SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 30

TO THE COMBINED LICENSE NOS. NPF-93 AND NPF-94

SOUTH CAROLINA ELECTRIC & GAS COMPANY

VIRGIL C. SUMMER NUCLEAR STATION UNITS 2 AND 3

DOCKET NOS. 52-027 AND 52-028

1.0 Introduction

By letter dated May 26, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15146A455), as supplemented by the letter dated May 28, 2015, and revised by letters dated June 9 and June 29, 2015, 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 Units 2 and 3 (VCSNS), COL Numbers NPF-93 and NPF-94, respectively.

The license amendment request (LAR) consists of changes to the Updated Final Safety Analysis Report (UFSAR) in the form of departures from the incorporated plant-specific Design Control Document (DCD) Tier 2 information and involves changes to Tier 2* information. The proposed changes are related to application of American Institute of Steel Construction (AISC) N690-1994, Specification for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities, and would allow use of American Welding Society (AWS) D1.1-2000, Structural Welding Code-Steel, in lieu of AWS D1.1-1992, which is the edition of AWS D1.1 identified in AISC N690-1994. The use of AWS D1.1-2000 would apply to future and installed structural welding.

In the letter dated May 28, 2015 (ADAMS Accession No. ML15148A815), the licensee provided additional information in LAR 15-09 S1. This supplement relates to the identification of material as Tier 2 or Tier 2*. The proposed UFSAR modifications include changes to information that the May 26, 2015, letter identified as being in Tier 2 that the supplement now identifies as Tier 2* information. This Tier 2* information is in UFSAR Subsections 3.8.3.2, 3.8.4.2 and 3H.3.1. In UFSAR Subsection 3.6.2.3.4.2, however, the supplement changes the designation of the proposed changes from Tier 2* to Tier 2.

In the letter dated June 9, 2015 (ADAMS Accession No. ML15160A486), the licensee provided additional information in PAR 15-09-02. The letter revised the application with supporting documentation to justify the use of load directionality allowed by AWS D1.1-2000 Section 2.14 for fillet welds.

In the letter dated June 29, 2015 (ADAMS Accession No. ML15181A079), the licensee provided additional information in LAR 15-09R1. This letter further revised the application, with

supporting documentation to justify the application of the load directionality provision of AWS D1.1-2000, Section 2.14 to linear fillet welds, and rectangular and circular weld groups concentrically loaded out-of-plane to the axis of the weld. This revision replaces "Enclosures 1 and 2" of the previous LAR submissions with "Enclosures 4 and 5", respectively.

The NRC staff issued an initial *Federal Register* notice of opportunity to request a hearing and a proposed No Significant Hazard Determination on June 8, 2015 (80 FR 32413). However, the June 29, 2015, letter revised the application including the No Significant Hazard Determination. Therefore, the staff issued a revised notice on July 9, 2015, (80 FR 39450).

2.0 Regulatory Evaluation

Regulations in Title 10 of the *Code of Federal Regulation* (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," require that structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

Regulations in 10 CFR Part 50, Appendix A, GDC 2, "Design Bases for Protection Against Natural Phenomena," require that structures, systems, and components 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.

Regulations in 10 CFR Part 50, Appendix A, GDC 4, "Environmental and Dynamic Effects Design Bases," require 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-coolant accidents.

Regulations in 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Appendix D, Section VIII.B.5.a and VIII.B.6 require prior NRC approval for changes to Tier 2 information that meet certain criteria specified in Section VIII.B.5. and changes to Tier 2* information, respectively. The proposed changes affect Tier 2 information and meet the specified criteria and affect Tier 2* information. Accordingly, the changes require NRC approval.

Regulations in 10 CFR 50.90 require, in part, that an application for an amendment follow, as far as applicable, the form prescribed for the original application. Accordingly, the LAR must follow 10 CFR 52.47(a)(9), which requires an evaluation of the design against the Standard Review Plan (SRP), including the difference in analytical techniques of the proposed design and the corresponding techniques given in the SRP acceptance criteria.

3.0 Technical Evaluation

3.1 Evaluation of Proposed Changes

INTRODUCTION

The NRC staff considered UFSAR Section 3.8, "Design of Category I Structures" to perform the

technical evaluation. The staff also reviewed portions of NUREG–1793, Supplement 2, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Plant Design" (NUREG-1793) (ADAMS Accession No. ML112061231), and the "Final Safety Evaluation Report for the Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 Combined License Application," (ADAMS Accession No. ML13275A125, ML13275A126 and ML13275A127), which documents the staff's technical evaluation of the relevant aspects of the AP1000 DCD and VCSNS FSAR, respectively. The requested change is related to the use of AWS D1.1-2000 and supplemental provisions in lieu of AWS D1.1-1992.

