

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 45

TO THE COMBINED LICENSE NO. NPF-93

AND LICENSE NO. 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 July 6, 2015 (Agencywide Document Access and Management System (ADAMS) Accession No. ML15188A275), South Carolina Electric & Gas Company (SCE&G) and on behalf of the South Carolina Public Service Authority (both referred to as licensees) requested that the U.S. Nuclear Regulatory Commission (NRC or Commission) amend the combined licenses (COLs) for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, COL Nos. NPF-93 and NPF-94, respectively. The license amendment request (LAR) 14-10 proposes a departure from Tier 2 material in the Updated Final Safety Analysis Report (UFSAR). The licensees also requested an exemption from Tier 1 of the generic design control document (DCD)¹ of the Design Certification for the Westinghouse Advanced Passive 1000 (AP1000). This exemption would allow a change in elements of the certification information in Tier 1 of the DCD incorporated by reference into the COL under Title 10, *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Appendix D, "Design Certification Rule for AP1000 Design," Section III.B. LAR 14-10 proposes a change to the feedwater controller program so it will respond as required to plant transients while minimizing the potential for actuation when it is not desirable. This entails a departure from DCD Tier 2, changing UFSAR Table 17.4-1, "Risk-Significant SSCs within the Scope of D-RAP." It also involves an associated change to Tier 1, Table 3.7-1, "Risk-Significant Components," which is the list of components that are subject to Inspections, Tests, Analyses, and Acceptance Criteria 3.7.00.01 (D-RAP ITAAC).

The feedwater control program will use low-range main feedwater flow and startup feedwater flow signals to determine the total flow aligned to the steam generators. This resulting signal, coincident with a narrow-range steam generator level signal, will initiate the automatic actuation logic for the startup feedwater pumps. The backup logic will actuate the startup feedwater pumps on a wide-range steam generator level signal (rather than a narrow-range steam generator level signal). The change will allow the normal steam generator level transient following a reactor trip to occur without causing the undesired actuation of the startup feedwater

¹ 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.

pumps. This is consistent with UFSAR Subsection 10.4.9.2.3.4. When the main feedwater pumps are not available, the startup feedwater pumps will still start automatically on a signal generated by the plant control system. This provides defense in depth by removal of residual heat through the steam generators before relying on safety-related systems (i.e., the passive residual heat removal heat exchanger) to remove heat from the reactor coolant system.

In a letter dated March 24, 2016 (ADAMS Accession No. ML16084A765), the licensees submitted a supplement to the original LAR. This additional information did not expand the scope of the LAR and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on September 1, 2015 (80 FR 52806).

2.0 REGULATORY EVALUATION

Regulations in 10 CFR Part 52, Appendix D, Section VIII B.5.a require prior NRC approval for departure from Tier 2 material if the departure involves a change to Tier 1 information. The proposed change to Tier 2 Table 17.4-1 affects Tier 1 Table 3.7-1.

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

Regulations in 10 CFR 52.63(b)(1) allow the licensees 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 complies with the requirements of 10 CFR 52.7 and if the special circumstances present outweigh the potential decrease in safety due to reduced standardization (10 CFR 52.7 points to 50.12 for specific exemptions). 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).

Regulations in 10 CFR 52.98(f) state that any modification to, addition to, or deletion from the terms and conditions of a COL including any modification to, addition to, or deletion from the ITAAC contained in the license is a proposed amendment to the license. Appendix C of each COL contains tables which the licensees are proposing to modify. Therefore, the proposed change requires a license amendment.

Regulations in 10 CFR 50.34(f)(2)(xii) require licensees to provide automatic and manual initiation of flow from the auxiliary feedwater system and auxiliary feedwater flow indication in the control room. The certified AP1000 design includes an exemption from these requirements since it does not include a safety-related auxiliary feedwater system. However, the pumps of the non-safety-related startup feedwater system (SFW) are used to supply feedwater to the steam generators during startup, hot standby, cool-down, and when main feedwater pumps are not available. In the final Safety Evaluation Report related to certification of the AP1000 standard design, NUREG-1793 the staff reviewed the SFW of the AP1000 and determined that it satisfies the intent of 10 CFR 50.34(f)(2)(xii).

Requirements for the reduction of risk from an anticipated transient without scram are addressed in 10 CFR 50.62. In part, 10 CFR 50.62(c)(1) requires that each pressurized water reactor must have equipment that is diverse from the reactor trip system (from sensor output to

final actuation device) that can automatically initiate the auxiliary (or emergency) feedwater system and initiate a turbine trip. The certified AP1000 design includes a non-safety-related diverse actuation system (DAS) to provide an alternate turbine trip function and alternate actuation signal of the passive residual heat removal heat exchanger for decay heat removal, which are separate and diverse from the reactor trip system and normal actuation signals of the passive residual heat removal heat exchanger. The other requirements of 10 CFR 50.62(c)(1) must still be met.

