SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 16 TO THE COMBINED LICENSE NO. NPF-93

AND LICENSE NO. NPF-94

SOUTH CAROLINA ELECTRIC AND 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 letters dated March 13, 2013, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13074A731), September 25, 2013 (ADAMS Accession No. ML13270A068), September 25, 2013 (ADAMS Accession No. ML13270A096), October 3, 2013 (ADAMS Accession No. ML13283A160), and October 3, 2013 (ADAMS Accession No. ML13281A241), South Carolina Electric and Gas Company (SCE&G/licensee) submitted license amendment requests (LARs) 13-10, 13-16, 13-17, 13-18, and 13-19, respectively and requested that the U.S. Nuclear Regulatory Commission (NRC/Commission) amend the combined licenses (COLs) for Virgil Summer Nuclear Station (VCSNS) Units 2 and 3, COL Numbers NPF-93 and NPF-94, respectively. The proposed LARs involve changes to the five Human Factors Engineering (HFE) Reports (prepared by Westinghouse Electric Company (Westinghouse) and reviewed by the U.S. Nuclear Regulatory Commission (NRC) as part of the design certification rule) that are incorporated by reference in the VCSNS updated final safety analysis Report (UFSAR). These are:

- HFE Design Verification Plan (APP-OCS-GEH-120) (LAR 13-16)
- HFE Task Support Verification Plan (APP-OCS-GEH-220) (LAR 13-17)
- HFE Integrated System Validation (APP-OCS-GEH-320) (LAR 13-10)
- Human Engineering Discrepancy Resolution Process (APP-OCS-GEH-420) (LAR 13-18)
- Plant Startup HFE Design Verification Plan (APP-OCS-GEH-520) (LAR 13-19)

The licensee stated that the five HFE validation and verification (V&V) activities (as defined in APP-OCS-GEH-120, APP-OCS-GEH-220, APP-OCS-GEH-320, APP-OCS-GEH-420 and APP-OCS-GEH-520) work together to describe the final processes to assess whether the AP1000 design attains a high standard of human factors adequacy and to demonstrate that the AP1000 HFE Program is satisfactorily complete.

The five LARs to change these reports are as follows:

- LAR 13-10 deals with HFE Report GEH-320, the Human Factors Engineering Integrated System Validation (ISV) Plan (dated February 15, 2013). The proposed changes add more details regarding implementation of the ISV Plan.

- LAR 13-16 deals with HFE Report GEH-120, the Human Factors Engineering Design Verification Plan (dated March 15, 2013). The proposed changes provide a number of clarifications to the Design Verification Plan that is required to align the plan with the latest plant design parameters.

- LAR 13-17 deals with HFE Report GEH-220, the Human Factors Engineering Task Support Verification Plan (dated March 15, 2013). The proposed changes are intended to better align the HFE Task Support Verification Plan with the AP1000 design and procedures.

- LAR 13-18 deals with HFE Report GEH-420, the Human Factors Engineering Discrepancy Resolution Process (dated April 5, 2013). The proposed changes are intended to refine the process for capturing and resolving human engineering discrepancies (HEDs) from the process document.

- LAR 13-19 deals with HFE Report GEH-520, the Plant Startup Human factors Engineering Design Verification Plan (dated May 10, 2013). The proposed changes are needed to confirm aspects of the design features of the human system interface (HSI) and operation and control centers systems (OCS) that could not be evaluated in other HFE V&V activities.

The licensee also stated that the HFE design verification (GEH-120) and task support verification (GEH-220) are complementary verification activities. Design verification focuses on assessing whether the final design products adhere to the HFE design guidelines. In contrast, the task support verification is based on the controls, indications, and alarms that were identified from the AP1000 task analyses, and ensures that controls, indications, and alarms are appropriately provided. The integrated system validation (GEH-320) is a more extensive and more complex testing activity, requiring use of a simulator, a realistic operating environment, plant operators, and realistic operating scenarios.

Each of these three V&V activities is executed separately. However, the results of these assessments feed into the human engineering discrepancy (HED) resolution process (GEH-420). Finally, the HFE Verification at Plant Startup (GEH-520) is a final check to address items that could not be fully addressed in the preceding assessments and to address any outstanding HEDs.

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 DCD [design control document], which is subject to the change process in the design certification rule") because they contain the "acceptance criteria" portion of the inspections, tests, and acceptance criteria (ITAAC) associated with HFE V&V process. Therefore, any change to the reports requires prior NRC approval through an LAR.

Licensee supplemented its application by letters dated:

- October 3, 2013 (ADAMS Accession No. ML13281A366), for LAR 13-10
- February 10, 2014 (ADAMS Accession No. ML14043A081), for LAR 13-17
- June 6, 2014 (ADAMS Accession No. ML14157A309), for LAR 13-19

In the supplemental letters, the licensee provided additional information that clarified the application, did not expand the scope of the application as originally noticed and did not change the NRC staff's original proposed "no significant hazards consideration" determination as published in the *Federal Register* on May 28, 2013 (78 FR 31984 for LAR 13-10), November 12, 2013 (78 FR 67412 for LAR 13-16, 78 FR 67411 for LAR 13-17, 78 FR 67413 for LAR 13-18, and 78 FR 67413 for LAR 13-19).

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 requires 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. The NRC staff considered the following regulatory requirements in reviewing the licensee's proposed UFSAR changes.

