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

February 13, 2019

Mr. George A. Lippard, III
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
P.O. Box 88, Mail Code 800
Jenkinsville, SC 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1 – RELIEF REQUEST (RR-4-17) FOR USE OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE CASE N-513-3 (EPID L-2018-LLR-0109)

Dear Mr. Lippard:

By letter dated August 14, 2018, the South Carolina Electric & Gas Company (SCE&G, the licensee) requested approval from the U.S. Nuclear Regulatory Commission (NRC) for relief from certain requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, IWA-4000 at Virgil C. Summer Nuclear Station (VCSNS), Unit 1.

SCE&G requested authorization for temporary acceptance of a pin-hole leak in lieu of performing an ASME Code repair on a degraded service water system pipe flange based on ASME Code Case N-513-3 "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1." The NRC has approved generic use of Code Case N-513-3 if the flaw falls within the scope of the code case. The flaw, subject to this relief request, is outside the scope allowed in the code case.

The licensee submitted the proposed alternative pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.55a(z)(2) on the basis that the ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety.

On August 15, 2018, the NRC staff verbally authorized the use of relief request RR-4-17 until the conclusion of the Unit 1 fall 2018 refueling outage (RF24), or until exceeding the temporary acceptance criteria of ASME Code Case N-513-3, or the temporary acceptance criteria of RR-4-17, whichever occurs first. This safety evaluation documents the NRC staff's detailed technical basis for the verbal authorization.

The NRC staff has reviewed the proposed alternative and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes the use of relief request RR-4-17 for VCSNS, Unit 1.

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

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

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-395

Enclosure:
Safety Evaluation

cc: Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST RR-4-17

USE OF ASME CODE CASE N-513-3

RENEWED FACILITY OPERATING LICENSE NO. NPF-12

SOUTH CAROLINA ELECTRIC & GAS COMPANY

VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-395

1.0 INTRODUCTION

By letter dated August 14, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18226A359), South Carolina Electric and Gas Company (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, IWA-4000, at Virgil C. Summer Nuclear Station (VCSNS), Unit 1.

The licensee submitted a relief request, RR-4-17, for temporary acceptance of a pin-hole leak in lieu of performing an ASME Code repair of the degraded service water system (SW) piping based on ASME Code Case N-513-3 "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1." ASME Code Case N-513-3 is approved for generic use in Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," dated March 2017 (ADAMS Accession No. ML16321A336) if the flaw falls within the scope of the code case. The flaw, subject to this relief request, is outside the scope allowed in the code case.

The licensee submitted the proposed alternative pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.55a(z)(2) on the basis that the ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety.

On August 15, 2018 (ADAMS Accession No. ML18227A104), the NRC verbally authorized the use of relief request RR-4-17 until the conclusion of the Unit 1 fall 2018 refueling outage (RF24), or until exceeding the temporary acceptance criteria of ASME Code Case N-513-3, or the temporary acceptance criteria of RR-4-17, whichever occurs first. This safety evaluation documents the NRC staff's detailed technical basis for the verbal authorization.

2.0 REGULATORY EVALUATION

The licensee has submitted a proposed alternative to the requirements of ASME Code, Section XI, Article IWA-4000, as it relates to the repair, or replacement of ASME Code Class 3, moderate energy SW 8-inch weld neck flange.

The NRC staff considered the following regulatory requirements and guidance in its evaluation.

Paragraph 10 CFR 50.55a(g)(4), *Inservice inspection standards requirement for operating plants*, states, in part:

> Throughout the service life of a boiling or pressurized water-cooled nuclear power facility,... [components (including supports)] that are classified as ASME Code Class 1, Class 2, and Class 3 must meet the requirements, [except design and access provisions and preservice examination requirements, set forth in Section XI,] ... to the extent practical within the limitations of design, geometry, and materials of construction of the components....

Pursuant to 10 CFR 50.55a(z), alternatives to the requirements of paragraphs (b) through (h) of this section may be used when authorized by the Director, Office of Nuclear Reactor Regulation. A proposed alternative must be submitted and authorized prior to implementation. The licensee must demonstrate that (1) the proposed alternative would provide an acceptable level of quality and safety; or (2) compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

ASME Code Case N-513, Revision 3, is approved for generic use in NRC RG 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 18, with one condition. This RG is incorporated into NRC regulations by reference in 10 CFR 50.55a. ASME Code Case N-513-3 provides criteria, which allows licensees to temporarily accept flaws, including through-wall flaws, in moderate energy Class 2 or 3 piping without performing repair or replacement activities.

