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

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

REQUEST FOR ALTERNATIVE NO. 8

COUNTERBORING OF CLASS 1 PIPING, COMPONENTS, AND FITTINGS

WITH WELD END TRANSITIONS

TO THE COMBINED LICENSE NOS. NPF-91 AND NPF-92

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

GEORGIA POWER COMPANY

OGLETHORPE POWER CORPORATION

MEAG POWER SPVM, LLC

MEAG POWER SPVJ, LLC

MEAG POWER SPVP, LLC

CITY OF DALTON

VOGTLE ELECTRIC GENERATING PLANT UNITS 3 AND 4

DOCKET NOS. 52-025 AND 52-026 (CAC NO. 000463)

1.0 INTRODUCTION

By letter dated October 20, 2017 (U.S. Nuclear Regulatory Commission's (NRC) Agencywide Documents Access and Management System (ADAMS) Accession No. ML17293A352), as supplemented by letter dated February 1, 2018 (ADAMS Accession No. ML18032A643), Southern Nuclear Operating Company, Inc. (SNC acting on behalf of all the licensees), requested NRC approval of an alternative, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z), to the requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME) Code, Section III, Subparagraph NB-4250(c) for Vogtle Electric Generating Plant (VEGP) Units 3 and 4. The proposed alternative would allow SNC to use alternative counterbore configurations on weld joints that will not meet the counterbore length requirements in ASME Code, Section III, Subparagraph NB-4250(c) for all ASME Code Class 1 piping, components, and fittings with weld end transitions.

Enclosure

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(c)(1) require components that are part of the reactor coolant pressure boundary must meet the requirements for Class 1 components in Section III of the ASME Code, except as provided in paragraphs (c)(2) through (4) of 10 CFR 50.55a.

Section 50.55a(g)(2)(i) of 10 CFR require that components (including supports) that are classified as ASME Code Class 1 must be designed and be provided with the access necessary to perform the required preservice and inservice examinations set forth in the editions and addenda of Section III or Section XI of the ASME Code incorporated by reference in paragraph (a)(1) of 10 CFR 50.55a.

Per 10 CFR 50.55a(z), alternatives to the requirements of paragraphs (b) through (h) of 10 CFR 50.55a or portions thereof may be used when authorized by the Director, Office of New Reactors. In proposing alternatives, the licensee must demonstrate that: (1) the proposed alternative would provide an acceptable level of quality and safety; or (2) compliance would result in hardship or unusual difficulty without a compensating increase in quality and safety.

3.0 TECHNICAL EVALUATION

3.1 SNC's Alternative

The components affected by this request are all ASME Code Class 1 piping, components, and fittings with weld end transitions at VEGP Units 3 and 4.

The ASME Code of Record for the construction of VEGP Units 3 and 4, is the 1998 Edition, including the 2000 Addenda, of ASME Code, Section III. The applicable ASME Code requirements are as follows.

ASME Code, Section III, Subsection NB-4250, "Welding End Transitions – Maximum Envelope," states that:

> The welding ends of items shall provide a gradual change in thickness from the item to the adjoining item. Any welding end transition which lies entirely within the envelope shown in Figure NB-4250-1 is acceptable provided:
>
> (a) the wall thickness in the transition region is not less than the minimum wall thickness of the adjoining pipe;
>
> (b) sharp reentrant angles and abrupt changes in slope in the transition region are avoided. When the included angle between any two adjoining surfaces of a taper transition is less than 150 deg., the intersection or corner (except for the weld reinforcement) shall be provided with a radius of at least $0.05t_{min}$ [where t_{min} is the minimum wall thickness]; and
>
> (c) if the weld is subject to preservice inspection, the length of the counterbore shall be $2t_{min}$ for pipe and t_{min} for components and fittings, as shown in Figure NB-4250-2 or Figure NB-4250-3.

ASME Code, Section III, Subsection NB-3630, “Piping Design and Analysis Criteria,” states that:

(a) The design and analysis of piping when subjected to the individual or combined effects of the loadings defined in NB-3100 and NB-3620 may be performed in accordance with this Subarticle. Design for pressure loading shall be performed in accordance with the rules of NB-3640. Standard piping products that meet the requirements of ANSI B16.9 or NB-3649 satisfy the requirements of NB-3640, and only the analysis required by NB-3650 need be performed.

