

February 19, 2002

MEMORANDUM TO: Richard P. Corriea, Chief
Section 2
Project Directorate II
Division of Licensing Project Management

FROM: Robert C. Hagar, Acting Chief/**RA**/
Design Basis Review Section
Plant Systems Branch
Division of Systems Safety and Analysis

Mark P. Rubin, Chief/**RA**/
Safety Program Section
Probabilistic Safety Assessment Branch
Division of Systems Safety and Analysis

SUBJECT: SAFETY EVALUATION INPUT - ONE-TIME EXTENSION OF
APPENDIX J TYPE A INTEGRATED LEAKAGE RATE TEST INTERVAL
FOR BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 & 2
(TAC NOS. MB3470 & MB3471)

The Plant Systems Branch and the Probabilistic Safety Assessment Branch have completed their review of the licensee's submittal dated November 26, 2001, which concerned a proposed technical specification change to allow a one-time extension to the test interval for the Brunswick Steam Electric Plant, Units 1 and 2, Appendix J Type A leakage rate test. The proposed one-time extension of the Type A test interval would be from 10 years to 15 years. Additional analysis and information were provided by the licensee in letters dated January 31, 2002, and February 5, 2002.

Based on our review, we find the licensee's proposal to be acceptable. Our evaluation is attached.

The Mechanical and Civil Engineering Branch will provide their input to the safety evaluation via a separate memorandum.

Our efforts on TAC Nos. MB3470 and MB3471 are complete.

Docket Nos.: 50-325, 50-324

Attachment: As stated

Contacts: J. Pulsipher, SPLB/DSSA/NRR
301-415-2811

M. Snodderly, SPSB/DSSA/NRR
301-415-2047

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SAFETY EVALUATION BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
PLANT SYSTEMS BRANCH AND
PROBABILISTIC SAFETY ASSESSMENT BRANCH
ONE-TIME EXTENSION OF APPENDIX J TYPE A INTEGRATED
LEAKAGE RATE TEST INTERVAL
BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2
DOCKET NOS. 50-325 AND 50-324

1.0 INTRODUCTION

By letter dated November 26, 2001, Carolina Power and Light Company, the licensee for Brunswick Steam Electric Plant, Units 1 and 2, requested a technical specification change that would allow a one-time extension for their Appendix J Type A test (containment integrated leakage rate test) interval from 10 years to 15 years. Additional analysis and information were provided by the licensee in letters dated January 31, 2002, and February 5, 2002.

The last Type A integrated leakage rate test performed at Brunswick Unit 1 was on February 15, 1991. The last Type A test performed at Brunswick Unit 2 was on February 28, 1993. Without an interval extension, the licensee would be required to perform a Type A test for both units during their upcoming refueling outages.

2.0 BACKGROUND

10 CFR Part 50, Appendix J, Option B requires a Type A test to be conducted at a periodic interval based on the historical performance of the overall containment system. Brunswick Technical Specification 5.5.12 requires the integrated leakage rate test to be performed at a frequency in accordance with 10 CFR Part 50, Appendix J, Option B, as modified by approved exemptions, and in accordance with the guidelines contained in Regulatory Guide 1.163, "Performance-Based Containment Leak-Test Program," dated September 1995, as modified by approved exceptions. This regulatory guide endorses, with certain exceptions, NEI 94-01, Revision 0, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," dated July 26, 1995.

A Type A test is an overall (integrated) leakage rate test of the containment structure. NEI 94-01 specifies an initial test interval of 48 months, but allows an extended interval of 10 years, based upon two consecutive successful tests. There is also a provision for extending the test interval an additional 15 months in certain circumstances.

The two most recent Type A tests at Brunswick Steam Electric Plant have been successful for both units, so their current Type A leakage rate test interval is 10 years.

The licensee is requesting a change to Technical Specification 5.5.12, "Primary Containment Leakage Rate Testing Program," which would indicate that they are allowed to take an exception from the Type A test interval guidelines in Regulatory Guide 1.163. Specifically, the proposed addition to Technical Specification 5.5.12, which would allow an exception to the Type A testing frequency specified in NEI 94-01, paragraph 9.2.3, reads as follows:

For Brunswick Unit 1:

- "f. NEI 94-01 - 1995, Section 9.2.3: The first Type A test performed after the February 15, 1991, Type A test shall be performed no later than March 21, 2006."