The staff performed a comparative review of the major differences between the two welding code versions. In addition, the staff reviewed the American Concrete Institute (ACI) 349-01 and American Institute of Steel Construction (AISC) N690-1994 design codes, which reference AWS D1.1-2000 and AWS D1.1-1992, respectively. The staff reviewed the licensee's proposed actions to evaluate the impact of the requested UFSAR changes related to the design of welding for seismic Category I structures in the nuclear island and seismic Category II portions of the turbine building and annex building on the overall safety of the nuclear power plant.

In the LAR, as documented in LAR 15-09 R1, Enclosure 4, the licensee proposed to depart from Tier 2 material in the UFSAR Subsections 3.3.2.3, "Effect of Failure of Structures or Components not Designed for Tornado Loads"; 3.6.2.3.4.2, "Analysis of Design of Pipe Whip Restraints"; 3.7.2, "Seismic System Analysis"; 3.7.2.8.3, "Turbine Building"; and 3A.1 and 3F.1, "Codes and Standards." The licensee similarly proposed to depart from Tier 2* information in UFSAR Subsections 3.8.4.2, "Applicable Codes, Standards, and Specifications"; 3.8.3.2, "Applicable Codes, Standards, and Specifications"; and 3H.3.1, "Governing Codes and Standards." The information designated as Tier 2 is descriptive, while the information designated as Tier 2* defines part of the methodology for analyzing weld capacity. Accordingly, the staff agree that the designation of this information as either Tier 2 or Tier 2*, respectively, provides appropriate regulatory control over changes to this information.

Each proposed change, whether in Tier 2 or Tier 2*, would address weld design code changes from AWS D1.1-1992 to AWS D1.1-2000. The licensee also proposed changes to UFSAR Subsections 3.8.3.2 and 3.8.4.2 beyond permitting the use of AWS D1.1-2000 in lieu of AWS D1.1-1992. The additional changes relate to the applicability of specific provisions in AWS D1.1-2000, which are excluded by AISC N690-1994. These include provisions for sizing complete joint penetration groove welds for tubular members and for matching weld metal for ASTM A992 steel (AISC N690-1994 only allows for the use of ASTM A36 steel). The changes also include extending the applicability for the use of directionality to design of fillet welds beyond what is specified in AISC N690-1994.

This LAR does not address the issue pertaining to partial joint penetration (PJP) welds reinforced by fillet welds identified by an NRC inspector during an inspection, test, analysis, and acceptance criteria (ITAAC) inspection of seismic Category I embedded plates used to anchor structural modules to the containment internal structures basemat.

The staff's evaluation of these design code changes and the impact of the changes to the safety of the nuclear power plant is summarized below.

3.1.1 Welding Code Change

In the LAR, the licensee proposed to allow the use of AWS D1.1-2000 in lieu of AWS D1.1-1992 as the code reference to AISC N690-1994 for weld design. The licensee stated that changing

the welding design for nuclear island structures and portions of Category II turbine and annex buildings is necessary to resolve an item noted by an NRC inspector. The use of the AWS D1.1-2000 welding code applies to future welding as well as installed welds. In addition, the licensee cites AWS D1.1-2000 provisions that differ from AISC N690-1994 provisions. These include sizing criteria for welds joining steel tubular members, matching weld metal for American Society of Testing and Material (ASTM) A992 steel, and the application of directionality in the design of fillet welds.

In order to make a determination on the acceptability of the AWS D1.1-2000 code, the staff reviewed the proposed changes against the regulations specified in 10 CFR 52.79(a)(41), which requires an evaluation of the design against the SRP including the identification of differences in analytical techniques between the proposed design and those provided in the SRP acceptance criteria. As a result of this review, the staff determined that SRP 3.8.4, "Other Seismic Category I Structures," Section 5, "Structural Acceptance Criteria," which sets forth the SRP acceptance criteria corresponding to this portion of the design, endorses AWS D1.1-2000 in Supplement 2 (2004) of AISC N690-1994. Accordingly, the use of AWS D1.1-2000 code is acceptable to the staff because it meets the structural acceptance criteria in SRP 3.8.4, Section 5.

