SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 21

TO THE COMBINED LICENSE NO. NFP-93

AND LICENSE NO. NFP-94

SOUTH CAROLINA ELECTRIC AND GAS

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

VIRGIL C. SUMMER NUCLEAR STATION UNITS 2 AND 3

DOCKET NOS. 52-027 AND 52-028

1.0 INTRODUCTION

By letter dated August 5, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14233A125) and revised by a letter dated August 28, 2014 (ADAMS Accession No. ML14245A601), South Carolina Electric & Gas Company (SCE&G/licensee) requested that the U.S. Nuclear Regulatory Commission (NRC) amend the combined licenses (COLs) for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, COL Numbers NPF-93 and NPF-94, respectively.

The proposed changes would depart from plant-specific Design Control Document (DCD) Tier 2* and associated Tier 2 material incorporated into the updated final safety analysis report (UFSAR) by revising the design changes related to the reinforced concrete (RC) to steel plate composite construction (SC) connections. The proposed changes are:

(1) Shift the design connections between the Auxiliary (Aux) Building, which is a reinforced concrete (RC) structure, and the Shield Building (SB), which is a steel plate concrete-filled composite (SC) structure approximately 6 feet from Azimuth 177° to 183° because of interferences with the reinforcement in the 5-foot-6-inch wall of the Aux Building and the fuel transfer canal.

(2) Modify the location of the vertical portion of the RC to SC connection near the Aux Building wall (Wall Q) north of the SB because of the proximity of the main steam (MS) line and the feedwater (FW) line penetrations.

(3) Revise the RC to SC connection between the SB and the Aux Building roof and wall in the critical section; and

(4) Revise applicable sections of the licensing basis document as a result of the proposed design changes.

In addition, as a result of the design changes to the connections mentioned above, the licensee proposes: 1) to increase the faceplates thickness of the SB wall module in some connection locations to facilitate the welding of heavy attachments and connections to the faceplates; 2) to design structural sleeves to replace the tie bars and studs in local areas; and to develop the capacity of the tie bars that have been displaced as a result of the penetrations through the SB wall panels; and 3) to reduce the width of the support plates that are connected to the vertical deformed bars anchored to the concrete below the RC to SC connection module as a result of a slight shift of the bars connected to the module.

By a letter dated November 3, 2014 (ADAMS Accession No. ML14307B277), the licensee provided additional information that clarified the application. This additional information is still within the scope of the application as originally noticed and did not change the staff's original proposed "no significant hazards consideration," determination published in the *Federal Register* on September 30, 2014 (79 FR 58824).

2.0 REGULATORY EVALUATION

Appendix D, "Design Certification Rule for the AP1000 Design," of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Section VIII.B.6 requires NRC approval for departures from Tier 2* information. Because the proposed amendment request involves changes to Tier 2* information NRC approval is required before making the Tier 2* changes addressed in this departure. 10 CFR Part 52, Appendix D, Section VIII.B.5.a requires prior NRC approval for Tier 2 departures that involve changes to Tier 2* information. The proposed changes affect Tier 2* Tables, text and figures.

The proposed changes to the design details of the RC to SC connections are required to comply with applicable and designated portions of American Concrete Institute (ACI), "Code Requirements for Nuclear Safety Related Structures," ACI-349-01; and American Institute of Steel Construction (AISC), "Specification for the Design, Fabrication and Erection of Steel Safety Related Structures for Nuclear Facilities," AISC-N690-1994; and supplementary requirements in Section 3.8.4.5, "Structural Criteria," of the UFSAR.

The NRC staff considered the following regulatory requirements in reviewing the license amendment request (LAR) that included the proposed UFSAR changes.

10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 1, "Quality Standards and Records," requires that structures, systems, and components (SSCs) important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

10 CFR Part 50, Appendix A, GDC 2, “Design Bases for Protection against Natural Phenomena,” requires that structures, systems, and components (SSCs) important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions.

10 CFR Part 50, Appendix A, GDC 4, “Environmental and Dynamic Effects Design Bases,” requires that structures, systems and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing and postulated accidents, including loss-of-cooling accidents.

10 CFR Part 50, Appendix S, “Earthquake Engineering Criteria for Nuclear Power Plants,” requires that nuclear power plants shall be designed so that, if safe-shutdown earthquake (SSE) ground motion occurs, certain structures, systems and components (SSCs) will remain functional and within applicable stress, strain, and deformation limits. The required safety functions of structures, systems, and components must be assured during and after the vibratory ground motion associated with the SSE ground motion through design, testing, or qualification methods.

