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RC-11-0117

U. S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555-0001

ATTN: R. E. Martin

Subject: VIRGIL C. SUMMER NUCLEAR STATION UNIT 1 (VCSNS)  
DOCKET NO. 50-395  
OPERATING LICENSE NO. NPF-12  
REQUEST TO USE ALTERNATIVES TO ASME CODE REQUIREMENTS  
IN VCSNS 3RD TEN YEAR INSERVICE INSPECTION INTERVAL  
(RR-III-07) Risk-Informed Extension of the Reactor Vessel In-Service  
Inspection Interval

References: Final Safety Evaluation for Pressurized Water Reactor Owners Group  
(PWROG) Topical Report (TR) WCAP-16168-NP, Revision 2, "Risk-  
Informed Extension of the Reactor Vessel In-Service Inspection Interval  
(TAC No. MC9768)," dated May 8, 2008.

Dear Sir or Madam:

Pursuant to 10 CFR 50.55a(a)(3)(i), South Carolina Electric & Gas Company (SCE&G), acting for itself and as an agent for South Carolina Public Service Authority (Santee Cooper), hereby submits the attached request for an alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, paragraph IWB-2412, Inspection Program B. VCSNS proposes to extend the inspection interval from 10 years to 20 years for methods specified in ASME, Section XI, paragraph IWB-2500 Examination Categories B-A, "Pressure Retaining Welds in Reactor Vessel" and B-D "Full Penetration Welded Nozzle Welds." SCE&G has determined that the proposed alternative and bases established within WCAP-16168-NP-A, Revision 2, apply to VCSNS Unit 1 and will maintain an acceptable level of quality and safety. The plant specific information supporting this proposed alternative is provided in Attachment 1.

The next inspection of Examination Categories B-A and B-D welds are scheduled to be performed in the 2012 Fall refueling outage. SCE&G requests approval of the proposed alternative by January 12, 2012 to support refueling milestones.

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No new commitments are being made to the NRC by this letter. If you should have any questions, please contact Mr. Bruce L. Thompson at (803) 931-5042.

Very truly yours,



Thomas D. Gatlin

JMG/TDG/jw

Attachments:

RR-III-07, Request For Alternative

c: K. B. Marsh  
S. A. Byrne  
J. B. Archie  
N. S. Carns  
J. H. Hamilton  
R. J. White  
W. M. Cherry  
V. M. McCree  
R. E. Martin  
NRC Resident Inspector  
K. M. Sutton  
NSRC  
RTS (CR-11- 02604)  
File (810.19-2)  
PRSF (RC-11-0117)

**South Carolina Electric & Gas Co. (SCE&G)  
Virgil C. Summer Nuclear Station Unit 1 (VCSNS)  
Relief Request**

RR-III-07

**1. ASME Code Component(s) Affected**

The affected component is the V. C. Summer Unit 1 Reactor Vessel (RV), specifically the following American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section XI (Reference 1) examination categories and item numbers covering examinations of the RV. These examination categories and item numbers are from IWB-2500 and Table IWB-2500-1 of the ASME BPV Code, Section XI.

Category B-A welds are defined as "Pressure Retaining Welds in Reactor Vessel"  
Category B-D welds are defined as "Full Penetration Welded Nozzles in Vessels"

**Examination**

<b>Category</b>	<b>Item No.</b>	<b>Description</b>
B-A	B1.11	Circumferential Shell Welds
B-A	B1.12	Longitudinal Shell Welds
B-A	B1.21	Circumferential Head Welds
B-A	B1.22	Meridional Head Welds
B-A	B1.30	Shell-to-Flange Weld
B-A	B1.40	Head-to-Flange Weld
B-D	B3.90	Nozzle-to-Vessel Welds
B-D	B3.100	Nozzle Inside Radius Section

(Throughout this request the above examination categories are referred to as "the subject examinations" and the ASME BPV Code, Section XI, is referred to as "the Code.")

**2. Applicable Code Edition and Addenda**

ASME Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1998 Edition through 2000 Addenda.