3.1.2 Implementation of AWS D1.1-2000 Provisions

In Enclosure 4 of the LAR, the licensee stated that a section-by-section review was performed to demonstrate that AWS D1.1-2000 continues to meet all requirements of AWS D1.1-1992. The licensee cited four AWS D1.1-2000 provisions as a result of this review, which the staff reviewed to assess the impact on the ability of the structures to perform their intended safety functions.

- The range of weld angles provided for skewed T joints, as depicted in AWS D1.1-2000, Figure 3.11-Detail C are more restrictive because of the dihedral angle requirement for sizing the weld. Hence, it is more conservative than the AWS D1.1-1992 code provisions, and therefore, it is acceptable.

- Requirements for sizing complete joint penetration groove welds are provided for welding tubular members in AWS D1.1-2000, Section 2.3.4.1 and Table 3.6. The staff reviewed the proposed changes to the licensing basis, which includes this requirement in UFSAR Tier 2* Subsections 3.8.3.2 and 3.8.4.2. This change is acceptable because requirements on the dimensions and groove angles for prequalified complete joint penetration (CJP) groove welds are more restrictive compared to the AWS D1.1-1992 code and preserve the safety margin.

- ASTM A992 steel has generally replaced ASTM A36 steel for structural field shapes due to industry changes in structural steel shape availability. The use of ASTM A992 steel is permitted in the UFSAR. UFSAR Tier 2* Subsections 3.8.3.2 and 3.8.4.2 include the addition of ASTM A992 matching weld metal. AWS D1.1-2000, Section 3.3 and Table 3.1 provide information on matching weld metal for ASTM A992 steel. This information is not available in AISC N690-1994 or earlier versions of the AWS standards. The staff has determined that AWS D1.1-2000 provisions for matching weld metal for ASTM A992 steel are acceptable because SRP 3.8.4, "Other Seismic Category I Structures," Section 5, "Structural Acceptance Criteria," endorses AWS D1.1-2000 in Supplement 2 (2004) of AISC N690-1994.

- AWS D1.1-2000, Section 2.14.4, "In-Plane Center of Gravity Loading," allows the direction of applied load to be considered for the design of fillet welds. For loading perpendicular to the axis of the weld group, this provision permits an increase in the predicted weld capacity up to 50% greater than loading parallel to the axis of the weld group. This increase is supported by testing data on lapped joint plate connections loaded by in-plane tension (see Figure 2.3 of AWS D1.1-2000, Page 8). The applicant extends the application of this provision in UFSAR Tier 2* Subsections 3.8.3.2 and 3.8.4.2 to out-of-plane loading, rectangular weld configurations, and circular weld configurations. The staff's review of this issue is documented below in Section 3.1.3, "Effect of Load Directionality of Fillet Weld Capacity."

3.1.3 Effect of Load Directionality on Fillet Weld Capacity

1. Linear fillet weld groups concentrically loaded in-plane

   As described in this SER, Sections 3.1.1 and 3.1.2, the licensee proposed to add AWS D1.1-2000 to the list of applicable codes and standards in the UFSAR. The code includes criteria that consider load directionality for linear fillet weld groups loaded in-plane. AWS D1.1-2000, Sections 2.14.4 and 2.14.5 allow for an increase in calculated weld capacity for in-plane loading perpendicular to linear fillet weld groups. The allowed increase in calculated fillet weld strength is related to the angle of loading with respect to the weld axis (i.e. 90 degrees for fillet welds loaded transverse to the weld axis, zero degrees for fillet welds loaded parallel to the weld axis). The increase in capacity is determined based on the equation in AWS D1.1-2000, 2.14.4, shown below.

   $$F_v = 0.30F_{EXX}(1+0.5\sin^{1.5}\Theta)$$

   where F_v is allowable unit stress in ksi,
   F_{EXX} is minimum tensile strength of filler metal in ksi,
   and Θ is the angle of loading defined above.

   The application of load directionality to fillet weld groups concentrically loaded in-plane is thus acceptable to the staff because AWS D1.1-2000 is endorsed in the structural acceptance criteria in SRP 3.8.4, Section 5.