In Appendix A, "General Design Criteria for Nuclear Power Plants," to Part 50, "Domestic Licensing of Production and Utilization Facilities," of Title 10, "Energy," of the *Code of Federal Regulations* (10 CFR 50), General Design Criterion (GDC) 18, "Instrumentation and Control," calls for instrumentation to be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions (as appropriate) to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. Appropriate controls are to be provided to keep these variables and systems within prescribed operating ranges. Human factors engineering evaluates procedures, instrumentation, and controls that respond to normal and accident plant conditions.

Regulations in 10 CFR 50.34(f)(2)(ii) require that a program be established and begun during construction, and that the program continue into the plant's period of operation, for integrating and expanding current efforts to improve plant procedures. The scope of the program shall include emergency procedures, reliability analyses, human factors engineering, crisis

management, operator training, and coordination with Institute of Nuclear Power Operations (INPO) and other industry efforts.

Regulations in 10 CFR 50.34(f)(2)(iii) require a control room design that reflects state-of-the-art human factors principles. Other portions of 10 CFR 50.34 also require a safety parameter display system (SPDS) console, and automatic indication of bypassed and operable status of safety systems.

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), which states that the control room design shall reflect state-of-the-art human factor principles[1].

3.0 TECHNICAL EVALUATION

The following sections provide the staff's evaluation of the proposed changes to the individual human factors engineering reports.

3.1 Evaluation of Changes to HFE Design Verification Plan (APP-OCS-GEH-120) (LAR 13-16)

Change 1: Updated Bibliography

Change 1 states:

> "Bibliography": Updated document revision numbers for APP-OCS-GEH-220, APP-OCS-GEH-320, APP-OCS-GEH-420, and APP-OCS-GEH-520. APP-GW-GJP-150, Revision 0, "Operating Procedures Verification and Validation [V&V]," Westinghouse Electric Company LLC (Proprietary), has also been added to the bibliography as well as to Section 1.2.3 and Section 1.4 (#3). APP-GW-J9Y-001 has been added to the Acronyms and Trademarks and Glossary of Terms sections.

Staff Evaluation: This change adds updated revision numbers to multiple documents in the "Bibliography" and "Reference" sections for consistency and to be in line with current approved documents associated with this procedure. This change ensures administrative accuracy and provides references to supporting material. The changes do not modify the scope, objectives, or methods of performance of the design verification process. The documents added to the bibliography provide additional information or add missing references but do not change the previously approved HFE design verification process. Accordingly, the staff finds this change acceptable.

Change 2: Preliminary nature of guideline allocations

Change 2 states:

[1] The licensing basis for VCSNS Units 2 and 3 is Revision 2 of NUREG-0711; therefore, the NRC review of this LAR is based on Revision 2 of NUREG-0711.

> Subsection 1.1.2, "Prerequisite," Section 2.1, "General Process," Section 2.3, "Criteria," Section 3.1, "Personnel Requirements and Techniques," and Appendices B and C: Clarified that the Human System Interface (HSI) design guideline allocations (non-safety control system, safety control system, wall panel information system, etc.) in Appendices B and C are preliminary and need to be checked and updated (if required) by the verifier prior to design verification.

Acceptance Criterion 11.4.2.3.2(2) in NUREG-0711 states that the characteristics of the HSI components should be compared with HFE guidelines.

Staff Evaluation: HFE guidelines (style guide) are documented in a design document specific to Westinghouse. Because guidelines are applicable to multiple aspects of the design, Appendices B and C were included in GEH-120 to provide guidance on applying the guidelines as the source of acceptance criteria for the design verification activity. If the HFE design changes, the appendices could change. The proposed changes ensure that personnel performing the design verification update the appendices to reflect any HFE design changes. This preserves the accuracy of the appendices and contributes to complete design verification. Accordingly, the staff finds that this change ensures that the design verification process conforms to the acceptance criterion stated above.

Change 3: Post-V&V changes

Change 3 states:

> Subsection 1.1.3, "Process Strategy": Added a description of the mechanism to deal with design changes after design verification has been completed. Added reference to APP-GW-G0Y-002, "AP1000 Configuration Management Plan," and WNA-PC-00005-WAPP, "AP1000 I&C Projects Configuration Management Plan."

Acceptance Criterion 11.4.4.2(6) in NUREG-0711 states in part that designs should be evaluated by repeating the appropriate analyses of the V&V. Portions of the HFE design verification analysis should be conducted to provide reasonable assurance that the design is consistent with HFE guidelines.

Staff Evaluation: Post-verification changes occur because of corrective actions for integrated system validation issues and system modifications. In both cases the changes being made to GEH-120 specify that the design changes will be evaluated and re-verified through a subsequent HFE design verification or as part of the plant startup HFE design verification. Both processes have been previously approved by the staff as part of the AP1000 design certification. The new procedure references added to GEH-120 describe the process used to identify differences between the original HFE design and the current design and ensure that the design verification is applied to the changes. Accordingly, the staff finds that this change ensures that post-verification design changes will receive a design verification that conforms to the acceptance criterion stated above.

Change 4: Risk-important human actions

Change 4 states:

> Subsection 1.2.1, "Applicability": APP-OCS-GLR-001, "AP1000 Post-Accident Risk-Important Human Actions Summary Report," is mentioned in Subsection 1.2.1 and is added to the bibliography.

Section 11.4.1.2.1 of NUREG-0711 describes sampling dimensions that define the scope of V&V activities. Acceptance Criterion 11.4.1.2.1(2) states that all risk-important human actions should be included in the sample.

