

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 35

TO THE COMBINED LICENSE NO. NPF-91

AND LICENSE NO. NPF-92

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

VOGTLE ELECTRIC GENERATING PLANT UNITS 3 AND 4

DOCKET NOS. 52-025 AND 52-026

1.0 INTRODUCTION

By letter dated January 30, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15030A505), Southern Nuclear Operating Company (SNC/licensee) requested that the U.S. Nuclear Regulatory Commission (NRC) amend the combined licenses (COLs) for Vogtle Electric Generating Plant (VEGP) Units 3 and 4, COL Numbers NPF-91 and NPF-92, respectively.

The proposed License Amendment Request (LAR) involves changes to three human factors engineering (HFE) plans (prepared by Westinghouse and reviewed by the NRC as part of the design certification rule) that are incorporated by reference in the VEGP 3 and 4 Updated Final Safety Analysis Report (UFSAR). These are:

- HFE Design Verification Plan (APP-OCS-GEH-120)
- HFE Task Support Verification Plan (APP-OCS-GEH-220)
- HFE Integrated System Validation Plan (APP-OCS-GEH-320)

Specifically, the licensee proposes to align the Design Verification Plan and Integrated Systems Validation (ISV) Plan with the Task Support Plan, update mapping of risk-important human actions (RIHAs) to the ISV accident scenarios where those actions are demonstrated, and provide clarifications and editorial corrections.

The contents of these reports are designated as Tier 2\* ("Tier 2 star," defined in Section 14.3 of the Standard Review Plan as "the portion of the Tier 2 information, designated as such in the generic design control document (DCD), which is subject to the change process in the design certification rule") because they contain the "acceptance criteria" portion of the inspections, tests, analyses, and acceptance criteria (ITAAC) associated with the HFE verification and validation process.

In a letter dated March 20, 2015 (ADAMS Accession No. ML15079A181), the licensee submitted additional information that supplemented the 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 March 17, 2015 (80 FR 13902).

## 2.0 REGULATORY EVALUATION

Appendix D, "Design Certification Rule for the AP1000 Design," of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Section VIII.B.6.a requires NRC approval for departures from Tier 2\* information. Because the proposed LAR involves changes to Tier 2\* information, NRC approval is required before making the Tier 2\* changes addressed in this departure. The NRC staff considered the following regulatory requirements in reviewing the licensee's proposed UFSAR changes.

Section 10 CFR 50.34(f)(2)(iii) requires a control room design that reflects state-of-the-art human factors principles.

NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2 (ADAMS Accession No. ML12205A463), provides guidance on how to meet 10 CFR 50.34(f)(2)(iii).

## 3.0 TECHNICAL EVALUATION

The following sections provide the staff's evaluation of the proposed changes to each of the HFE plans.

### **3.1 Evaluation of Changes to HFE Design Verification Plan (APP-OCS-GEH-120)**

Change 1: Update to the Design Verification Plan to provide final confirmation that the safety parameter display information meets accepted HFE principles.

Change 1 states:

It is proposed that text be added to Section 1.3, "Scope," of the Design Verification Plan to provide final confirmation that the safety parameter display information for the AP1000 meets accepted HFE principles.

Staff Evaluation: The licensee submitted the proposed revision to the Design Verification Plan, which includes the safety parameter display system (SPDS) in Section 1.2.2, "List of Human Systems Interfaces Requiring Verification." This section is part of Section 1.2, "Scope."

The revision is necessary because the Task Support Verification Plan, which was previously approved by the staff, requires that the Design Verification Plan provide final confirmation that the SPDS information meets accepted HFE principles. This change ensures consistency between the Design Verification Plan and the Task Support Verification Plan. Accordingly, the staff concludes the change is acceptable.

Change 12: Update revision numbers and remove document numbers that were inadvertently added to the reference section of the UFSAR.

