to support the examination of some of the Unit 2 welds, conditioning was required to obtain better examination coverage. In addition, some welds were considered limited examinations due to the configuration of the weld. The staff finds it acceptable that the remaining weldments to be examined at Unit 2 will be examined during the spring 2009 refueling outage.

The licensee did not implement the original RI-ISI program until the second period of the third interval, which may delay completion of the required examinations. Because the proposed RI-ISI program will be implemented at the beginning of the fourth 10-year ISI interval, the staff expects the licensee to complete all required inspections within the fourth interval.

The staff finds that the third interval RI-ISI program may be extended to the fourth interval because the licensee has implemented the NRC-approved RI-ISI program during the third interval without encountering any significant problems. Further, there are no significant changes from the original RI-ISI program. The staff notes that the inspections performed for the third ISI interval as a result of the Unit 2 ISI interval extension cannot be counted for the first period of the fourth ISI interval.

3.3 Risk-Informed Evaluation

The licensee is requesting relief that would permit continued use of a previously approved RI-ISI program plan during the fourth 10-year ISI interval instead of the ASME Code, Section XI program. An acceptable RI-ISI program plan is expected to meet the five key principles of risk-informed decisionmaking, as discussed in RGs 1.174 and 1.178. These principles are:

1. The proposed change meets the current regulations unless it is explicitly related to a requested exemption or rule change.
2. The proposed change is consistent with the defense-in-depth philosophy.
3. The proposed change maintains sufficient safety margins.
4. When proposed changes result in an increase in core damage frequency and/or large early release frequency, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.
5. The impact of the proposed change should be monitored by using performance measurement strategies.

The first principle is met in this relief request because an alternative ISI program may be authorized pursuant to 10 CFR 50.55a(3)(i); therefore, an exemption request is not required.

The second and third principles require assurance that the alternative program is consistent with the defense-in-depth philosophy and that sufficient safety margins are maintained, respectively. The licensee stated that the fourth interval RI-ISI program will be a continuation of the current application that was approved by NRC letter dated November 28, 2001. In this letter, the staff reviewed the licensee's application of the RI-ISI methodology and concluded that it was consistent with the methodology described in EPRI TR-112657. The licensee stated in its letter

dated December 19, 2007, that the fourth interval RI-ISI program was updated in accordance with the approved methodology. Assurance that the second and third principles are met is based on application of the approved methodology and not on the particular inspection locations selected. Therefore, the staff considers the second and third principles are met.

The fourth principle requires an estimate of the change in risk, and the change in risk is dependent on the number and location of inspections in the proposed ISI program as compared to the number and location of inspections that would be inspected under requirements of the ASME Code, Section XI. In its letter dated December 19, 2007, the licensee states that the fourth interval RI-ISI program has been updated and continues to meet the EPRI TR-112657 risk acceptance guidelines. Satisfying the EPRI TR-112657 risk acceptance guidelines for using the approved methodology provides confidence that any increase in risk should be small and consistent with the intent of the Commission's Safety Goal Policy Statement; therefore, the fourth principle of risk-informed decisionmaking is met.

The fifth principle of risk-informed decisionmaking requires that the impact of the proposed change be monitored using performance measurement strategies. In its letter dated April 20, 2001, the licensee stated that the RI-ISI program is a living program requiring feedback of new and relevant information to ensure appropriate identification of highly safety significant piping locations. The licensee confirmed in the December 19, 2007, letter that the fourth interval RI-ISI program has been updated; thus, the program continues to be a living program and satisfies the fifth principle.

Based on the above discussion, the staff concludes that the five key principles of risk-informed decisionmaking are satisfied by the licensee's proposed fourth 10-year RI-ISI program; therefore, the proposed program for the fourth 10-year ISI interval is acceptable.

4.0 CONCLUSION

Based on the information provided in the licensee's submittals, the NRC staff has determined that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the use of the RI-ISI program described in RR ISI-02, dated June 10, 2008, for BSEP, Units 1 and 2, for the fourth 10-year ISI inspection interval, which will conclude on May 10, 2018.

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

Principal Contributors: John Tsao
Stephen Dinsmore

Date: November 4, 2008