

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 64

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

SOUTH CAROLINA ELECTRIC & GAS COMPANY

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 September 2, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16246A214), South Carolina Electric & Gas Company (SCE&G), on behalf of itself and the South Carolina Public Service Authority (hereafter referred to as the licensee) submitted license amendment request (LAR) 16-08 requesting that the U.S. Nuclear Regulatory Commission (NRC) amend the combined licenses (COL) for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, COL Numbers NPF-93 and NPF-94, respectively.

The proposed amendment provides for departure from approved AP1000 Design Control Document (DCD) Tier 2 information (as incorporated into the Updated Final Safety Analysis Report (UFSAR) as plant-specific DCD information) and proposes changes to plant-specific Tier 1 information (and corresponding changes to COL Appendix C) for each of the VCSNS Units 2 and 3 COLs. The proposed amendment proposes changes to a plant-specific Tier 1 (and COL Appendix C) table and UFSAR tables to clarify the flow area for the Automatic Depressurization System (ADS) fourth stage squib valves and to reduce the minimum effective flow area for the second and third stage ADS control valves.

SCE&G also requested an exemption from the provisions of Title 10 of the Code of Federal Regulations (10 CFR) Part 52, Appendix D, Section III.B, "Design Certification Rule for the AP1000 Design, Scope and Contents," to allow a departure from the elements of the certification information in Tier 1 of the generic DCD.<sup>1</sup>

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<sup>1</sup> While the licensee describes the requested exemption as being from Section III.B of 10 CFR Part 52, Appendix D, the entirety of the exemption pertains to proposed departures from Tier 1 information in the generic DCD. In the remainder of this evaluation, the NRC will refer to the exemption as an exemption from Tier 1 information to match the language of Section VIII.A.4 of 10 CFR Part 52, Appendix D, which specifically governs the granting of exemptions from Tier 1 information.

In order to modify UFSAR (the plant-specific DCD) Tier 1 information, the NRC must find the licensee's exemption request included in its submittal for the LAR acceptable. The staff's review of the exemption request and the LAR is included in this safety evaluation.

The staff's proposed no significant hazards consideration determination was published in the Federal Register on December 20, 2016 (81 FR 92863).

By letter dated July 25, 2016 (ADAMS Accession No. ML16207A340), Southern Nuclear Operating Company, Inc. (SNC), the licensee for Vogtle Electric Generating Plant (VEGP) Units 3 and 4, submitted LAR 16-012. VCSNS's LAR 16-08 is identical in technical content to that of the license amendment request submitted to the NRC by SNC for VEGP Units 3 and 4. On December 29, 2016 the NRC issued License Amendment No. 62 for VEGP Units 3 and 4 (ADAMS Accession No. ML16357A640) regarding LAR 16-012.

## 2.0 REGULATORY EVALUATION

As defined in Section II of Appendix D to 10 CFR Part 52, Tier 1 information includes inspections, tests, analyses, and acceptance criteria (ITAAC) and design descriptions, among other things. Therefore, a licensee referencing Appendix D incorporates by reference all Tier 1 information contained in the generic DCD. The Tier 1 ITAAC and the design descriptions, along with the plant-specific ITAAC, were included in Appendix C of the COL at its issuance.

10 CFR Part 52, Appendix D, Section VIII.A.4 states that exemptions from Tier 1 information are governed by the requirements in 10 CFR 52.63(b)(1) and 10 CFR 52.98(f). It also states that the Commission will deny such a request if it finds that the design change will result in a significant decrease in the level of plant safety otherwise provided by the design.

10 CFR 52.63(b)(1) allows the licensee who references a design certification rule to request NRC approval for an exemption from one or more elements of the certification information. The Commission may only grant such a request if it determines that the exemption will comply with the requirements of 10 CFR 52.7, which, in turn, points to the requirements listed in 10 CFR 50.12 for specific exemptions. In addition, the Commission must consider whether special circumstances, as required by 10 CFR 52.7 and 50.12, outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption. Therefore, any exemption from the Tier 1 information certified by Appendix D to 10 CFR Part 52 must meet the requirements of 10 CFR 50.12, 52.7, and 52.63(b)(1).