Change 12 is summarized in Table 1 of the licensee's submittal. This change updates the revision number of the Design Verification Plan in the bibliography sections of the Task Support Verification Plan and the ISV Plan. This change also removes the document number that was

inadvertently added to the Design Verification Plan document title in the reference section of the UFSAR.

Staff Evaluation: This change adds the updated revision number for the Design Verification Plan to the Task Support Verification Plan, the ISV Plan, and the VEGP Units 3 and 4 UFSAR. This change ensures administrative accuracy and provides references to supporting materials. Accordingly, the staff finds this change is acceptable.

Additionally, removing the document report number from the title removes redundant information; the document report number is located in a column adjacent to the title. This change ensures administrative accuracy. Accordingly, the staff finds this change is acceptable.

### **3.2 Evaluation of Changes to HFE Task Support Verification Plan (APP-OCS-GEH-220)**

Change 2: Clarification regarding requirements for the existence of indications, alarms, key page links, and controls and where they are displayed.

Change 2 states:

Change 2a: A change is proposed to reword the FBTA (function-based task analysis) recommendations related to the location of indications, alarms, and key links on the function-based displays. The change provides clarification to the information to be contained in the FBTA Summary Report.

This change clarifies the following:

- Key display page links are provided on function-based displays to allow navigation to associated system displays for more detail and control interface.
- Indications and alarms recommended by the summary report can be on either the function-based display or the associated system displays.
- Controls are only on system displays.

The change also clarifies that the FBTA Summary Report does not merely provide optional recommendations for the design of function-based and associated system displays. It provides the interface requirements (i.e., key links, controls, indications, and alarms) that are required to be addressed for these displays.

An additional change is proposed to update the revision number of APP-OCS-J1A-030 in the Task Support Verification Plan to reflect the current version of this document.

Change 2b: To preclude the need for unnecessary revisions to Tier 2\* text in the future, a change is proposed to remove the section number from the reference to APP-OCS-J1A-030.

NUREG-0711, Review Element "Task Analysis," Section 5.4, "Review Criteria," Acceptance Criterion (5) states the task analysis results should be used to define a minimum inventory of alarms, displays, and controls necessary to perform crew tasks based on both task and instrumentation and control requirements.

Acceptance Criterion (6) states in part that the task analysis results should provide input to the design of human system interface (HSIs).

Staff Evaluation, Change 2a: The proposed change to clarify the information to be contained in the FBTA Summary Report about the location of indications, alarms, and key links on the displays provides additional detail that does not change the process previously approved by the staff. Accordingly, the staff finds this change is acceptable.

The proposed change to revise the Task Support Verification Plan to state that the FBTA Summary Report provides requirements for the design of HSI displays instead of optional recommendations is a clarification that conforms to the acceptance criteria. Accordingly, the staff finds this change is acceptable.

The proposed change to update the revision number for the FBTA Results Report (APP-OCS-J1A-030) ensures administrative accuracy and is acceptable.

Staff Evaluation, Change 2b: The proposed change to remove the specific section number from the listed reference is an administrative change that does not reduce the scope of the information. Accordingly, this change is also acceptable.

Change 12: Update revision numbers and remove document numbers that were inadvertently added to the reference section of the UFSAR.

Change 12 is summarized in Table 1 of the licensee's submittal. This change updates the revision number of the Task Support Verification Plan in the bibliography sections of the Design Verification Plan and the Integrated Systems Validation (ISV) Plan. This change also removes the document number that was inadvertently added to the Task Support Verification Plan document title in the reference section of the UFSAR.

Staff Evaluation: This change adds the updated revision number for the Task Support Verification Plan to the Design Verification Plan, the ISV Plan, and the VEGP Units 3 and 4 UFSAR. This change ensures administrative accuracy and provides references to supporting materials. Accordingly, the staff finds this change is acceptable.

