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

February 9, 2017

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 FROM THE REQUIREMENTS OF THE ASME CODE REGARDING SERVICE WATER SYSTEM PIPING (CAC NO. MF9082)

Dear Mr. Lippard:

By letter dated January 13, 2017, South Carolina Electric & Gas Company (SCE&G, 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, Unit 1.

The licensee submitted Relief Request RR-4-11 to propose an alternative flaw evaluation to that of 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," to disposition a pin hole leak in lieu of performing an ASME Code repair of the 8-inch, ASME Code Class 3 service water system piping.

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

On January 14, 2017, the Nuclear Regulatory Commission (NRC) verbally authorized the use of Relief Request RR-4-11 to disposition of the subject piping at Virgil C. Summer Nuclear Station, Unit 1, until the end of the April 2017 refueling outage (RF23), or exceeding the temporary acceptance criteria of Code Case N-513-3 and the relief request, whichever occurs first. The NRC staff determined that the proposed alternative is technically justified and provides a reasonable assurance of the structural integrity of the affected piping. This safety evaluation documents the technical basis for the NRC's verbal authorization.

All other ASME Code requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable, including 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 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 w/enclosure: Distribution via Listserv

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TEMPORARY ACCEPTANCE OF DEGRADATION IN SERVICE WATER PIPING

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 January 13, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17017A172), 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.

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee submitted Relief Request RR-4-11 to temporary accept a pin hole leak in lieu of performing an ASME Code repair of the degraded service water (SW) system 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," with a slight modification.

On January 14, 2017 (ADAMS Accession No. ML17017A217), the Nuclear Regulatory Commission (NRC) verbally authorized the use of Relief Request RR-4-11 to disposition of the subject piping at VCSNS, Unit 1, until the end of the April 2017 refueling outage (RF23), or exceeding the temporary acceptance criteria of Code Case N-513-3 and the relief request, whichever occurs first. The NRC staff determined that the proposed alternative is technically justified and provides a reasonable assurance of the structural integrity of the affected piping. This safety evaluation documents the technical basis for the NRC's verbal authorization.

Enclosure

2.0 REGULATORY EVALUATION

Adherence to Section XI of the ASME Code is mandated by 10 CFR 50.55a(g)(4), which states, in part, that ASME Code Class 1, 2, and 3 components will meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI.

Pursuant to 10 CFR 50.55a(z) alternatives to requirements may be authorized by the NRC if the licensee demonstrates that: (1) the proposed alternatives provide an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

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 ASME Code Component Affected

The affected component is the ASME Code Class 3, 8-inch weld neck flange of the SW system. The component is fabricated with carbon steel SA-105.

3.2 Applicable Code Edition and Addenda

The ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 2007 Edition through 2008 Addenda.

3.3 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.

3.4 Reason for Request

On January 11, 2017, the licensee discovered a pin hole approximately 1.5 inches downstream of Diesel Generator Cooler 'A' SW Return Valve XVB03121A-SW. A mist was spraying onto an adjacent wall and running down the pipe at approximately 1 milliliter (ml) per minute. The licensee measured the affected pipe wall thickness using ultrasonic testing (UT).

The licensee stated that an ASME Code repair is a hardship without a compensating increase in the level of quality and safety because a Code repair would require a plant shutdown to replace the pipe/valve flange. The flange is located between valve XVB03121A-SW and the service water pond. The flange cannot be isolated from other portions of the service water system piping. 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.

3.4 Proposed Alternative and Basis for Use

In lieu of an ASME Code repair, the licensee proposed to use modified ASME Code Case N-513-3 to temporary accept the pin hole leak as discussed below.

Flaw Characterization

The licensee classified the degradation as a non-planar through wall flaw, and not a crack-type indication. The licensee noted that because of the wear mechanism, which has been identified as cavitation induced erosion, there is only a single identified flaw. The remaining area of the flange (other than the pin hole) has seen only nominal wall thinning based on the UT examination.

Structural Integrity

VCSNS, Unit 1, Technical Specification 4.0.5 states that the 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 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 x t)^0.5 where Ro is the outside radius and 't' is the wall thickness of the pipe. The licensee performed a flaw evaluation to accept the flaw using guidance from ASME Code Case N-513-3 and ASME Code, Section III, 2007 Edition through 2008 Addenda. The licensee's evaluation results show 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 0.02 inches within a diameter of 1.5 inch of the hole.