Staff Evaluation: APP-OCS-GLR-001 provides updated and more detailed information about the post-accident risk-important human actions in line with the latest plant design and operating procedures. The list of risk-important human action remains unchanged. Accordingly, the staff concludes the change is acceptable as additional task detail does not change the process previously approved by the staff in GEH-120, Revision B. The design verification process continues to conform to the acceptance criterion stated above.

Change 5: Design verification scope

Change 5 states:

> Subsection 1.2.2, "List of Human System Interfaces Requiring Verification": Updated and clarified list of HSI Resources and [Operation and Control Centers]. Amended Appendices B and C accordingly.

Section 11.4.1.2.1 of NUREG-0711, "Sampling Dimensions," identifies a sampling process that can be used to identify elements that will be subject to design verification. The AP1000 design certification did not apply the sampling process and instead made the following commitment in APP-OCS-GEH-020 (WCAP-15860, ADAMS Accession No. ML032930333), "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan," Section 3, "HFE Design Verification":

> The HFE design verification will include all HSI in the control room, remote shutdown workstations, and the TSC [Technical Support Center]. Local control stations will be reviewed to the extent that they are required for *risk-important* human actions as defined by the PRA [Probabilistic Risk Analysis].

Staff Evaluation: This change added to and rearranged a proprietary list of HSI resources and operational and control centers contained in GEH-120. The addition makes the list of HSI resources complete and in line with the latest AP1000 design. The Technical Support Center (TSC) was removed from the list because of shared design verification responsibilities with COL applicants. This change is addressed in more detail in the next change. Accordingly, the staff finds the change acceptable because the original approved design verification scope is being maintained with the exception of the TSC.

Change 6: Design verification scope

Change 6 states:

> Subsection 1.2.3, "Limitation of Scope": Added that TSC is not included as part of the HFE design verification. Added that the verification for the Emergency

> Operation Facility (EOF) and TSC are addressed in Task Support Verification and/or Design Verification at Plant Startup.

NUREG-0711, Revision 2, does not address V&V guidance specific to the TSC. The licensee committed to conform to NUREG-0696, "Functional Criteria for Emergency Response Facilities," which states in Section 9 that,

> The design, development, qualification, and installation of the SPDS [safety parameter display system], TSC, EOF, and NDL [nuclear data link] facilities and systems shall be independently verified and validated by qualified personnel other than the original designers and developers.

Staff Evaluation: The Chapter 18 HFE V&V scope of work is limited to the provision of data and displays from the AP1000 control system to support the TSC and EOF functions. This is addressed in APP-OCS-GEH-220, "Human Factors Engineering Task Support Verification Plan." The remainder of the HFE design is verified and validated by drills and exercises in accordance with NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants" (ADAMS Accession No. ML040420012). This includes completion of an emergency exercise identified as an ITAAC. Chapter 13 of the licensee's final safety analysis report (FSAR) provides further detail about these commitments. Because the design verification suggested in the NUREG guidance quoted above is still accomplished, the staff finds the change acceptable.

Change 7: Exceptions from WCAP-15860

Change 7 states:

> Subsection 1.4, "List of Exceptions from WCAP-15860." A new section is added and includes three exceptions.
>
> 1st exception - The HFE design verification will only identify deviations and will not justify or attempt to resolve them. Deviation justification will be performed as part of the HED resolution process, as described in APP-OCS-GEH-420, "Human Factors Engineering Discrepancy Resolution Process."
>
> 2nd exception - The TSC will not be addressed in the HFE design verification, but will be addressed in the HFE Task Support Verification, APP-OCS-GEH-220, and HFE Design Verification at Plant Startup, APP-OCS-GEH-520.
>
> 3rd exception - The verification of the Emergency Operating Procedure (EOP) format will be addressed by the AP1000 Operations Procedure Group as part of their procedure V&V process.

Acceptance Criterion 2.4.3(3) in NUREG-0711 states in part that the integration of design activities should be identified.

Staff Evaluation: The first exception deletes deviation justification from the design verification process because that activity already exists in APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process." The staff verified that HED process information

deleted from GEH-120 exists in GEH-420. The scope, objectives, and method of performance of HED resolution has not changed. Unnecessary redundancy has been removed. Accordingly, the staff finds this change acceptable.

The second exception is addressed in change 6 above.

The third exception was initially not acceptable. Acceptance Criterion 9.4(6) in NUREG-0711 states in part that all procedures should be verified and validated. While the procedure verification is addressed in a Westinghouse internal procedure (APP-GW-GJP-150, "Operating Procedures Verification and Validation"), the licensing commitment to implement this procedure would no longer be included in licensing-basis material. The following concerns were communicated to the licensee:

- Section 13.5.2.1 ("Operating and Emergency Operating Procedures") of the Summer FSAR states, "This information is addressed in the DCD."

- COL action items 18.9.1 and 13.5.1 in the AP1000 DCD both indicate that APP-GW-GLR-040, "Plant Operations, Surveillance, and Maintenance Procedures" (ADAMS Accession No. ML072410227) fully addresses the action item.

- These documents do not explicitly address operating procedure V&V. GLR-040 only "fully addresses the action item" when taken in conjunction with WCAP-15860, which provides a programmatic-level commitment to complete procedure V&V. Usually the staff finds this detail in a Procedure Generation Package (PGP) but Section 13.5 of the DCD and the associated reference to APP-GW-GLR-040 do not describe a PGP or explain procedure V&V activities.

