November 28, 2001

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

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2 - SAFETY EVALUATION FOR THE RISK-INFORMED INSERVICE INSPECTION (RI-ISI) PROGRAM (TAC NOS. MB1760 AND MB1761)

Dear Mr. Keenan:

By letter dated April 20, 2001, as supplemented August 31, 2001, you requested that the NRC approve a risk-informed inservice inspection (ISI) program as an alternative to your current ISI program at the Brunswick Steam Electric Plant (BSEP), Units 1 and 2, for Class 1 piping welds, Categories B-J and B-F.

Your proposed RI-ISI program was developed in accordance with the Electric Power Research Institute (EPRI) methodology contained in EPRI Topical Report TR-112657, Revision B-A, which has been approved by the NRC staff. This relief request was proposed pursuant to the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i) for the second period of the third 10-year ISI interval at both BSEP units.

The staff's review of the proposed RI-ISI program concludes that the program is an acceptable alternative to the current ISI program based on the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI requirements for Class 1, Categories B-J and B-F welds, and therefore, the proposed alternative is authorized for the third 10-year ISI interval at both BSEP units pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the licensee's alternative provides an acceptable level of quality and safety. The staff's Safety Evaluation is enclosed.

Please contact Donnie Ashley at (301) 415-3191 if you have any questions regarding this matter.

Sincerely,

/RA/
Richard P. Correia, Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-325 and 50-324

Enclosure: As stated

cc w/encl: See next page

November 28, 2001

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

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2 - SAFETY EVALUATION FOR THE RISK-INFORMED INSERVICE INSPECTION (RI-ISI) PROGRAM (TAC NOS. MB1760 AND MB1761)

Dear Mr. Keenan:

By letter dated April 20, 2001, as supplemented August 31, 2001, you requested that the NRC approve a risk-informed inservice inspection (ISI) program as an alternative to your current ISI program at the Brunswick Steam Electric Plant (BSEP), Units 1 and 2, for Class 1 piping welds, Categories B-J and B-F.

Your proposed RI-ISI program was developed in accordance with the Electric Power Research Institute (EPRI) methodology contained in EPRI Topical Report TR-112657, Revision B-A, which has been approved by the NRC staff. This relief request was proposed pursuant to the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i) for the second period of the third 10-year ISI interval at both BSEP units.

The staff's review of the proposed RI-ISI program concludes that the program is an acceptable alternative to the current ISI program based on the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI requirements for Class 1, Categories B-J and B-F welds, and therefore, the proposed alternative is authorized for the third 10-year ISI interval at both BSEP units pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the licensee's alternative provides an acceptable level of quality and safety. The staff's Safety Evaluation is enclosed.

Please contact Donnie Ashley at (301) 415-3191 if you have any questions regarding this matter.

Sincerely,

/RA/
Richard P. Correia, Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-325 and 50-324

Enclosure: As stated

cc w/encl: See next page

Distribution:

PUBLIC	EDunnington	PPatnaik	DHarrison	BBonser, RII
PDII R/F	DAshley	ACRS	HBerkow	
RCorreia	OGC	GHill (4)	SRosenberg	

Accession Number ML013320632
*No substantive change to SE

OFFICE	PDII-2\PM	PDII-2\LA	SPSB/DSSA*	EMCB/DE*	OGC	PDII-2\SC
NAME	DAshley	EDunnington	MRubin	TChan	DCummings	RCorreia
DATE	11/13/01	11/9/01	10/26/01	10/26/01	11/19/01	11/28/01

OFFICIAL RECORD COPY

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RISK-INFORMED INSERVICE INSPECTION PROGRAM RELIEF REQUEST

CAROLINA POWER & LIGHT COMPANY

BRUNSWICK STEAM ELECTRIC PLANT UNITS 1 AND 2

DOCKET NOS. 50-325 AND 50-324

1.0 INTRODUCTION

Current inservice inspection (ISI) requirements for the Brunswick Steam Electric Plant (BSEP), Units 1 and 2, are contained in the 1989 Edition of Section XI, Division 1 of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, entitled "Rules for Inservice Inspection of Nuclear Power Plant Components" (hereinafter referred to as the ASME Code). In a submittal dated April 20, 2001 (Reference 1), Carolina Power & Light Company (the licensee) proposed a new risk-informed inservice inspection (RI-ISI) program as an alternative to a portion of their current ISI program. Additional clarifying information was provided by the licensee in a letter dated August 31, 2001 (Reference 2).

