



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

July 19, 2012

Mr. Thomas D. Gatlin
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
Jenkinsville, SC 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1, ALTERNATIVE RELIEF
REQUEST (RR)-III-07 FOR THIRD TEN-YEAR INSERVICE INSPECTION
INTERVAL (TAC NO. ME6879)

Dear Mr. Gatlin:

By letter dated August 16, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11231A250, South Carolina Electric & Gas Company (SCE&G), the licensee, requested approval from the U.S. Nuclear Regulatory Commission (NRC) to use an alternative, Relief Request (RR)-III-07, to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Paragraph IWB-2412, Inspection Program B, for the V.C. Summer Nuclear Station, Unit 1 (VCSNS). Additional information was submitted by SCE&G on February 1, 2012 (ADAMS Accession No. ML12033A130). Specifically, the alternative was requested pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i) to extend the inservice inspection (ISI) interval for examinations of the reactor pressure vessel (RPV) welds (Category B-A) as well as the nozzle-to-vessel welds and inner radius sections (Category B-D) from 10 years to 20 years.

The NRC staff has reviewed the subject request and concludes that the proposed alternative provides an acceptable level of quality and safety. Therefore, the NRC staff authorizes the proposed alternative in accordance with 10 CFR 50.55a(a)(3)(i) for the third 10-year interval. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

A handwritten signature in black ink, reading "Nancy Salgado", is positioned above the typed name.

Nancy Salgado, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-395

Enclosure: Safety Evaluation

cc w/encl: Distribution via Listserv



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO ALTERNATIVES TO ASME CODE REQUIREMENTS

THIRD TEN-YEAR INSERVICE INSPECTION PROGRAM INTERVAL

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1

DOCKET NO. 50-395

1.0 INTRODUCTION

By letter dated August 16, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11231A250), South Carolina Electric & Gas Company (SCE&G), the licensee, requested approval from the U.S. Nuclear Regulatory Commission (NRC) to use an alternative, RR-III-07, to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Paragraph IWB-2412, Inspection Program B, for the V.C. Summer Nuclear Station, Unit 1 (VCSNS). Additional information was submitted by SCE&G on February 1, 2012 (ADAMS Accession No. ML12033A130). Specifically, the alternative was requested pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i) to extend the inservice inspection (ISI) interval for examinations of the reactor pressure vessel (RPV) welds (Category B-A) as well as the nozzle-to-vessel welds and inner radius sections (Category B-D) from 10 years to 20 years.

2.0 REGULATORY REQUIREMENTS

In accordance with 10 CFR 50.55a (g)(4), the licensee is required to perform ISI of ASME Code Class 1, 2, and 3 components and system pressure tests during the first 10-year interval and subsequent 10-year intervals that 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), subject to the limitations and modifications listed therein.

For the third ISI interval at VCSNS which ends in 2013, the Code of Record for the inspection of ASME Code Class 1, 2, and 3 components is the 1998 Edition through the 2000 Addenda of the ASME Code, Section XI. The regulation in 10 CFR 50.55a(a)(3) states, in part, that the Director of the Office of Nuclear Reactor Regulation may authorize an alternative to the requirements of 10 CFR 50.55a(g). For an alternative to be authorized, as per 10 CFR 50.55a(a)(3)(i), the licensee must demonstrate that the proposed alternative would provide an acceptable level of quality and safety.

2.1 Background

The ISI of Category B-A and B-D components consists of visual and ultrasonic examinations intended to discover whether flaws have initiated, whether pre-existing flaws have extended, and whether pre-existing flaws may have been missed in prior examinations.

These examinations are required to be performed at regular intervals, as defined in Section XI of the ASME Code.

