

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 51

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 January 19, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16019A403), and supplemented by a letter dated March 1, 2016 (ADAMS Accession No. ML16061A427), South Carolina Electric & Gas Company (SCE&G/licensee) requested 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 license amendment request (LAR), 15-21, 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. The proposed amendment would allow changes to construction methods and construction sequence used for the composite floors and roof of the auxiliary building.

In the letter dated March 1, 2016, the licensee provided additional information that supplemented the application. This information did not expand the scope of the application and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on March 15, 2016 (81 FR 13837).

2.0 REGULATORY EVALUATION

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

10 CFR Part 50, Appendix A, General Design Criteria (GDC) 1, "Quality Standards and Records," requires, in part, that structures, systems, and components important to safety be designed, fabricated, erected, constructed, and tested to quality standards commensurate with the importance of the safety functions to be performed.

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

10 CFR Part 50, Appendix A, GDC 4 "Environmental and Dynamic Effects Design Bases," requires, in part, that structures, systems, and components important to safety shall be appropriately protected against dynamic effects associated with missiles, pipe whipping, and discharging fluids, excluding dynamic effects associated with pipe ruptures, the probability of which is extremely low under conditions consistent with the design basis for the piping.

3.0 TECHNICAL EVALUATION

3.1 Proposed Changes

The UFSAR states that several floors in the Auxiliary building are designed as one-way reinforced concrete (RC) slabs continuously supported on steel beams. The beams span between concrete walls, and the slab spanning across the beams is underlain by metal decking for composite action. The concrete slab is anchored to the structural steel by shear connectors, which are welded to the top flange of the floor beam. The concrete slab and the floor beam form a composite floor system. The transformed section after the concrete hardens is able to carry the design loads. No shoring is needed during the construction as the steel beams and the support walls can carry all the weight of the uncured concrete.

LAR 15-21 requests that provisions be made in the UFSAR that allow shoring in localized areas while using unshored construction elsewhere. Local shoring is needed to support the interrupted span of the metal deck to accommodate floor openings and under beams end where the support wall may be sequenced for later construction to accommodate wall penetrations.

In Enclosure 1 of the LAR dated January 19, 2016, the licensee proposed changes to the UFSAR. Specifically, the licensee proposed changes to the following Tier 2* information to UFSAR Subsection 3H.5.2, "Composite Structures (Floor and Roof)":

- a) Revise the statement in first paragraph to clarify that the unshored construction is only applicable to beams:

The beams are designed as unshored, composite beams with formed metal deck spanning perpendicular to the members.

- b) Delete the next statement:

~~Unshored construction is used.~~

- c) Revise the third bullet in the construction sequence under "Structural Description"

to apply the requirements for the use of no shoring to beams by adding the following at the end to read:

During concreting, no shoring is provided for the beams supporting the floors and roof. Local shoring of the metal deck at penetrations and other openings in the floor and supporting wall, or to act as temporary support at the location of an incomplete wall, is acceptable.

3.2 Evaluation of Proposed Changes

The information presented by the licensee in this LAR was evaluated by the NRC staff for its completeness, quality, and clarity, and a technical review of the proposed changes requested by this LAR was performed. As part of this license amendment, SCE&G did not request any changes to design; it only requested the use of temporary shoring at some locations within the area identified in UFSAR, Subsection 3H.5.2, Tier 2*.

VCSNS Units 2 and 3 UFSAR, Subsection 3.8.4.5 establishes that the analysis and design of concrete structures conform to American Concrete Institute (ACI) 349-01, "Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary," and steel structures conform to American Institute of Steel Construction, Inc. (AISC) N690-94, "Specification for Safety-Related Steel Structures for Nuclear Facilities." Both ACI 349-01 and AISC N690-94 provide design requirements for the metal decks, composite beams, and concrete walls discussed in the LAR. According to the LAR, the licensee considered the code requirements when making the proposed changes to the construction sequence and method.

The NRC staff considered UFSAR Section 3.8, "Design of Category I Structures" in performing 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" (ADAMS Accession No. ML112061231), and the "Final Safety Evaluation Report for the Virgil C. Summer Nuclear Station Units 2 and 3 Combined License Application" (ADAMS Accession No. ML110450305), both of which document the staff's technical evaluation of the AP1000 DCD and VCSNS Units 2 and 3 UFSAR, respectively. The requested changes are related to the construction method and sequence for the auxiliary building floors and roof.

3.2.1 Evaluation of Construction Methods

The proposed amendment involves changes to construction methods from unshored to shored construction, resulting in changes to construction sequence for the composite floors, roof, and support walls at penetrations, openings, and beam ends. Approval of the proposed amendment would limit the use of unshored construction to only the design and construction of supporting beams.

The staff considers the structural performance of the composite floors and roof in the auxiliary building to see if a different analysis method is needed because of the proposed change in construction methods. Staff finds structural performance depends only on the strength of reinforced concrete and steel beams, not on the use of shoring systems. In the construction sequence with the use of unshored construction, the steel beams are designed to support the full weight of the wet concrete and other construction loads. The use of shoring (i.e., localized temporary support) for penetrations or openings should not give rise to significant load transfer after the shoring is removed. Similarly, the localized shoring of the metal deck and the removal

of the shoring does not adversely affect the steel beams in the construction sequence of concrete placement because the metal deck is more flexible than the steel beams. If the deck opening is near the beam mid-span, a slight increase in compressive stress in the concrete is possible when the shoring is removed. In all cases, the impact due to shoring is insignificant. Moreover, the design of the auxiliary building composite floors and roof using localized temporary supports is in conformance with ACI 349-01 and AISC-1998 N690, Paragraph Q1.11.2.2. The staff concludes that the use of shoring for the metal deck at penetrations or openings does not change the structural model used for the evaluation of the auxiliary building and the design of the nuclear island structures with the changes remains in conformance with the applicable codes and, therefore, are acceptable.