Additionally, removing the document report number from the title section of the UFSAR reference section removes redundant information; the document report number is located in a column adjacent to the title. This change ensures administrative accuracy. Accordingly, the staff finds this change is acceptable.

### **3.3 Evaluation of Changes to HFE Integrated System Validation Plan (APP-OCS-GEH-320)**

Change 3: Clarification to how ISV Objective 2 is satisfied.

Change 3 states:

A change is proposed to Section 1.2, "Purpose," of the ISV Plan to describe how this objective is met without expanding the scope of ISV to include the "full array of manual and automatic AP1000 system features." Specifically, Section 1.2 is updated to state that the objective is met by performing a broad range of important tasks necessary to respond to the events specified in the ISV Plan Section 5.1.1, "Events."

The change also specifies that data is collected during these events and analyzed per ISV Plan Section 6, "Data," and that human engineering discrepancy (HED) are identified, including any applicable to function allocation assignment.

NUREG-0711, Review Element 11, "Human Factors Verification and Validation," Section 11.1, "Background," states in part that the sampling of operational conditions to support verification and validation (V&V) tests is important because reviews of new plants can involve hundreds or thousands of individual HSI components.

Staff Evaluation: There is no requirement for operating crews to exercise the "full array of manual and automatic features" during ISV. Events included in the ISV are selected in accordance with the sampling process described in NUREG-0711, Section 11.4.1, "Operational Conditions Sampling." This change conforms to the acceptance criteria because the additional information provided in Section 1.2 under Objective 2 concerning the collection of data is an enhancement that aligns with information in Section 6 of the ISV Plan that was previously approved by the staff. Accordingly, the staff finds this change is acceptable.

Change 4: Correction to the ISV Plan to state that EOF and TSC V&V is performed within task support verification, not design verification.

Change 4 states:

A change is proposed to revise Section 1.3 of the ISV Plan to reference the Task Support Verification Plan, APP-OCS-GEH-220, instead of the Design Verification Plan, APP-OCS-GEH-120 for verification and validation of the EOF and TSC.

Also, the change will add APP-OCS-GEH-220 to the Bibliography section of the ISV Plan.

NUREG-0711, Review Element 2, "HFE Program Management," Section 2.4.1, "General HFE Program Goals and Scope," Acceptance Criterion (3) states in part that the HFE program should address the technical support center (TSC) and emergency operations facility (EOF).

WCAP-15860, "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan," specifically requires that the TSC be included in the Design Verification Plan; however, the current revision of the Design Verification Plan, which was approved by the staff, lists exceptions to WCAP-15860. One of the exceptions is that the TSC will be addressed by the Task Support Verification Plan instead of the Design Verification Plan.

Staff Evaluation: The change to the ISV Plan to reference the Task Support Verification Plan instead of the Design Verification Plan is necessary to provide consistency between the ISV Plan, Task Support Verification Plan, and WCAP-15860. This change is acceptable.

The change to add the Task Support Verification Plan to the bibliography of the ISV Plan is necessary to provide an accurate list of references. Accordingly, this change is also acceptable.

Change 5: Update to the ISV Plan to provide final confirmation that the safety parameter display information meets accepted HFE principles.

Change 5 states:

It is proposed that text be added to Section 1.3, "Scope," of the ISV Plan to provide final confirmation that the safety parameter display information meets accepted HFE principles.

Staff Evaluation: The licensee submitted the proposed revision to the ISV Plan, which includes a discussion in Section 1.3, "Scope," of how the ISV provides final confirmation that the safety parameter display system (SPDS) information meets accepted HFE principles. The revision is necessary because the Task Support Verification Plan, which was previously approved by the staff, states that the ISV Plan will provide final confirmation that the SPDS information meets accepted HFE principles. This change ensures consistency between the ISV Plan and the Task Support Verification Plan. Accordingly, the staff concludes the change is acceptable.

Change 6: Correction to the RIHA mapping to accidents.