**3. Applicable Code Requirement**

IWB-2412, Inspection Program B, requires volumetric examination of essentially 100% of RV pressure-retaining welds identified in Table IWB-2500-1 once each ten-year interval. The V. C. Summer Unit 1 third 10-year inservice inspection (ISI) interval ends in 2013. The applicable Code for the fourth 10-year ISI interval will be selected in accordance with the requirements of 10 CFR 50.55a.

#### **4. Reason for Request**

An alternative is requested from the requirement of IWB-2412, Inspection Program B, that volumetric examination of essentially 100% of RV pressure-retaining Examination Category B-A and B-D welds be performed once each ten-year interval. Extension of the interval between examinations of Category B-A and B-D welds from 10 years to up to 20 years will result in a reduction in man-rem exposure and examination costs.

#### **5. Proposed Alternative and Basis for Use**

South Carolina Electric & Gas Company (SCE&G) proposes to not perform the ASME Code required volumetric examination of the V. C. Summer Unit 1 RV full penetration pressure-retaining Examination Category B-A and B-D welds for the third inservice inspection, currently scheduled for 2012. SCE&G will perform the third ASME Code required volumetric examination of the V. C. Summer Unit 1 RV full penetration pressure-retaining Examination Category B-A and B-D welds in the fourth inservice inspection interval in 2023 plus or minus one refueling outage. The proposed date is consistent with the date provided in OG-06-356 (Reference 2) and OG-10-238 (Reference 3).

In accordance with 10 CFR 50.55a(a)(3)(i), an alternate inspection interval is requested on the basis that the current interval can be extended based on a negligible change in risk by satisfying the risk criteria specified in Regulatory Guide 1.174 (Reference 4).

The methodology used to conduct this analysis is based on that defined in the study WCAP-16168-NP-A, Revision 2, "Risk-Informed Extension of the Reactor Vessel In-service Inspection Interval" (Reference 5). This study focuses on risk assessments of materials within the beltline region of the RV wall. The results of the calculations for V. C. Summer Unit 1 were compared to those obtained from the Westinghouse pilot plant evaluated in WCAP-16168-NP-A, Revision 2. Appendix A of the WCAP identifies the parameters to be compared. Demonstrating that the parameters for V. C. Summer Unit 1 are bounded by the results of the Westinghouse pilot plant qualifies V. C. Summer Unit 1 for an ISI interval extension. Table 1 below lists the critical parameters investigated in the WCAP and compares the results of the Westinghouse pilot plant to those of V. C. Summer Unit 1. Tables 2 and 3 provide additional information that was requested by the NRC and included in Appendix A of Reference 5.

<b>Table 1: Critical Parameters for the Application of Bounding Analysis for V. C. Summer Unit 1</b>			
<b>Parameter</b>	<b>Pilot Plant Basis</b>	<b>Plant-Specific Basis</b>	<b>Additional Evaluation Required?</b>
Dominant Pressurized Thermal Shock (PTS) Transients in the NRC PTS Risk Study are Applicable	NRC PTS Risk Study (Reference 6)	PTS Generalization Study (Reference 7)	No
Through-Wall Cracking Frequency (TWCF)	1.76E-08 Events per year (Reference 5)	1.26E-12 Events per year (Calculated per Reference 5)	No
Frequency and Severity of Design Basis Transients	7 heatup/cooldown cycles per year (Reference 5)	Bounded by 7 heatup/cooldown cycles per year	No
Cladding Layers (Single/Multiple)	Single Layer (Reference 5)	Single Layer	No

Table 2 below provides a summary of the latest RV inspection for V. C. Summer Unit 1 and an evaluation of the recorded indications. This information confirms that satisfactory examinations have been performed on the V. C. Summer Unit 1 RV.