In performing its technical review, the NRC staff evaluated the LAR for compliance with regulations, applicable regulatory codes, guides, and standards, and approved precedents. In addition, the NRC staff reviewed the licensee’s current licensing and design basis, as described in its UFSAR.

3.0 TECHNICAL EVALUATION

To perform the technical evaluation, the NRC staff considered UFSAR Sections 3.7, “Seismic Design,” and 3.8, “Design of Category I Structures.” The staff also examined the portions of NUREG–1793, Supplement 2, “Final Safety Evaluation Report Related to Certification of the AP1000 Standard Plant Design” (ADAMS Accession No. ML112061231), and “Final Safety Evaluation Report for the Virgil C. Summer Nuclear Station,” (ADAMS Accession No. ML110450305) documenting the staff’s technical evaluation of those aspects of the AP1000 Design DCD and VCSNS COL application, respectively. The staff reviewed the LAR to evaluate the impact of the requested UFSAR changes on the design changes to the RC/SC Connections.

In the LAR, the licensee proposed to depart from the UFSAR Tier 2* information by requesting to 1) shift the design connections between the Aux Building and the Shield Building approximately 6 feet from Azimuth 177° to 183° because of interferences with the reinforcement in the 5-foot-6-inch wall of the Aux Building and the fuel transfer canal; 2) modify the vertical portion of the RC/SC connection in the location near the Aux Building wall (Wall Q) north of the SB because of the proximity of the MS line and the feedwater (FW) line penetrations; 3) revise the RC to SC connections between the SB and the Aux Building roof and wall in the critical section; and 4) revise applicable sections of the licensing basis document as a result of the proposed design changes.

The SB is a seismic Category I structure that surrounds the containment vessel. It shares a common basemat with the Containment Building and the Aux Building. The SB uses concrete-filled steel plate construction as well as reinforced concrete for a portion of the wall. The faceplates of the SC modules are considered as the reinforcing steel, bonded to the concrete by headed studs and tie bars. The overall configuration of the SB is established from functional

requirements related to radiation shielding, missile barrier, passive component cooling, and natural disasters such as tornadoes and seismic events.

The Aux Building is a seismic Category I reinforced concrete and structural steel structure. It is a C-shaped section of the nuclear island that wraps around approximately 50 percent of the circumference of the SB. The floor slabs and the structural walls are structurally connected to the SB. The function of the Aux Building is to provide protection and separation for the seismic Category I mechanical and electrical equipment located outside the containment; and to provide protection for the safety-related equipment against the consequences of postulated internal or external events.

A portion of the SB wall interfacing with the Aux Building is constructed of reinforced concrete. The design and construction of the RC to SC connection requires the use of both ACI 349-01 and AISC N690-1994 to address the different components of the connections, including rebar and structural steel components.

During the review, the staff applied the guidance of the Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition (NUREG-0800) Section 3.8, as well as relevant regulatory guides, with references to related industry standards. The staff's technical evaluation of the LAR focused on verifying whether the proposed changes are consistent with applicable codes and standards, and is carried out using acceptable analysis and design methods.

For determining the adequacy of the proposed UFSAR changes, the staff considered the potential effects of the RC to SC connection changes on the safety functions of the SB and the Aux Building structures to be constructed at the VCSNS site; the design and analysis procedures; the stiffness of the structure; and the local and global response of the overall structure.

The staff evaluated the design criteria for the RC to SC connections outlined in Subsections 3.8.3.5.3, "Structural Wall Modules," and 3.8.4.5.5.6, "Design of Connections," of the AP1000 DCD and the VCSNS UFSAR, which referenced the AP1000 TR APP-GW-GLR-602, "AP1000 Shield Building Design Details for Select Wall and RC/SC Connections," (TR-GLR-602-Proprietary). The staff also reviewed applicable and designated portions of ACI 349-01 and AISC N690-1994 for the RC to SC connections; and the Tier 2* information in the UFSAR related to the RC to SC connections, i.e., Appendix 3H, "Auxiliary and Shield Building Critical Sections." Below is a summary of the staff's technical evaluation.

