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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO ASME CODE CASE N-416-1

CAROLINA POWER & LIGHT COMPANY

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

DOCKET NOS. 50-325 AND 50-324

1.0 INTRODUCTION

The Technical Specifications for Brunswick Steam Electric Plant, Units 1 and 2 (BSEP), state that the inservice inspection and testing of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission, pursuant to 10 CFR 50.55a(g)(6)(i). As stated in 10 CFR 50.55a(a)(3), the alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if (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 difficulties without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first ten-year interval and all subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) on the date twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

The applicable edition of Section XI of the ASME Code for the Brunswick Steam Electric Plant, Units 1 and 2, second 10-year inservice inspection (ISI) Interval is the 1980 Edition, through Winter 1981 Addenda. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval.

Pursuant to 10 CFR 50.55a(g)(5)(iii), if the licensee determines that conformance with an examination requirement of Section XI of the ASME Code is impractical for its facility, information should be submitted to the Commission in support of that determination. After evaluation of the determination, pursuant to 10 CFR 50.55a(g)(6)(i), the Commission may grant

relief and may impose alternative requirements that are determined to be authorized by law; will not endanger life, property, or the common defense and security; and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed.

By letter dated August 21, 1995, Carolina Power & Light (licensee) requested approval for the implementation of the alternative rules of ASME Section XI Code Case N-416-1, dated February 15, 1994, entitled "Alternative Pressure Test Requirement for Welded Repairs or Installation of Replacement Items by Welding Class 1, 2, and 3, Section XI, Division 1," pursuant to 10 CFR 50.55a(a)(3).

The NRC staff has reviewed and evaluated the licensee's request and supporting information to use Code Case N-416-1 as a proposed alternative to the ASME Code requirements for BSEP.

2.0 BACKGROUND

2.1 Component Identification

ASME Class 1, 2, and 3 Piping Systems

2.2 ASME Code Section XI Second Interval Requirements

The 1980 Edition through Winter 1981 Addenda, Section XI, IWA-4400 (a) requires that a system hydrostatic test be performed in accordance with IWA-5000 after repairs by welding on the pressure retaining boundary.

2.3 Licensee's Basis for Request

The licensee states in its letter dated August 21, 1995:

> If required hydrostatic testing following welded repairs and installation of replacement items by welding is impractical, it is currently necessary to defer the testing as allowed by Code Case N-416 or to request relief from ASME Code required tests. Impracticality of testing may be the result of various situations, ranging from boundary valve isolation problems to incorporation of components within the hydrostatic test boundary. Since hydrostatic test pressures are higher than nominal operating pressures, hydrostatic pressure testing frequently requires significant effort to set-up and perform. The need to use special equipment (e.g., temporary attachment of test pumps and gauges) and the need for individual valve lineups, can cause the testing to become the critical path activity during outages.
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> Piping components are designed for a number of different loadings that are postulated to occur under the various modes of plant operation. Hydrostatic testing only subjects the piping components to a small increase in pressure over the design pressure and, therefore, does not

present a significant challenge to pressure boundary integrity. Accordingly, hydrostatic pressure testing is primarily regarded as a means to enhance leakage detection during the examination of components under pressure, rather than solely as a measure to determine the structural integrity of the components.

Additionally, hydrostatic testing is often impractical to perform following repair or replacement activities. Experience has demonstrated that leaks are not being discovered as a result of hydrostatic test pressures propagating a preexisting through-wall flaw. Typically, when leaks are identified, they occur at flanges, packing, seals, etc., whether at hydrostatic test pressure or normal operating pressure.

In some cases, welded repairs and installation of replacement items by welding are unexpected and are often identified only during the performance of in-service inspections. In such cases, it is necessary to request ASME Code relief on an expedited basis to avoid startup delays or exceeding limiting conditions of operation.

ASME Code Case N-416-1 provides increased testing flexibility and can considerably reduce, or eliminate relief requests associated with welded repairs or installation of replacement items by welding. This is accomplished while maintaining an acceptable level of quality and safety.

Use of hydrostatic tests deferrals, which are presently allowed in the current ASME Code Case N-416 for Class 2 components, are not an appropriate solution because the test must be eventually performed, and it is the performance of the test itself that is burdensome.

Endorsement of ASME Code Case N-498, "Alternate Rules for 10 Year Hydrostatic Pressure Testing for Class 1 and 2 Systems Section XI, Division 1," by the NRC in Regulatory Guide 1.147 has eliminated the requirement to perform the 10-year hydrostatic pressure testing for Class 1 and 2 systems, except for those hydrostatic tests which were deferred pursuant to ASME Code Case N-416. The approval of ASME Code Case N-416-1 will eliminate the need to perform any unnecessary hydrostatic pressure tests during the next Unit 2 refueling outage (Reload 11) and will result in substantial cost savings and reduced radiation exposure over the life of both Brunswick Unit 1 and Unit 2. Approval of this request is in accordance with 10 CFR 50.55a(a)(3) because compliance with the ASME Code, Section XI, IWA-4000 requirements would result in hardship and unusual difficulty without a compensating increase in the level of quality and safety. The alternative system leakage test and inspection requirements specified by ASME Code Case N-416-1 provide an acceptable level of quality and safety.