10 CFR 52.98(f) requires NRC approval for a proposed amendment to the COL for any modification to, addition to, or deletion from the terms and conditions of a COL. LAR 16-08 involves changes to plant-specific Tier 1 ITAAC information and its corresponding COL Appendix C information, so NRC approval is required.

The specific NRC technical requirements applicable to LAR 16-08 are the general design criteria (GDC) in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." In particular, these technical requirements include the following GDC:

GDC 2, "Design bases for protection against natural phenomena," requires that structures, systems, and components (SSCs) important to safety 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.

GDC 4, “Environmental and dynamic effects design bases,” requires that SSCs important to safety 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. These SSCs shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.

GDC 35, “Emergency core cooling,” requires that a system to provide abundant emergency core cooling be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented, and (2) clad metal-water reaction is limited to negligible amounts.

GDC 36, “Inspection of emergency core cooling system,” requires that the emergency core cooling system be designed to permit appropriate periodic inspection of important components, such as spray rings in the reactor pressure vessel, water injection nozzles, and piping, to assure the integrity and capability of the system.

GDC 37, “Testing of emergency core cooling system,” requires that the emergency core cooling system be designed to permit appropriate periodic pressure and functional testing to assure (1) the structural and leaktight integrity of its components, (2) the operability and performance of the active components of the system, and (3) the operability of the system as a whole and, under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation, including operation of applicable portions of the protection system, the transfer between normal and emergency power sources, and the operation of the associated cooling water system.

10 CFR Part 52, Appendix D, Section III.B requires a licensee referencing 10 CFR Part 52, Appendix D to incorporate by reference and comply with the requirements of Appendix D, including all Tier 1 information contained in the generic AP1000 DCD.

10 CFR Part 52, Appendix D, Section VIII.B.5.a allows an applicant or licensee who references 10 CFR Part 52, Appendix D to depart from Tier 2 information without prior NRC approval, unless the proposed departure involves a change to or departure from Tier 1 information, Tier 2\* information, the Technical Specifications, or requires a license amendment under 10 CFR Part 52, Appendix D, Section VIII, paragraphs B.5.b or B.5.c. LAR 16-08, as supplemented, involves a departure from the plant-specific Tier 1 ITAAC information, so NRC approval is also required to change the Tier 2 UFSAR information.

### 3.0 TECHNICAL EVALUATION

#### 3.1 EVALUATION OF EXEMPTION

The regulations in Section III.B of Appendix D to 10 CFR Part 52 require a licensee referencing Appendix D to 10 CFR Part 52 to incorporate by reference and comply with the requirements of Appendix D, including all Tier 1 information contained in the generic AP1000 DCD. As defined in Section II of Appendix D to 10 CFR Part 52, Tier 1 information includes ITAAC and design descriptions, among other things. Therefore, a licensee referencing Appendix D incorporates by reference all Tier 1 information contained in the generic DCD. The Tier 1 ITAAC and the

design descriptions, along with the plant-specific ITAAC, were included in Appendix C of the COL at its issuance. In LAR 16-08, the licensee requests a permanent exemption from the provisions of 10 CFR Part 52, Appendix D, Section III.B, to allow a departure from elements of the certification information in Tier 1 of the generic AP1000 DCD. Because the changes to plant-specific Tier 1 information and corresponding changes to the associated COL Appendix C information, as identified by the licensee, result in the need for a departure, an exemption from the certified design information is required.

The Tier 1 information for which a plant-specific departure and exemption is being requested includes changes to tables to clarify the flow area for the ADS fourth stage squib valves and to reduce the minimum effective flow area for the second and third stage ADS control valves. The result of this exemption would be that the licensee could implement modifications to Tier 1 information described and justified in LAR 16-08 if, and only if, the NRC approves LAR 16-08. This exemption is a permanent exemption limited in scope to the particular Tier 1 information specified.