Change 6 states:

A change is proposed to Section 5.1.1, "Events," to update the mapping of RIHAs to accidents and to include an additional accident (Loss of Heat Sink) to account for all RIHAs.

Associated Tier 2 changes are proposed to increment the revision number of APP-OCS-GLR-001, "AP1000 Post-Accident Risk-Important Human Actions Summary Report," in APP-OCS-GEH-120, APP-OCS-GEH-220, and APP-OCS-GEH-320 and to increment the revision number of APP-OCS-GEH-321, "AP1000 Human Factors Engineering Integrated System Validation Scenario Information," in APP-OCS-GEH-320. These references include information related to the mapping of RIHAs to accidents performed in the ISV. Though these documents are not considered to contain licensing basis text, their revision number in APP-OCS-GEH-320 is considered to be Tier 2 information. Therefore, the changes to the revision number of these references involve the Tier 2\* changes proposed by this change.

NUREG-0711, Review Element 11, "Human Factors Verification and Validation," Section 11.4.1.2.1, "Sampling Dimensions," Acceptance Criterion (1) states in part that transients; accidents; and reasonable, risk-significant, beyond-design-basis events, which should be determined from the plant specific PRA; should be included in the ISV.

Acceptance Criterion (2) states in part that all RIHAs should be included in the sample of personnel tasks included in the ISV.

Staff Evaluation: Revision 3 of the ISV Plan, which was previously approved by the staff, lists the various simulated accidents that will be included in the ISV scenarios to demonstrate reliable implementation of the RIHAs. The licensee describes this as "mapping" the RIHAs to ISV scenarios. This revision changes the specific scenarios that will test certain RIHAs; however, all RIHAs are still associated with, or mapped to, a scenario that will be included in the ISV. Accordingly, the staff concludes the change is acceptable.

Including a simulated loss of heat sink accident in an ISV scenario will allow for the demonstration of certain RIHAs. This change conforms to the acceptance criteria, and the staff therefore concludes the change is acceptable.

The proposed change to update the revision numbers of Tier 2 documents that are referenced in the ISV Plan ensures administrative accuracy and provides access to supporting materials. Accordingly, the staff concludes the change is acceptable.

Change 7: Change to the list of exceptions from WCAP-15860 related to EOPs.

Change 7 states:

A change is proposed to Section 1.5, "List of Exceptions from WCAP-15860," and Section 5.1.2, "Procedures," to revise the justification for this exception. The revised justification will continue to require that the ISV scenarios include a representative subset of EOPs. However, it will no longer require ISV to assess knowledge, skills, and abilities addressed in EOPs. The new justification will be consistent with the other sections of the ISV Plan, specifically ISV Objective 3 (see Section 1.2 of the ISV Plan) and Section 5.1.1, "Events." It will also specify that the actual subset of EOPs to be exercised during ISV corresponds to the required events of Section 5.1.1 of the ISV Plan.

NUREG-0711, Review Element 9, "Procedure Development," Section 9.1, "Background," states in part that procedures "support and guide personnel interactions with plant systems and their response to plant-related events."

Staff Evaluation: Procedures are tools; they do not "address" operator knowledge, skills, and abilities. This change eliminates vague information in the ISV Plan and replaces it with accurate information (located in Section 1.2 of the ISV Plan under ISV Objective 3) that was previously approved by the staff. Accordingly, the staff concludes the change is acceptable.

Change 8: Align statements within the ISV Plan that describe the use of Post-72 Hour Equipment Operating Procedures, Refueling and Outage Procedures, and Severe Accident Management Guidelines.

Change 8 states:

Change 8a: This proposed change removes contradictory information regarding the inclusion of Post-72 Hour Equipment Operating Procedures and Severe Accident Management Guidelines by deleting these procedure categories from the list in Section 5.1.2 in the ISV Plan.