RC to SC Connection Shift

In Enclosure 1 (page 4 of 24) the LAR, the licensee stated that a portion of the RC to SC connections between the SB wall and the western wall (Wall N) of the Aux Building will be shifted by approximately 6 feet from Azimuth 177° to 183° because the connection interferes with the reinforcement in the 5-foot-6-inch northern wall and the fuel transfer canal (UFSAR Figure 3H.5-16, Sheet 2, "Surface Plates on Cylindrical Section," and Figure 6, "Rollout View Detailing Nominal Spacing of Tie Bars," of (TR-GLR-602- Proprietary). The licensee noted in the LAR that shifting the location of the RC to SC connections does not change the pertinent details of the connection or the sizes of the deformed bars, faceplates, support plates, endplates, and mechanical connectors. The licensee also stated that the newly formed RC wall segment as a result to the shift is designed and analyzed in accordance with ACI 349-01.

In reviewing the LAR, including Figure 3H.5-16, Sheet 2 of Appendix 3H, “Auxiliary and Shield Building Critical Sections,” of the UFSAR; the “Proposed Changes to the Updated Final Safety Analysis Report,” and Figure 6 in the revisions to TR-GLR-602, the staff noticed that because of the shift, a portion of the SB wall that was constructed of SC construction is now converted to RC construction. The newly formed RC wall is 3-feet thick, has a height of approximately 46 inches and a width of 6 feet. This change from SC to RC encompasses a relatively small area when compared to the overall structure of the SB.

The staff focused its review on the potential effects of the shift on the design commitments and the analysis results, the stiffness of the structure, and the local and global response of the overall structure. The newly formed RC wall is designed and analyzed in accordance with ACI 349-01, which is consistent with the existing SB RC wall design commitment. The material properties and proportions of the newly formed wall are essentially the same as the properties and proportions of the existing portion of SB RC wall. Therefore, there will be minimal change in the overall weight and stiffness of the structure and as such, there will be minimal impact of the analysis results. Accordingly, the staff concludes that, while shifting the RC to SC connection location creates an addition to the existing portion of the SB RC wall, the licensee is not departing from the methods of design and analysis referenced in the AP1000 DCD.

In Enclosure 1 (Page 18 of 24) of the LAR, the last but one paragraph states, in part, “The effect of shifting the location of the RC to SC connections in the SB wall has been considered in the calculation and analysis of the SB and other nuclear island structures,” and that, “Shifting the location of the RC to SC connections in the SB wall does not change the local and global response of the SB or the Aux Building. The change in demand for the connection zone demand is small and results in no impact on the RC to SC connection design. The demand to capacity ratio is minimally affected in the zone changed to RC.”

The staff reviewed Table 3H.5-14, Sheets 1 through 3, “Design Summary of Enhanced Shield Building Cylindrical Wall Load Combinations, and Comparison to Acceptance Criteria,” at elevation 180 feet near fuel handling building roof; at elevation 175 feet near intersection with Wall 7.3; and at grade elevation on the west side, respectively. The tables showed the demands for the different load combinations as a result of the design changes. The results in the tables indicate that the demand changes are relatively small and do not affect the local and global behavior of the SB structure. As indicated above, this minor change in the demands is expected because of the minimal change in wall weight and stiffness.

The staff concludes that the proposed change to shift the RC to SC connection from Azimuth 177° to 183° is acceptable because it did not impact the safety design function of the SB wall; the design of the newly formed wall is carried out according to ACI 349-01, which is consistent with the current approved design method in the certified AP1000 design; and the relocation of the RC to SC connection change did not change the local and global response of the SB because the change in weight and stiffness is minor.

Modified RC to SC Connection

In Enclosure 1(Page 4 of 24) of the LAR, the licensee stated that the vertical portion of the RC to SC connection in the location near the Aux Building wall (Wall Q) north of the SB will be modified because of its proximity to the MS line and the FW line penetrations. The licensee noted in the LAR that modifying the vertical portion of the connection between Azimuth 337° and 352° as shown in Figures 6 of TR-GLR-602 and 3H.5-16 Sheet 1, “Surface Plate on Cylindrical Section,” of the UFSAR, provides a direct mechanical connection between the hoop

reinforcement in the RC and the SC SB wall module. The licensee stated that with the RC portion of the SB wall in its original location, the MS line and the FW line penetrations would displace or interrupt many of the hoop bars and that the reinforcement displaced by the MS and the FW line penetrations would have to be formed around those same penetrations, which would result in highly congested reinforcement penetration areas.