- Approving an exception from this WCAP commitment would leave either no commitment to procedure V&V or, at best, a confusing commitment in the HFE Design Verification Plan (APP-OCS-GEH-120) where one would not normally expect to find procedure V&V commitments. It is preferable that such commitment be included in Chapter 13 within the discussion of operating procedures and within the context of a procedures generation package.

In a letter dated February 10, 2014 (ADAMS Accession No. ML14043A081), the licensee committed to revise GEH-040 to include a summary of the procedure V&V process. This document is cited within Chapters 13 and 18 of the UFSAR and provides an acceptable central point to include a summary of the procedure V&V activity. Accordingly, the staff finds this change acceptable.

Change 8: Design verification scope

Change 8 states:

> Section 1.2.3, "Limitation of Scope," and Section 1.4, "List of Exceptions from WCAP-15860," Item #2, deleted statement that design verification of the Technical Support Center (TSC) will be in the scope of the human factors design verification at plant startup.

Staff Evaluation: See Change 6.

Change 9: Procedure Verification and Validation

Change 9 states:

> Section 1.2.3, "Limitation of Scope," and Section 1.4, "List of Exceptions from WCAP-15860," Item #3, added reference to APP-GW-GJP-150, "Operating Procedures Verification and Validation."

Staff Evaluation: Procedure V&V is addressed in Chapter 13. The addition of this reference provides access to supporting material and does not change that process which has previously been approved. Accordingly, the staff finds this change acceptable. The staff's evaluation of Change 7 above explains initial, additional staff concerns, which were subsequently resolved, related to documentation adequacy for the procedure V&V activity.

Change 10: HED tracking system

Change 10 states:

> Section 2.1, "General Process": Included a note that Human Engineering Discrepancies (HEDs) are entered into the SmartPlant Foundation (SPF) Human Factors (HF) Tracking System.

Acceptance Criterion 2.4.4 in NUREG-0711 states in part that a tracking system should be available to address human factors issues.

Staff Evaluation: The licensee stated that the SPF tool has been added to track HEDs identified during the HFE design verification. APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process," provides staff approved direction on how HEDs are managed. This direction is not affected by this change. The change provides more specificity on how HEDs are tracked but does not change the previous commitment to track them. Accordingly, the staff finds this change acceptable.

Change 11: Deletion of HED Information

Change 11 states:

> Section 2.1, "General Process": Deleted information on the HED resolution process, responsibilities, prioritization, resolution, and the justification of deviations.

Staff Evaluation: This information was deleted because it exists in APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process." The staff verified that HED process information deleted from GEH-120 exists in GEH-420. The scope, objectives, and method of performance of HED resolution has not changed. The interface between the design verification and the HED resolution process is now more clearly defined. Accordingly, the staff finds this change acceptable.

Change 12: Removal of inconsistent and redundant information

Change 12 states:

> Section 2.1, "General Process": Deleted "priority 1 and priority 2." Changed the description of design verification completion from approval of the HED resolution report (APP-OCS-GER-420) to the approval of the design verification results (APP-OCS-GER-120).
>
> Deleted the sentence "The OCS Product Manager is responsible for the HFE design verification activity and resource assignment."

Staff Evaluation: The "priority 1 and priority 2" text was deleted because it was inconsistent with APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process," which states that all HEDs are entered into the human factors tracking system.

The sentence identifying management responsibilities was redundant to information in the subsequent paragraph.

Correcting inconsistencies and removing redundancy clarifies procedure guidance. The processes described in the current revisions of GEH-120 and GEH-420 remains consistent with what is described in the previously approved procedures. Accordingly, the staff finds the changes addressing inconsistency and redundancy acceptable.

Redefining when design verification is complete is consistent with the changes being implemented to collect all HED actions into the HFE resolution process described in APP-OCS-GEH-420. This change to GEH-120 only realigns direction between procedures; the activities originally approved are just being moved between procedures. Accordingly, the staff finds this change acceptable.

Change 13: Management titles

Change 13 states:

> Section 2.2, "Resource Assignment": Changed "OCS Product Manager" to "HF Manager" (in multiple sections).

Staff Evaluation: Section 18.2.2.2 of the AP1000 design certification, "Organizational Placement and Authority," describes the organization of the human system interface design team and its relation to the AP1000 design organization in Figure 18.2-2 of the design certification. This section also states:

> The structure of the organization may change, but the functional nature of the human system interface design team is retained through the change. The human system interface design team consists of an instrumentation and control system manager, advisors/reviewers team, core human system interface design team, and human system interface technical lead.

The staff finds that the proposed change is consistent with the design certification statements because the functional elements in the description above are being maintained. Accordingly, the staff finds this change acceptable.

Change 14: Definition of independent verifier

Change 14 states:

> Section 2.2, "Resource Assignment," and Glossary: Changed the definition of "Independent verifier" and included a reference to WEC 3.3.3.

Staff Evaluation: The use of independent verification within the design verification activity is not addressed in NUREG-0711. The proposed definition of independent verifier continues to add additional assurance that the design verification process, as previously approved by the staff, is implemented effectively. Accordingly, the staff finds this change acceptable.

Change 15: New cited document

Change 15 states:

> Section 2.3, "Criteria": Added to bibliography APP-GW-GRP-001, "Local Panels and Maintainability Human Factors Design Guidelines."

Staff Evaluation: The additional reference provides proprietary guidance on applying HFE design guidelines to local plant equipment. Inclusion of the reference does not change the previously approved HFE design verification process. Accordingly, the staff finds this change acceptable.