For Brunswick Unit 2:

- "f. NEI 94-01 - 1995, Section 9.2.3: The first Type A test performed after the February 28, 1993, Type A test shall be performed no later than February 28, 2008."

Thus, the proposed technical specification changes would effectively allow Brunswick Steam Electric Plant, Units 1 and 2, a one-time extension of the current 10-year Type A test interval to a 15-year interval. The NRC staff notes that the proposed change to the Brunswick Unit 1 Technical Specifications would actually extend the required Type A test interval to approximately 15 years and 1 month. The licensee has stated that the requested interval for Brunswick Unit 1 is based upon current plans regarding the scheduled 2006 Unit 1 refueling outage. The licensee has stated that the conclusions of its probabilistic safety assessment (which are based upon a 15-year surveillance interval) are not impacted by the additional one-month period because Unit 1 will be shut down during that additional period for the scheduled refueling outage.

3.0 EVALUATION

The licensee has performed a risk impact assessment of extending the Type A test interval to 15 years. The assessment was provided to the staff in a November 26, 2001, letter from the licensee. Additional analysis and information were provided by the licensee in letters dated January 31, 2002, and February 5, 2002. In performing the risk assessment, they considered the guidelines of NEI 94-01, the methodology used in EPRI TR-104285, "Risk Impact Assessment of Revised Containment Leak Rate Testing," and Regulatory Guide 1.174, "An Approach For Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis."

The basis for the current 10-year test interval is provided in Section 11.0 of NEI 94-01, Revision 0, and was established in 1995 during development of the performance-based Option B to Appendix J. Section 11.0 of NEI 94-01 states that NUREG-1493, "Performance-Based Containment Leak-Test Program," September 1995, provided the technical basis to support rulemaking to revise leakage rate testing requirements contained in Option B to Appendix J. The basis consisted of qualitative and quantitative assessments of the risk impact (in terms of increased public dose) associated with a range of extended leakage rate test intervals. To supplement the NRC's rulemaking basis, NEI undertook a similar study. The results of that study are documented in EPRI Research Project Report TR-104285.

The EPRI study used an analytical approach similar to that presented in NUREG-1493 for evaluating the incremental risk associated with increasing the interval for Type A tests. The EPRI study estimated that relaxing the test frequency from 3 in 10 years to 1 in 10 years, will increase the average time that a leak detectable only by a Type A test goes undetected from 18 to 60 months. Since Type A tests only detect about 3 percent of leaks (the rest are identified during local leak rate tests based on industry leakage rate data gathered from 1987 to 1993), this results in a 10 percent increase in the overall probability of leakage. The risk contribution of pre-existing leakage, in percent of person-rem/year, for the PWR and BWR representative plants confirmed the NUREG-1493 conclusion that a reduction in the frequency of Type A tests from 3 per 10 years to 1 per 10 years leads to an "imperceptible" increase in risk ranging from 0.02 to 0.14 percent.

Building upon the methodology of the EPRI study, the licensee assessed the change in the predicted person-rem/year frequency. The licensee quantified the risk from sequences that have the potential to result in large releases if a pre-existing leak were present. Since the Option B rulemaking in 1995, the staff has issued RG 1.174 on the use of probabilistic risk assessment (PRA) in risk-informed changes to a plant's licensing basis. The licensee has proposed using RG 1.174 to assess the acceptability of extending the Type A test interval beyond that established during the Option B rulemaking. RG 1.174 defines very small changes in the risk-acceptance guidelines as increases in core damage frequency (CDF) less than 10^{-6} per reactor year and increases in large early release frequency (LERF) less than 10^{-7} per reactor year. Since the Type A test does not impact CDF the relevant criterion is the change in LERF. The licensee has estimated the change in LERF for the proposed change and the cumulative change from the original 3 in 10 year interval. RG 1.174 also discusses defense-in-depth and encourages the use of risk analysis techniques to help ensure and show that key principles, such as the defense-in-depth philosophy, are met. The licensee estimated the change in the conditional containment failure probability for the proposed change to demonstrate that the defense-in-depth philosophy is met.