In reviewing the LAR, including Figure 3H.5-16, Sheet 1 of Appendix 3H, "Auxiliary and Shield Building Critical Sections," of the UFSAR; the "Proposed Changes to the Updated Final Safety Analysis Report (Enclosure 6 — Security-Related and Proprietary Information)," and Figure 6 in the revisions to TR-GLR-602 (Proprietary) the staff noticed that the RC to SC connection portion of the SB wall and the Aux Building near the MS line and the FW line penetrations is now designed as a steel weldment assembly because of the complexity of the reinforcement around the penetrations. In Enclosure 7 (Proprietary), the licensee stated that the welded steel assembly is designed according to the requirements in AISC N690-1994 and that it carries the load from a vertical connection plate on one side of the penetration to the SB wall faceplates on the other side. Additionally, the licensee noted that as a result of displacements of the tie bars and studs in the local area caused by the MS line and the FW line penetrations, a structural sleeve will be used to replace the penetrations through the wall panels and connection modules. The structural steel is designed to replace the tie bar area and develop the capacity of the tie bars displaced.

The staff focused its review on the potential effects of the modified RC to SC connections on the design and analysis methods, and the local and global response of the overall structure as a result of the revised RC to SC connections surrounding the penetrations. The modified RC to SC connection assembly in the regions of the MS line and the FW line penetrations is designed as a steel weldment, by joining two different metal pieces into one assembly.

The staff noted that in the design and analyses of the proposed revised penetration design, the licensee remains committed to the design and analyses approaches in the UFSAR. Specifically, the applicable portions of AISC N690-1994 and ACI 349-01 requirements that are used in the current design of the RC to SC connection also apply to the design of the steel weldment assembly. Additionally, the design of the steel welded assembly will include structural penetration sleeve that satisfies the design criteria and requirements specified in Subsections 3.8.3.5.3, "Structural Wall Modules," and 3.8.4.5.5, "Shield Building Structural Wall Modules," of the UFSAR.

The area of the steel welded connection assembly shown on Figure 3H.5-16 of the proposed changes to the UFSAR Enclosure 6, page 13 of 22 (Security-Related and Proprietary information), is relatively small in comparison to the overall structure. Based on the relatively small area of the steel welded connection assembly; the licensee's commitment to the design and analysis of the steel weldment being consistent with the current commitment and criteria in the UFSAR; the licensee's commitment to use the applicable portions of the AISC N690-1994 code; and the licensee's commitment to design the welded connection assembly to 125 percent of the specified yield strength of the adjacent rebar consistent with ACI 349 Chapter 21 provisions, the staff finds the proposed design change to have a minor impact on the local and global behavior of the overall structure and therefore be acceptable.

Revised Auxiliary Building RC roof to Shield Building SC wall connection

In Enclosure 1 (Page 5 of 24) of the LAR, the licensee stated that the RC to SC connection between the Aux Building roof and the SB wall will be revised to reduce the rebar congestion in the roof and simplifies the fabrication and construction of these structures. Additionally, the revised RC to SC connection assembly will be welded and mechanically connected in order to eliminate the need for separate reinforcement bars connecting the SB wall to the roof of the Aux Building; and provides a direct connection of the Aux Building roof reinforcement to the SB SC wall.

On page 5 of Enclosure 1, the licensee stated, "The details of connections between the auxiliary building roof and the shield building wall vary because of loads on the connection and the orientation of the wall to the roof reinforcement arrangement. Connection or ring plates, which provide connections to the top and bottom roof reinforcement, are welded to built-up connection plates on the outer faceplates for a standard shield building wall module. The added faceplate thickness is provided on the inside surface of the faceplates and does not change the thickness of the shield building wall."

The staff reviewed the detail information presented in the paragraph quoted above and noted that the licensee did not provide sufficient information related to the added face plate thickness on the inside surface of the SB wall. However, in Enclosure 8 of the LAR (ADAMS Accession No. ML14307B277), the licensee's revision states that the thicker faceplates are used because the local stresses in the vicinity of the connections would otherwise require stiffeners or other reinforcement of the faceplate; it facilitates the heavy welding of the backing and connection plates to the faceplate; and extending the area of the face plate over the entire width or height of the SB wall module would optimize the fabrication of the module. The licensee further stated that the evaluation of the SB wall in the areas with thicker faceplates includes consideration of the reduction of the concrete thickness. In its analysis, licensee finds that the reduction in concrete thickness does not affect the capacity of the concrete to carry compression, nor does it reduce any additional concrete failure modes that were not considered in the analysis. The licensee stated that the analysis was completed with an updated structural model that includes the changes that impact the configuration, mass, and stiffness of the SB structure.