(b) Within a given piping system, the stress and fatigue analysis shall be performed in accordance with one of the methods given in NB-3650, NB-3200, or Appendix II. Stress indices are given in NB-3680 for standard piping products, for some fabricated joints, and for some fabricated piping products. Some piping products designed for pressure by applying the rules of NB-3649 may not be listed in NB-3680. For such products, the designer shall determine the stress indices as required in NB-3650.

(c) When a design does not satisfy the requirements of NB-3640 and NB-3650, the more detailed alternative analysis given in NB-3200 or the experimental stress analysis of Appendix II may be used to obtain stress values for comparison with the criteria of NB-3200.

ASME Code, Section III, Subsubsection NB-3213.2 defines Gross Structural Discontinuity as “a geometric or material discontinuity which affects the stress or strain distribution through the entire wall thickness of the pressure retaining member. Gross discontinuity type stresses are those portions of the actual stress distributions that produce net bending and membrane force resultants when integrated through the wall thickness. Examples of gross structural discontinuities are head-to-shell and flange-to-shell junctions, nozzles (NB-3331), and junctions between shells of different diameters or thicknesses.”

ASME Code, Section III, Subsubsection NB-3213.3 defines Local Structural Discontinuity as “a geometric or material discontinuity which affects the stress or strain distribution through a fractional part of the wall thickness. The stress distribution associated with a local discontinuity causes only very localized types of deformation or strain and has no significant effect on the shell type discontinuity deformations. Examples are small fillet radii, small attachments, and partial penetration welds.”

ASME Code, Section III, Subsection NCA-3360, “Certification of the Construction Specification, Design Drawings, and Design Report,” states that:

(a) The Construction Specification, Design Drawings, and Design Report shall be reviewed and certified to be correct and in accordance with the Design Specification and this Section by one or more Registered Professional Engineers competent in the field of design of concrete components and qualified in accordance with the requirements of Appendix XXIII of Section III Appendices. These Registered Professional Engineers are not required to be independent of the organization designing the component. Distribution of Construction Specification, Design Drawings, and the Design Report is shown in Table NCA-3200-1.

(b) In order for the Designer to certify the Construction Specification and Design Drawings, it is necessary that the Design Specification has been certified. For the Constructor or Fabricator to do work in accordance with Construction Specifications and Design Drawings, it is necessary that these documents have been certified.

ASME Code, Section III, Subsection NCA-3370, "Revision of Design Drawings and Construction Specification," states that:

> Design Documents issued for use in construction shall be revised to reflect any change in the Design. Changes to Design Documents shall be reviewed and certified in accordance with NCA-3360.

SNC proposed to use alternative counterbore configurations on weld joints for all ASME Code Class 1 piping, components, and fittings with weld end transitions. SNC stated that alternative counterbore configurations on weld joints will meet the configuration requirements of ASME Code, Section III, Figure NB-4250-1; and will be at or above the minimum wall thickness required by ASME Code, Section III. SNC further stated that alternative counterbore configurations on weld joints will ensure that the required preservice and inservice examinations can be performed on essentially 100 percent of the required examination volume. SNC stated that a description of alternative counterbore configurations on weld joints will be documented in the VEGP Units 3 and 4, Design Specification. SNC also stated that use of alternative counterbore configurations on weld joints will be documented in the applicable VEGP Units 3 and 4, N-5 Data Reports.

SNC stated that the requirements of ASME Code, Section III, Subparagraph NB-4250(c) were implemented to ensure that ASME Code Class 1 weld joints can be inspected after welding activities, and that counterboring ensures a flat surface that ensures inspectability of the weld joint. SNC stated that there are situations where counterbores meeting ASME Code, Section III, Subparagraph NB-4250(c) encroach on the minimum wall thickness required by ASME Code, Section III (e.g., in elbows); and that there are situations where it is possible to adequately perform the required preservice and inservice examinations without meeting the counterboring requirements in Subparagraph NB-4250(c). SNC further stated that counterbores meeting ASME Code, Section III, Subparagraph NB-4250(c) may reduce safety margins by reducing the pressure boundary thickness. SNC referenced a plant specific case at another domestic plant that was under construction related to a weld at an elbow. SNC stated that, for the specific case, a counterbore in accordance with ASME Code, Section III, Subparagraph NB-4250(c) would have challenged the minimum wall thickness at the elbow transition, and that a shorter counterbore length would have eliminated the challenge to the minimum wall thickness at the elbow.