2.2 Summary of WCAP-16168-NP, Revision 2 and NRC Safety Evaluation

In 2008, the Pressurized Water Reactor (PWR) Owners Group submitted a topical report WCAP-16168-NP, Revision 2, "Risk-Informed Extension of Reactor Vessel In-Service Inspection Interval" (ADAMS Accession No. ML082820046), to the NRC in support of making a risk-informed assessment of extensions to the ISI intervals for Category B-A and B-D components. The NRC staff's safety evaluation (SE) approving WCAP-16168 was issued on May 8, 2008 (ADAMS Accession No. ML081060053) and the approved version, (referred to as WCAP-16168-NP-A), was transmitted to NRC on June 13, 2008 (ADAMS Accession No. ML082820046). In the report, the PWR Owners Group took data associated with three different domestic PWR vendor designs (referred to as the pilot plants), and performed the necessary studies on each of the pilot plants required to justify the proposed extension for the ISI interval for Category B-A and B-D components from 10 to 20 years.

The analyses in the WCAP-16168-NP-A used probabilistic fracture mechanics tools and inputs from the work described in the NRC's pressurized thermal shock (PTS) risk re-evaluation (NUREG-1806, ADAMS Accession No. ML061580318 and NUREG-1874, ADAMS Accession No. ML070860156). The PWR Owners Group analyses incorporated the effects of fatigue crack growth and inservice inspection. Design basis transient data was used as input to the fatigue crack growth evaluation. The effects of ISI were modeled consistently with the previously-approved probabilistic fracture mechanics codes (WCAP-14572-NP-A, ADAMS Accession Nos. ML012630327, ML012630349, and ML12630313). These effects were put into evaluations performed with the Fracture Analysis of Vessels-Oak Ridge (FAVOR) computer code (ADAMS Accession No. ML042960391). All other inputs were identical to those used in the PTS risk re-evaluation.

From the results of the studies, the PWR Owners Group concluded that the ASME Code, Section XI 10-year inspection interval for Category B-A and B-D components in PWR RPVs can be extended to 20 years. Their conclusion from the results for the pilot plants was considered to apply to any plant designed by the three vendors (Westinghouse, Combustion Engineering, and Babcock and Wilcox) as long as the critical, plant-specific parameters (defined in Appendix A of the WCAP) are bounded by the pilot plants.

The staff's conclusion in its SE for WCAP-16168-NP-A indicates that the methodology presented in WCAP-16168-NP-A, in concert with the guidance provide by Reg. Guide 1.174, Rev. 1 (ADAMS Accession No. ML04290391), is acceptable for referencing in requests to implement alternatives to ASME Code inspection requirements for PWR plants in accordance with the limitations and conditions in the SE.

3.0 PROPOSED RR-III-07 FOR V.C. SUMMER NUCLEAR STATION, UNIT 1

3.1 Description of Proposed Alternative

In RR-III-07, the licensee proposes to defer the ASME Code required Category B-A and B-D weld ISI of VCSNS until 2023 plus or minus one refueling outage. This schedule is consistent

with the schedule proposed in the revision to the revised PWR Owners Group letter, OG-10-238, dated July 12, 2010 (ADAMS Accession No. ML11153A033).

3.2 Components for Which Relief is Requested

The affected component is the VCSNS RPV. The following examination categories and item numbers from IWB-2500 and Table IWB-2500-1 of the ASME Code, Section XI, are addressed in RR-III-07:

Examination

<u>Category</u>	<u>Item Number</u>	<u>Description</u>
B-A	B 1.11	Circumferential Shell Welds
B-A	B 1.12	Longitudinal Shell Welds
B-A	B 1.21	Circumferential Head Welds
B-A	B 1.22	Meridional Shell Welds
B-A	B 1.30	Shell-to-Flange Weld
B-A	B 1.40	Head-to-Flange Weld
B-D	B 3.90	Nozzle-to-Vessel Welds
B-D	B 3.100	Nozzle Inner Radius Section

3.3 Basis for Proposed Alternative

The basis for the alternative is found in WCAP-16168-NP-A. Plant-specific parameters for the subject plant are summarized in Attachment 1 to the licensee's letter of August 16, 2011. The format of the information is patterned after that found in Appendix A of WCAP-16168-NP-A.

