

September 1, 2015

Mr. Thomas D. Gatlin
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88, Mail Code 800
Jenkinsville, SC 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1 – ALTERNATIVE REQUEST
REGARDING ROOT MEAN SQUARE DEPTH SIZING REQUIREMENTS
(TAC NO. MF5612)

Dear Mr. Gatlin:

By letter dated January 20, 2015, as supplemented by letter dated June 30, 2015, South Carolina Electric and Gas Company (SCE&G, the licensee) requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV Code). SCG&E proposed to use an alternative to the to the flaw depth sizing root mean square error (RMSE) criteria in Appendix VIII, Section XI of the ASME Code at the Virgil C. Summer Nuclear Station (VCSNS), Unit 1.

The application was submitted pursuant to Title 10 of the *Code of Federal Regulations*, 50.55a(g)(5)(iii). The licensee requested relief and to use alternative requirements (if necessary), for inservice inspection on the basis that the ASME Code requirement is impractical.

The U. S. Nuclear Regulatory Commission staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that SCE&G has adequately addressed all of the regulatory requirements set forth in 50.55a(g)(6)(i), and therefore authorizes the proposed alternative.

T. Gatlin

- 2 -

If you have any questions, please contact the Project Manager, Shawn Williams, at 301-415-1009 or via e-mail at Shawn.Williams@nrc.gov.

Sincerely,

/RA/

Robert J. Pascarelli, 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

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
ALTERNATIVE REQUEST REGARDING ALTERNATIVE DEPTH SIZING ROOT MEAN

SQUARE ERROR CRITERIA

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 January 20, 2015 (Agency Wide Document Management System (ADAMS) Accession No. ML15022A655), as supplemented by letter dated June 30, 2015 (ADAMS Accession No. ML15187A171), South Carolina Electric and Gas Company (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV Code). The relief request RR-4-07 pertains to the flaw depth sizing root mean square error (RMSE) criteria in Appendix VIII, Section XI of the ASME Code at the Virgil C. Summer Nuclear Station (VCSNS), Unit 1.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii) the licensee requested relief and to use alternative requirements (if necessary), for inservice inspection on the basis that the ASME Code requirement is impractical.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), the ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the 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.

Enclosure

Pursuant to 10 CFR 50.55a(g)(5)(iii) ISI program update: Notification of impractical Inservice Inspection (ISI) ASME Code requirements, if the licensee has determined that conformance with an ASME Code requirement is impractical for its facility, the licensee must notify the NRC and submit, as specified in Section 50.4, information to support the determinations. Determinations of impracticality in accordance with Section 50.55a must be based on the demonstrated limitations experienced when attempting to comply with the ASME Code requirements during the inservice inspection interval for which the request is being submitted. Requests for relief made in accordance with Section 50.55a must be submitted to the NRC no later than 12 months after the expiration of the initial or subsequent 120-month inspection interval for which relief is sought.

Pursuant to 10 CFR 50.55a(g)(6)(i), Impractical ISI requirements: Granting of relief, the Commission will evaluate determinations under paragraph (g)(5) of Section 50.55a that ASME Code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines are authorized by law, will not endanger life or 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 on the facility.

Pursuant to 10 CFR 50.55a(g)(6)(ii)(F) Augmented ISI requirements: Examination requirements for Class 1 piping and nozzle dissimilar-metal butt welds, licensees of existing operating pressurized water reactors (PWR) as of July 21, 2011, must implement the requirements of ASME Code Case N-770-1, "Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated With UNS N06082 or UNS W86182 Weld Filler Material With or Without Application of Listed Mitigation Activities Section XI, Division 1," subject to the conditions specified in paragraphs (g)(6)(ii)(F)(2) through (g)(6)(ii)(F)(10) of Section 50.55a, by the first refueling outage after August 22, 2011.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and the NRC to authorize the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 Component Affected

The components affected are ASME Code Class 1 reactor pressure vessel (RPV) cold leg nozzle dissimilar metal (DM) butt welds. In accordance with ASME Code Case N-770-1 (Table 1), they are classified as Inspection Item B.

The licensee identified the welds in Attachment 1 to RR-4-07. In the June 30, 2015, supplement, the licensee provided materials of constructions and a schematic diagram of the welds.

3.2 Applicable Code Edition and Addenda

The code of record for the fourth 10-year ISI interval is the 2007 Edition through 2008 Addenda to the ASME Code.

3.3 Duration of Relief Request

The licensee submitted this relief request for the fourth 10-year ISI interval which commenced on January 1, 2014, and will end on December 31, 2023.

3.4 ASME Code Requirement

ASME Code Case N-770-1, as required by 10 CFR 50.55a(g)(6)(ii)(F), requires the RPV cold leg nozzle to safe end DM butt welds to be inspected by the ultrasonic testing (UT). Foot Note 3 of Table 1 in N-770-1 requires that the UT meets the applicable requirements of Appendix VIII, Section XI of the ASME Code.

For UT of the Class 1 DM piping and vessel nozzle butt welds, the UT procedures, personnel, and equipment shall be qualified in accordance with Supplement 10 "Qualification Requirements for Dissimilar Metal Piping Welds" of Appendix VIII. Paragraph 3.3(c) of Supplement 10 states 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 do not exceed 0.125 inch.

3.5 Basis for Impracticality and Relief

The licensee stated that, to date, although utilities' vendors have qualified in accordance with Supplement 10 requirements for flaw detection and length sizing for inspections performed from inside diameter (ID) surface of the weld, the qualification for flaw depth sizing has not yet been successful to meet the Supplement 10 required 0.125 inch RMSE. To date, no vendor has been capable of meeting the 0.125 inch RMSE criterion.