SNC further stated that:

- Alternative counterbore configurations on weld joints will meet the configuration requirements of ASME Code, Section III, Figure NB-4250-1. In addition, SNC stated that alternative counterbore configurations on weld joints will be at or above the minimum wall thickness required by ASME Code, Section III.

- Alternative counterbore configurations on weld joints will ensure that the required preservice and inservice examinations can be performed on essentially 100 percent of the required examination volume. SNC further stated that alternative counterbore configurations on weld joints will be supported by an inspection evaluation that concludes it is inspectable.

- The VEGP Units 3 and 4, Design Specification will describe the weld joint where the alternate counterbore configuration is used and the use of the alternative counterbore configuration will be documented in the applicable VEGP Units 3 and 4, N-5 Data Reports.

- The use of alternative counterbore configurations on weld joints for all ASME Code Class 1 piping, components, and fittings with weld end transitions provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1).

3.2 NRC Staff Evaluation

Section 50.55a of 10 CFR requires that components of nuclear power plants meet the requirements of the ASME Code, except where alternatives have been authorized by the Commission pursuant to 10 CFR 50.55a(z). Pursuant to 10 CFR 50.55a(z)(1), SNC requested approval to use alternative counterbore configurations on weld joints for all ASME Code Class 1 piping, components, and fittings with weld end transitions. ASME Code Class 1 piping, components, and fittings with weld end transitions are subject to preservice inspection. Therefore, if the weld end transition includes a counterbore, the counterbore must meet ASME Code, Section III, Subparagraph NB-4250(c), which requires a counterbore length of $2t_{min}$ for pipe and t_{min} for components and fittings (where t_{min} is the minimum wall thickness).

The counterbore length requirements in Subparagraph NB-4250(c) were added in the 1997 Addendum of ASME Code, Section III to ensure that ASME Code Class 1 weld joints are designed to be inspectable in order to meet the preservice and inservice examination requirements in the ASME Code. The NRC staff understands that counterboring in accordance with ASME Code, Section III, Subparagraph NB-4250(c) can encroach on the minimum wall thickness in elbows; and that it may be possible to perform the required inservice and preservice examinations on weld joints using counterbore configurations different from those required in ASME Code, Section III, Subparagraph NB-4250(c).

SNC requested approval to use alternative counterbore configurations on weld joints for all ASME Code Class 1 piping, components, and fittings with weld end transitions as a contingency because of a plant specific construction issue at another construction site, although at the time of the request, no specific locations at VEGP Units 3 or 4, had been identified where alternative counterbore configurations on weld joints would need to be used. SNC stated that alternative counterbore configurations include counterbores shorter than the required lengths in ASME Code, Section III, Subparagraph NB-4250(c).

SNC stated that alternative counterbore configurations on weld joints will meet the configuration requirements of ASME Code, Section III, Figure NB-4250-1. The NRC staff finds this acceptable because ASME Code, Section III, Subsection 4250 states that any weld end transition which lies entirely within the envelope shown in Figure NB-4250-1 is acceptable provided that Subparagraphs NB-4250(a), (b), and (c) are met. SNC's alternative request only proposes an alternative to ASME Code, Section III, Subparagraph NB-4250(c), therefore, alternative counterbore configurations on weld joints are required to meet ASME Code, Section III, Subparagraphs NB-4250(a) and (b). As stated previously, the counterbore is provided to ensure the welds are inspectable in order to meet the required preservice and inservice examinations can be performed on essentially 100 percent of the required examination volume. SNC further stated that alternative counterbore configurations on weld joints will be supported by an inspection evaluation that concludes it is inspectable. The NRC staff finds this acceptable because the preservice and inservice examinations specified in the ASME Code, and required by 10 CFR 50.55a, will be performed on essentially 100 percent of the required examination volume for alternative counterbore configurations on weld joints. The NRC staff notes that ASME Code, Section XI, SubArticle IWA-2200, "Examination Methods," is still applicable and states that: "Essentially 100 percent coverage is achieved when the applicable examination coverage is greater than 90 percent; however, in no case shall the examination be terminated when greater than 90 percent coverage is achieved, if additional coverage of the required examination surface or volume is practical."