2. Linear fillet weld groups concentrically loaded out-of-plane

   The licensee proposed in UFSAR Subsections 3.8.3.2 and 3.8.4.2 to supplement the provisions of directionality in AWS D1.1-2000 to allow for the application to linear weld groups concentrically loaded out-of-plane. More recent versions of the code (e.g., AWS D1.1-2008) allow the application of directionality to fillet welds loaded out-of-plane based on substantial test data. In the LAR, the licensee refers to the cruciform-shape test results described in the paper by Ng et al, 2004 (LAR Reference 6) to support the application of directionality to increase calculated fillet weld capacity for weld groups concentrically loaded out-of-plane and transverse to the linear weld axis.

   The application of load directionality to fillet weld groups concentrically loaded out-of-plane is acceptable to the staff because substantial testing has been performed on this weld configuration. This testing demonstrates increased capacity for welds

loaded out-of-plane in cruciform configurations. Additionally, the AWS D1.1 code committee has accepted these test results and removed the out-of-plane restriction for versions of the code issued since 2008.

3. Rectangular fillet weld groups loaded in-plane

   The licensee proposed in UFSAR Subsections 3.8.3.2 and 3.8.4.2 to apply directionality to rectangular weld groups. The licensee stated that the strength of the weld group is limited to the larger of (1) the combined strength of the individual weld elements using 1.0 times the strength of the longitudinally oriented element and 1.0 times the strength of the transversely oriented element and (2) the combined strength of the individual weld elements using 0.825 times the strength of the longitudinally oriented element and 1.5 times the strength of the transversely oriented element. The staff reviewed this method against AWS D1.1-2000 provisions and concluded that the allowed combined strength limited by the above conditions has design advantages and includes restrictions for certain fillet weld applications when compared with AWS D1.1-2000 provisions. The commentary to AWS D1.1-2008 C-2.5.4.4 "Concentrically Loaded Weld Groups," explains that these provisions were incorporated into AWS D1.1 code versions after 2008 to account for load-deformation compatibility. The application of load directionality subjected to the limitations provided by the applicant in the UFSAR is acceptable to the staff because these provisions are conservative when compared with AWS D1.1-2000 provisions and are consistent with load-deformation compatibility considerations.

4. Rectangular and circular fillet weld groups loaded concentrically out-of-plane

   For rectangular and circular welds loaded concentrically out-of-plane, the licensee stated that the loading condition and stress distribution in the welds is equivalent to that in linear weld groups. The addition of Section 2.5.4.4, "Concentrically Loaded Weld Groups," which accounts for load-deformation compatibility, allows the capacity for each weld element to be calculated and combined, accounting for the angle of loading with respect to the axis of the weld group. For rectangular welds, this translates into adding the capacities for each leg of the rectangular weld. For a circular weld, the assumption is made that the circular weld can be approximated by an infinite number of small linear welds.

   In order to justify the application of directionality to rectangular and circular welds, and demonstrate that weld behavior for rectangular and circular welds is similar to straight line welds in regard to loading perpendicular to the axis of the weld, the licensee performed finite element analysis (FEA) for out-of-plane loading on linear, rectangular, and circular fillet weld groups to compare the stress states between concentrically loaded linear and circular fillet welds.

   The licensee performed an FEA for out-of-plane loading on fillet welds to compare the differences between linear welds and concentrically loaded circular fillet welds. The FEA documented in the LAR is from Westinghouse Electric Company's proprietary calculation number APP-CA00-S3C-005, Rev. 1, "FEA of Circular Fillet Weld Subject to Out-of-Plane Loading." For the purpose of understanding the requested LAR changes and confirming equivalent load-displacement behavior of the FEA benchmarking against test number seven in the report by Gomez et al., "Strength and Ductility of Welded Joints Subjected to Out-of- Plane Bending," the

staff performed an audit of the calculation report on July 8, 2015 (ADAMS Accession No. ML15205A046). The staff reviewed the three-step FEA analysis the licensee used to justify the application of directionality to circular fillet welds in the FEA calculation report. These steps are addressed in the calculation:

(a) Linear elastic analyses: The FEA (ANSYS) uses linear material properties for three fillet weld configurations: i) linear, ii) rectangular, and iii) circular. The analyses focus on the behavior of the fillet welds instead of capacities.

(b) Nonlinear Benchmarking: The licensee analyzed a quarter cruciform geometry with an FE model that used nonlinear elastic-plastic material properties that the licensee validated by comparison to test results shown in the Gomez report.

(c) Nonlinear parametric study: The licensee used a "slice" of FE models with nonlinear material properties to investigate the effects of fillet weld shape, size, length, and the weld connections in four groups.

