

November 21, 2006

Mr. Jeffrey Archie
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
Jenkinsville, South Carolina 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1 - RELIEF REQUESTS
RR-III-03 AND RR-III-04 (TAC NO. MD2422)

Dear Mr. Archie:

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated June 20, 2006 (ADAMS ML061720495), as supplemented on October 19, 2006 (ADAMS ML 062990461), the South Carolina Electric and Gas Company, the licensee for the Virgil C. Summer Nuclear Station, Unit 1, requested relief from certain examination qualification requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI.

The NRC staff's evaluation and conclusions are contained in the enclosed Safety Evaluation. The NRC staff found the licensee's Relief Requests RR-III-03 and RR-III-04 acceptable. The NRC staff concludes that for Relief Request RR-III-03, compliance with the required flaw depth acceptance criteria of ASME Code, Section XI, Appendix VIII, Supplement 10 is impractical. The NRC staff also concludes that the proposed alternative to Supplement 10 and Code Case N-695, paragraph 3.3(c) is acceptable because it will provide reasonable assurance of structural integrity.

For Relief Request RR-III-04, the NRC staff concludes that compliance with the requirement of ASME Code, Section XI, Appendix VIII, Supplement 10, pertaining to the detection of axial flaws in the presence of a rough surface, is impractical. The NRC staff also concludes that the proposed alternative of using profiling and eddy current testing to supplement the ultrasonic testing is acceptable because it provides reasonable assurance that axial flaws in the presence of rough surface will be detected, and thus provides reasonable assurance of structural integrity.

J. Archie

-2-

Therefore, relief is granted for Relief Requests RR-III-03 and RR-III-04, pursuant to 10 CFR 50.55a(g)(6)(i) for the remainder of the third 10-year inservice inspection interval. All other ASME Code, Section XI requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

/RA/

Evangelos C. Marinos, 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/enclosure: See next page

J. Archie

-2-

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUESTS RR- III-03 and RR-III-04

FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-395

1.0 INTRODUCTION

By letter dated June 20, 2006, as supplemented by letter dated October 19, 2006, South Carolina Electric & Gas Company (the licensee) submitted Relief Requests RR-III-03 and RR-III-04 for Nuclear Regulatory Commission (NRC) approval. Specifically, the licensee proposed alternatives to the requirements of meeting the root mean square error (RMSE) of 0.125 inches in depth sizing and the capability of detecting axial flaws in the presence of surface roughness as specified in American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, Appendix VIII, Supplement 10, "Qualification Requirements for Dissimilar Metal Piping Welds." The subject relief requests will be used for inservice inspection (ISI) in the remainder of the third 10-year interval at Virgil C. Summer Nuclear Station, Unit 1 (VCSNS).

2.0 REGULATORY REQUIREMENTS

Title 10 of the *Code of Federal Regulations*, 10 CFR 50.55a(g), specifies that ISI of nuclear power plant components shall be performed in accordance with the requirements of the ASME Code, Section XI, 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), 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. According to 10 CFR 50.55a(g)(5)(iii), if the licensee has determined that conformance with certain Code requirements is impractical for its facility, the licensee shall notify the Commission and submit, as specified in §50.4, justification to support the determinations.

Enclosure

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 preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that ISI of components and system pressure tests conducted during the first 10-year interval and 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) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The information provided by the licensee in support of the request has been evaluated by the NRC staff and the bases for disposition are documented below.

3.0 TECHNICAL EVALUATION

3.1 Components for Which Relief is Requested

All ASME Code, Class 1 reactor vessel to primary piping dissimilar metal field welds (Category BF, Item # B5.10). In the risk-informed ISI program, these welds correspond to Examination Category R-A, Item R1.15 welds in Code Case N-577-1, Table 1. During the VCSNS refueling outage 16, the bravo hot leg nozzle-to-pipe dissimilar metal weld will be examined. The bravo hot leg is located at 265 degrees, reactor vessel angular reference.

3.2 Applicable Code Edition and Addenda

The Code of record for the third 10-year ISI program at VCSNS is the ASME Code, Section XI, 1998 Edition with 2000 addenda.

3.3 Relief Request RR-III-03

3.3.1 Applicable Code Requirement

For the subject dissimilar metal piping welds, the Code requires that volumetric examination is to be performed in accordance with Section XI, Appendix VIII, Supplement 10. In Paragraph 3.2(a) of Supplement 10 for sizing acceptance criteria, it requires that examination procedures, equipment, and personnel are qualified for depth sizing when the RMSE of the flaw depth measurements, as compared to the true flaw depths, is less than or equal to 0.125 inches.