All of the critical parameters listed in Tables 1, 2, and 3 of Attachment 1 to the licensee's letter of August 16, 2011, are bounded by the WCAP-16168-NP-A pilot plant.

3.4 Duration of Proposed Alternative

The licensee states that the applicability of the alternative is for the third (currently scheduled to end in 2013) and fourth (currently scheduled to end in 2023) 10-year inservice inspection intervals with the next ASME Categories B-A and B-D RPV welds at VCSNS.

4.0 STAFF TECHNICAL EVALUATION

The staff has reviewed Attachment 1 to the licensee's letter dated August 16, 2011. In Table 1, the "Frequency and Severity of Design Transients" for VCSNS were found to be bounded by WCAP-16168-NP-A. Also, the VCSNS RPV uses single layer cladding, as assumed in and bounded by the WCAP-16168-NP-A analysis.

Table 2 of the submittal includes additional information pertaining to previous RPV inspections and the next inspection. The next inspection for VCSNS Unit 1 would be in 2023, plus or minus one refueling outage. The staff has reviewed the revised PWR Owners Group plan (OG-10-238) and agrees that the proposed alternative matches the inspection plan for the PWR fleet and is therefore acceptable to the staff.

With regards to the results from past interval inspections, there was one indication in the most recent interval inspection. The indication was evaluated by the licensee and found to be acceptable per IWB-3500 of the ASME Code, Section XI. The one indication in the beltline plate material was located inside of the inner 1 inch or one-tenth thickness of the RPV beltline region. The indication was found to be acceptable according to the requirements of the alternate PTS Rule in 10 CFR 50.61a; therefore, there is no requirement for remedial action or further analysis.

By letter dated January 9, 2012, the staff requested additional information regarding the one indication that was found in the beltline weld region. The licensee's letter dated February 1, 2012, included the dimensions of the one indication in the plate material found in the beltline region during the second interval inspection; furthermore, the licensee stated that the indication was not found in the first interval inspection. The fact that the second interval inspection found the indication that was not found by the first interval inspection can be attributed to the increased sensitivity of the inspection done during the second interval inspection, performed in accordance with the demonstration process required by ASME Code, Section XI, Appendix VIII, which was not in effect at the time of the first interval inspection.

On the basis of the above information, the staff concludes that the beltline region indication found in the second interval inspection at VCSNS may have been a fabrication-induced defect that was not detected in the pre-service or previous inservice examinations. There is no evidence that the beltline region indication is growing due to any active aging mechanism; the size is acceptable per IWB-3500 of the ASME Code, Section XI, and the flaw limits in the alternate PTS Rule. Based upon this information, the staff concludes that the additional information for VCSNS in Table 2 is bounded by the information in WCAP-16168-NP-A.

The calculation of the through-wall cracking frequency (TWCF) was performed using inputs from Table 3 of Attachment 1 of the submittal as a basis. The request uses the Regulatory Guide (RG) 1.99, Rev. 2, methodology to calculate ΔT_{30} . The calculations were independently verified via staff calculation and the differences between the licensee's and staff's calculations were found to be insignificant. The TWCF calculations were found to be acceptably low as determined by the methodology prescribed in WCAP-16168-NP-A and detailed in Table 3 of the submittal.

Based on this information, the staff concludes that the details of the TWCF calculations for VCSNS in Table 3 of the proposed alternative are bounded by WCAP-16168-NP-A, and are therefore acceptable.