Change 16: New cited document and addition of HED directions

Change 16 states:

> Section 3.2, "Discrepancy Documentation": Added to bibliography APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process," to describe the detailed processes for documenting and processing HEDs. Updated the description of the HFE discrepancy form and changed Appendix A to the current Design Verification form in the HF Tracking System.

Acceptance Criterion 2.4.3(3) in NUREG-0711 states in part that the integration of design activities should be identified.

Staff Evaluation: The additional reference provides clarification on the interface between GEH-120 and GEH-420. Additional guidance is provided to personnel conducting the design verification for completing the HFE discrepancy form. The clarifying information does not change the previously approved HFE design verification process. Accordingly, the staff finds this change acceptable.

Change 17: HED direction and addition of new reference

Change 17 states:

> Section 3.3, "Deliverables": Minor updates regarding the HF Tracking System, HED resolution process. Added document APP-GW-GRP-001, "Local Panels and Maintainability Human Factors Design Guidelines," to the bibliography.

Staff Evaluation: The changes made in Section 3.3 of GEH-120 reflect the changes described in the previous sections of this evaluation. The changes in Section 3.3 ensure that the document is internally consistent. Accordingly, the staff finds this change acceptable.

Change 18: Minor editorial changes

Change 18 states:

> There are several other minor editorial changes in sections not expressly listed above. These changes make the document clearer and have no effect on the objectives and scope of the task support verification plan.

Staff Evaluation: The editorial changes in GEH-120 were reviewed. They were all confirmed to have no effect on the scope, objectives, or method of performance of the design verification plan previously approved by the staff. Accordingly, the staff finds these changes acceptable.

3.2 Evaluation of Changes to HFE Task Support Verification Plan (APP-OCS-GEH-220) (LAR 13-17)

Change 1: Correction to revision history

Change 1 states:

> "Record of Changes" corrects the description in the revision history for Revision 0 to delete the statement that a reference to WNA-WI-00207-WAPP "Human Factors Tracking System" was added. This reference was not added in Revision 0.

Staff Evaluation: This change ensures administrative accuracy. This change does not affect the task support verification process as originally approved and is therefore acceptable.

Change 2: Updated Bibliography

Change 2 states:

> "Bibliography" is updated for revision numbers for APP-OCS-GEH-120, APP-OCS-GEH-320, APP-OCS-GEH-420 and APP-OCS-GEH-520. Document 14, APP-OCS-J1R-220, is updated from Revision 0 to Revision 1 in line with the current approved OSA-2 Summary Report. APP-GW-GJP-150,

Revision 0, and two other documents are also added to the reference section. Updated document revision numbers for the related HF V&V plan in order for the revision numbers to be consistent throughout the documents.

Staff Evaluation: This change adds updated revision numbers to multiple documents in the "Bibliography" and "Reference" sections for consistency, and to be in line with current approved documents associated with this procedure. These changes ensure administrative accuracy and consistency between documents. The changes do not modify the scope, objectives, or methods of performance of the ISV process. The documents added to the bibliography provide additional information or add missing references but do not change the previously approved HFE design verification process. Accordingly, the staff finds this change acceptable.

Change 3: Reference description update

Change 3 states:

> "References" updates the reference to the Westinghouse Design Verification procedure (WEC 3.3.3) in line with the current approved procedure.

Staff Evaluation: This change ensures administrative accuracy. This change does not affect the task support verification process as originally approved and is therefore acceptable.

Change 4: Post-V&V changes

Change 4 states:

> Section 1.1, "Overview," was changed to account for design changes that occur after task support verification has been complete. The new revision includes a short description of the configuration management process and how this process will be utilized to assess and maintain the validity of the task support verification results against subsequent design or operating procedure changes. The new, proposed revision adds a reference to this configuration management process, APP-GW-G0Y-002, "AP1000 Configuration Management Plan," and WNA-PC-00005-WAPP, "AP1000 I&C Projects Configuration Management Plan."

Acceptance Criterion 11.4.4.2(6) in NUREG-0711 states in part that designs should be evaluated by repeating the appropriate analyses of the V&V. For example, the HSI task support verification should be conducted to provide reasonable assurance that the design satisfies personnel task requirements.

Staff Evaluation: Post-verification changes occur as a result of corrective actions for integrated system validation issues and system modifications. In both cases, the GEH-220 changes specify that the design changes will be evaluated and re-verified through a subsequent HFE task support verification or as part of the plant startup HFE design verification. Both processes have been previously approved by the staff as part of the AP1000 design certification. The procedure references added to GEH-220 describe the process used to identify differences between the original HFE design and the current design and ensure that the task support verification is applied to the changes. Accordingly, the staff finds that this change ensures that

post-verification configuration changes will receive a task support verification that conforms to the acceptance criterion stated above and is therefore, acceptable.

Change 5: Operational Sequence Analysis scope correction

Change 5 states:

> Section 1.2.1, "Applicability," is changed to correct the scope of the Operational Sequence Analyses (OSA) with respect to the Emergency Operating Procedures (EOPs) to performance for the "full range of activities in the EOPs" versus the previous performance for the "complete set of EOPs."