During the review of the FEA results, the staff noted that the pressure loading is applied concentrically in all of the steps. The staff also reviewed one of the ANSYS input files to confirm the loading and boundary conditions of the FE models. For both linear and non-linear analysis, the staff confirmed that the shape of the weld (i.e., line, rectangular or circle) does not significantly affect the failure plane shift. In regard to item (a), the staff confirmed that the analyses demonstrated the angle shift of the failure plane occurs when the weld is subject to loading transverse to the weld axis. The staff also confirmed the failure plane of the weld shift orientations from the theoretical 45 degrees to 74 – 90 degrees with respect to the weld leg. For this reason, the modeled strength of transversally loaded welds increases. This observation applies to all shapes of the fillet welds. In regard to item (b), the staff verified that the calculated fillet weld capacity agrees well with the test data. In regard to item (c), non-linear analysis encompasses non-linear material properties to examine weld capacity. For "slice" FE models, symmetry boundary conditions are also applied, as the geometries and boundary conditions are symmetric in the direction of loading. The staff determined that the stresses in circular welds are comparable to the stresses in linear welds of equivalent length. The staff concluded that the shape of the welded part, either a solid bar or a tube, does not have a significant effect on the circular weld stresses.

Based on a comparison of the FEA with the testing results of the Gomez report, as described above, the staff finds that application of the directionality provisions of AWS D1.1-2000 using an increase factor of 1.5 is acceptable for linear and circular fillet welds loaded concentrically out-of-plane.

3.1.4 Licensing Basis Changes

In "Enclosures 4 and 5" of the LAR, the licensee proposed changes to the UFSAR consistent with the proposed welding code changes. These changes to the UFSAR are listed, and evaluated below for consistency and clarification.

1. In the third paragraph, Subsection 3.3.2.3, the licensee incorporated welding provisions for the turbine building, and added a reference to AWS D1.1-2000 for the design, qualification, fabrication, and inspection of seismic Category II structures. Also, the change included the addition of a cross reference to supplemental requirements in UFSAR Subsections 3.8.4.4.1 and 3.8.4.5.

2. In the first paragraph, Subsection 3.6.2.3.4.2, the licensee added a reference to the AWS D1.1-2000 code.

3. In the third paragraph, Subsection 3.7.2, the licensee added a reference to the AWS D1.1-2000 code for the design, qualification, fabrication, and inspection of seismic Category II structures.

4. In the third paragraph, Subsection 3.7.2.8.3, the licensee added a reference to the AWS D1.1-2000 for the design, qualification, fabrication, and inspection of the turbine building first bay. Also, the change included the addition of a cross reference to supplemental requirements in UFSAR Subsections 3.8.4.4.1 and 3.8.4.5.

5. In Subsections 3A.1, 3F.1 and 3H.3.1, the license added references to the AWS D1.1-2000 code.

The NRC staff reviewed the proposed changes and finds them acceptable on the technical basis set forth above, and because the additions provide clarity and consistency to the licensing basis. The proposed changes are consistent with the other changes evaluated in Sections 3.1.1, 3.1.2, and 3.1.3 above. Moreover, the changes are acceptable because they are consistent with codes and standards acceptable to the staff.

Summary

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

(1) The proposed change to allow the welding code in AWS D1.1-2000 to be applied to welding of structural components for seismic Category I structures in nuclear island and seismic Category II portions of turbine building and annex building is acceptable because AWS D1.1-2000 is endorsed by the NRC in SRP 3.8.4 (2007 version) and AISC N690-1994 Supplement 2.

(2) The proposed changes identified in AWS D1.1-2000, which differ from AISC N690-1994, are acceptable. The matching weld metal specification and the sizing of complete joint penetration groove welds for welding tubular members as required in AWS D1.1-2000 is endorsed by NRC in SRP 3.8.4 (2007).

(3) The directionality provisions of AWS D1.1-2000, which allow an increase of 1.5 in the calculated capacity for linear fillet welds and circular fillet welds subject to concentric loading out-of-plane, are acceptable based on the analysis benchmarked with industry test results. The licensee provided sufficient justification for extending the provisions of the AWS code to out-of-plane loading. The changes are acceptable as they meet the structural acceptance criteria in Section 5 of SRP 3.8.4.

For the reasons specified above, the NRC staff finds that the proposed UFSAR changes to Subsections 3.3.2.3, 3.6.2.3.4, 3.7.2, 3.7.2.8.3, 3.8.3.2, 3.8.4.2, 3A1, 3F.1 and 3H.3.1 are acceptable.