2.4 Proposed Alternative Examination

The licensee proposes to apply Code Case N-416-1 as alternative rules for welded repairs or installation of replacement items by welding in Class 1, 2, and 3 piping. The licensee also proposes to perform surface examinations on the root (pass) layer of butt and socket welds on the pressure retaining boundary of Class 3 components when the surface examination method is used in accordance with Section III of the ASME Code.

3.0 EVALUATION

In lieu of hydrostatic pressure testing for welded repairs or installation of replacement items by welding, Code Case N-416-1 requires a visual examination (VT-2) be performed in conjunction with a system leakage test using the 1992 Edition of Section XI, in accordance with paragraph IWA-5000, at nominal operating pressure and temperature. This code case also specifies that non-destructive examination (NDE) of the welds be performed in accordance with the applicable subsection of the 1992 Edition of Section III.

The 1989 Edition of Sections III and XI are the latest editions referenced in 10 CFR 50.55a. The staff has compared the system pressure test requirements of the 1992 Edition of Section XI to the requirements of IWA-5000 of the 1989 Edition of Section XI. In summary, the 1992 Edition imposes a more uniform set of system pressure test requirements for Code Class 2 systems. The terminology associated with the system pressure test requirements for Code Class 2 has been clarified and streamlined. The test frequency and test pressure conditions associated with these tests have not been changed. The hold times for these tests has either remained unchanged or increased. The corrective action with respect to removal of bolts from leaking bolted connections has been relaxed in the 1992 Edition, but use of this change has been accepted by the staff in previous safety evaluations. The post-welded repair NDE requirements of the 1992 Edition of Section III remain the same as the requirements of the 1989 Edition of Section III. Therefore, the staff finds this aspect of Code Case N-416-1 to be acceptable.

Hardships are generally encountered with the hydrostatic tests performed in accordance with the Code. For example, since hydrostatic test pressure would be higher than the nominal operating pressure, hydrostatic pressure testing frequently requires significant effort to set up and perform. The need to use special equipment, such as temporary attachment of test pumps and gages, and the need for individual valve lineups can cause the testing to be on critical path.

Piping components are designed for a number of loadings that would be postulated to occur under the various modes of plant operation. Hydrostatic testing only subjects the piping components to a small increase in pressure over the design pressure and, therefore, does not present a significant

challenge to pressure boundary integrity. Accordingly, hydrostatic pressure testing is primarily regarded as a means to enhance leakage detection during the examination of components under pressure, rather than solely as a measure to determine the structural integrity of the components.

The industry indicates that experience has demonstrated that leaks are not being discovered as a result of hydrostatic test pressures propagating a preexisting flaw through wall. They indicate that when leaks are found, in most cases, they are found when the system is at normal operating pressure. This is due largely to the fact that hydrostatic pressure testing is required only upon installation and then once every 10-year inspection interval, while system leakage tests at nominal operating pressures are conducted a minimum of once each refueling outage for Class 1 systems and each 40-month inspection period for Class 2 and 3 systems. In addition, leaks may be identified by plant operators during system walkdowns, which may be conducted as often as once a shift.

Following the performance of welding, the code requires volumetric examination of repairs or replacements in Code Class 1 and 2, but would also allow only a surface examination of the final weld pass in Code Class 3 piping components. There are no ongoing NDE requirements for Code Class 3 components except for visual examination for leaks in conjunction with the 10-year hydrostatic tests and the periodic pressure tests.

Considering the NDE performed on Code Class 1 and 2 systems and considering that the hydrostatic pressure tests rarely result in pressure boundary leaks that would not occur during system leakage tests, the staff believes that increased assurance of the integrity of Class 1 and 2 welds is not commensurate with the burden of performing hydrostatic testing. However, considering the nature of NDE requirements for Code Class 3 components, the staff does not believe that the requirement in Code Case N-416-1 of only performing system pressure testing is an acceptable alternative unless additional surface examinations on the root pass layer of butt and socket welds on the pressure retaining boundary of Class 3 components are performed when the surface examination method is used in accordance with Section III of ASME Code. In its August 21, 1995, letter, the licensee committed to perform this additional examination. The staff finds this commitment acceptable.

For clarification, it should be noted that, consistent with the Code Case requiring performance of NDE in accordance with the methods and acceptance criteria of the 1992 Edition of Section III, the scope of examination should also be in accordance with the 1992 Edition of Section III. The additional surface examination of the root layer of Class 3 pressure retaining welds should be performed only when those pressure retaining welds are required to have a surface examination performed in accordance with the 1992 Edition of Section III. For those Class 3 welds receiving radiography in lieu of a surface examination in accordance with Section III, no additional surface examination of the root layer needs to be performed.

3.0 CONCLUSION

The staff concludes that compliance with the Code hydrostatic testing requirements for welded repairs or replacements of Code Class 1, 2, and 3 components would result in hardships without a compensating increase in the level of quality and safety. Accordingly the licensee's proposed alternative to use Code Case N-416-1 is authorized for the Brunswick Steam Electric Plant, Units 1 and 2, pursuant to 10 CFR 50.55a(a)(3)(ii) with the provision that surface examinations are performed on the root (pass) layer of butt and socket welds on the pressure retaining boundary of Class 3 components when the surface examination method is used in accordance with Section III of the ASME Code. Use of Code Case N-416-1 is authorized until such time as the Code Case is published in a future revision of Regulatory Guide 1.147. At that time, if the licensee intends to continue to implement this code case, the licensee is to follow all provisions in Code Case N-416-1, with limitations issued in Regulatory Guide 1.147 if any.

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