As stated in Section VIII.A.4 of Appendix D to 10 CFR Part 52, an exemption from Tier 1 information is governed by the requirements of 10 CFR 52.63(b)(1) and 52.98(f). Additionally, Section VIII.A.4 of Appendix D to 10 CFR Part 52 provides that the Commission will deny an exemption request if it finds that the requested change to Tier 1 information will result in a significant decrease in the level of safety otherwise provided by the design. Pursuant to 10 CFR 52.63(b)(1), the Commission may grant exemptions from one or more elements of the certification information, so long as the criteria given in 10 CFR 52.7 which, in turn, references 10 CFR 50.12, are met and that the special circumstances, as defined by 10 CFR 50.12(a)(2), outweigh any potential decrease in safety due to reduced standardization.

Pursuant to 10 CFR 52.7, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 52. As 10 CFR 52.7 further states, the Commission's consideration will be governed by 10 CFR 50.12, "Specific exemptions," which states that an exemption may be granted when: (1) the exemptions are authorized by law, will not present an undue risk to public health and safety, and are consistent with the common defense and security; and (2) special circumstances are present. Specifically, 10 CFR 50.12(a)(2) lists six special circumstances for which an exemption may be considered. It is necessary for one of these special circumstances to be present in order for the NRC to consider granting an exemption request. The licensee stated that the requested exemption meets the special circumstances of 10 CFR 50.12(a)(2)(ii). That subsection defines special circumstances as when "[a]pplication of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule." The staff's analysis of each of these findings is presented below.

### 3.1.1 AUTHORIZED BY LAW

This exemption would allow the licensee to implement approved revisions to Tier 1 information and corresponding information in COL Appendix C in the plant-specific DCD. This exemption is a permanent exemption limited in scope to particular Tier 1, Table 2.1.2-4 information. Subsequent changes to Tier 1, Table 2.1.2-4, or any other Tier 1 information would be subject to the exemption process specified in Section VIII.A.4 of Appendix D to 10 CFR Part 52 and the requirements of 10 CFR 52.63(b)(1). As stated above, 10 CFR Part 52, Appendix D, Section VIII.A.4 allows the NRC to grant exemptions from one or more elements of the Tier 1 information. Based on 10 CFR Part 52, Appendix D, Section VIII.A.4, the staff has determined

that granting of the licensee's proposed exemption will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, as required by 10 CFR 50.12(a)(1), the exemption is authorized by law.

### 3.1.2 NO UNDUE RISK TO PUBLIC HEALTH AND SAFETY

The underlying purpose of Appendix D to 10 CFR Part 52 is to ensure that the licensee will construct and operate the plant based on the approved information found in the DCD incorporated by reference into the licensee's licensing basis. The proposed changes would clarify the as-manufactured flow area for the ADS fourth stage squib valves and the reduction of the minimum effective flow area for the second and third stage ADS control valves, as presented in the Tier 1 ITAAC table. These changes will enable the licensee to safely construct and operate the facility consistent with the performance of the as-built components for the AP1000 design certified by the NRC by updating the information mentioned above found in Tier 1, Table 2.1.2-4, of the DCD. These changes will not impact the ability of the systems or equipment to perform their design function. These changes do not add any new equipment or system interfaces to the current plant design. The flow area changes do not introduce any new industrial, chemical, or radiological hazards that would represent a public health or safety risk, nor do they modify or remove any design or operational controls or safeguards intended to mitigate any existing on-site hazards. Furthermore, the proposed changes would not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures. Accordingly, these changes do not present an undue risk from any new equipment or systems. Therefore, as required by 10 CFR 50.12(a)(1), the staff finds that there is no undue risk to public health and safety.