The RI-ISI program is limited to ASME Class 1, Categories B-J and B-F welds. The program was developed in accordance with the Electric Power Research Institute (EPRI) methodology contained in the NRC-approved EPRI Topical Report TR-112657, Revision B-A (Reference 3).

In the proposed RI-ISI program, piping failure potential estimates were determined using the EPRI TR-112657 guidance, which utilizes industry piping failure history, plant-specific piping failure history, and other relevant information. Using the failure potential and supporting insights on piping failure consequences from the licensee's probabilistic risk assessment (PRA), ranking of piping segments was established for determination of new inspection locations. The proposed program maintains the fundamental requirements of the ASME Code, such as the examination technique, examination frequency, and acceptance criteria. However, the proposed program reduces the required examination locations significantly while demonstrating that an acceptable level of quality and safety is maintained. Thus, the proposed alternative approach is based on the conclusion that it provides an acceptable level of quality and safety and, therefore, is in conformance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i).

2.0 SUMMARY OF PROPOSED APPROACH

The licensee is required to perform ISI of ASME Code Category B-F and B-J piping welds during successive 10-year intervals. Currently, all Category B-F welds and 25 percent of all Category B-J piping welds in ASME Class 1 piping greater than 1-inch in nominal diameter are selected for volumetric and/or surface examination based on existing stress analyses and cumulative usage factors.

The licensee submitted the application as an RI-ISI "template" application. Template applications are short overview submittals intended to expedite preparation and review of RI-ISI submittals that comply with a pre-approved methodology. The licensee proposed to implement the staff-approved RI-ISI methodology delineated in EPRI TR-112657. In accordance with the guidance in EPRI TR-112657, some elements inspected under the augmented inspection programs are credited as RI-ISI inspections, but none of the augmented inspections were changed as a result of the selections.

The implementation of an RI-ISI program for piping should be initiated at the start of a plant's 10-year ISI interval, consistent with the requirements of the ASME Code and Addenda committed to by the licensee in accordance with 10 CFR 50.55a. However, the implementation may begin at any point in an existing interval, as long as the examinations are scheduled and distributed consistent with the ASME Code requirements (e.g., the minimum examinations completed at the end of the three inspection periods under ASME Code Program B should be 16 percent, 50 percent, and 100 percent, respectively, and the maximum examinations credited at the end of the respective periods should be 34 percent, 67 percent, and 100 percent), unless the NRC approves an alternative to these requirements.

The licensee has requested approval of this alternative for implementation during the second period of the third 10-year ISI interval of both units of BSEP, beginning with the Unit 1 refueling outage currently scheduled for March 2, 2002. According to Reference 1, BSEP entered the second period of the third 10-year ISI interval on May 11, 2001. The licensee, in a letter dated August 8, 2000, requested approval of an alternative to the minimum examination percentages associated with ASME Code Categories B-J and B-F for the first inspection period of the current inspection interval for BSEP Unit 2. Approval of the alternative was requested to allow the delay of certain ASME Class 1 piping weld examinations that might no longer be required following implementation of the RI-ISI program. This alternative was authorized by the NRC in a letter dated November 29, 2000.

It is also the staff's view that the inspections for the RI-ISI program and for the balance of the ISI program should be on the same interval start and end dates. This can be accomplished by either implementing the RI-ISI program at the beginning of the interval or merging the RI-ISI program into the ISI program for the balance of the inspections if the RI-ISI program is to begin during an existing ISI interval. One reason for this view is that it eliminates the problem of having different Codes of Record for the RI-ISI program and for the balance of the ISI program. A potential problem with using two different interval start dates and hence two different Codes of Record would be having two sets of repair/replacement rules depending upon which program identified the need for repair (e.g., a weld inspection versus a pressure test). In Reference 1, the licensee stated that upon approval of the RI-ISI program, procedures that comply with the guidelines described in EPRI TR-112657 would be prepared to implement and monitor the program. The new program will be integrated into the third 10-year ISI interval.