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

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Request for Alternative

3.1.1 ASME Code Component Affected

The affected component is ASME Code Class 3, moderate energy SW 8-inch weld neck flange downstream of valve XVB03121B-SW. The flange is located in the discharge line from the 'B' train emergency diesel generator heat exchangers and is fabricated in accordance with the requirements of ASME Code, Section II, SA-105, "Specification for Carbon Steel Forgings for Piping Applications."

3.1.2 Applicable Code Edition and Addenda

The ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 2007 Edition through 2008 Addenda is the applicable code of record for the current inservice inspection interval at VCSNS, Unit 1.

3.1.3 Applicable Code Requirement

The licensee is required to perform repair/replacement activities in accordance with Article IWA-4000 of the ASME Code, Section XI, 2007 Edition through 2008 Addenda.

3.1.4 Reason for Request

On August 13, 2018, the licensee discovered a pin-hole leak on the downstream flange of Diesel Generator Cooler 'B' SW Return Valve XVB03121B-SW. The leak is spraying onto an adjacent wall and the floor at approximately 20 ml/minute. The licensee noted that the degraded condition is not in compliance with Article IWA-4000 of the ASME Code, Section XI, 2007 Edition through 2008 Addenda.

The licensee stated that an ASME Code repair is considered a hardship without a compensating increase in the level of quality and safety because an ASME Code repair would require a plant shutdown to replace the flange. The flange is located between valve XVB03121B-SW and the service water pond and cannot be isolated from the other portions of the SW piping.

3.1.5 Proposed Alternative and Basis for Use

In lieu of performing the ASME Code required repair, the licensee proposed to use a slightly modified ASME Code Case N-513-3, for the temporary acceptance of the pin-hole leak as discussed below.

Flaw Characterization

The licensee stated that the degradation is a non-planar through wall flaw, and no evidence was found to indicate a crack-type indication. The licensee also indicated that the average thickness in the vicinity of the pin-hole is 0.156 inches. These determinations were made based on ultrasonic testing (UT) inspection performed by a Quality Control inspector, qualified as a UT Level II inspector.

Structural Integrity

The licensee stated that VCSNS, Unit 1 Technical Specification 4.0.5, states that structural integrity of an ASME component is determined in accordance with either the original construction code or the ASME Code, Section XI, approved code cases or regulatory-approved methods of evaluation. The licensee noted that in the application of ASME Code Case N-513-3, the flaw (the pin-hole) meets all provisions of the code case except Section 1(c) where the flaw falls beyond the distance of $(Ro * t)^{0.5}$ where 'Ro' is the outside radius and 't' is the wall thickness of the pipe. In Enclosure 2 of the application, the licensee performed a flaw evaluation to accept the flaw using guidance from ASME Code Case N-513-3. The licensee's evaluation results demonstrate that the existing defect is structurally acceptable. The licensee noted that further degradation is acceptable as long as the average thickness of the remaining material outside the hole is greater than 0.046 inches within a diameter of 2 inches of the hole.

Flow Margin

The pin-hole leak is located downstream of the 'B' Emergency Diesel Generator heat exchangers and downstream of the discharge valve XVB03121B-SW on the discharge line to the SW pond. A leak at this location does not affect the ability to provide cooling water to the emergency diesel generator heat exchangers. The current leakage from the pin-hole is approximately 20 ml/minute. In its flow margin evaluation, the licensee conservatively assumed a leak rate of 11.5 gallons per minute (gpm) based on a 0.375 inch diameter hole at an internal pipe pressure of 20 pounds per square inch gauge (psig). The licensee also noted the four existing SW pin-hole leaks downstream of the 'A' and 'B' Component Cooling Water Heat Exchanger Return Valves (XVB03123A/B-SW), that have a postulated combined allowable leakage of 50.3 gpm, but are not part of this relief request.

The licensee stated that the SW pump is designed to supply 16,800 gpm of flow, therefore the postulated leak rate of 11.5 gpm from a 0.375 inch diameter hole combined with all the A and B system SW leaks (i.e., 11.5 gpm + 50.3 gpm), would not have a significant effect on the performance of the pump. The licensee further stated that a recent routine code check valve test on the SW 'B' Train measured the total system flow to be 13,036 gpm. The design minimum required post-accident flow for a train of SW is 12,237 gpm. The licensee noted that this check valve testing alignment is comparable to the post-accident SW alignment. Therefore, the licensee determined that there is a flow margin of approximately of 800 gpm (i.e., 13,036 gpm – 12, 237 gpm). The licensee stated that the postulated combined leakage of 61.8 gpm would not adversely affect SW flow margin.