Staff Evaluation: Section 11.4.1.2.1, "Sampling Dimensions," of NUREG-0711 identifies a sampling process that can be used to identify elements that will be subject to task support verification. The AP1000 design certification did not apply the sampling process and instead made the following commitment in APP-OCS-GEH-020 (WCAP-15860), "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan," Section 3, "HFE Design Verification":

> The HSI Task Support Verification methodology will describe how, in each case, the HSI resources will be verified to ensure that all alarms, displays, controls,
>
> Procedures, and data-processing required for task performance are available, and that the characteristics of the HSI (for example, units of measure, accuracy, precision, and dynamic response) match task requirements.

This change removes redundant tasks that occur across EOPs and improves the efficiency of the verification process. Removing redundancy does not result in pertinent tasks being exempted and therefore the intent of the original task support verification process as originally approved is maintained.

The NUREG-0711 guidance for task support verification allows for sampling of procedures. The task support verification process described in GEH-220 is more inclusive than regulatory guidance would suggest. Accordingly, the staff finds this change acceptable with respect to the task support verification element.

This change has a potential secondary impact on the task analysis element of NUREG-0711 in that the operational sequence analysis is a method used to link tasks to support a detailed assessment of attributes such as workload, information requirements, and situational and performance shaping factors. These attributes are described in more detail in Table 5.1, "Task Considerations," in NUREG-0711.

The task analysis scope is addressed in NUREG-0711 acceptance Criterion 5.4(1), which states in part that,

> The scope of the task analysis should include:
>
> - selected representative and important tasks from the areas of operation, maintenance, test, inspection, and surveillance

- full range of plant operating modes, including startup, normal operation, abnormal and emergency operations, transient conditions, and low-power and shutdown conditions

The proposed change is consistent with this acceptance criterion in that it associates a "full range of activities" from EOPs with the operational sequence analysis. This language ensures that important tasks from emergency operations are evaluated in the operational sequence analysis. Accordingly, the staff finds this change acceptable with respect to the task analysis element.

Change 6: Exceptions from WCAP-15860

Change 6 states:

> Section 1.4, "List of Exceptions from WCAP-15860," is added to take four exceptions to commitments, scope, purpose, and issues as stated in WCAP-15860, "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan":
>
> - Procedure verification will not be included in the HFE task support verification, but will be implemented by the AP1000 Plant Operations procedures group as part of their procedure V&V activities. This also adds a reference to APP-GW-GJP-150, "Operating Procedures Verification and Validation." APP-GW-GJP-150 provides details of the procedure V&V process undertaken by the Westinghouse Procedures Group.
>
> - Operational sequence task analyses are not performed on the complete set of EOPs, but on a set of EOPs covering the full range of activities, as described in APP-OCS-J1R-110, "Operational Sequence Analysis Methodology," and APP-OCS-J1R-210, "AP1000 Operational Sequence Analysis (OSA-2) Implementation Plan."
>
> - Aspects related to accuracy and precision will be covered through I&C testing activities. HFE issues related to dynamic response, such as completion of risk-important human actions within a time window defined by the probabilistic risk assessment, will be evaluated during the integrated system validation (ISV) per APP-OCS-GEH-320, "AP1000 Human Factors Engineering Integrated System Validation Plan." This also deleted the exception that task support verification will not cover the characteristics of the HSI such as accuracy and precision. The only exception is that dynamic response will not be addressed. The task analyses and task support verification address HSI characteristics to the extent possible given that both of these analyses are table-top assessments. The task analyses identifies the personnel task requirements in terms of, for example, the information required, the

range, and the precision (e.g., number of decimal places needed in numerical digital readouts). Therefore, these will be addressed in task support verification. However, the task support verification does not use a control system, development system, or the simulator as an input to the assessment. Therefore, aspects such as dynamic response and control system timings cannot realistically be addressed. These will be tested as part of the I&C testing. The text has been corrected to include accuracy and precision within the scope of task support verification.

- The task analyses will not be revised as a result of the task support verification. Consistent with this, indications, controls, and alarms appearing on an HSI resource not identified by any of the task analyses will be flagged and reviewed. However, the task analyses will not be revised as a result of the task support verification. If further analysis and review indicates that the indications, controls, and alarms are shown to be necessary to support operator performance, the additional tasks requiring the indications, controls, and alarms will be documented, but the task analyses will not be revised.

Staff Evaluation: The first exception was initially not acceptable. Acceptance Criterion 9.4(6) in NUREG-0711 states in part that all procedures should be verified and validated. While the procedure verification is addressed in a Westinghouse internal procedure (APP-GW-GJP-150 "Operating Procedures Verification and Validation"), the licensing commitment to complete the procedure would no longer be included in licensing-basis material. The following concerns were communicated to the licensee:

- Section 13.5.2.1 ("Operating and Emergency Operating Procedures") of the Summer FSAR states: "This information is addressed in the DCD."

- COL action items 18.9.1 and 13.5.1 in the AP1000 DCD both indicate that APP-GW-GLR-040, "Plant Operations, Surveillance, and Maintenance Procedures" (ADAMS Accession No. ML072410227) fully addresses the action item.

- These references do not explicitly address operating procedure V&V. GLR-040 only "fully addresses the action item" when taken in conjunction with WCAP-15860, which provides a programmatic-level commitment to complete procedure V&V. Usually the staff finds this detail in a Procedure Generation Package, but Section 13.5 of the DCD and the associated reference to APP-GW-GLR-040 do not describe a PGP or explain procedure V&V activities.