The staff finds that the BSEP RI-ISI program meets the ASME Code and 10 CFR 50.55a requirements for minimum and maximum inspections during inspection periods and intervals, including the applicable aspects of the ASME Code, for BSEP Unit 1. For BSEP Unit 2, a prior relief request was approved by the staff to allow the licensee to not meet the minimum examination percentages associated with ASME Code Categories B-J and B-F for the first period of the current ISI interval. In Reference 1, the licensee indicated that they will meet the ASME examination percentage requirements in the subsequent second and third periods of the current ISI interval. Therefore, the staff also finds that the BSEP RI-ISI program meets the allowed alternative minimum and maximum examination percentages for BSEP Unit 2.

3.0 EVALUATION

The licensee's submittal was reviewed with respect to the methodology and criteria contained in EPRI TR-112657. Further guidance in defining acceptable methods for implementing an RI-ISI program is also provided in Regulatory Guide (RG) 1.174, RG 1.178, and Standard Review Plan (SRP) Chapter 3.9.8 (References 4, 5, and 6).

3.1 Proposed Changes to ISI Program

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee has proposed to implement an RI-ISI program in accordance with the methodology contained in EPRI TR-112657 as an alternative to the ASME Code examination requirements for ASME Class 1 piping for BSEP. A general description of the proposed changes to the ISI program was provided in Sections 3 and 5 of the licensee's submittal.

3.2 Engineering Analysis

In accordance with the guidance provided in RGs 1.174 and 1.178, an engineering analysis of the proposed changes using a combination of traditional engineering analysis and supporting insights from the BSEP PRA was performed. The licensee discussed how the engineering analyses conducted for the BSEP RI-ISI program ensure that the proposed changes are consistent with the principles of defense-in-depth and that adequate safety margins will be maintained. The licensee evaluated a piping location's susceptibility to a particular degradation mechanism that may be a precursor to a leak or rupture and then performed an independent assessment of the consequences of a failure at that location. In general, the approach is consistent with the process approved in EPRI TR-112657.

The BSEP RI-ISI program is limited to ASME Class 1 piping, Examination Category B-F and B-J welds only. The licensee stated in Reference 1 that other non-related portions of the ASME Code requirements, such as inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements, will be unaffected by the RI-ISI program and will be retained. This is consistent with the guidelines provided in EPRI TR-112657, and therefore is acceptable.

In Reference 1, the licensee states that all existing relief requests that had been approved by the NRC will remain in place (i.e., none are withdrawn due to the RI-ISI application). The licensee also states that the current augmented ISI program for flow-accelerated corrosion (FAC) is not affected or changed by the RI-ISI program. The augmented examinations for intergranular stress corrosion cracking (IGSCC) also remain unchanged, except for Category "A" welds, which are considered resistant to IGSCC and are subsumed into the RI-ISI program as having a low failure potential if no other degradation mechanisms are present. This is consistent with the guidance contained in EPRI TR-112657 and in Generic Letter (GL) 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel," and therefore is acceptable.

The BSEP has recently completed the end of their first period of the third 10-year ISI interval. The licensee indicated that 27.7 percent of the examinations at Unit 1 and 9.0 percent at Unit 2 required by the ASME Code were completed in the first period. The licensee proposed to complete the remaining 72.3 percent of the examinations at Unit 1 and 91.0 percent at Unit 2 in the second and third periods based on the requirements of the RI-ISI program. The staff prefers completion of all examinations under a single program in an ISI interval. However, since the licensee completed more than the ASME Code-required minimum percentage of

examinations (16 percent) in the first period at Unit 1 and had a previously approved alternative to meeting the required minimum percentage at Unit 2, the staff concludes that the total number of examinations to be performed under the RI-ISI program, as proposed by the licensee, is adequate and acceptable. The licensee further indicates that subsequent inspection intervals will entail inspection of 100 percent of the selected RI-ISI program locations, which is consistent with the ASME Code requirement of 100-percent implementation of an ISI program in each 10-year ISI interval, and therefore, is acceptable. However, it is recognized that the RI-ISI program selected inspection locations may be adjusted in the future to ensure that the appropriate identification of high safety-significant locations is maintained.