The SW pond contains approximately 38.5 x 10^6 gallons of water and has the capability of being filled by a cross-tie valve from the circulating water system if water level drops below the alarm limit. The licensee noted that a postulated total leakage of 61.8 gpm would be negligible on the SW pond level.

Spray Concerns

The licensee stated that the current small stream from the pin-hole leak is directed toward the wall in the diesel building 427-foot elevation and is not currently adversely affecting any surrounding equipment. The leakage is towards the wall, and there is no active safety-related equipment that would be adversely impacted by the leakage. The system pressure is low at the defect location (20 psig or less). Therefore, the only potential effect from the spray would be the open/close limit switches and the conduit/terminal box for the limit switches on valve XVB03121B-SW. The valve limit switches are only used for position indication because XVB03121B-SW is a manual valve and no position change is required for the safety-related function. If it is assumed that the existing defect opens to a 0.375 inch diameter hole, the orientation and location of the leak would lead to the resulting spray deflecting off the wall and pooling on the floor prior to affecting any equipment in the vicinity of the valve excluding the limit switches and associated conduit/terminal box for XVB03121B-SW. The closest equipment is the Diesel Generator Fuel Oil Transfer Pumps and these are approximately 15 feet away from the pin-hole and on the other side of the valve. The spray would not have adequate velocity from the 0.375-inch hole at approximately 20 psig to adversely affect these pumps.

Flooding

In its flooding analysis, the licensee assumed a 30-minute operator action and no floor drain capability or sump pump operation. If it is assumed that the existing defect opens to a 0.375

inch diameter hole, the discharge would be approximately 11.5 gpm (at design upset pressure of 20 psig) and would increase the calculated flood level in the 400-foot elevation from 48.1 inches to 49.0 inches. The level in the 427-foot elevation is unaffected since the curb heights limit the water level in this elevation and any water cascading above these curbs will drain to the 400-foot level.

Under normal operating conditions, the diesel generator building sump pumps have a 40-gpm capacity each. There are two redundant 100% capacity sump pumps which can be used during normal plant operations. The diesel generator building sump pumps would have sufficient capacity to prevent building flooding from the postulated 11.5 gpm leak rate.

Extent of Condition

The licensee will implement an augmented examination in accordance with Section 5.0 of ASME Code Case N-513-3.

Compensatory Monitoring Plan

The licensee will quantify the leakage from the pin-hole leak at least once every 24 hours until the leak is repaired. The licensee will perform UT examinations of no more than 30 day intervals around the degraded area to characterize flaw growth. The licensee stated that the monitoring plan will remain in place until the SW is removed from service and the degraded flange is repaired.

3.1.5 Duration of Proposed Alternative

The licensee stated that it will complete a code compliant repair during the next refueling outage which is scheduled to start on October 6, 2018. Therefore, the duration of the proposed alternative is approximately 4 months until repaired during the outage, or until the acceptance criteria of the proposed alternative are exceeded. The station is currently in its 4th 10-year interval, which began on January 1, 2014, and is scheduled to end on December 31, 2023.

3.2 NRC Staff Evaluation

The licensee has proposed to use ASME Code Case N-513-3, which is conditionally approved for generic use by licensees as referenced in NRC RG 1.147. Specifically, ASME Code Case N-513-3 provides alternative evaluation criteria for temporary acceptance of flaws, including through-wall flaws, in moderate energy Class 2 and 3 piping. In the application of ASME Code Case N-513-3, the flaw being evaluated must fall within the scope of the code case as describe in Section 1.0 of ASME Code Case N-513-3. The flaw subject to this relief request falls outside the scope allowed in the code case. The NRC staff evaluated the proposed alternative based on the provisions of ASME Code Case N-513-3, and ASME Codes, Section III and XI.

Hardship

Based on the information provided by the licensee, the NRC staff determines that an ASME code repair would require a plant shutdown to replace the pipe flange. The NRC staff recognizes that immediate repair of moderately degraded piping could require a plant shutdown within the plants required action statement timeframes of the observed degradation. Shutdown activities result in additional dose and plant risk that would be inappropriate when a degraded condition is demonstrated to retain adequate margin to maintain the component's function and

structural integrity. Accordingly, the NRC staff agrees that under these circumstances, compliance with certain ASME Code requirements may result in hardship without a compensating increase in the level of quality and safety.

Flaw Characterization

The NRC staff finds that the licensee has used UT to measure the wall-thickness of the affected area of the pipe. The licensee classified the degradation as a non-planar through-wall flaw, not a crack. The NRC staff notes that the licensee has identified the degradation mechanism as cavitation-induced erosion and that there is only a single identified flaw. The NRC staff finds that the licensee has satisfied the flaw-characterization requirements of paragraphs 2(a) and 2(b) of ASME Code Case N-513-3.