- Approving an exception from this WCAP commitment would leave no commitment to procedure V&V except for the proposed additional reference to APP-GW-GJP-150, "Operating Procedures Verification and Validation." The addition of a parenthetical statement citing the procedure and adding the procedure to the list of references is not considered sufficient as a licensing-basis commitment. It is also preferable that any commitment be included in Chapter 13 within the discussion of operating procedures and within the context of a procedures generation package.

In a letter dated February10, 2014 (ADAMS Accession No. ML14043A081), the licensee committed to revise GEH-040 to include a summary of the procedure V&V process. This document is cited within Chapters 13 and 18 of the UFSAR and provides an acceptable central point to include a summary of the procedure V&V activity. Accordingly, the staff finds this change acceptable.

Relative to the second bullet, the staff finds the exception acceptable as discussed above in Change 5.

Relative to the third bullet, acceptance Criterion 11.4.2.1.2(2) in NUREG-0711 states:

> *HSI characterization* – The inventory should describe the characteristics of each HIE components within the scope of the review. The following is a minimal set of information for the characterization:
>
> - a unique identification code number or name
> - associated plant system and subsystem
> - associated personnel functions/subfunction
> - type of HSI component
> - display characteristics and functionality [e.g., plant variables/parameters, units of measure, accuracy of variable/parameter, precision of display, dynamic response, and display format (bar chart, and trend plot)
> - control characteristics and functionality [e.g., continuous versus discrete settings, number and type of control modes, accuracy, precision, dynamic response, and control format (method of input)]
> - user-system interaction and dialog types (e.g., navigation aids and menus)
> - location in data management system (e.g., identification code for information display screen)
> - physical location in the HSI (e.g., control panel section), if applicable

In the initial submittal it was unclear whether verification of instrument accuracy and precision specifications were being deleted from the task support verification process. The licensee provided clarification that the exception only deletes verification of dynamic responses from the task support verification scope.

Dynamic response is identified by acceptance Criterion 11.4.2.1.2(2) in NUREG-0711 as a characteristic of a display and control. This criterion is contained within the verification section of the guidance. However, the staff agrees that the verification process is not an effective method for verifying dynamic responses. The better test is conducted as part of I&C testing and the integrated system validation activity. The validation activity test bed attributes include acceptance Criterion 11.4.3.2.2(7), which states:

> *Data Dynamics Fidelity* – A high degree of data dynamics fidelity should be represented. The process model should be capable of providing input to the HSI in a manner such that information flow and control responses occur accurately and in a correct response time; e.g., information should be provided to personnel with the same delays as would occur in the plant.

The test bed for the AP1000 integrated system validation is a near-full-scope simulator that addresses this characteristic. Accordingly, the staff concludes that verifying dynamic responses is best accomplished as part of integrated system validation as the licensee has proposed.

Relative to the fourth bullet, NUREG-0711 does not contain guidance specific to updating the task analysis after verification activities. The staff notes that Criterion 3, "Design Control," in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR 50 would apply to safety-related components and would require controls on the design bases for these components. Accordingly, the staff finds this change acceptable.

Change 7: Work Load Analysis

Change 7 states:

> Section 2.1, "Background," is revised to identify that analysis data will be maintained in a data base versus diagrams. The scope of each of the two phases of work load analysis has been redefined. (Summarized to avoid inclusion of proprietary information)

Acceptance Criterion 11.4.2.2.2(1) in NUREG-0711 states:

> *Criteria Identification* - The criteria for Task Support Verification come from task analyses of HSI requirements for performance of personnel tasks that are selected operational conditions should be defined.

Staff Evaluation: The criteria for Task Support Verification come from the Task Analysis results. The licensee has changed the scope of each phase of workload analysis but the two phases together continue to conform to the original approved scope approved in GEH-220, Revision B. While task analysis results may now be identified in a different stage, a complete set of task analysis results are provided as input for task support verification. The use of a database to collect the criteria increases efficiency of the verification activity but does not change the methods used to identify the controls, alarms, and displays being verified. The task support verification process continues to conform to the acceptance criterion cited above. Accordingly, the staff finds these changes acceptable.

Change 8: Computerized HED Tracking System

Change 8 states:

> Section 2.2, "Verification Plan For Function-Based Task Analysis," is updated to delete detailed information in the description about APP-OCS-J1A-030 ["Function-Based Task Analysis Summary Report"], to delete the discrepancy worksheet, and to add information about the SmartPlant Foundation (SPF) Human Factors (HF) Tracking System (a database tracking tool) into which any discrepancy will be entered. This change concerning the SPF HF Tracking System is also changed throughout the document.

Acceptance Criterion 11.4.2.2.2(6) in NUREG-0711 states in part that the human engineering discrepancy should be documented to identify what aspect of the HSI does not meet guidance.

Staff Evaluation: The change from paper- to computer-based discrepancy documentation does not affect the scope, objectives, or method of performance of the task support verification plan. The information deleted (e.g., page numbers) from the detailed description of J1A-030 was verified to have no impact on the input to task support verification provided by that document. Accordingly, the staff finds these changes acceptable.

Change 9: Reference to Risk-Important Human Actions

Change 9 states:

> Section 2.4.1, "Prerequisite," is revised to add a necessary reference to APP-OCS-GLR- 001, "AP1000 Post-Accident Risk-Important Human Actions Summary Report."

Section 11.4.1.2.1 of NUREG-0711 describes sampling dimensions that define the scope of V&V activities. Acceptance Criterion 11.4.1.2.1(2) states that all risk-important human actions should be included in the sample.