<b>Table 2: Additional Information Pertaining to Reactor Vessel Inspection for V. C. Summer Unit 1</b>																	
Inspection methodology:	The latest ISI was conducted in accordance with the ASME Code, Section XI and Section V, 1989 Edition, no Addenda and 1995 Edition with 1996 Addenda. Examinations of Category B-A and B-D welds were performed to ASME Section XI Appendix VIII 1995 Edition with the 1996 Addenda, as modified by 10 CFR 50.55a(b)(2)(xiv, xv and xvi). Future inservice inspections will be performed to ASME Section XI Appendix VIII requirements.																
Number of past inspections:	Two 10-Year inservice inspections have been performed.																
Number of indications found:	<p>There was one indication identified in the beltline region during the most recent inservice inspection. This indication, in plate material, is acceptable per Table IWB-3510-1 of Section XI of the ASME Code. This indication is within the inner 1/10<sup>th</sup> or 1" of the RV thickness and is acceptable per the requirements of the Alternate PTS Rule, 10 CFR 50.61a (Reference 8) since the number of actual flaws is less than the allowable number of plate flaws for each flaw size increment. A disposition of this flaw against the limits of the Alternate PTS Rule is shown in the table below.</p> <table border="1"> <thead> <tr> <th colspan="2">Through-Wall Extent, TWE (in.)</th><th rowspan="2">Scaled maximum number of plate flaws</th><th rowspan="2">Number of Flaws (Axial/ Circ.)</th></tr> <tr> <th>TWE<sub>MIN</sub></th><th>TWE<sub>MAX</sub></th></tr> </thead> <tbody> <tr> <td>0.075</td><td>0.375</td><td>48</td><td>1 (0/1)</td></tr> <tr> <td>0.125</td><td>0.375</td><td>19</td><td>1 (0/1)</td></tr> </tbody> </table>			Through-Wall Extent, TWE (in.)		Scaled maximum number of plate flaws	Number of Flaws (Axial/ Circ.)	TWE <sub>MIN</sub>	TWE <sub>MAX</sub>	0.075	0.375	48	1 (0/1)	0.125	0.375	19	1 (0/1)
Through-Wall Extent, TWE (in.)		Scaled maximum number of plate flaws	Number of Flaws (Axial/ Circ.)														
TWE <sub>MIN</sub>	TWE <sub>MAX</sub>																
0.075	0.375	48	1 (0/1)														
0.125	0.375	19	1 (0/1)														
Proposed inspection schedule for balance of plant life:	The third inservice inspection is scheduled for 2012. This inspection will be performed in 2023 plus or minus one refueling outage. The proposed date is consistent with the date provided in OG-06-356 (Reference 2) and OG-10-238 (Reference 3).																

Table 3 summarizes the inputs and outputs for the calculation of through-wall cracking frequency (TWCF).

<b>Table 3: Details of TWCF Calculation for V. C. Summer Unit 1 at 56 Effective Full Power Years (EFPY)</b>								
Inputs								
Reactor Coolant System Temperature, $T_{RCS}$ [°F]:			N/A		$T_{wall}$ [inches]:			7.875
No.	Region and Component Description	Material Heat No.	Cu <sup>(1)</sup> [wt%]	Ni <sup>(1)</sup> [wt%]	R.G. <sup>(1)</sup> 1.99 Pos.	CF <sup>(1)</sup> [°F]	RT <sub>NDT(u)</sub> <sup>(1)</sup> [°F]	Fluence [ $10^{19}$ Neutron/cm <sup>2</sup> , E > 1.0 MeV]
1	Inter. Shell Long. Weld BC	4P4784	0.05	0.91	2.1	42.2	-44	2.55
2	Inter. Shell Long. Weld BD	4P4784	0.05	0.91	2.1	42.2	-44	2.55
3	Lower Shell Long. Weld BA	4P4784	0.05	0.91	2.1	42.2	-44	2.55
4	Lower Shell Long. Weld BB	4P4784	0.05	0.91	2.1	42.2	-44	2.55
5	Int. To Lower Shell Circ. Weld AB	4P4784	0.05	0.91	2.1	42.2	-44	6.32
6	Intermediate Shell 11-1	A9154-1	0.10	0.51	1.1	65.0	30	6.32
7	Intermediate Shell 11-2	A9153-2	0.09	0.45	1.1	58.0	-20	6.32
8	Lower Shell 10-1	C9923-2	0.08	0.41	1.1	51.0	10	6.32
9	Lower Shell 10-2	C9923-1	0.08	0.41	1.1	51.0	10	6.32
Outputs								
Methodology Used to Calculate $\Delta T_{30}$ :				Regulatory Guide 1.99, Revision 2 <sup>(2)</sup>				
	Controlling Material Region No. (From Above)	RT <sub>MAX-XX</sub> [°R]	Fluence [ $10^{19}$ Neutron/cm <sup>2</sup> , E > 1.0 MeV]	FF (Fluence Factor)	$\Delta T_{30}$ [°F]	TWCF <sub>95-XX</sub>		
Limiting Axial Weld - AW		6	571.01	2.55	1.252	81.34	0.00E+00	
Limiting Plate - PL		6	583.65	6.32	1.446	93.98	5.02E-13	
Circumferential Weld - CW		6	583.65	6.32	1.446	93.98	0.00E+00	
TWCF <sub>95-TOTAL</sub> ( $\alpha_{AW}TWCF_{95-AW} + \alpha_{PL}TWCF_{95-PL} + \alpha_{CW}TWCF_{95-CW}$ ):								1.26E-12