The NRC staff's SE for WCAP-16168-NP-A states that the dates for future inspections must be identified and must be within plus or minus one refueling cycle of the dates identified in the implementation plan provided to the NRC in PWROG letter OG-06-356, "Plan for Plant Specific Implementation of Extended Inservice Inspection Interval ..." dated October 21, 2006 (ADAMS

Accession No. ML082210245). The licensee for VCSNS Unit 1 applied for and this evaluation authorizes the extension of the ISI interval for the subject reactor vessel welds from the third interval, which would require the inspections to be performed by 2013, into the fourth ISI interval which will require the inspections to be performed by 2023. With respect to the "Subsequent ISI Date" of 2043 in the above PWROG letter, and in later editions of that report, the licensee did not apply for and this evaluation does not address inspections beyond VCSNS's fourth interval. Thus, only VCSNS's current (third) 10-year ISI interval for the subject welds is being extended to a period of 20 years. Alternatives to ASME Code ISI requirements beyond the fourth interval would need to be addressed by further requests applicable to those intervals.

In summary, the licensee has demonstrated through its submittals that the RPV for VCSNS is bounded by the information in WCAP-16168-NP-A. The submittals demonstrate that there is no significant additional risk associated with extending the ISI third interval for Category B-A and B-D components from 10 years to 20 years.

5.0 CONCLUSION

The staff has completed its review of the submittals for RR-III-07 regarding VCSNS. The staff concludes that increasing the ISI third interval for Category B-A and B-D components from 10 years to 20 years results in no appreciable increase in risk. This conclusion is based on the finding that the plant-specific information provided by the licensee is bounded by the data in WCAP-16168-NP-A and the request meets the applicable conditions and limitations described in WCAP-16168-NP-A. Therefore, the NRC staff concludes that Relief Request RR-III-07 provides an acceptable level of quality and safety and the alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i) until 2023, plus or minus one refueling outage.

All other requirements of the ASME Code, Section XI, not specifically included in the request for the proposed alternative, remain in effect. All other ASME Code, Section XI requirements not specifically included in the proposed alternative remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: C. Fairbanks

Date: July 19, 2012

July 19, 2012

Mr. Thomas D. Gatlin
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
Jenkinsville, SC 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1, ALTERNATIVE RELIEF
REQUEST (RR)-III-07 FOR THIRD TEN-YEAR INSERVICE INSPECTION
INTERVAL (TAC NO. ME6879)

Dear Mr. Gatlin:

By letter dated August 16, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11231A250, South Carolina Electric & Gas Company (SCE&G), the licensee, requested approval from the U.S. Nuclear Regulatory Commission (NRC) to use an alternative, Relief Request (RR)-III-07, to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Paragraph IWB-2412, Inspection Program B, for the V.C. Summer Nuclear Station, Unit 1 (VCSNS). Additional information was submitted by SCE&G on February 1, 2012 (ADAMS Accession No. ML12033A130). Specifically, the alternative was requested pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i) to extend the inservice inspection (ISI) interval for examinations of the reactor pressure vessel (RPV) welds (Category B-A) as well as the nozzle-to-vessel welds and inner radius sections (Category B-D) from 10 years to 20 years.

The NRC staff has reviewed the subject request and concludes that the proposed alternative provides an acceptable level of quality and safety. Therefore, the NRC staff authorizes the proposed alternative in accordance with 10 CFR 50.55a(a)(3)(i) for the third 10-year interval. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

/RA/

Nancy Salgado, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-395
Enclosure: Safety Evaluation
cc w/encl: Distribution via Listserv

DISTRIBUTION:

Public LPL2-1 R/F
RidsAcrs_AcnwMailCTR Resource
RidsNrrDoriDpr Resource

RidsNrrDssStsb Resource
RidsNrrLASFiguroa Resource
RidsRgn2MailCenter Resource

RidsNrrPMSummer Resource
RidsOgcRp Resource
CFairbanks, NRR

ADAMS Accession No. ML12191A163

* By memo dated

** By E-mail

OFFICE	NRR/LPL2-1/PM	NRR/LPL2-1/LA**	DE/DD*	NRR/LPL2-1/BC	NRR/LPL2-1/PM
NAME	RMartin	SFiguroa (sf)	MCheek	NSalgado	RMartin
DATE	07/10/12	07/10/12	07/03/12	07/19/12	07/19/12

OFFICIAL RECORD COPY