The licensee further stated that the revised RC to SC design connection, including the design detail variations, of the Aux Building roof to the SB wall module is in compliance with applicable portion of AISC N690-1994 and ACI 349-01 requirements and the supplemental requirements prescribed in Subsection 3.8.4.5.5.6, "Design of Connections," of the UFSAR. The licensee also stated that the roof reinforcement bars are welded to the connection plates, or to plates welded to the connection plates, using a flare bevel weld in conformance with American Welding Society (AWS), Structural Welding Code, AWS D1.4. Further, the licensee commits to design the welded connection assembly to 125 percent of the specified yield strength of the reinforcement bars, in accordance with ACI 349-01.

Staff performed the review of the mark-up copies of the UFSAR, and the AP1000 License Report, TR-GLR-602 (Proprietary), and concludes that the proposed change to revise the RC to SC connection between the SB wall and the Aux Building roof is a conservative approach that is consistent with Section 3.8 of the UFSAR and does not impact the design connection requirements prescribed in applicable portions of the AISC N690-1994 and the ACI 349-01 codes that are referenced in the UFSAR and therefore acceptable. Additionally, the staff finds the proposed change to revise the connection to be acceptable because the licensee was able to demonstrate, with an updated structural model that includes the changes that impact the

configuration, mass, and stiffness of the SB structure, that the local and global response of the structure as a result of the revised connection to have a minor impact.

Licensing Basis Changes

In Enclosure 1 (pages 8 through 13) of the LAR, the licensee proposed the licensing basis change descriptions to the UFSAR and the AP1000 Shield Building Design Details for Select Wall and RC/SC Connections Report, TR-GLR-602 (Proprietary). The staff evaluated the proposed changes against applicable and designated portions of ACI 349-01 and AISC N690-1994; Revision 2 of the VCSNS UFSAR, dated June 26, 2014; and TR-GLR-602 (Proprietary).

The staff reviewed the LAR, along with the referenced enclosures, and observed that the licensee did not adequately address the required information related to the use of the term 'typical' verses 'examples' or 'representative.' The use of the word 'typical' in the UFSAR indicates the specific construction design that will be used. In several places in the LAR 'typical' is being replaced in Tier 2* documents by 'examples' or 'representative,' which may imply alternative design can be used. The staff had the following concerns related to the discrepancy associated with the description of certain figures in the enclosures:

(1) On page 5 of 24, of Enclosure 1, the last paragraph states that, "An example of the connection is shown in the revised Figure 7 of APP-GW-GLR-602."

(2) On page 7 of 24, of Enclosure 1, the 2nd paragraph states that, "Figure 7 of APP-GW-GLR-602 showing an example of the connection of the auxiliary building roof to the shield building wall."

(3) On page 17 of 21, of Enclosure 6, the 3rd paragraph states that in Section 4 of the Technical Report (APP-GW-GLR-602), "Figure 7 shows representative details for the connections between the auxiliary building roof and the shield building wall."

(4) On page 3 of 21, of Enclosure 6, the last paragraph states that, "Figure 3H.5-7 also shows examples of the connections between the auxiliary building wall and the shield building SC wall modules."

(5) On page 15 of 21, of Enclosure 6, the 4th paragraph states that in Section 4, "Technical Background," of Enclosure 7, "Figure 1 shows the representative details for the vertical RC/SC connection zone which are based on Figure 4.1-2 of the enhanced SB design report [APP-1200-S3R-003]," Reference 1 of the TR-GLR-602 report, which is referenced in the UFSAR (Reference 57).

However, in the revised Enclosure 8 of the LAR the licensee states that the terms 'representative,' and 'example,' will be replaced with the term 'typical.' The licensee also provided mark-up copies of the UFSAR and the TR-GLR-602 report with the updated changes. Based on the information provided by the licensee, the staff finds the response to the staff concern related to the description of the figures mentioned above to be acceptable because the term 'typical' will be similar in concept to the "typical" arrangements of the RC/SC connections; and most importantly, licensee remains committed to performing the design of the RC/SC connections in accordance with applicable portions of ACI 349-01 and AISC N690-1994. Accordingly, the issue is resolved.