3.2.2 Evaluation of Construction Sequence

The proposed amendment involves changes to construction methods and construction sequence, resulting in a change to the loading path. The staff evaluated the proposed amendment to determine if there is an impact and risk on load transfer due to changes in construction sequence and to the resulting loading path. There are two cases in unshored construction where shoring would be used to provide temporary support for penetrations/openings: (a) shoring around openings where the metal deck has penetrations, and the span of the metal deck is interrupted by the opening; and (b) shoring under steel beams supporting the metal deck until the support concrete wall is complete. It was not clear to the staff for case (b) on the extent of the use of the shoring and how the load transfer will be made from the shoring system to the support wall to be constructed.

On February 4, 2016, the staff held a public teleconference with Southern Nuclear Operating Company, the licensee for the Vogtle Electric Generating Plant Units 3 and 4, and SCE&G to discuss the use of shoring to provide temporary support for openings used in construction activities and to request more detail on the extent of use of shoring under steel beams supporting the metal deck until the support wall is complete. The staff also requested clarification on how the load transfer will be made from the shoring to the support wall to be constructed. The public meeting handout can be found at ADAMS Accession No. ML16033A051, and the public meeting summary can be found at ADAMS Accession No. ML16075A423.

In a letter dated March 1, 2016, the licensee provided supplemental information to the LAR (LAR-15-21S1) (ADAMS Accession No. ML16061A427) in response to staff's comments. In the response, the licensee stated that the AP1000 auxiliary building steel composite beams were designed as unshored. However, regardless if it was constructed as "shored" or "unshored," the ultimate strength of a steel composite beam is the same. The requested shoring refers to temporary support for the beam at or near its end, precluding at points along its length addressed in AISC N690. On occasions, construction sequencing may require that the beams or metal deck be set in place before a supporting wall is completed. When the installation of a penetration in a wall is not complete and the adjacent concrete is not placed yet, the metal decking or end of the steel beam may be supported by shoring until the concrete is completed. The permanent support may have shoring until the remaining concrete in the wall is placed, set, and cured. Then the temporary support is removed under controlled conditions. In the end, the load is carried by RC in the floor and wall and permanent supports; the stress state is no different from the pure unshored construction.

The NRC staff reviewed the change of load path and load transfer in the construction sequencing for the use of shoring at the beam ends and at the openings to see if there is a significant transfer of loads when the shoring is removed. The staff found that the proposed changes are allowed by the applicable codes and that the safety risk from loading path alteration is insignificant, discounting the design-basis accident conditions, and therefore are acceptable.

Summary

The staff reviewed all of the proposed changes in LAR 15-21; staff agrees that, in both cases of localized shoring, the composite floor behavior remains unaffected. There are no changes to the design, functional capabilities, design analysis, or safety analysis. Moreover, tests, experiments, and procedures described in the licensing basis were not changed by these departures. Therefore, because the requirements of the applicable codes, AISC N690 and ACI 349, which govern the design and construction of composite floors, are met by the UFSAR, the staff finds that the proposed changes in the LAR are acceptable and provide clarity to the licensing basis.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20, "Standards for Protection Against Radiation." The NRC staff has determined that the amendment involves no significant 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, and there has been no public comment on such finding (81 FR 13837, published on March 15, 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.

6.0 CONCLUSION

The staff has concluded, based on the considerations discussed above and confirming that these changes do not change an analysis methodology, assumptions, or the design itself, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that 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 acceptable.

7.0 REFERENCES

1. Request for License Amendment (LAR) 15-21: Use of Localized Shoring for Composite Floors and Roof in Auxiliary Building, letter from South Carolina Electric & Gas Company, dated January 19, 2016 (ADAMS Accession No. ML16019A403).
2. VCSNS, Units 2 & 3 – LAR 15-21S1: Supplement 1 to License Amendment Request 15-21, Use of Localized Shoring for Composite Floors and Roof in Auxiliary Building, dated March 1, 2016 (ADAMS Accession No. ML16061A427).
3. VEGP, Units 3 & 4 – LAR 15-020 Follow-up Public Meeting, dated February 4, 2016 (ADAMS Accession No. ML16033A051).
4. 02/04/2016 – Summary of Public Meeting with Southern Nuclear Operating Company and South Carolina Electric and Gas (ADAMS Accession No. ML16075A423).
5. Virgil C. Summer Nuclear Station Units 2 and 3 (VCSNS) Updated Final Safety Analysis Report (UFSAR), Revision 3, dated July 1, 2015 (ADAMS Accession No. ML15196A214).
6. AP1000 Design Control Document, Revision 19, dated June 13, 2011 (ADAMS Accession No. ML11171A500).
7. Virgil C. Summer Nuclear Station Units 2 and 3 Final Safety Evaluation Report, dated August 17, 2011 (ADAMS Accession No. ML110450305).
8. 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).
9. American Concrete Institute (ACI), “Code Requirements for Nuclear Safety Related Concrete Structures,” (ACI 349-01).
10. American Institute of Steel Construction (AISC), “Specification for Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities,” AISC N690-1994.