Based on these findings, the NRC staff concludes that there is reasonable assurance that the requirements of GDC 1, GDC 2, and GDC 4 ("General Design Criteria for Nuclear Power

Plants") in Appendix A to 10 CFR Part 50 will continue to be met. Therefore, the staff finds the proposed changes to be acceptable.

4.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission's regulations in 10 CFR 50.92 state that the Commission may make a final determination that a license amendment involves no significant hazards consideration if operation of the facility in accordance with the amendment would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in the margin of safety.

As required by 10 CFR 50.91(a), the licensee has provided its analysis of the issue of no significant hazards consideration in its letter dated June 29, 2015, as presented below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The design functions of the nuclear island structures are to provide support, protection, and separation for the seismic Category I mechanical and electrical equipment located in the nuclear island. The nuclear island structures are structurally designed to meet seismic Category I requirements as defined in Regulatory Guide 1.29. The design functions of the seismic Category II portions of the annex building and turbine building are to provide integrity for non-seismic items located in the proximity of safety-related items, the failure of which during a safe shutdown earthquake could result in loss of function of safety-related items.

   The use of AWS D1.1-2000 and the supplemental provisions provide criteria for the design, qualification, fabrication, and inspection of welds for nuclear island structures and seismic Category II portions of the annex building and turbine building. These structures continue to meet the applicable portions of ACI 349, the remaining applicable portions of AISC N690 not related to requirements for welding, including the supplemental requirements described in UFSAR Subsections 3.8.4.4.1 and 3.8.4.5, and the supplemental requirements identified in the UFSAR Subsection 3.8.3 for structural modules. The use of AWS D1.1-2000 does not have an adverse impact on the response of the nuclear island structures, or seismic Category II portions of the annex building and turbine building to safe shutdown earthquake ground motions or loads due to anticipated transients or postulated accident conditions. The change does not impact the support, design, or operation of mechanical and fluid systems. There is no change to plant systems or the response of systems to postulated accident conditions. There is no change to the predicted radioactive releases due to normal operation or postulated accident conditions. The plant response to previously evaluated accidents or external events is not adversely affected, nor does the change described create any new accident precursors.

   Therefore, the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The proposed change includes the use of AWS D1.1-2000 and supplemental provisions to provide criteria for the design, qualification, fabrication, and inspection of welds for nuclear island structures and the seismic Category II portions of the annex building and turbine building. The proposed change provides a consistent set of requirements for welding of structures required to be designed to the requirements of ACI 349 and AISC N690. The change to the details does not change the design function, support, design, or operation of mechanical and fluid systems. The change to the welding criteria does not result in a new failure mechanism for the pertinent structures or new accident precursors. As a result, the design function of the structures is not adversely affected by the proposed change.

   Therefore, the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No.

   The AWS codes are consensus standards written, revised, and approved by industry experts experienced in welding and weld design. The proposed change adds AWS D1.1-2000 to the list of applicable codes and standards in the UFSAR and adds supplemental provisions consistent with AWS D1.1-2010. The 2000 edition includes criteria that consider directionality in the weld, which allows for an increase factor on structural fillet weld strength relative to the angle of load direction. Supplemental provisions are added to the provisions in AWS D1.1-2000 for the application of directionality for linear fillet weld groups concentrically loaded in-plane to the axis of the weld that include elements oriented both longitudinally and transversely to the direction of applied load to address deformation of the welds. The change also specifies extension of the application of directionality provisions to linear and concentrically loaded rectangular and circular fillet weld groups loaded out-of-plane to the axis of the weld to supplement the conditions specified in AWS D1.1. These changes are supported by tests that provide the justification for criteria that consider the directionality. These changes can be similarly applied to welds in the AP1000 to continue to provide the necessary safety margin.

   Therefore, the proposed amendment does not involve a significant reduction in a margin of safety.

The NRC staff reviewed the licensee's analysis above and generally agrees with that analysis. However, the staff has not reviewed AWS D1.1–2010, and is not making any conclusion in regard to that standard. In addition, AWS D1.1-2000 only allows credit for additional margin that was not previously considered in the application of AISC N690-1994, and the use of AWS D1.1-2000 as described in the application does not significantly reduce any existing margin credited in the FSAR. Further, as described above in § 3.1.2 of this SE, AWS D1.1-2000 is more

restrictive than AWS D1.1-1992 in certain respects, and does not significantly reduce any margin of safety in this regard. Finally, the NRC previously approved the use of AWS D1.1-2000, when it certified the AP1000 design. Accordingly, the staff concludes that the amendment meets the three criteria of 10 CFR 50.92. Therefore, the NRC staff has made a final determination that the amendment does not involve a significant hazards consideration.