SNC stated that alternative counterbore configurations on weld joints will be at or above the minimum wall thickness required by ASME Code, Section III. The NRC staff finds this acceptable because having alternative counterbore configurations on weld joints at or above the minimum wall thickness required by ASME Code, Section III maintains structural integrity of the weld joints.

SNC stated that no evaluations have been performed to determine the effect the alternative counterbore configurations on weld joints have on the stress analysis since the length of the required counterbore in ASME Code, Section III, Subparagraph NB-4250(c) does not impact the structural integrity piping evaluation. SNC stated that stress analyses for the Advanced Passive 1000 (AP1000) piping and components are based on satisfying minimum wall thickness required by the ASME Code. Updated Final Safety Analysis Report states that the fatigue analyses on AP1000 weld joints were performed in accordance with ASME Code, Section III, SubArticle NB-3600. SNC concluded that alternate counterbore configurations on weld joints will not result in any impact to piping stress analysis because alternative counterbore configurations on weld joints will be at or above the minimum wall thickness required by ASME Code, Section III. The NRC staff reviewed the alternative counterbore configurations on weld joints, specifically, shorter length counterbore, and finds that the taper transition of shorter length counterbores has a minimal effect on the fatigue analysis and that the fatigue analyses on AP1000 weld joints were performed in accordance with ASME Code, Section III, SubArticle NB-3600. Therefore, the NRC staff finds this acceptable since the fatigue analyses on AP1000 weld joints were performed in accordance with ASME Code, Section III, SubArticle NB-3600 and the alternative counterbore configurations on weld joints will not result in a significant effect to piping stress analysis.

SNC stated that the VEGP Units 3 and 4, Design Specification will describe the weld joint where an alternative counterbore configuration is used and the use of the alternative counterbore configuration on weld joints will be documented in the applicable VEGP Units 3 and 4, N-5 Data Reports. The NRC staff finds that alternative counterbore configurations on weld joints will be documented appropriately because ASME Code, Section III, Subsection NCA-3370 requires that design documents issued for use in construction be revised to reflect any change in the design and that changes to design documents be reviewed and certified in accordance with ASME Code, Section III, Subsection NCA-3360.

The NRC staff reviewed the information provided and finds that SNC has demonstrated that the proposed alternative provides an acceptable level of quality and safety because the alternative counterbore configurations on weld joints will:

1. Meet the configuration requirements in ASME Code, Section III, Figure NB-4250-1;

2. Be at or above the minimum wall thickness required by ASME Code, Section III;

3. Result in less material being removed from piping, components, and fittings which results in lower actual stress levels in the piping, components, and fittings.

4. Ensure that the required preservice and inservice examinations can be performed on essentially 100 percent of the required examination volume, which satisfies the intent for why Subparagraph NB-4250(c) was added to the ASME Code; and

5. Be appropriately documented in the VEGP Units 3 and 4, Design Specification and applicable N-5 Data Reports.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the proposed alternative to the requirements of the 1998 Edition, including the 2000 Addenda, of ASME Code, Section III, Subparagraph NB-4250(c) provides an acceptable 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)(1), and is in compliance with the ASME Code requirements. Therefore, the NRC staff authorizes PSI-ALT-08 at VEGP Units 3 and 4, for the life of the facility. All other requirements of ASME Code, Sections III and XI, and 10 CFR 50.55a, for which an alternative has not been specifically requested and authorized, remain applicable.

5.0 REFERENCES

1. VEGP 3&4-PSI-ALT-08, “Request for Alternative: Counterboring of Class 1 Piping, Components, and Fittings with Weld End Transitions,” October 20, 2017 (ADAMS Accession No. ML17293A352).

2. “Request for Additional Information ALT-08-01,” January 9, 2018 (ADAMS Accession No. ML18009A270).

3. VEGP 3&4-PSI-ALT-08S1, “Response to Request for Additional Information Regarding Counterboring of Class 1 Piping, Components, and Fittings with Weld end Transitions,” February 1, 2018 (ADAMS Accession No. ML18032A643).

4. February 15, 2018, Public Meeting Summary (ADAMS Accession No. ML18059A909).