### 3.1.3 CONSISTENT WITH COMMON DEFENSE AND SECURITY

The proposed exemption would allow changes to elements of the plant-specific Tier 1 DCD. This is a permanent exemption limited in scope to particular Tier 1, Table 2.1.2-4 information. Subsequent changes to Tier 1 information would be subject to full compliance by the licensee as specified in Section VIII.A.4 of Appendix D to 10 CFR Part 52. The proposed changes would clarify the as-manufactured flow area for the ADS fourth stage squib valves and the reduction of the minimum effective flow area for the second and third stage ADS control valves, as presented in the Tier 1 ITAAC table. These changes will enable the licensee to safely construct and operate the facility consistent with the performance of the as-built components for the AP1000 design certified by the NRC by updating the information mentioned above found in Tier 1, Table 2.1.2-4, of the DCD. The changes do not alter or impede the design, function, or operation of any plant SSCs associated with the facility's physical or cyber security and, therefore, do not affect any plant equipment that is necessary to maintain a safe and secure plant status. In addition, the changes have no impact on plant security or safeguards. Therefore, as required by 10 CFR 50.12(a)(1), the staff finds that the common defense and security is not impacted by this exemption.

### 3.1.4 SPECIAL CIRCUMSTANCES

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. The underlying purposes of Section III.B of Appendix D to 10 CFR Part 52 is to ensure that the licensee will construct and operate the plant based on the approved information found in the

AP1000 DCD, which was incorporated by reference into the licensee's licensing basis. The proposed changes to Tier 1 and Tier 2 will enable the licensee to safely construct and operate the AP1000 facility consistent with established acceptance criteria used in the design certified by the NRC.

Special circumstances are present in the particular circumstances discussed in LAR 16-08 because the application of Section III.B of Appendix D to 10 CFR Part 52 in this circumstance does not serve the underlying purpose of the rule. The proposed change implements changes to Tier 1 information. This exemption request and associated revisions to Tier 1 information demonstrate that the applicable regulatory requirements will continue to be met. Consequently, the safety impact that may result from any reduction in standardization is minimized because the proposed design change does not result in a reduction in the level of safety. Therefore, the staff finds that the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of an exemption from Section III.B of Appendix D to 10 CFR Part 52 exist.

### 3.1.5 SPECIAL CIRCUMSTANCES OUTWEIGH REDUCED STANDARDIZATION

This exemption would allow the implementation of changes to Tier 1 information as proposed in LAR 16-08. The proposed changes would clarify the as-manufactured flow area for the ADS fourth stage squib valves and the reduction of the minimum effective flow area for the second and third stage ADS control valves, as presented in the Tier 1 ITAAC table. These changes will enable the licensee to safely construct and operate the facility consistent with the performance of the as-built components for the AP1000 design certified by the NRC by updating the information mentioned above found in Tier 1, Table 2.1.2-4, of the DCD. The design functions of the systems associated with this request are consistent with the current design of the plant in supporting the actual system functions. The design functions of these systems will continue to be maintained because the associated revisions to the Tier 1 information demonstrate that the applicable regulatory requirement will continue to be met. Consequently, the safety impact that may result from any reduction in standardization is minimized, because the proposed design change does not result in a reduction in the level of safety. Based on the foregoing reasons, as required by 10 CFR Part 52.63(b)(1), the staff finds that the special circumstances outweigh the effects the departure has on the standardization of the AP1000 design.

### 3.1.6 NO SIGNIFICANT REDUCTION IN SAFETY

This exemption would allow the implementation of changes to Tier 1 information as proposed in LAR 16-08. The changes will not significantly impact the functional capabilities of these components. The proposed changes will not adversely affect the ability of the SSCs to perform their design functions and the level of safety provided by the current systems and equipment therein is unchanged. Therefore, based on the foregoing reasons and as required by 10 CFR Part 52, Appendix D, Section VIII.A.4, the staff finds that granting the exemption would not result in a significant decrease in the level of safety otherwise provided by the design.

## 3.2 TECHNICAL EVALUATION OF DEPARTURE

LAR 16-08 proposes changes to clarify the flow area for the ADS fourth stage squib valves and to reduce the minimum effective flow area for the second and third stage ADS control valves. The requested amendment involves changes to the UFSAR in the form of departures from the incorporated plant-specific DCD Tier 2 licensing basis information in Table 14.3-2, "Design Basis Accident Analysis," and Table 15.6.5-10, "AP1000 ADS Parameters." The proposed changes to the licensing basis also involve changes to the ITAAC in COL Appendix C and

associated plant-specific DCD Tier 1 information in Table 2.1.2-4.

