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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE RELIEF REQUEST TO USE ASME CODE CASE N-416-1 FOR

SOUTH CAROLINA ELECTRIC AND GAS COMPANY

VIRGIL C. SUMMER NUCLEAR STATION

DOCKET NUMBER 50-395

1.0 INTRODUCTION

The Code of Federal Regulations, 10 CFR 50.55a, requires that inservice inspection (ISI) of American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 systems be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda, except where the Commission grants specific written relief pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50-55a(a)(3) indicates that alternatives to the requirements of paragraph (g) may be used, when authorized by the 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 difficulty 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 that become effective subsequent to editions specified in 10 CFR 50.55a(g)(2) and (g)(3), except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservic Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. Paragraph (g)(4)(ii) requires that inservice examination of components and system pressure tests conducted during successive 120-month inspection intervals comply with the requirements of the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The second 10-year interval for the V. C. Summer Nuclear Station (VCSNS) began on January 1, 1994, and ends on December 31, 2003. The licensee's ISI program is based on the 1989 edition of ASME Code Section XI. 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 shall 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.

South Carolina Electric and Gas Company's (SCE&G's) April 29, 1998, letter proposed an alternative to the requirements of the ASME Boiler and Pressure Vessel Code, Section XI. SCE&G requested approval to implement 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)(i) for VCSNS Class 1, 2, and 3 systems. We have reviewed and evaluated the licensee's request and supporting information to use Code Case N-416-1 as a proposed alternative to the Code requirements for VCSNS.

2.0 EVALUATION

2.1 Licensee's Request

SCE&G requested relief from performing the Code-required hydrostatic pressure test following a welded repair or replacement of a component by welding for Class 1, 2, or 3 piping and/or components. As an alternative, SCE&G requested full implementation of Code Case N-416-1, including the added NRC provisions in Draft Regulatory Guide DG-1050 (Revision 12 to Regulatory Guide 1.147).

2.1.1 Licensee's Component Identification

This request is for all ASME Class 1, 2, or 3 piping and/or components that would require a hydrostatic pressure test following a welded repair on the pressure boundary per IWA-4700.

2.1.2 ASME Code, Section XI, Second Interval Requirements

Section XI, Subparagraph IWA-4700 requires that, after certain welding repairs on the pressure-retaining boundary, a system hydrostatic test be performed in accordance with IWA-5000.

2.1.3 Licensee's Proposed Alternative Examinations

SCE&G proposed performing alternative examinations in accordance with ASME Code Case N-416-1 in lieu of hydrostatic pressure testing as follows:

- Apply the guidance of Code Case N-416-1 for welded repairs or installation of replacement items by welding.

- Perform a surface examination of the root pass layer of butt and socket welds of the pressure-retaining boundary of Class 3 components when ASME Code Section III calls for a surface examination.

2.1.4 Licensee's Basis for Relief

The licensee's basis for relief is as follows:

> As described in a previous SER [Safety Evaluation Report] evaluation (TAC NO. M89213) for V. C. Summer, dated December 1, 1994, concerning use of the provisions of Code Case N-416-1 on Class 1 and 2; hardships are generally encountered with the performance of hydrostatic testing in accordance with the Code. Examples of the hardships are: gagging safety/relief valves, placing the system in a[n] off-normal state, erecting temporary supports for steam lines, and the expense of additional resources required to set-up, calibrate and operate special test gauges and equipment. Also, the hydrostatic test can extend the system out-of-service time that may lead to plant shutdowns due to exceeding allowed outage times in Technical Specifications, or at least extend outage duration.
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> The SER also describes that the piping components are designed based on numerous types of design loadings which are postulated to occur under various modes of operation. Since the hydrostatic test only imparts a small increase above design to one of the loading factors, it is clear that the hydrostatic test does very little to demonstrate the total structural integrity of the pressure boundary. Therefore, the hydrostatic test is regarded as a means of enhanced leak testing. Also, industry experience indicates that leaks are not being discovered as a result of hydrostatic test pressures propagating a preexisting flaw through wall, but rather, the majority of the system leaks are identified during normal operation.
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> Based on the NDE [nondestructive examination] that is performed, per this relief request, it is highly unlikely that a leak would be found at all and even more unlikely that hydrostatic conditions would be necessary to detect a leak that would not be readily detected at system operating pressure. Therefore, the alternative requirements provided in this relief request provide an acceptable alternative to the ASME Code and maintain the level of quality [and] safety.

2.1.5 Evaluation

Code Case N-416-1 requires the licensee to perform a visual examination (VT-2) in conjunction with a system leakage test in lieu of hydrostatic pressure testing for welded repairs or installation of replacement items by welding. The Code case specifies that the licensee is to perform NDE of the welds in accordance with the applicable Subsection of the 1992 Edition of Section III. The Code case also specifies that the licensee is to perform the system leakage test at nominal operating pressure and temperature, in accordance with paragraph IWA-5000 of the 1992 Edition of Section XI.

The 1989 Edition of Sections XI and III is the latest edition 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 1, 2, and 3 systems. The terminology associated with the system pressure test requirements for all three Code classes 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

have either remained unchanged or increased. The corrective actions with respect to removing bolts from leaking bolted connections are relaxed in the 1992 Edition. The staff has accepted this relaxation 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, we find this aspect of Code Case N-416-1 to be acceptable.

Piping components are designed for a number of loadings that would be postulated to occur under the various plant operating modes. 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.

Industry experience has demonstrated that leaks are not being discovered as a result of hydrostatic test pressures propagating a preexisting flaw through wall. This experience indicates that, in most cases, licensees find leaks when the system is at normal operating pressure. This is largely due to hydrostatic pressure testing only being required upon installation and then once during every 10-year inspection interval. Licensees conduct system leakage tests at nominal operating pressures 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, plant operators may identify leaks during system walkdowns which may be conducted as often as once a shift.

Following welding, the Code requires volumetric examination of repairs or replacements in Code Classes 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.

Performing hydrostatic testing of Class 1 and 2 piping components following a welded repair or replacement of components is not necessary for the following reasons:

- The licensee performs NDE on Code Class 1 and 2 systems.

- Hydrostatic pressure tests rarely result in pressure boundary leaks that would not occur during system leakage tests.

However, Class 3 components have reduced NDE requirements. Accordingly, eliminating hydrostatic pressure testing for Code Class 3 components, while only performing system pressure testing, is acceptable only if the licensee performs additional surface examinations on the root pass layer of pressure-retaining boundary butt and socket welds. Additional surface examinations are to be performed in accordance with Section III.

For clarification, it should be noted that the Code case requires performing NDE in accordance with methods and acceptance criteria in the 1992 Edition of Section III. The scope of the 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 the licensee's proposed alternative to use Code Case N-416-1 with the licensee's proposed additional examinations provides an acceptable level of quality and safety. The additional examinations are as follows: 1) perform additional surface examinations on the root pass layer of butt and socket welds on the pressure-retaining boundary of Class 3 components, and 2) the surface examination method will be in accordance with Section III. Therefore, the use of Code Case N-416-1, with the additional surface examination as noted above, is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the duration of the currently approved ISI program plan interval or until the Code case is approved for general use by reference in Regulatory Guide 1.147. At that time, the licensee must follow the conditions, if any, specified in the Regulatory Guide.

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