The licensee stated that its contracted vendor has demonstrated the ability to meet the flaw depth sizing qualification with the RMSE of 0.189 inch. The addition of the difference between the required RMSE and the demonstrated RMSE ($0.189 - 0.125 = 0.064$) will compensate for the possible variance in measured depth.

3.6 Proposed Alternative

The licensee proposed an alternative flaw depth sizing RMSE criteria. The proposed alternative is, in the event that a flaw is detected in the subject welds and requires depth sizing, the licensee will add the difference (i.e., $0.189 - 0.125 = 0.064$) between the required RMSE of 0.125 inch and the vendor demonstrated RMSE of 0.189 inch to the measured depth of a detected flaw.

The licensee also proposed that should its vendor demonstrate an improved depth sizing RMSE prior to the performance of examinations of the subject welds, the difference of that improved RMSE will be substituted for the 0.189 inch RMSE.

In addition, in the June 30, 2015 letter, the licensee proposed the following:

- For flaws detected and measured by the UT as less than 50 percent through wall depth, adding the proposed correction factor ($0.189 - 0.125 = 0.064$) to the depth of any flaw found by the UT prior to flaw evaluation for flaws less than 50 percent through wall satisfactorily reduces the effect of the increased sizing error associated with not meeting the ASME Code required 0.125 inch RMSE.
- For flaws detected and measured by the UT as 50 percent through wall depth or greater, and remain in service without mitigation or repair, the licensee will perform a flaw evaluation and submit to the NRC for review and approval prior to reactor startup. The flaw evaluations shall include the inner profile of the weld, pipe and nozzle in the region at and surrounding the flaw, an estimate of the percentage of potential surface areas with UT probe lift-off, and information on the mechanism that caused the flaw.

3.7 NRC Staff Evaluation

The NRC staff has evaluated RR-4-07 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff review focused on whether a technical justification exists to support the determination that the ASME Code requirement is impractical, imposing the requirements could result a burden upon the facility, and the structural integrity and leak tightness of the affected component is reasonably assured.

Impracticality

The NRC staff determined that the licensee provided adequate description and technical information to support the basis for impracticality. The NRC staff confirmed that attempts have been made by the industry to qualify the UT procedure from the ID surface since 2002. Enhancements in examination such as use of commercially available advanced UT systems, transducers, and software have not been resulted in the desired improvements in performance to meet the ASME Code acceptable RMSE criteria for the ID ultrasonic inspection. To date, there has not been any inspection vendor capable to meet the qualification requirement of the RMSE of not greater than 0.125 inch established by the ASME Code for the UT procedure from the ID surface.

The NRC staff finds that the industry's efforts have shown the impracticality of obtaining the RMSE of 0.125 inch, given the challenges of weld geometry, rough ID surfaces, multiple materials, and microstructural anisotropies. Therefore, imposing the ASME Code requirements could result in a burden upon the facility.

Safety Significance of Correction Factor

In July 2012, the NRC staff reviewed the proprietary Performance Demonstration Initiative (PDI) program (administered by the Electric Power Research Institute (EPRI)) data used in blind tests.) This review was conducted to verify the information and analysis presented by industry in the public meeting held between the NRC, PDI, EPRI, and industry on March 16, 2012 (ML12097A071) and June 19, 2012 (ML12173A517 and ML12173A522). Based on this review, the NRC staff determined that adding the industry proposed correction factor (procedure RMSE - 0.125 inch) to the depths of any flaw found by the UT prior to flaw evaluation for flaws less than 50 percent through wall satisfactorily reduces the effect of the increased sizing error

associated with not meeting the ASME Code required 0.125 inch RMSE. If any cracks are detected and measured by the UT as 50 percent through wall depth or greater and to remain in service without mitigation or repair, a flaw evaluation shall be performed and submitted for the NRC review and approval prior to reactor startup.

The flaw evaluations shall include:

- a) the inner profile of the weld, pipe, and nozzle in the region at and surrounding the flaw,
- b) an estimate of the percentage of potential surface areas with UT probe lift-off, and
- c) information on mechanism which caused the crack.

NRC staff concerns regarding the possibilities of large under sizing errors in deep flaws is addressed by requiring the NRC review and approval of the flaw evaluations prior to reactor startup when a flaw with 50 percent through wall or greater is discovered and is to remain in service without mitigation or repair.

Therefore, the NRC staff finds that for flaws measured less than 50 percent through wall depth, adding the licensee's proposed correction factor (procedure RMSE - 0.125 inch) to the depths of any flaw found by the inspections, and obtaining the NRC review and approval prior to startup for any flaws measured as 50 percent through wall depth or greater, provides reasonable assurance of structural integrity and leak tightness of the subject welds.

4.0 CONCLUSION

As set forth above, the NRC staff determines that it is impractical for the licensee to comply with the ASME Code, Section XI requirement. The NRC staff also determines that the proposed alternative provides reasonable assurance of structural integrity and leak tightness of the subject welds. Granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii). Therefore, the NRC staff grants RR-4-07 at VCSNS, Unit 1, for the fourth 10-year ISI interval which commenced on January 1, 2014, and will end on December 31, 2023.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the staff remain applicable, including the third party review by the Authorized Nuclear In-service Inspector.

Principle Contributor: Ali Rezai, NRR