3.0 TECHNICAL EVALUATION

3.1 EVALUATION OF EXEMPTION

INTRODUCTION

The regulations in Section III.B of Appendix D to 10 CFR Part 52 require a holder of a COL referencing Appendix D to 10 CFR Part 52 to incorporate by reference and comply with the requirements of Appendix D, including certified information in Tier 1 of the generic AP1000 DCD. The licensees have identified a reason to change the actuation logic of the startup feedwater pumps. This results in the need for a departure; an exemption from the certified design information within plant-specific Tier 1 material is required to implement it.

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, 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 safety. Pursuant to 10 CFR 52.63 (b)(1), the Commission may, upon application by applicants or licensees referencing a certified design, grant exemptions from one or more elements of the certification information, so long as the criteria given in 10 CFR 52.7 and 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.

The requirements of 10 CFR Part 52, Appendix D, and 10 CFR 50.12, 10 CFR 52.7, and 10 CFR 52.63 state that the NRC may grant exemptions from the requirements from the regulations provided six conditions are met. The staff's analysis of these six conditions is discussed below.

3.1.1 AUTHORIZED BY LAW

This exemption would allow the licensees to implement approved changes to Tier 1 information. This is a permanent exemption limited in scope to particular Tier 1 information. Subsequent changes to Tier 1 information would also be subject to the exemption process specified in Section VIII.A.4 of Appendix D to 10 CFR Part 52. As stated above, 10 CFR 52.63(b)(1) allows the NRC to grant exemptions from one or more elements of the certification information. The NRC staff determined that granting of the licensees' proposed exemption will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission regulations. Therefore, as required by 10 CFR 50.12(a)(1), the exemption is authorized by law.

3.1.2 NO UNDUE RISK TO THE PUBLIC HEALTH AND SAFETY

The underlying purpose of Appendix D to 10 CFR Part 52 is to ensure that the licensees will construct and operate the plant based on the approved information found in the DCD

incorporated by reference into the plant licensing basis. The plant-specific Tier 1 DCD will continue to reflect the approved licensing basis for VCSNS Units 2 and 3 and will maintain a consistent level of detail with that which is currently provided elsewhere in Tier 1 of the plant-specific DCD. These proposed changes are evaluated and found to be acceptable in Section 3.2 of this safety evaluation. The change would allow the licensees to implement modifications to Tier 1 information described and justified in LAR 14-10. 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 the licensees to implement modifications to the Tier 1 information. This is a permanent exemption limited in scope to particular Tier 1 information. Subsequent changes to this Tier 1 information or any other Tier 1 information would be subject to full compliance by the licensees as specified in Section VIII.A.4 of Appendix D to 10 CFR Part 52. The systems involved in LAR 14-10 are not related to physical security systems. Therefore, as required by 10 CFR 50.12(a)(1), the staff finds that this exemption has no impact on the common defense and security.

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 purposes of the rule or is not necessary to achieve the underlying purpose of the rule. The underlying purpose of the Tier 1 information is to ensure that the licensees will construct and operate the plant based on the certified information found in the DCD incorporated by reference into the plants licensing basis.

The licensees achieve this purpose, in part, when they provide ITAAC that accurately reflect the plant design and are adequate to verify the construction of the approved design. The requested exemption would allow the licensees to implement the changes proposed in LAR 14-10. The requested change will facilitate plant construction and maintain or enhance future safe plant operation and maintenance, while supporting the ability of the startup feedwater system to perform its design functions. Accordingly, this change to the certified information will enable the licensees to safely construct, maintain, and operate the AP1000 facility consistent with the design certified by the NRC in 10 CFR Part 52, Appendix D.

Special circumstances are present in the particular circumstances discussed in this request, because application of the current generic certified design information in Tier 1 as required by 10 CFR Part 52, Appendix D, Section III.B, would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. Therefore, the staff finds the special circumstances exist for granting of an exemption from the Tier 1 information as required by 10 CFR 50.12(a)(2)(ii).

3.1.5 SPECIAL CIRCUMSTANCES OUTWEIGH REDUCED STANDARDIZATION

This exemption would allow the implementation of changes to VCSNS Units 2 and 3, Tier 1 information proposed in LAR 14-10. Based on the nature of the proposed changes to the generic Tier 1 information and the understanding that these changes were identified while finalizing design details for the AP1000, this exemption may be requested by other AP1000 licensees and applicants. However, a review of the reduction in standardization resulting from the departure from the generic DCD determined that even if other AP1000 licensees and

applicants do not request this same departure, the special circumstances will continue to outweigh any decrease in safety from the reduction in standardization because the key design functions of the startup feedwater system associated with this request will be maintained. This exemption request and the associated changes to VCSNS Units 2 and 3, Tier 1 information demonstrate that there is a minimal change from the standard information provided in the generic AP1000 DCD, which is offset by the special circumstances identified above. The changes have no effect on any systems, structures, or components achieving their design function. Based on this, as required by 10 CFR 52.63(b)(1), the staff finds that the special circumstances outweigh the potential decrease in safety due to reduced standardization of the AP1000 design.