On page 7 of 24 of Enclosure 1, the licensee stated that, “The roof details provided for Region A and Region B are proposed to be removed since information for this type of roof or floor is provided in Subsection 3H.5.2.2 and Figure 3H.5-6. Also, the information for Region B is duplicated in Section A of Figure 3H.5-7.” The staff reviewed the figures mentioned above and noted that the sizing and spacing of the reinforcement bars, including the region shown on Figure 3H.5-6, are different than the information shown on Figure 3H.5-7. The staff had a concern for deleting the reinforcement floor detail in Regions A and B on Figure 3H.5-7 of the UFSAR.

However, in the revision Enclosure 8 of the LAR, the licensee states that the sizing and spacing of the reinforcement for the roof shown on Figure 3H.5-7 was not intended to be changed to the size and spacing shown in Figure 3H.5-6. The licensee agreed to reinstate the Reinforcement Floor Detail figure for Region A and proceeded to delete the Region B figure because the detail information is duplicated in Section A on Figure 3H.5-7 of the UFSAR. The licensee also provided a mark-up copy of the UFSAR with the updated changes. Based on the information provided by the licensee, the staff concludes that the licensee adequately addressed the staff concern related to the deletion of certain figures shown on Figure 3H.5-7 of the UFSAR.

In addition, on page 10 of 24 of Enclosure 1, for the proposed revision to Figure 3H.5-7, the licensee proposed to add the following note, “The details of the connections between the auxiliary building roof reinforcement and the shield building wall vary because of loads on the connection and the orientation of the wall to the roof reinforcement arrangement.” The staff reviewed note 3 on the proposed figure on page 11 of 21 of Enclosure 6 and noted that additional information is needed that clearly describes the variation of the connection between the SB wall and the Aux Building roof.

However, in the revision Enclosure 8 of the LAR, the licensee states that the connection configurations, including the use and design of the backing plates, connection plates, spacer plates, shear lugs, stiffener plates, mechanical connectors, tie bars and tie plates inside the SB wall modules, are based on loading and local geometry considerations; and are designed to the requirements of AISC N690-1994; and the welding of the floor reinforcement to the connection assembly is in conformance with AWS D1.4.

The staff reviewed LAR revision Enclosure 8 to the staff concern related to the variation of the connection between the Aux Building roof and the SB wall and finds that the licensee remains committed to the analysis and design criteria prescribed in the UFSAR; the licensee remains committed to performing the design in accordance with applicable portions of the AISC N690-1994 code; and the licensee is committed to design the welded connection assembly to 125 percent of the specified yield strength of the adjacent rebar consistent with ACI 349 Chapter 21 provisions. Based on the above, staff finds the change to variation of the connection between the Aux Building roof and the SB wall to be acceptable.

Also, the licensee proposed to include additional information in the UFSAR Subsection 3.8.4.5.5.6, “Design of Connections,” which describes the location of the connections between the SB steel plate modules and the standard reinforced concrete. The additional information also describes the requirements for the connections. The licensee stated that the connection design provide for the direct transfer of forces from the RC reinforcing steel to the SC plates; loads are transferred directly from the faceplates to the reinforced concrete using reinforcing bars, mechanical connections, and welds; the mechanical connections develop 125 percent of the specified yield of the connected reinforcement bar; and the loads that are out of plane of the wall are carried through the full thickness of the SB walls. In addition, the licensee provided a

brief description of Figure 3H.5-7 and Figure 7 of the TR-GLR-602 report and stated that the connection designs details satisfy the requirements of AISC N690-1994. The staff reviewed the additional information in Subsection 3.8.4.5.5.6 of the UFSAR and finds the proposed text to be acceptable because the information presented is consistent with the connection design criteria in applicable portion of codes and standards that are acceptable to the staff.

Conclusion

The staff reviewed the licensee's proposed changes provided in the LAR. Based on the staff's technical evaluation, the staff finds that:

(1) The proposed change to shift the design connections between the Aux Building, which is an RC structure, and the SB, which is an SC structure approximately 6 feet from Azimuth 177° to 183° because of interferences with the reinforcement in the 5-foot-6-inch wall of the Aux Building and the fuel transfer canal, is in accordance with relevant codes and standards; and the impact of the proposed design change on the local and global behavior of the structure is minimal.