In Tables 5-1-1 and 5-1-2 of the licensee's April 20, 2001, submittal, a detailed listing regarding the number of Category B-F and B-J welds selected for inspection in the RI-ISI program, in comparison with the respective number of welds selected under the current Code ISI program, is provided. The RI-ISI program reduces the total number of B-F and B-J welds to be examined to 66 at Unit 1 and 61 at Unit 2 from a total under the existing ASME Code program of 155 and 145, respectively. The reduction is significant (approximately 57 percent at each unit) and the number of welds credited from augmented inspections is in conformance with the guidelines established in EPRI TR-112657 (i.e., less than 50 percent of the total selected welds) and therefore is acceptable. In addition, the RI-ISI program selected 11 out of a total of 34 welds at Unit 1 and 7 out of a total of 22 welds at Unit 2 in the high risk region (about 33 percent in comparison to a minimum of 25 percent required by EPRI TR-112657), 55 out of a total of 405 welds at Unit 1 and 54 out of a total of 403 at Unit 2 in the medium risk region (about 13 percent in comparison to a minimum of 10 percent required by EPRI TR-112657), and 66 out of a total of 515 B-F and B-J welds at Unit 1 and 61 out of a total of 503 B-F and B-J welds at Unit 2 (adequate to meet a minimum of 10 percent in EPRI TR-112657 for defense-in-depth considerations). Thus, the staff concludes that the RI-ISI selection of examination locations, although greatly reduced in total number from the ASME Code program, meets the guidance of EPRI TR-112657, and therefore is adequate and acceptable.

The licensee also described its alternative thermal stratification, cycling, and striping susceptibility screening criteria, which consist of additional considerations to the previously approved criteria stated in EPRI TR-112657. The additional considerations include conditions of potential mixing of fluid in the turbulent penetration region at branch piping connections, diminished stratified temperature differences at locations which lack a sustained source of cold or hot fluid, and situations with a low potential for cyclic thermal fluctuation at a leaking valve. The licensee indicated in Reference 1 that the alternative screening criteria are consistent with the criteria recently submitted by EPRI for generic approval as contained in the report "Interim Thermal Fatigue Management Guidelines (MRP-24)." The staff found that the proposed alternative screening criteria are consistent with MRP-24, which was evaluated by the staff, and therefore is acceptable. It is expected that the licensee will meet the guidelines in MRP-24 when the report is finalized.

Piping systems within the scope of the RI-ISI program were divided into piping segments. Pipe segments are defined as lengths of pipe whose failure would lead to similar consequence and are exposed to the same degradation mechanism. The licensee's submittal also stated that failure potential estimates were generated utilizing industry failure history, plant-specific failure history, and other relevant information using the guidance provided in EPRI TR-112657. The staff concludes that the licensee has met the SRP 3.9.8 guidelines to confirm that a systematic process was used to identify pipe segments' susceptibility to common degradation mechanisms, and to categorize these degradation mechanisms into the appropriate degradation categories with respect to their potential to result in a postulated leak or rupture.

Additionally, the licensee stated that the consequences of pressure boundary failure (PBF) were evaluated and ranked based on their impact on core damage frequency (CDF) and large early release frequency (LERF), and that the impact due to both direct and indirect effects was considered using the guidance provided in EPRI TR-112657. The licensee reported no deviations from the consequence evaluation methodology in EPRI TR-112657. Based on the above discussion, the staff finds the consequence evaluation performed for this application to be acceptable.