5.0 PUBLIC COMMENTS

On June 8, 2015, the NRC staff published a notice of the NRC's consideration of the proposed license amendment request for VCSNS, proposed no significant hazards consideration determination, and opportunity for a hearing in the *Federal Register* (80 FRN 32413). Subsequently, the licensee revised the application on June 29, 2015 and the NRC staff re-issued the notice on July 9, 2015 (80 FR 39450). In accordance with the requirements in 10 CFR 50.91, the notice provided a 30-day period for public comment on the proposed no significant hazards consideration (NSHC) determination. Public comments were received regarding the proposed amendment (References 8, 9, and 10). The NRC staff has addressed the issues within the scope of the proposed NSHC determination below. Some of the issues discussed in the public comments, however, are not within the scope of the proposed NSHC determination. Under the unique circumstances presented by this amendment request and for convenience, the NRC staff has also addressed comments relating to the licensing basis for the facility below. One additional comment appeared to request enforcement action, and the staff treated that comment in accordance with the process in Management Directive 8.11.

5.1 No Significant Hazards Consideration discussion:

Public Comment:

In Reference 10 the commenter stated, "The licensee discussion for Criterion 3, significant reduction in the margin of safety, does takes credit for testing performed by the industry and reported in a journal. It is my understanding that the NRC has not reviewed/accepted those tests. Moreover, the licensee has not provided robust justification (in Technical Evaluation Section of the LAR) indicating its applicability to the Vogtle Units 3 and 4 Welds. The licensee has utilized the Finite Element Analysis to support its changes. The summary of that discussion should have included in this NO-SHC [No Significant Hazards Consideration Determination]. Therefore, the licensee determination for no significant hazards consideration required by 10 CFR 50.92(c) is incomplete and flawed."

NRC Response:

The NRC staff acknowledges the comment. However, as pointed out by the commenter, the licensee discussed its approach for using the test results by utilizing the FEA model. The NRC staff audited the licensee's calculations and, as discussed in Section 3 of this safety evaluation, the staff determined that the licensee appropriately justified the use of the test results in its evaluation. As stated above, AWS D1.1-2000 only allows credit for additional margin that was not previously considered in the application of AISC N690-1994, and the use of AWS D1.1-2000 as described in the application does not significantly reduce any existing margin credited in the FSAR. Further, as described above in § 3.1.2 of this SE, AWS D1.1-2000 is more restrictive than AWS D1.1-1992 in certain respects, and does not significantly reduce any margin of safety in this regard. Finally, the NRC previously approved the use of AWS D 1.1–2000, when it certified the AP1000 design. Accordingly, the staff has made a final determination that the proposed amendment involves no significant hazards considerations.

5.2 Current Licensing Basis:

Comment 1:

In Reference 10 the commenter stated “The licensee submittal dated June 29, 2015 (ML15181A079) states in part, The use of AWS D1.1-2000 is necessary for future welding and for installed welding to resolve an item noted by a Nuclear Regulatory Commission (NRC) inspector.

This implies that the current design only includes 2000 STD and the new licensing basis going forward will be STD 2000 rather than 1992 for the subject welds.

However, the proposed changes to UFSAR Section 3.8.3.2 states, AWS D1.1-2000 is an acceptable code for use in lieu of AWS D1.11992 for the design, qualification, fabrication, and inspection for AISC N690 applications.

This statement is confusing in that it does not provide clear licensing basis for the subject welds. This statement implies that the current code of use is 1992 but you can use of 2000 code as an acceptable code and this is not true based on the current design. Moreover, down the road (from 10 years from now) when the licensee design engineer wants modify or revise this, he/she should have clear and crisp understanding of the licensing basis and the proposed change does not provide the clarity in the licensing basis. In addition, in one of the public meeting related to this license amendment request, the licensee stated that it wants to retain 1992 code as approved with the certified AP1000 design, If 1992 code is not used, there is no reason to keep it. And by deleting the 1992 code from the Vogtle licensing basis has no impact the AP1000 Certification Rule and other COL applicants can still use 1992 Code.

Based upon above, the NRC should ask licensee to revise the proposed changes to the UFSAR to reflect clear licensing basis and then only the staff should approve the licensee request.”