Change 8b: This proposed change deletes Refueling and Outage Procedures from the list in Section 5.1.2 in the ISV Plan. Section 5.1.2 is also revised to state that no ISV events are performed in Mode 6 instead of stating that no ISV events are performed in outage and refueling modes. Section 5.1.2 then clarifies that there are events that could occur with the plant in Mode 6. These events are exercised in the ISV scenarios while in Mode 5 in lieu of Mode 6.

NUREG-0711, Review Element 11, "Human Factors Verification and Validation," Section 11.4.1.2.1, "Sampling Dimensions," Acceptance Criterion (1) states in part that accidents (e.g., main steam line break, positive reactivity addition, control rod insertion at power, anticipated transient without scram, and various-sized loss-of coolant accidents) should be included in the ISV. It also states in part that normal operational events including plant shutdown or refueling should be included in the ISV.

Staff Evaluation, Change 8a: NUREG-0711 does not state that the ISV must exercise the severe accident management guidelines, which are designed to mitigate core damage, or the post-72 hour equipment operating guidelines. Section 5.1.1 of the ISV Plan states that the simulator will not model core damage or post-72 hour accident scenarios, and this was previously approved by the staff. Accordingly, the staff concludes the change is acceptable.

Staff Evaluation, Change 8b: The ISV Plan lists the events and plant modes of operation that will be included in the scenarios. The scenarios will cover events in Modes 1 – 5. Mode 6 is entered from Mode 5 when at least one reactor vessel head bolt is untightened in preparation for refueling. This is not an action that is modeled on the simulator; operators do not have indication of the reactor vessel head bolts in the main control room. Events that could occur during Mode 6, e.g., loss of shutdown cooling, could also occur in Mode 5. There are ISV scenarios that exercise events in Mode 5 that could also occur in Mode 6. Thus, the ISV scenarios still include conditions that are representative of the range of events that could be encountered during operation of the plant. Accordingly, the staff concludes the change is acceptable.

Change 9: Update obsolete statement about design verification occurring prior to ISV.

Change 9 states:

A change is proposed to update Section 6.2, "Methods," by removing the obsolete statement that design verification occurs prior to ISV. This change aligns Section 6.2 with Figure 1.1-1, "AP1000 Verification and Validation Activities," in the ISV Plan.

Staff Evaluation: VEGP Units 3 and 4 license Amendment No. 015 (ADAMS Accession Nos. ML13326A871 and ML13354B867) approved a change to the HFE plans to permit design verification, task support verification, and the ISV to occur in parallel. Figure 1.1-1, "AP1000 Verification and Validation Activities," was approved by the staff in an earlier revision of the ISV Plan, and the figure shows that design verification, task support verification, and ISV may occur in parallel. The proposed change deletes incorrect information and ensures that information in the ISV Plan is accurate. Accordingly, this change is acceptable.

Change 10: Clarification to the ISV Plan that the HED Resolution Process prioritizes HEDs.

Change 10 states:

The changes are proposed to clarify Sections 7, 7.2, and 7.3 of the ISV Plan by explicitly stating that HED prioritization occurs under APP-OCS-GEH-420, and is to be documented in the associated report.



NUREG-0711, Review Element 11, “Human Factors Verification and Validation,” Section 11.3, “Applicant Submittals,” states that applicants should submit a results summary report to facilitate the staff’s review of verification and validation evaluations, which includes HED resolution. NUREG-0711, Review Element 11, “Human Factors Verification and Validation,” Section 11.4.4.2, “Human Engineering Discrepancy Resolution Review Criteria,” Acceptance Criterion (4) states in part that each HED should be fully documented including assessment category (priority for correction).

Staff Evaluation: The staff previously approved the AP1000 Human Factors Engineering Discrepancy Resolution Process (APP-OCS-GEH-420), which conforms to the acceptance criteria in NUREG-0711. This change adds information to the ISV Plan to specify that HEDs identified during the conduct of the ISV will be prioritized and documented in accordance with APP-OCS-GEH-420. This clarification ensures ISV HEDs are evaluated in accordance with previously reviewed and approved procedures. Accordingly, the staff finds this change is acceptable.