3.3 Probabilistic Risk Assessment

The BSEP Individual Plant Examination (IPE) was submitted in August 1992. The IPE identified a CDF of 2.7E-5/year. The staff evaluation report (SER) dated January 21, 2000, concluded that the BSEP IPE and associated documentation satisfied the intent of GL 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities."

The licensee has maintained their IPE/Probabilistic Safety Assessment (PSA) as a "living model." Periodic updates of the BSEP PSA model have occurred since its first development and are controlled by procedures, including the requirement that plant engineers screen proposed modifications for impact to the Maintenance Rule or PSA programs. The model used for the RI-ISI program is the final BSEP 1998 model of record (MOR 98), which was a major upgrade that incorporated additional system modeling details and enhanced the treatment of common cause failure, circular logic, loss of offsite power recovery, human reliability analysis, and a complete update of the associated failure database. The draft MOR 98 model was independently reviewed in April 2000, including observations related to the PSA technical elements specified in the Boiling Water Reactor Owners' Group (BWROG) PSA Peer Review Certification Process. This review recognized the upgraded BSEP model as containing excellent structure, level of detail, and documentation. All significant comments and insights from this review of the draft model were resolved during the development of the final MOR 98 model. The licensee did indicate that they had identified potentially non-conservative assumptions involving the treatment of dc chargers in the model. A sensitivity study was performed by the licensee that indicated that it does not impact the conclusions of the RI-ISI consequence analysis.

In its submittal, the licensee reported an MOR 98 base CDF of 2.7E-5/year when a truncation value of 1E-9/year is used. The licensee also stated that they are currently updating their Level 2 model, but results were not yet available. Based on the IPE Level 2 results, the licensee assigned an LERF value that is approximately 12 percent of the CDF value. This LERF value was used as part of the consequence evaluation. In addition, using the preliminary results of the updated Level 2 model, the licensee determined that no pipe segments would change in risk ranking.

The staff recognizes that the quantitative results of the BSEP MOR 98 model are used as order-of-magnitude estimates for several risk and reliability parameters used to support the assignment of segments into three broad consequence categories. The staff did not review the BSEP PSA to assess the accuracy of the quantitative estimates. The staff believes that inaccuracies in the models or in assumptions large enough to invalidate the broad categorizations developed to support RI-ISI should have been identified during the staff's review of the IPE, by the licensee's model update control program, and/or during its independent review. The EPRI methodology applied by the licensee requires that for Class 1 piping, inspections should not be significantly less than 10 percent unless adequately justified regardless of the quantitative results of the risk analyses. Therefore, while minor errors or

inappropriate assumptions in the IPE could affect the consequence categorization of a few segments and thus the location of several inspections, these errors will not invalidate the general results or conclusions of this Safety Evaluation. The staff finds the quality of the licensee's PSA sufficient to support the application of the approved EPRI methodology and the proposed RI-ISI program.

The degradation category and the consequence category were combined according to the approved methodology described in EPRI TR-112657 to categorize the risk significance of each segment. The risk significance of each segment is used to determine the number of weld inspections required in each segment.

The licensee conducted a risk impact analysis per the requirements of Section 3.7 of EPRI TR-112657. The analysis estimates the net change in risk due to the positive and negative influence of adding and removing locations from the inspection program. The licensee performed the risk quantification using the "Simplified Risk Quantification Method" described in Section 3.7 of EPRI TR-112657. The licensee used the highest evaluated conditional core damage probability (CCDP) and conditional large early release probability (CLERP) values of 1E-2 and 3E-3, respectively, for high consequence category segments. This CLERP value represents an isolable medium loss-of-coolant accident (LOCA) in the reactor building and corresponds to the failure probability of a motor-operated valve (MOV) to close on demand. These LOCA scenarios were assumed to lead to core damage and containment bypass. For medium consequence category segments, bounding estimates of 1E-4 and 1E-5 were used for CCDP and CLERP, respectively.