The specific change descriptions provided in the LAR are as follows:

- a. The Acceptance Criteria for COL Appendix C (and plant-specific DCD Tier 1) Table 2.1.2-4 ITAAC Item 8.d.iv is revised to reduce the minimum effective flow area through each second and third stage ADS control valve from  $\geq 21$  in<sup>2</sup> to  $\geq 19$  in<sup>2</sup>.
- b. The ITAAC for COL Appendix C (and plant-specific DCD Tier 1) Table 2.1.2-4 ITAAC Item 8.d.iii are revised to clarify that the inspection conducted for each fourth stage ADS squib valve is to determine the as-manufactured flow area through each valve, and that the as-manufactured flow area through each fourth stage ADS squib valve is  $\geq 67$  in<sup>2</sup>.
- c. UFSAR Table 14.3-2 line for "Reference" column entry "Table 15.6.5-10" is revised as follows:
  - (1) The Design Feature description "ADS Valve Flow Areas (in<sup>2</sup>)" is changed to "ADS Valve Minimum Effective Flow Areas (in<sup>2</sup>)."
  - (2) The Values for the ADS Stage 2 Control Valve and ADS Stage 3 Control Valve for the renamed "ADS Valve Minimum Effective Flow Areas (in<sup>2</sup>)" Design Feature are changed from  $\geq 21$  to  $\geq 19$ .
  - (3) The Values for the ADS Stage 4A Valve and ADS Stage 4B Valve for the renamed "ADS Valve Minimum Effective Flow Areas (in<sup>2</sup>)" Design Feature are changed from  $\geq 67$  to  $\geq 66$ , and a note is added stating, "The ADS Stage 4A Valve and ADS Stage 4B Valve minimum effective flow areas of  $\geq 66$  in<sup>2</sup> are assumed in the small-break loss of coolant accident (LOCA) analyses to account for potential deformation during actuation that may reduce the effective flow area to less than the required as-manufactured flow area of  $\geq 67$  in<sup>2</sup>."
- d. UFSAR Table 15.6.5-10 is revised as follows:
  - (1) The title is changed from "AP1000 ADS Parameters" to "ADS Parameters Used in Small-Break LOCA Analyses."
  - (2) The column description "Minimum Valve Flow Area (for each path, in<sup>2</sup>)" is changed to "ADS Valve Minimum Effective Flow Area (for each path, in<sup>2</sup>)" and Note 4 is removed from the column entries.
  - (3) The values for the second and third stage ADS control valves (Stage 2 – Control/Stage 3 – Control) in the renamed "ADS Valve Minimum Effective Flow Area (for each path, in<sup>2</sup>)" column are changed from 21 to 19.
  - (4) The values for the Stage 4A and Stage 4B ADS squib valves in the renamed "ADS Valve Minimum Effective Flow Area (for each path, in<sup>2</sup>)" column are changed from 67 to 66.

The staff reviewed the information provided in LAR 16-08 and conducted an audit of the supporting documents made available in the Westinghouse Electric Corporation (WEC) electronic reading room (ERR). A staff audit report is available in the NRC public document room (ADAMS Accession No. ML16357A730). The staff review of LAR 16-08 and its supporting documentation is described in the following paragraphs:

In an AP1000 reactor, the ADS provides depressurization of the Reactor Coolant System (RCS) to allow the Passive Core Cooling System to supply gravity-driven cooling water from the In-containment Refueling Water Storage Tank (IRWST) to mitigate a design-basis accident. The ADS Stage 1 through 4 valves open in sequence based on Core Makeup Tank level and time delays to allow a controlled RCS depressurization. The flow rates through the valves in each stage of the ADS control the rate of RCS depressurization. Therefore, the minimum flow areas through the valves in each ADS stage affect the RCS depressurization rate, and subsequently the core uncover time and fuel rod heat-up during a design-basis accident. LAR 16-08 reports that the flow testing for the ADS Stage 2, 3 and 4 valves found the actual flow areas for these valves to be less than the minimum flow areas assumed in the accident analyses. LAR 16-08 summarizes the revised accident analyses with the reduced flow areas for the ADS valves to demonstrate adequate reactor core cooling in the event of a design-basis accident. LAR 16-08 describes the evaluation of several safety analyses with primary focus on the postulated small break LOCA analysis.