NRC Response:

AISC N690-1994 references AWS D1.1-1992, which the NRC found acceptable for use for VCSNS Units 2 and 3. The staff has also found the use of AWS D1.1-2000 acceptable for applications related to the use of AISC N690-1994. Therefore, it is acceptable to the staff if the licensee uses either code as long as its use is appropriately documented for any application related to the use of the AISC N690 code. Further, the licensee documents the version of the AWS standard used for any particular weld. In addition, some welds have already been installed in accordance with AISC N690-1994 and AWS D1.1-1992, and since those codes are currently approved for use at VCSNS Units 2 and 3, there is no reason for the licensee to revise its documentation for those welds to reflect AWS D1.1-2000.

Comment 2 (Use of AWS D.1.1 2010):

In Reference 10 the commenter stated “The licensee has discussed and justified changes related weld configuration not covered by AWS2000 standard. Licensee states that it has added supplemental provisions consistent with AWS D1.1-2010. This statement is partially true in that the licensee has not identified AWS 2010 standard in the markup of UFSAR changes. The NRC staff should ask licensee to add a reference to 2010 Standard in the markup of the UFSAR changes before the NRC approves the licensee request.”

NRC Response:

As discussed in Section 3 of this safety evaluation, the NRC staff has reviewed each of the supplemental provisions requested by the licensee in regard to certain welding details and concluded that it is appropriate to allow the use of these provisions beyond those described in AWS D1.1-2000. As described in Section 3 of this SE, the licensee individually justified the use of these supplemental provisions without requesting the use of AWS D1.1-2010, and there is no need for the NRC to review or approve the use of AWS D1.1-2010 in connection with the supplemental provisions described in the amendment request.

6.0 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.

7.0 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 increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and 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 (80 FR 39450; published on July 9, 2015), and has now made a final finding that the amendment involves no significant hazards consideration. 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.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) the amendment does not (a) involve a significant increase in the probability or consequences of an accident previously evaluated, or (b) create the possibility of a new or different kind of accident from any previously evaluated, or (c) involve a significant reduction in a margin of safety and therefore, the amendment does not involve a significant hazards consideration; (2) there is reasonable assurance that the health and safety of the public will not be endangered by construction activities in the proposed manner; (3) such activities will be conducted in compliance with the Commission's regulations; and (4) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

8.0 REFERENCES

1. Request for License Amendment 15-009R2: Use of AWS D1.1-2000 Criteria for Structural Welds, letters from South Carolina Electric & Gas Company (SCE&G), dated May 26, 2015 (ADAMS Accession No. ML15146A455, May 28, 2015 (ADAMS Accession No. ML15148A815), June 9, 2015 (ADAMS Accession No. ML15160A486), and June 29, 2015 (ADAMS Accession No. ML15181A079).

2. Virgil C. Summer Nuclear Station Updated Final Safety Analysis Report (UFSAR), Revision 3, dated July 15, 2015 (ADAMS Accession No. ML15196A214).

3. AP1000 Design Control Document, Revision 19, dated June 13, 2011 (ADAMS Accession No. ML11171A500).

4. Virgil C. Summer Nuclear Station, Final Safety Evaluation Report (FSER), dated September, 2013, (ADAMS Accession Nos. ML13275A125, ML13275A126 and ML13275A127).

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

6. Regulatory Audit Plan for the review of calculations Methodology Supporting Use of AWS D1.1-2000 Criteria for Structural Welds for Vogtle Electric Generating Plant, Unit 3 and 4 and V. C. Summer Units 2 and 3, dated July 30, 2015(ADAMS Accession No. ML15188A426).

7. Summary of Audit Report for Vogtle Electric Generating Plant, Units 3 and 4, and Virgil C. Summer Nuclear Station, Units 2 and 3, dated July 08, 2015 (ADAMS Accession No. ML15205A046).

8. Comment (1) of Ravindra Joshi on Virgil C. Summer Nuclear Station, Units 2 and 3 License Amendment Application, June 24, 2015 (ADAMS Accession No. ML15187A073)

9. Comment (1) of Ravindra Joshi on Virgil C. Summer Nuclear Station, Units 2 and 3, License Amendment Application, July 21, 2015 (ADAMS Accession No. ML15208A106).

10. Comment (2) of Ravindra Joshi on Virgil C. Summer Nuclear Station, Units 2 and 3, License Amendment Application, August 4, 2015 (ADAMS Accession No. ML15225A082).