The likelihood of PBF was determined by the presence of different degradation mechanisms, and the rank was based on the relative failure probability. The basic likelihood of PBF for a piping location with no degradation mechanism present was given as x_o and is expected to have a value less than 1E-8. Piping locations identified as having a medium failure potential were given a likelihood of $20x_o$. In addition, the analysis was performed with and without taking credit for enhanced inspection effectiveness due to an increased probability of detection (POD) from application of the RI-ISI approach. The licensee stated that the PBF likelihoods and POD values used in the analysis are consistent with those used in the approved RI-ISI pilot applications.

For BSEP Unit 1, the licensee estimated the aggregate change in CDF to be 1.19E-8/year and estimated the aggregate change in LERF to be 3.58E-9/year, excluding credit for any increased POD due to the use of improved inspection techniques. Including the expected increase in POD results in an estimated aggregate change in CDF of 5.11E-9/year and an estimated aggregate change in LERF of 1.54E-9/year. For BSEP Unit 2, when excluding credit for any increased POD, the licensee estimated the aggregate change in CDF to be 1.09E-8/year and estimated the aggregate change in LERF to be 3.27E-9/year. Including the expected increase in POD results in an estimated aggregate change in CDF of 7.26E-9/year and an estimated aggregate change in LERF of 2.19E-9/year.

The staff finds the licensee's process to evaluate and bound the potential change in risk reasonable because it accounts for the change in the number and location of elements inspected, recognizes the difference in degradation mechanism related to failure likelihood, and considers the effects of enhanced inspection. System-level and aggregate estimates of the changes in CDF and LERF are less than and thus consistent with the corresponding guideline values in EPRI TR-112657. The staff finds that redistributing the welds to be inspected with consideration of the risk significance of the segments provides assurance that segments whose

failure have a significant impact on plant risk receive an acceptable and often improved level of inspection. Therefore, the staff concludes that the implementation of the RI-ISI program as described in the licensee's application will have a very small impact on risk consistent with the guidelines of RG 1.174, and thus will not cause the NRC safety goals to be exceeded.

3.4 Integrated Decisionmaking

As described in the licensee's submittal, an integrated approach is utilized in defining the proposed RI-ISI program by considering in concert the traditional engineering analysis, risk evaluation, and the implementation and performance monitoring of piping under the program. This is consistent with the guidelines of RG 1.178.

The selection of pipe segments to be inspected is described in Section 3.5 of the submittal using the results of the risk category rankings and other operational considerations. Tables 3.5-1 and 3.5-2 of the submittal provide the number of locations and inspections by risk category for the various systems for Units 1 and 2, respectively. Tables 3.6-1 and 3.6-2 of the submittal present the risk impact results for each system for Units 1 and 2, respectively. Likewise, Tables 5-1-1 and 5-2-1 and Tables 5-1-2 and 5-2-2 of the submittal provide the final summary tables, comparing the number of inspections required under the existing ASME Code ISI program with the alternative RI-ISI program by risk region and risk category for each system for Units 1 and 2, respectively.

The licensee used the methodology described in EPRI TR-112657 to guide the selection of examination elements within high and medium risk-ranked piping segments. The methodology described in EPRI TR-112657 calls for maintaining existing augmented programs, other than thermal fatigue and IGSCC Category A piping welds, which the RI-ISI program supersedes. The EPRI topical report describes targeted examination volumes (typically associated with welds) and methods of examination based on the type(s) of degradation expected. The staff has reviewed these guidelines and has determined that, if implemented as described, the RI-ISI examinations should result in improved detection of service-related degradations over that currently required by the ASME Code.

The staff finds that the location selection process is acceptable since it is consistent with the process approved for EPRI TR-112657, takes into account defense-in-depth, and includes coverage of systems subjected to degradation mechanisms, in addition to those covered by augmented inspection programs.

The objective of the ISI program required by the ASME Code is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary that may impact plant safety. Based on the integrated approach for the improved detection of service-related degradation and location selection, the staff concludes that the proposed RI-ISI program does meet this objective. Further, since the RI-ISI program is based on inspection for cause, the element selection process targets specific degradation mechanisms.