(2) The proposed change to modify the location of the vertical portion of the RC to SC connection near the Aux Building wall north of the SB because of the proximity of the main steam line and the feedwater line penetrations was performed in accordance with applicable portions of the AISC N690-1994 code. Additionally, the licensee is committed to design the welded connection assembly to 125 percent of the specified yield strength of the adjacent rebar consistent with ACI 349 Chapter 21 provisions. The impact of the proposed design change on the local and global behavior of the overall structure is minimal.

(3) The propose change to revise the RC to SC connection between the SB wall and the Aux Building roof and wall in the critical section was performed in accordance with codes and standards committed in the UFSAR. The licensee demonstrated, with an updated structural model that includes the changes that impact the configuration, mass, and stiffness of the SB structure, that the impact of the design change on the local and global response of the structure is minimal.

(4) The proposed change to revise applicable sections of the licensing basis document was performed to reflect changes related to the shifts in the location of the connections, the rearrangement of the reinforcement bars to reduce congestion and interferences design, and changes to the mechanical connections.

For the reasons specified above, the U.S. Nuclear Regulatory Commission (NRC) staff finds that the proposed UFSAR changes to Subsections 3.8.4.5.5.6, 3H.5.2.1, 3H.5.6, 3H.5.7.1, 3H.5.7.2, and 3H, Tables 3H.5-14 Sheet 1 through 3, acceptable. Similarly, the staff finds the proposed UFSAR changes to Figures 3H.5-7, 3H.5-16 Sheet 1, and 3H.5-16 Sheet 2 acceptable. Furthermore, the supporting analysis provided in the LAR meets the relevant design code provisions and do not alter the relevant conclusions made for the AP1000 standard design.

Based on these findings, the NRC staff concludes that there is reasonable assurance that the requirements of General Design Criterion GDC 1, GDC 2, and GDC 4 of 10 CFR Part 50, Appendix A, and 10 CFR Part 50, Appendix S, will continue to be met. Therefore, the staff finds the proposed changes to be acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations in 10 CFR 50.91(b)(2), the South Carolina State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20, "Standards for Protection Against Radiation." The NRC staff has determined that the amendment involves no significant change in the types or significant increase in the amounts of any effluents that may be released off site. Also, the NRC staff has determined that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (*Federal Register* (FR) notices published on September 30, 2014 (78 FR 58824). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The staff has concluded, based on the considerations discussed in Section 3.0, that there is reasonable assurance that (1) the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public. Therefore, the staff finds the changes proposed in this license amendment request acceptable.

The NRC approval of changes to the TR "APP-GW-GLR-602, AP1000 Shield Building Design Details for Select Wall and RC/SC Connections" (prepared by Westinghouse and reviewed by the NRC as part of the design certification rule and that is incorporated by reference in the VCSNS Units 2 and 3 UFSAR), included in this LAR, applies only to the COLs Nos. NPF-93 and NPF-94 and should not be construed as a generic approval of that TR.

7.0 REFERENCES

1. Request for License amendment request-Reinforced Concrete (RC) to Steel Plate Composite Construction (SC) Connections (LAR 13-014) letter from South Carolina Electric & Gas Company (SCE&G) dated August 5, 2013 (ADAMS Accession No. ML14233A125) and revised by letters dated August 28, 2014 (ADAMS Accession No. ML14245A601) and November 3, 2014 (ADAMS Accession No. ML14307B277)

2. Virgil C. Summer Nuclear Station (VCSNS) Updated Final Safety Analysis Report (UFSAR), Revision 2, dated June 26, 2014 (ADAMS Accession No. ML14183B195).

3. Virgil C. Summer Nuclear Station Final Safety Evaluation Report (FSER) dated August 17, 2011 (ADAMS Accession No. ML110450305).

4. Final Safety Evaluation Report Related to Certification of the AP1000 Standard Plant Design, Supplement 2, NUREG 1793, dated August 5, 2011 (ADAMS Accession No. ML112061231).

5. AP1000 Design Control Document, Revision 19, dated June 13, 2011 (ADAMS Accession No. ML11171A087).

6. AP1000 license Report, APP-GW-GLR-602, “AP1000 Shield Building Design Details for Select Wall and RC/SC Connections,” Revision 5, dated October 2014.

7. American Concrete Institute (ACI), *Code Requirements for Nuclear Safety Related Structures*, ACI-349-01.

8. American Institute of Steel Construction (AISC), “Specification for the Design, Fabrication and Erection of Steel Safety Related Structures for Nuclear Facilities,” AISC-N690-1994.

9. American Welding Society (AWS), *Structural Welding Code*, AWS D 1.4-2000.