The licensee provided an analysis which estimated all of these risk metrics and whose methodology is consistent with previously approved submittals. The following conclusions can be drawn from the analysis associated with extending the Type A test frequency:

1. A slight increase in risk is predicted when compared to that estimated from current requirements. Given the change from a 10 year test interval to a 15 year test interval, the increase in the total integrated plant risk is estimated to be 0.001 percent. The increase in the total integrated plant risk, given the change from a 3 in 10 year test interval to a 15 year test interval, was 0.002 percent. NUREG-1493 concluded that a reduction in the frequency of tests from 3 per 10 years to 1 per 10 years leads to an

“imperceptible” increase in risk ranging from 0.02 to 0.14 percent. Therefore, the increase in the total integrated plant risk for the proposed change is considered small and supportive of the proposed change.

2. RG 1.174 provides guidance for determining the risk impact of plant-specific changes to the licensing basis. RG 1.174 defines very small changes in the risk-acceptance guidelines as increases in CDF less than 10^{-6} per reactor year and increases in LERF less than 10^{-7} per reactor year. Since the Type A test does not impact CDF, the relevant criterion is LERF. The increase in LERF resulting from a change in the Type A test interval from 1 in 10 years to 1 in 15 years is estimated to be 5.1×10^{-8} /year. The increase in LERF resulting from a change in the Type A test interval from the original 3 in 10 years to 1 in 15 years is estimated to be 1.5×10^{-7} /year.

There are two major conservatisms in the delta LERF estimate by the licensee. First, the class 3B frequency was based on the CDF which includes containment bypass sequences. Including this type of sequence is conservative because the containment would be bypassed whether or not there was an undetected preexisting flaw in the containment liner. Second, there is some probability that the undetected flaw in the containment liner estimated as part of the class 3B frequency would be detected as part of the IWE visual examination process of the containment liner. If one assumes a 50 percent probability that the containment liner flaw would be detected by the IWE visual examination process then the delta LERF would go from $1.5E-07$ to $7.5E-08$. Increasing the Type A interval to 15 years is considered to be a very small change in LERF.

The 50 percent assumption is conservative based on the amount of the containment liner that is visually inspected as part of the IWE examination process. The examinations required by Subsection IWE will be completed during the Second Inspection Period which takes place between May 11, 2001 and May 10, 2005. A general visual examination will be performed on the accessible surface areas of primary containment that are not submerged or insulated. The examinations of the Drywell include over 90 percent of the Drywell's leakage boundary. For the Suppression Chamber, the accessible surface area above the water line represents greater than 50 percent of the entire leakage boundary. For the Vent System, only the lower portion of the downcomers is submerged. In addition, three defects of the Drywell liner were identified by IWE visual examinations during the Spring 1999 outage. The applicable requirements of Subsection IWE were being implemented for the first time during this outage. The defects were not identified by previous Type A ILRT leakage results.

3. RG 1.174 also encourages the use of risk analysis techniques to help ensure and show that the proposed change is consistent with the defense-in-depth philosophy. Consistency with the defense-in-depth philosophy is maintained if a reasonable balance is preserved among prevention of core damage, prevention of containment failure, and consequence mitigation. The change in the conditional containment failure probability was estimated to increase by 0.0010 for the proposed change and 0.0031 for the cumulative change of going from a test interval of 3 in 10 years to 1 in 15 years. The staff finds that the defense-in-depth philosophy is maintained based on the change in the conditional containment failure probability for the proposed amendment.

The staff recognizes the limitations of a conditional containment failure probability approach. For plants, such as Brunswick Steam Electric Plant, with core damage frequency estimates well below 10^{-4} , the ability of the containment to withstand events of even lower probability becomes less clear. Therefore, it is important to consider other risk metrics in conjunction with the conditional containment failure probability, such as total LERF. The licensee has sufficiently demonstrated that the total LERF for internal events is less than 10^{-5} for the purpose of this evaluation.

Based on these conclusions, the staff finds that the increase in predicted risk due to the proposed change is within the acceptance guidelines while maintaining the defense-in-depth philosophy of RG 1.174 and, therefore, is acceptable.

4.0 CONCLUSION

Based on the foregoing evaluation, the staff finds that the interval until the next Type A test at Brunswick Steam Electric Plant, Units 1 and 2, may be extended to 15 years, and that the proposed changes to Technical Specification 5.5.12 are acceptable.