(1) Reference 9

(2) Reference 10

## **6. Duration of Proposed Alternative**

This request is applicable to the V. C. Summer Unit 1 inservice inspection program for the third and fourth 10-year inspection intervals.

## **7. Precedents**

- "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – Relief Request No. RR-40, Reactor Vessel Weld Examination Interval Extension (TAC Nos. ME1634, ME1635, and ME1636)," dated February 22, 2010 (ML100290415).
- "Safety Evaluation of Relief Requests to Extend the Inservice Inspection Interval for Reactor Vessel Examinations for Salem Nuclear Generating Station, Unit Nos. 1 and 2 (TAC Nos. ME1478, ME1479, ME1480 and ME1481)," dated February 22, 2010 (ML100491550).
- "Arkansas Nuclear One, Unit 2 – Request for Alternative ANO2-ISI-004, to Extend the Third 10-Year Inservice Inspection Interval for Reactor Vessel Weld Examinations (TAC No. ME2508)," dated September 21, 2010 (ML102450654).
- "Joseph M. Farley Nuclear Plant, Unit 2 (Farley Unit 2) – Relief Request for Extension of the Reactor Vessel Inservice Inspection Date to the Year 2020 (Plus or Minus One Outage) (TAC No. ME3010)," dated July 12, 2010 (ML101750402).
- "Three Mile Island Nuclear Station, Unit 1 (TMI-1) – Request to Extend the Inservice Inspection Interval for Reactor Vessel Weld and Internal Examinations, Proposed Alternative Request Nos. RR-09-01 and RR-09-02 (TAC Nos. ME2483 and ME2484)," dated September 21, 2010 (ML102390018).



## **8. References**

1. ASME Boiler and Pressure Vessel Code, Section XI, 1998 Edition through 2000 Addenda, American Society of Mechanical Engineers, New York.
2. OG-06-356, "Plan for Plant-Specific Implementation of Extended Inservice Inspection Interval per WCAP-16168-NP, Revision 1, 'Risk-Informed Extension of the Reactor Vessel In-service Inspection Interval.'" MUHP 5097-99, Task 2059," October 31, 2006.
3. OG-10-238, "Revision to the Revised Plan for Plant Specific Implementation of Extended Inservice Inspection Interval per WCAP-16168-NP, Revision 1, 'Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval.'" PA-MS-C-0120," July 12, 2010.
4. NRC Regulatory Guide 1.174, Revision 1, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," November 2002.
5. WCAP-16168-NP-A, Revision 2, "Risk-Informed Extension of the Reactor Vessel In-service Inspection Interval," June 2008.
6. NUREG-1874, "Recommended Screening Limits for Pressurized Thermal Shock (PTS)," March 2010 (Available on NRC website).
7. NRC Letter Report, "Generalization of Plant-Specific Pressurized Thermal Shock (PTS) Risk Results to Additional Plants," December 14, 2004 (ADAMS Accession Number ML042880482).
8. Code of Federal Regulations, 10 CFR Part 50.61a, "Alternate Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events," U.S. Nuclear Regulatory Commission, Washington D. C., Federal Register, Volume 75, No. 1, dated January 4, 2010 and No. 22 with corrections to part (g) dated February 3, 2010, March 8, 2010, and November 26, 2010.
9. WCAP-16306-NP, Revision 0, "Evaluation of Pressurized Thermal Shock for V. C. Summer," August 2004 (ADAMS Accession Number ML043010235).
10. NRC Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," May 1988.