3.1.6 NO SIGNIFICANT REDUCTION IN SAFETY

This exemption proposes to revise the plant-specific DCD Tier 1 information by departing from the certified design in the control logic for actuation of the startup feedwater pumps. The startup feedwater system continues to meet the design function of residual heat removal for defense in depth. The proposed change does not adversely affect any system, structure, or component design function described in the UFSAR. Therefore, 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 PROPOSED CHANGES

LAR 14-10 proposes to modify the control logic implemented in the plant control system for automatic actuation of the SFW pumps. Both the plant control system and SFW are risk-significant, though neither system is safety-related. The SFW provides the defense-in-depth function of core decay heat removal with active components, thereby reducing the frequency of challenge to safety-related systems (When available, the SFW system obviates the need for decay heat removal via the passive core cooling system.). The logic implemented in the plant control system is designed to actuate the two SFW pumps and control feedwater flow to the steam generators.

Currently, the primary control logic actuates on a low-flow signal from the wide-range main feedwater flow instrumentation coincident with a low-level signal from the narrow-range steam generator level instrumentation. The backup control logic actuates on a low-level signal from narrow-range steam generator level instrumentation. The actuation setpoint is well below the normal steam generator level; however, anticipated level fluctuation after a reactor trip may cause SFW pumps to start. The potential automatic actuation of the SFW pumps on a reactor trip is not consistent with the Advanced Light Water Reactor Utility Requirements Document (ALWR URD). Volume 3, Chapter 1, of the ALWR URD includes Requirement 3.5.3, which states that reactor trips not complicated by failures beyond those that caused the trip should not result in the initiation of the backup feedwater system. In addition, the UFSAR Tier 2 Subsection 10.4.9.2.3.4 states, "Following a reactor trip that is not the result of a main feedwater system malfunction and in which the main feedwater system remains available, the startup feedwater pumps do not automatically start." The changes proposed in the LAR 14-10 bring the design into alignment with the guidance in ALWR URD and the description in the UFSAR. Both the primary and backup control logic for the two SFW pumps would be modified:

- For the revised primary control logic, SFW pumps will start on a signal developed from low-range main feedwater flow, SFW flow, and narrow-range steam generator level. The low-range main feedwater flow and SFW flow signals are used to determine the

total feedwater flow aligned to the steam generators. Low total feed flow coincident with a low narrow-range steam generator level signal will initiate the automatic actuation for the SFW pumps.

- The revised backup control logic will initiate automatic actuation for the SFW pumps on a low-level signal from the wide-range steam generator level instrumentation. The expected steam generator level transient that follows a reactor trip would be accommodated without actuating the SFW pumps so long as main feedwater is available (so long as failures beyond those that caused the trip do not occur).

The staff found that the proposed changes would allow the SFW pumps to perform their function while removing the potential for undesired automatic actuation on a reactor trip. The revised control logic for the SFW pumps would be consistent with the guidance included in ALWR URD. In addition, the staff found that the proposed changes to both the primary and backup control logic for the SFW pumps still meet the description of automatic actuation for the SFW pumps in the UFSAR. The modifications of the control logic of the SFW pumps do not change the functionality of the main feedwater system or the SFW. The requirements of 10 CFR 50.34(f)(2)(xii) are still met. Moreover, the changes proposed do not affect the DAS, so the requirements of 10 CFR 50.62(c)(1) are still met. Finally, the staff concludes that the design change does not reduce plant safety and the requirements of 10 CFR 50.12, 52.7 and 52.63(b)(1) are satisfied. Therefore, the changes to the control logic for the automatic actuation of the two SFW pumps as proposed in LAR 14-10 are acceptable. Corresponding changes to the scope of the design reliability assurance program (D-RAP) are consistent with the Commission position on D-RAP implementation. This position is set out in the June 30, 1994, staff requirements memorandum related to SECY-94-084.

4.0 STATE CONSULTATION

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

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 does not involve: (1) a significant hazards consideration, (2) a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, or (3) a 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 the relevant *Federal Register* notices (80 FR 52806, published on September 1, 2015). 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 is required for the proposed 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 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

With regard to the license amendment request, 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 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 LAR 14-10 to be acceptable.

With regard to the exemption request, the staff has determined that pursuant to 10 CFR Part 52, Appendix D, Section VIII.A.4 and VIII.B.4, 10 CFR 50.12, 10 CFR 52.7, and 10 CFR 52.63, 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) has special circumstances present, (5) has special circumstances that outweigh the potential decrease in safety due to reduced standardization, and (6) does not significantly reduce the level of safety at the licensees' facility. Therefore, the staff grants the licensees an exemption from the requirements of 10 CFR Part 52, Appendix D, and Tier 1.

7.0 REFERENCES

1. V. C. Summer Nuclear Station, Units 2 and 3, Updated Final Safety Analysis Report (UFSAR), Revision 3, dated July 1, 2015 (ADAMS Accession No. ML15196A214).
2. V.C. Summer Nuclear Station, Units 2 and 3, Final Safety Evaluation Report (FSER) dated August 17, 2011 (<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr2153/>).
3. 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).
4. AP1000 Design Control Document, Revision 19, dated June 13, 2011 (ADAMS Accession No. ML11171A500).