Similarly, Code Case N-695, "Qualification Requirements for Dissimilar Metal Piping Welds, Section XI, Division 1," paragraph 3.3(c), also requires that examination procedures, equipment, and personnel are qualified for depth sizing when the RMSE of the flaw depth measurements, as compared to the true flaw depths, does not exceed 0.125 inches. Code Case N-695 is endorsed in Regulatory Guide 1.147, Revision 14, and is an alternative for Section XI, Appendix VIII, Supplement 10.

3.3.2 Licensee Proposed Alternative and Basis for Use

The licensee stated that a request of relief from the required RMSE in depth sizing is needed because the contracted vendor for ultrasonic testing (UT) did not meet the qualification

requirement for depth sizing. The contracted vendor has demonstrated the ability to meet the depth sizing qualification requirement with a RMSE of 0.189 inches instead of the required 0.125 inches.

The licensee proposed to use Code Case N-695, with a RMSE of 0.189 inches instead of the 0.125 inches specified for depth sizing in the Code Case. The licensee also proposed that if an indication is detected and requires depth sizing, the 0.064 inches difference between the required RMSE and the demonstrated RMSE ($0.189 - 0.125 = 0.064$) will be added to the measured through-wall extent for comparison to the applicable acceptance standard. The licensee stated that the addition of the difference between the qualified and demonstrated sizing tolerance to the measured depth will provide an acceptable level of safety and quality. Furthermore, the licensee also proposed that if the contracted vendor demonstrate an improved depth sizing RMSE prior to the performance of these examinations, the difference of that improved RMSE will be substituted for the 0.189 inches.

3.3.3 Staff Evaluation

Both ASME Code, Section XI, Appendix VIII, Supplement 10 and Code Case N-695 require that in the qualification of examination procedures, equipment, and personnel for UT of dissimilar metal piping welds, the RMSE in flaw depth sizing does not exceed 0.125 inches. The licensee's contracted inspection vendor did not meet this requirement. The contracted vendor has demonstrated a RMSE of 0.189 inches in depth sizing instead of the required 0.125 inches. The nuclear industry is in the process of qualifying personnel in accordance with the Supplement 10 and Code Case N-695 requirements, as implemented through the Electric Power Research Institute's (EPRI) Performance Demonstration Initiative (PDI) Program. At the time of this granting of relief, the EPRI-PDI Program has not qualified anyone to meet the required RMSE value for flaw depth sizing performed from the inside surface of pipe weldment mockup samples. Therefore, the NRC staff finds that since the required vendor personnel to meet the RMSE value of 0.125 inches in the qualification examination are not yet available, it is impractical to meet this requirement of the Code.

To compensate for the larger RMSE in flaw sizing, the licensee proposed that, in the event that a flaw is identified during the examination of the subject welds, the licensee will add 0.064 inches to the measured flaw depth. The 0.064 inches is the difference in the demonstrated sizing error of 0.189 inches and the code-required RMSE of 0.125 inches. The NRC staff has determined that this approach is acceptable because it provides a reasonable adjustment to the measured flaw depth in flaw evaluation to ensure structural integrity.

3.3.4 Conclusion

Based on the above review, the NRC staff concludes that compliance with the required RMSE value of the ASME Code, Section XI, Appendix VIII, Supplement 10 is impractical. The NRC staff also concludes that the proposed alternative to Supplement 10 and Code Case N-695, paragraph 3.3(c) is acceptable because it will provide reasonable assurance of structural integrity. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), relief is granted for VCSNS for the remainder of the third 10-year ISI interval. The grant of relief is authorized by law and will not endanger life or property, or the common defense, and security and is otherwise in the public interest given the consideration of the burden upon the licensee. All other ASME Code, Section XI requirements for which relief was not specifically requested and authorized herein by

the NRC staff remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

3.4 Relief Request RR-III-04

3.4.1 Applicable Code Requirement

The Code requires that the procedures, equipment, and personnel used for the UT of the referenced dissimilar metal piping welds shall be qualified to the ASME Code, Section XI, Appendix VIII, Supplement 10.

3.4.2 Licensee Proposed Alternative and Basis for Use

The licensee stated that the procedures to be used by the contracted inspection vendor for the UT of dissimilar metal piping welds are not fully qualified to the requirements of the ASME Code, Section XI, Appendix VIII, Supplement 10. The vendor's procedure is qualified only for the detection and length sizing of circumferential flaws because transducer contact could not be maintained in certain areas of the specimen in the scanning for axial flaws during the qualification process. The reason for the failure of detecting the axial flaws is attributed to the presence of surface roughness which prevented the proper contact of the transducer to the inside surface of the specimen.