Flow Margin

The pin hole leak is located downstream of the 'A' Emergency Diesel Generator heat exchangers and downstream of the discharge valve XVB03121A-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 a fine mist which is less than 1 ml per 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 (psi). The SW pump is designed to supply 16,800 gpm of flow. A leak rate of 11.5 gpm from a 0.375 inch diameter hole would not have a significant effect on the performance of the pump. The licensee stated that a recent routine code check valve test on the SW 'A' Train measured the total system flow to be 12,953 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 system alignment. Therefore, there is a flow margin of approximately of 716 gpm (12,953 gpm – 12, 237 gpm). The licensee stated that a postulated leakage of 11.5 gpm would not adversely affect SW system flow margin.

The SW pond contains approximately 38.5E6 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 leak of 11.5 gpm would have a negligible affect the SW pond level.

Spray Concerns

The licensee stated that the current small stream of mist coming 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. 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 [pounds per square inch gauge] 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 XVB03121A-SW. The valve limit switches are only used for position indication because XVB03121A-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 XVB03121A-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 psi 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. The location of the pin hole leak is above the standing water level of the SW pond. Therefore, if the 'A' SW pump was secured, water from the SW pond would not back flow into the diesel building through the defect area.

Under normal operating conditions, the diesel generator building sump pumps have a 40 gpm capacity each. There are two redundant 100 percent 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. The diesel generator building sump pumps are not available during a loss of offsite power. The water from the spray will collect at the floor near the pipe and drain to a nearby floor drain which goes to the Emergency Diesel Generator Building sump which has pumps to remove the excess water.

Extent of Condition

The licensee will implement an augmented examination in accordance with Section 5 of 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 system is removed from service and the degraded flange is repaired.

3.5 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 April 8, 2017. Therefore, the duration of the proposed alternative

is approximately 4 months until repaired during the outage. The station is in its 4th 10-year interval effective from January 1, 2014, through and including December 31, 2023.

3.6 NRC Staff Evaluation

The NRC staff evaluated the proposed alternative based on the provisions of ASME Code Case N-513-3, and the 2007 edition through 2008 addenda of the ASME Code, Sections III and XI as follows:

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 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 flange portion of 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 unaffected wall thickness ranges from 0.317 inches to 0.348 inches. The lowest wall thickness of the affected area was measured to be about 0.085 inches. The NRC staff notes that the design pressure for the affected pipe and flange is 20 psi which is low.

The licensee noted that further degradation is acceptable as long as the average thickness of the remaining material outside the hole is greater than 0.02 inches within a diameter of 1.5 inch of the hole. Based on independent calculations, the NRC staff determines that with a low pressure of 20 psi, the minimum required wall thickness would be less than 0.02 inches. As reported by the licensee, the minimum measured thickness in the vicinity of the leaking pin hole was about 0.085 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 of the degradation that will exceed the licensee proposed acceptance criteria without being detected is remote. The NRC staff finds that there is a sufficient margin in terms of flaw size and leak rate with respect to the acceptable limits. Therefore, the NRC staff finds that the structural integrity of the subject flange will be maintained until the next refueling outage based on the flaw evaluation and periodic monitoring plan.

Flow Margin

The NRC staff notes that the pin hole occurs on the section of the service water 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 716 gpm exists. The NRC staff considers that a maximum allowable leak rate of 11.5 gpm would not challenge the flow margin of 716 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 the diesel building sump pump (40 gpm) will be able to remove the leakage. During a loss of offsite power when the diesel building sump pump cannot operate, the leakage can be drained to the emergency diesel generator building sump which has pumps to remove leaking water. Therefore, NRC staff concludes that flooding is not a concern in the diesel generator pump building as a result of the 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 of Code Case N-513-3.

Monitoring

The NRC staff finds that the licensee has satisfied the monitoring requirements of Code Case N-513-3 because the licensee will 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.

On the basis of above evaluation, the NRC concludes 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

The NRC staff concludes that the proposed alternative provides a reasonable assurance of structural integrity of the subject SW piping. The NRC staff concludes that complying with IWA-4000 of the ASME Code, Section XI, 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 authorizes the use of Relief Request RR-4-11 at VCSNS, Unit 1, until the end of the April 2017 refueling outage (RF23), or exceeding the temporary acceptance criteria of Code Case N-513-3 and the relief request, 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: John Tsao

Date: February 9, 2017

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1 – RELIEF FROM THE REQUIREMENTS OF THE ASME CODE REGARDING SERVICE WATER SYSTEM PIPING (CAC NO. MF9082)

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