Structural Integrity

The nominal pipe-size of the affected pipe segment is 8 inches. However, the pin-hole is located on the flanged portion of the pipe to valve XVB03121A-SW which has a diameter that is larger than the nominal 8 inches. The licensee used an outer diameter of 9.6875 inches in its calculations. Based on the licensee's thickness measurement using UT, the affected wall-thicknesses range from 0.052 inches to 0.416 inches. The average wall-thickness of the affected area was measured to be 0.156 inches. The NRC staff notes that the design pressure for the affected pipe and flange is 20 psig and would not challenge the structural integrity of the flange.

The licensee noted that further degradation is acceptable as long as the average thickness of the remaining material outside the hole is greater than 0.046 inches within a diameter of 2.0 inches of the hole. Based on independent calculations, the NRC staff finds that with a pressure of 20 psig, the minimum required wall thickness calculated by the licensee would be acceptable for retaining structural integrity. As reported by the licensee, the minimum measured thickness in the vicinity of the leaking pin-hole was about 0.052 inches. In addition, the licensee stated that it will quantify the leakage daily and perform wall thickness measurements every 30 days. The NRC staff finds that the likelihood that the degradation would exceed the licensee proposed acceptance criteria without being detected is remote. The NRC staff finds that there is sufficient margin in terms of flaw-size and leak rate with respect to the acceptable limits. Therefore, based on the flaw evaluation on the periodic monitoring plan, the NRC staff finds that the structural integrity of the subject flange will be maintained until the next refueling outage NRC staff notes that any further degradation will be detected and corrected prior to exceeding the proposed acceptance criteria.

Flow Margin

The NRC staff notes that the pin-hole occurs on the section of the SW pipe that discharges to the SW pond. A leakage occurring in this pipe segment does not affect the safety function of the SW piping. However, a significant leak rate may affect the performance of the upstream SW pump. Based on the difference between the total measured test flow rate and the minimum required flow rate through SW piping, the licensee stated that a margin of nearly 800 gpm exists. The NRC staff considers that a maximum allowable leak rate of 11.5 gpm would not challenge the flow margin of 800 gpm. The NRC staff finds that the SW has sufficient flow margin to compensate for an allowable leak rate of 11.5 gpm and that a leak rate of 11.5 gpm will not affect the performance of the SW pump.

Spray Concerns

The NRC staff notes that the licensee has demonstrated that based on the orientation and location of a conservative 0.375 inch diameter leaking hole, no safety equipment and structure will be affected significantly. The NRC staff finds that the licensee has addressed the spray concern adequately.

Flooding

The NRC staff notes that the licensee evaluated the flooding based on a postulated 0.375-inch hole with a corresponding leak rate of 11.5 gpm. The NRC staff finds that the capacity of each of the two redundant diesel generator building sump pumps (40 gpm) will be able to remove the leakage. Therefore, the NRC staff finds that flooding is not a concern in the diesel generator building as a result of the postulated leakage.

Extent of Condition

The NRC staff finds that the licensee has satisfied the extent of condition inspection because it will perform an augmented examination in accordance with Section 5.0 of ASME Code Case N-513-3.

Compensatory Monitoring Plan

The NRC staff finds that the licensee has satisfied the monitoring requirements of ASME Code Case N-513-3, because the licensee will monitor and quantify the leakage from the pin-hole leak at least once every 24 hours until the leak is repaired. In addition, the licensee will perform UT examinations of no more than 30-day intervals around the degraded area to characterize flaw-growth.

NRC Staff Conclusion

On the basis of above evaluation, the NRC staff finds that the licensee has demonstrated that the proposed alternative will provide reasonable assurance that the structural integrity of the subject SW piping and its intended safety function will be maintained.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the proposed alternative provides reasonable assurance of structural integrity of the subject SW piping component, and that complying with the specified ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes the use of relief request RR-4-17 until the end of the fall 2018 refueling outage, or until the temporary acceptance criteria of ASME Code Case N-513-3, or the licensee's proposed alternative are exceeded, whichever occurs first.

All other requirements in ASME Code, Section XI, for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Roger Kalikian, NRR

Date: February 13, 2019

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1 – RELIEF REQUEST (RR-4-17) FOR USE OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE CASE N-513-3 (EPID L-2018-LLR-0109) DATED FEBRUARY 13, 2019

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NAME	SWilliams	KGoldstein	SRuffin	MMarkley
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