To supplement the UT for the detection of axial flaws, the licensee proposed to use surface geometry software (profilometry) in conjunction with a focused immersion ultrasonic transducer positioned to permit accurate profiling data across the examination volume to assist the examiner in confirming locations where raw data indicates lack of transducer contact due to geometry. In addition to the profilometry, eddy current examination (ET) will be used to supplement the UT of the volume immediately under the inside diameter (ID) surface where sufficient surface roughness exists which may limit the UT to detect axial flaws. The eddy current technique to be utilized consists of: (1) up to two plus-point probes applied circumferentially on the ID surface in scan increments of 0.8 inches (for axial flaws) and 0.25 inches axially; and (2) use of automated systems for data collection and analysis.

The target flaw size for the eddy current procedure is 0.28 inches long, which is well within the ASME Code planar flaws acceptance standard of 0.45 inches long for austenitic materials.

The licensee stated that the UTs, supplemented by ETs and profilometry will be conducted to the maximum extent possible and are subject to third party review by the Authorized Nuclear Inservice Inspector.

3.4.3 NRC Staff Evaluation

The licensee's contracted vendor did not fully meet the qualification requirements of ASME Code, Section XI, Appendix VIII, Supplement 10. As shown in the procedure performance summary issued to the contacted vendor by the PDI, a limitation is noted for the detection of axial flaws in Supplement 10 field weld configurations. This is due to the UT transducer's lift-off from the rough surface resulting from the unfavorable ID geometry conditions such as counter bore or the weld root protrusion. However, the contracted vendor is qualified for the detection of axial flaws when the welds are ground or machined smooth. The staff notes that the PDI

program is not successful in qualifying examiners to detect axial flaws in the presence of rough surface. Therefore, the NRC staff has determined that to comply with the subject Code qualification requirement is impractical at this time.

The licensee proposed the use of ID profiling and the ET to supplement the UT for the detection of axial flaws when significant surface roughness is present in the welds. The ID profiling will confirm the presence of rough surface and the ET will assure the detection of surface breaking flaws. The ET methodology to be used is similar to that used in the VCSNS 2000, 2002 and 2003 outages. The technique was refined based on examinations performed on field samples removed from VCSNS during the 2000 refueling outage. The field samples contained surface induced primary water stress corrosion cracking flaws and nonrelevant indication resulting from surface geometry and metallurgical interfaces. In addition, the licensee's contracted vendor has performed approximately 12 similar examinations using a combined ET/UT approach in the past 2 to 3 years. Therefore, the NRC staff has determined that the licensee's proposed alternative of using ID profiling and the ET will provide reasonable assurance that the axial flaws in the presence of rough surface will be detected.

3.4.4 Conclusion

Based on the above review, the NRC staff concludes that compliance with the requirement of ASME Code, Section XI, Appendix VIII, Supplement 10 pertaining to the detection of axial flaws in the presence of a rough surface is impractical. The NRC staff also concludes that the proposed alternative of using profiling and the ET to supplement the UT is acceptable because it provides reasonable assurance that axial flaws in the presence of rough surface will be detected and will thus provide reasonable assurance of structural integrity. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), relief is granted for VCSNS for the remainder of the third 10-year ISI interval. The grant of relief is authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest, given the consideration of the burden upon the licensee. All other ASME Code, Section XI requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: W. Koo

Date: November 21, 2006

Mr. Jeffrey B. Archie
South Carolina Electric & Gas Company

VIRGIL C. SUMMER NUCLEAR STATION

cc:

Mr. R. J. White
Nuclear Coordinator
S.C. Public Service Authority
c/o Virgil C. Summer Nuclear Station
Post Office Box 88, Mail Code 802
Jenkinsville, South Carolina 29065

Ms. Kathryn M. Sutton, Esquire
Winston & Strawn Law Firm
1400 L Street, NW
Washington, DC 20005-3502

Resident Inspector/Summer NPS
c/o U.S. Nuclear Regulatory Commission
576 Stairway Road
Jenkinsville, South Carolina 29065

Chairman, Fairfield County Council
Drawer 60
Winnsboro, South Carolina 29180

Mr. Henry Porter, Assistant Director
Division of Waste Management
Bureau of Land & Waste Management
Dept. of Health & Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Thomas D. Gatlin, General Manager
Nuclear Plant Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88, Mail Code 300
Jenkinsville, South Carolina 29065

Mr. Ronald B. Clary, Manager
Nuclear Licensing
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88, Mail Code 830
Jenkinsville, South Carolina 29065