Change 11: Correction to the ISV Plan which incorrectly uses the term “scenario.”

Change 11 states:

A change to Section 7.3 text is proposed to replace the inappropriate usage of the term “scenario” with the term “trial.”

Staff Evaluation: This change corrects the terms so they are consistently used throughout the ISV Plan. Accordingly, the staff finds this change acceptable.

Change 12: Change revision numbers and remove document numbers that were inadvertently added to the reference section of the UFSAR.

Change 12 is summarized in Table 1 of the licensee’s submittal. This change updates the revision number of the ISV Plan in the bibliography sections of the Design Verification Plan and the Task Support Verification Plan. This change also removes the document number that was inadvertently added to the ISV Plan document title in the reference section of the UFSAR.

Staff Evaluation: This change adds the updated revision number for the ISV Plan to the Design Verification Plan, the Task Support Verification Plan, and the VEGP Units 3 and 4 UFSAR. This change ensures administrative accuracy and provides references to supporting materials. Accordingly, the staff finds this change is acceptable.

Additionally, removing the document report number from the title section of the UFSAR reference section removes redundant information; the document report number is located in a column adjacent to the title. This change ensures administrative accuracy. Accordingly, the staff finds this change is acceptable.

### **3.4 Summary**

The staff concludes that the changes proposed in LAR 15-001 conform to HFE-related regulatory guidance as explained in the technical evaluation section of this report. In general, the changes are administrative or reflect additional detail that has become available since approval of previous revisions of the HFE implementation plans. This additional detail has, in general, increased the clarity and usability of the HFE plans, which support effective

implementation of the associated ITAAC. Based on these findings, the NRC staff concludes that there is reasonable assurance that the requirements of Appendix D, "Design Certification Rule for the AP1000 Design," to 10 CFR 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" and 10 CFR 50.34(f)(2)(iii) will continue to be met. Therefore, the staff finds the proposed changes to be acceptable.

#### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations in 10 CFR 50.91(b) (2), the Georgia 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 (80 FR 13902; published on March 17, 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 need be prepared in connection with the issuance of the amendment.

#### 6.0 CONCLUSION

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

The LAR addresses changes to HFE Reports. Where approval of these changes is provided, such approval is only applicable to VEGP Units 3 and 4 and should not be interpreted as generic approval.

## 7.0 REFERENCES

1. Request for License Amendment – Human Factors Verification and Validation Plan Updates to Support Integrated System Validation (LAR 15-001) letter from Southern Nuclear Operating Company (SNC) to U.S. Nuclear Regulatory Commission, dated January 30, 2015 (ADAMS Accession No. ML15030A505).
2. Southern Nuclear Operating Company, Inc., “Vogtle Electric Generating Plant (VEGP) Updated Final Safety Analysis Report (UFSAR),” Revision 2, dated July 3, 2013 (ADAMS Accession No. ML13205A347).
3. Westinghouse Electric Company LLC, “AP1000 Human Factors Engineering Design Verification Plan,” APP-OCS-GEH-120, Revision 3 (Proprietary).
4. Westinghouse Electric Company LLC, “AP1000 Human Factors Engineering Task Support Verification Plan,” APP-OCS-GEH-220, Revision 4 (Proprietary).
5. Westinghouse Electric Company LLC, “AP1000 HFE Integrated System Validation Plan,” APP-OCS-GEH-320, Revision 6 (Proprietary).
6. U.S. Nuclear Regulatory Commission, “Human Factors Engineering Program Review Model,” NUREG-0711, Revision 2, dated February 2004 (ADAMS Accession No. ML12205A463).
7. U.S. Nuclear Regulatory Commission, “Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design,” NUREG-1793, Supplement 2 (ADAMS Accession No. ML112061231).