Chapter 4 of EPRI TR-112657 provides guidelines for the areas and/or volumes to be inspected, as well as the examination method, acceptance standard, and evaluation standard for each degradation mechanism. Based on the review of the cited portion of the EPRI TR, the staff concludes that the examination methods for the proposed RI-ISI program are appropriate since they are selected based on specific degradation mechanisms, pipe sizes, and materials of concern.

3.5 Implementation and Monitoring

Implementation and performance monitoring strategies require careful consideration by the licensee and are addressed in Element 3 of RG 1.178 and SRP 3.9.8. The objective of Element 3 is to assess the performance of the affected piping systems under the proposed RI-ISI program by implementing monitoring strategies that confirm the assumptions and analyses used in the development of the RI-ISI program. To approve an alternative pursuant to 10 CFR 50.55a(a)(3)(i), implementation of the RI-ISI program, including inspection scope, examination methods, and methods of evaluation of examination results, must provide an acceptable level of quality and safety.

In the licensee's submittal, the licensee stated that upon approval of the RI-ISI program, procedures that comply with the EPRI TR-112657 guidelines will be prepared to implement and monitor the RI-ISI program. The licensee confirmed that the applicable portions of the ASME Code not affected by the change, such as inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements, would be retained.

The licensee stated in Section 4 of the submittal that the RI-ISI program is a living program and its implementation will require feedback of new relevant information to ensure the appropriate identification of high safety significant piping locations and that significant changes may require more frequent adjustment as directed by NRC bulletin or GL requirements or by industry or plant-specific feedback.

The proposed periodic reporting requirements meet existing ASME Code requirements and applicable regulations and therefore are considered acceptable. The proposed process for RI-ISI program updates meets the guidelines of RG 1.174 that risk-informed applications must include performance monitoring and feedback provisions. Therefore, the process for program updates is considered acceptable.

4.0 <u>CONCLUSION</u>

In accordance with 10 CFR 50.55a(a)(3)(i), proposed alternatives to regulatory requirements may be used when authorized by the NRC when the applicant demonstrates that the alternative provides an acceptable level of quality and safety. In this case, the licensee's proposed alternative is to use the risk-informed process described in the approved EPRI TR-112657. The staff concludes that the licensee's proposed RI-ISI program, which is consistent with the methodology described in EPRI TR-112657, will provide an acceptable level of quality and safety with regard to the number of inspections, locations of inspections, and methods of inspection.

The staff finds that the results of the different elements of the engineering analysis are considered in an integrated decisionmaking process. The impact of the proposed change in the ISI program is founded on the adequacy of the engineering analysis and acceptable change in plant risk in accordance with RG 1.174 and RG 1.178 guidelines.

The BSEP methodology also considers implementation and performance monitoring strategies. Inspection strategies ensure that failure mechanisms of concern have been addressed and there is adequate assurance of detecting damage before structural integrity is affected. The risk significance of piping segments is taken into account in defining the inspection scope for the RI-ISI program.

System pressure tests and visual examination of piping structural elements will continue to be performed on all ASME Class 1, 2, and 3 systems in accordance with the ASME Code program. The RI-ISI program applies the same performance measurement strategies as existing ASME Code requirements and, in addition, increases the inspection volumes at weld locations.

The BSEP methodology provides for conducting an engineering analysis of the proposed changes using a combination of engineering analysis with supporting insights from a PRA. Defense-in-depth and quality are not degraded in that the methodology provides reasonable confidence that any reduction in existing inspections will not lead to degraded piping performance when compared to existing performance levels. Inspections are focused on locations with active degradation mechanisms as well as selected locations that monitor the performance of piping systems.

The licensee has stated that the ASME Code minimum and maximum inspection requirements for Program B will be met and that the RI-ISI inspections and the balance of the inspections will be on the same interval start and end dates. The staff finds that the BSEP RI-ISI program meets the ASME Code requirements for minimum and maximum inspections during inspection periods and intervals. The staff also finds that the licensee's RI-ISI program at BSEP meets the 10 CFR 50.55a requirements for program submittal to the NRC.