In LAR 16-08, the licensee proposes changes to the VCSNS Units 2 and 3 UFSAR in the form of departures from the plant-specific DCD Tier 2 licensing information in Table 14.3-2 and Table 15.6.5-10. LAR 16-08 also proposes changes to the ITAAC in Appendix C to the VCSNS Unit 2 and 3 COL, and associated plant-specific DCD Tier 1 information in Table 2.1.2-4. The staff reviewed the flow test reports, calculations, and analyses made available in the ERR to evaluate the basis and support for LAR 16-08 submitted by the licensee of VCSNS Unit 2 and 3. In addition, the staff discussed the information in the ERR documents with licensee and WEC personnel.

LAR 16-08 indicates that testing was performed to determine the flow coefficient  $C_v$  for a sample valve similar to the ADS Stage 2 and 3 motor operated valves (MOVs). As a result, LAR 16-08 indicates that the test resulted in a flow area of 19.5 in<sup>2</sup> at 85 percent and 100 percent full open stroke, which does not meet the minimum effective flow area of 21 in<sup>2</sup> specified in the valve data sheet. The staff reviewed the WEC flow test report for the ADS Stage 2 and 3 MOVs that measured the volumetric flow rate from multiple tests to determine the actual flow coefficient and to calculate the effective flow area for these valves based on fluid system analysis. The staff verified that the flow area reduction for the ADS Stage 2 and 3 MOVs determined in the flow test report and assumed in LAR 16-08 is appropriate.

LAR 16-08 proposes the use of a 19 in<sup>2</sup> minimum flow area for the ADS Stage 2 and 3 MOVs based on the flow test results. LAR 16-08 describes the results of the evaluation of the reduced flow area on the RCS depressurization rate and reactor core heat-up. The staff reviewed the WEC flow calculation for the ADS Stage 2 and 3 valves to verify that it reflects the appropriate minimum flow area based on the flow test results. The staff found that the documents supporting LAR 16-08 have incorporated the new minimum flow area for the ADS Stage 2 and 3 globe valves and are therefore acceptable.

As noted in LAR 16-08, the staff identified an issue with the small margin in the manufactured diameter of the shear cap for the ADS Stage 4 squib valves during an inspection of the valve vendor in February 2012. Subsequently, the staff identified the reduction in flow area below the

manufactured value for the ADS Stage 4 squib valve following actuation of the valve during an inspection of the qualification flow test in December 2013. During the review of LAR 16-08, the staff verified that the WEC calculation for the IRWST and containment sump injection lines, and ADS line resistances, had been updated to reflect the new minimum flow area for the ADS Stage 4 squib valves based on the flow test results, and are therefore acceptable.

LAR 16-08 indicates that the changes to the flow areas of the ADS Stage 2, 3 and 4 valves do not result in: (1) the calculated total oxidation of the cladding at any point exceeding 0.17 times the total cladding thickness before oxidation; (2) the calculated total amount of hydrogen generated from the chemical reaction of the cladding with water or steam exceeding 0.01 times the hypothetical amount that would be generated if all the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react; and (3) the calculated core temperature not being maintained at an acceptably low value after any successful initiation operation of the passive core cooling system, and does not adversely affect decay heat being removed for the extended period of time required by the long-lived radioactivity remaining in the core. The staff reviewed and verified that the analysis and related calculations used to provide these results are acceptable.