Based on the above, the staff concludes that the licensee's proposed alternative is authorized for the third 10-year ISI interval at both BSEP units pursuant to 10 CFR 50.55a(a)(3)(i), on the basis that the licensee's alternative provides an acceptable level of quality and safety.

5.0 REFERENCES

1. Letter, David C. DiCello (Carolina Power & Light Company), to U.S. Nuclear Regulatory Commission, *Brunswick Steam Electric Plant, Unit Nos. 1 and 2, Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62, Third 10-year Inservice Inspection Program - Request for Approval of Risk-Informed Inservice Inspection Program*, BSEP 01-0013, April 20, 2001.

2. Letter, David C. DiCello (Carolina Power & Light Company), to U.S. Nuclear Regulatory Commission, *Brunswick Steam Electric Plant, Unit Nos. 1 and 2 Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62 Response to Request for Additional Information - Third 10-year Inservice Inspection Program - Request for Approval of Risk-Informed Inservice Inspection Program (NRC TAC Nos. MB1760 and MB1761)*, BSEP 01-0093, August 31, 2001.

3. Electric Power Research Institute, *Revised Risk-Informed Inservice Inspection Evaluation Procedure*, TR-112657, Revision B-A, December 1999.

4. U.S. Nuclear Regulatory Commission, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis*, Regulatory Guide 1.174, July 1998.

5. U.S. Nuclear Regulatory Commission, *An Approach for Plant-Specific Risk-Informed Decision Making: Inservice Inspection of Piping*, Regulatory Guide 1.178, September 1998.

6. U.S. Nuclear Regulatory Commission, *Standard Review Plan for Trial Use for the Review of Risk-Informed Inservice Inspection of Piping*, NUREG-0800, SRP Chapter 3.9.8, September 1998.

Principal Contributors: Prakash Patnaik
Donald Harrison

Date: November 28, 2001

Mr. J. S. Keenan
Carolina Power & Light Company

Brunswick Steam Electric Plant
Units 1 and 2

cc:

Mr. William D. Johnson
Vice President and Corporate Secretary
Carolina Power & Light Company
Post Office Box 1551
Raleigh, North Carolina 27602

Mr. Donald E. Warren
Brunswick County Board of Commissioners
Post Office Box 249
Bolivia, North Carolina 28422

Resident Inspector
U.S. Nuclear Regulatory Commission
8470 River Road
Southport, North Carolina 28461

Mr. John H. O'Neill, Jr.
Shaw, Pittman, Potts & Trowbridge
2300 N Street, NW.
Washington, DC 20037-1128

Mr. Mel Fry, Director
Division of Radiation Protection
N.C. Department of Environment
and Natural Resources
3825 Barrett Dr.
Raleigh, North Carolina 27609-7721

Mr. C. J. Gannon
Plant Manager
Carolina Power & Light Company
Brunswick Steam Electric Plant
Post Office Box 10429
Southport, North Carolina 28461

Public Service Commission
State of South Carolina
Post Office Drawer 11649
Columbia, South Carolina 29211

Ms. Margaret A. Force
Assistant Attorney General
State of North Carolina
Post Office Box 629
Raleigh, North Carolina 27602

Mr. Robert P. Gruber
Executive Director
Public Staff - NCUC
Post Office Box 29520
Raleigh, North Carolina 27626-0520

Mr. J. J. Lyash
Director - Site Operations
Carolina Power & Light Company
Brunswick Steam Electric Plant
Post Office Box 10429
Southport, North Carolina 28461

Mr. Norman R. Holden, Mayor
City of Southport
201 East Moore Street
Southport, North Carolina 28461

Mr. Dan E. Summers
Emergency Management Coordinator
New Hanover County Department of
Emergency Management
Post Office Box 1525
Wilmington, North Carolina 28402

Mr. Terry C. Morton
Manager
Performance Evaluation and
Regulatory Affairs CPB 7
Carolina Power & Light Company
Post Office Box 1551
Raleigh, North Carolina 27602-1551

Mr. David C. DiCello
Manager - Regulatory Affairs
Carolina Power & Light Company
Post Office Box 10429
Southport, NC 28461