LAR 16-08 indicates that a sensitivity analysis was performed for the most recent limiting small-break LOCA safety analysis case to estimate the effect of the proposed changes to the flow areas of the ADS Stage 2, 3, and 4 valves. The staff reviewed and verified that the sensitivity analysis and related calculations to evaluate the impact on LOCA safety analyses does not result in a maximum fuel element cladding temperature exceeding 2200°F. In evaluating the sensitivity analysis, the staff found that the results support the conclusion that the acceptance criteria remain satisfied for the peak clad temperature, maximum clad oxidation (and related maximum hydrogen generation), coolable geometry, and long-term cooling. With respect to the bases for the sensitivity analysis, the staff reviewed the technical information provided in supporting documents to ensure that the evaluations were reasonable and applicable for their use in assessing the effects for reduced flow areas in the ADS Stage 2, 3, and 4 valves.

Based on its review, the staff concludes that the licensee has provided acceptable flow calculations and analyses to support the changes requested in LAR 16-08 for VCSNS Unit 2 and 3. The staff verified the proper application of flow test results and calculations, and sensitivity calculations, to support LAR 16-08. The staff finds the licensee's flow testing, calculations, and sensitivity analysis are reasonable to support the VCSNS Unit 2 and 3 ADS Stages 2, 3, and 4 flow area reduction specified in LAR 16-08. The staff concludes that the new values for the effective flow areas for the ADS Stage 2, 3, and 4 valves are acceptable in satisfying the regulatory criteria in GDC 2, 4, 35, 36, and 37 with respect to cladding oxidation, hydrogen generation, and core temperature at VCSNS Unit 2 and 3 during design-basis events.

#### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations in 10 CFR 50.91(b), the designated 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 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. Also, 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 (81 FR 92863, published on December 20, 2016). 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.

Because the exemption is necessary to allow the changes proposed in the license amendment, and because the exemption does not authorize any activities other than those proposed in the license amendment, the environmental consideration for the exemption is identical to that of the license amendment. Accordingly, the exemption meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with the issuance of the exemption.

## 6.0 CONCLUSION

The staff has determined that pursuant to Section VIII.A.4 of Appendix D to 10 CFR Part 52, the exemption (1) is authorized by law, (2) presents no undue risk to the public health and safety, (3) is consistent with the common defense and security, (4) presents special circumstances, (5) the special circumstances outweigh the potential decrease in safety due to reduced standardization, and (5) does not reduce the level of safety at the licensee's facility. Therefore, the staff grants the licensee an exemption from Tier 1 information requested by the licensee.

The staff has concluded, based on the considerations discussed in Section 3.2 of this safety evaluation, 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 to be acceptable.

## 7.0 REFERENCES

1. VCSNS Units 2 and 3 Combined Operating License, Appendix C, "Virgil C Summer Nuclear Station Unit 2 [or 3] Inspections, Tests, Analyses, and Acceptance Criteria," dated March 30, 2012 (ADAMS Accession Nos. ML113190437 and ML113190931, as applicable).
2. VCSNS Units 2 and 3 UFSAR, Revision 4, dated July 1, 2016 (ADAMS Accession No. ML16193A229).
3. AP1000 DCD, Revision 19, dated June 13, 2012 (ADAMS Accession No. ML11171A500).

4. U.S. Nuclear Regulatory Commission, Final Safety Evaluation Report Related to the Combined Licenses for Virgil C. Summer Nuclear Station, Units 2 and 3, dated August 17, 2011 (ADAMS Accession No. ML110450305).
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. SCE&G, VCSNS Units 2 and 3, Request for License Amendment and Exemption LAR 16-08, "Automatic Depressurization System (ADS) Stage 2, 3 & 4 Valve Flow Area Changes and Clarifications," dated September 2, 2016 (ADAMS Accession No. ML16246A214).
7. NRC Audit Report of Flow Test Reports and Calculations in Support of Request for License Amendments and Exemptions related to Automatic Depressurization System Stage 2, 3 & 4 Valve Flow Area Changes (ADAMS Accession No. ML16357A730).