Staff Evaluation: APP-OCS-GLR-001 provides updated and more detailed information regarding the post-accident risk-important human actions in line with the latest plant design and operating procedures. The list of risk-important human action remains unchanged. Accordingly, the staff concludes the change is acceptable because additional task detail does not change the process previously approved by the staff in GEH-120 Revision B. The design verification process continues to conform to the acceptance criterion stated above.

Change 10: Operational Sequence Analysis

Change 10 states:

> Section 2.5, "Verification Plan for MTIS Activities," corrected typographical error. The Maintenance, Test, Inspection, and Surveillance (MTIS) results are provided in the Operational Sequence Analysis (OSA)-1 documentation, not OSA-2.

Acceptance Criterion 11.4.2.2.2(1) in NUREG-0711 states:

> *Criteria Identification* - The criteria for Task Support Verification come from task analyses of HSI requirements for performance of personnel tasks that are selected operational conditions should be defined.

Staff Evaluation: The criteria for task support verification come from the task analysis results. The licensee changed the scope of each phase of workload analysis but the two phases together continue to conform to the original approved scope approved in GEH-220, Revision B. While task analysis results may now be identified in a different stage, a complete set of task analysis results are provided as input for task support verification. The task support verification process continues to conform to the acceptance criterion cited above. Accordingly, the staff finds these changes acceptable.

Change 11: Addition of new reference

Change 11 states:

> Section 2.6, "Verification Plan for Emergency Operations Facility and Technical Support Center Task Functions," is revised to add a necessary reference to APP-OCS-J0A-001, "AP1 000 Human Factors Engineering Analysis to Support Technical Support Center and Emergency Operations Facility Design."

Staff Evaluation: APP-OCS-J0A-001 summarizes the results of the Technical Support Center and Emergency Operations Facility task analysis which are used as input criteria to the task support verification activity. These changes do not affect the scope, objectives, or method of performance of the task support verification plan. Accordingly, the staff finds this change acceptable.

Change 12: Provide more specific reference to the UFSAR

Change 12 states:

> Section 3.1, "Verification Plan for Minimum Inventory Equipment," is revised to clarify that the requirements/commitments to be met are only those for minimum inventory equipment as specified in UFSAR Section 18.12, versus what could be interpreted as a commitment for the entire UFSAR.

Staff Evaluation: The clarification to specify that the HSI minimum inventory equipment is specified in UFSAR Section 18.12 is made to provide consistency and to more clearly identify the location of the minimum inventory equipment in the UFSAR. This does not affect the scope, objectives, or method of performance of the task support verification plan. Accordingly, the staff finds this change acceptable.

Change 13: Addition of new reference

Change 13 states:

> Section 4.2.1, "AP1000 Implementation," is revised to add a necessary reference to APP-OCS-J1-024, "AP1000 Operation and Control Centers Systems Presentation of Safety Functions Design Basis."

Staff Evaluation: APP-OCS-J1-024 provides detailed descriptions and design basis for how the AP1000 HSI resources address the safety parameter display system (SPDS) requirement. The document provides input criteria to the task support verification. This change does not affect the scope, objectives, or method of performance of the task support verification plan. Accordingly, the staff finds this change acceptable.

Change 14: Consistency between sections

Change 14 states:

> Section 4.4.2, "Verification Plan," is corrected to add the automatic depressurization system operation controls to the task support verification plan.

Staff Evaluation: This correction provides consistency within the GEH-220 document and does not affect the scope, objectives, or method of performance of the task support verification plan. Accordingly, the staff finds this change acceptable.

Change 15: Post-accident monitoring

Change 15 states:

> Section 4.11, "10 CFR 50.34(f)(2)(xix) - Post-Accident Monitoring Instrumentation," is clarified by deleting the sentence, "The normal control room display system is used for the display of non-safety-related signals which are not required to be displayed by a qualified system," because this 10 CFR requirement is not applicable to equipment not required to be displayed by a qualified system.

Staff Evaluation: Regulatory Guide (RG) 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," describes design requirements for post-accident monitoring indication. Based on the design requirements, data may be displayed either by the normal control room display system or the qualified data processing system. Section 4.11 in GEH-220 continues to describe this interface with RG 1.97 accurately. The deleted sentence improves clarity but does not affect the scope, objectives, or method of performance of the task support verification plan. Accordingly, the staff finds this change acceptable.

Change 16: Clarification of Emergency Habitability System function

Change 16 states:

> Section 4.13.1, "AP1000 Implementation," is clarified to reflect that it is the Main Control Room Emergency Habitability System that functions to protect the operators and support the MCR equipment and HSI resources. Further clarification and improvement is made by relocating the last paragraph of the section to the first paragraph.

Staff Evaluation: The staff verified that the changes do not affect the scope, objectives, or method of performance of the task support verification plan. Accordingly, the staff finds this change acceptable.

Change 17: Main Control Room Habitability System verification

Change 17 states:

> Section 4.13.2, "Verification Plan," is clarified to reflect that it is the functionality of the Main Control Room Emergency Habitability System that is being verified and not the associated HSI resources.

Acceptance Criterion 11.4.2.2.2(2) in NUREG-0711 states:

> *General methodology* - The HSIs and their characteristics (as defined in the HSI inventory and characterization) should be compared to the personnel task requirements in the task analysis.

Staff Evaluation: This change clarifies that this section of the task support verification process addresses the compressed-air system component verification for the main control room (MCR) emergency habitability system. The HSI resources supporting the MCR emergency habitability system are still addressed through the minimum inventory task support verification described in Section 3.1 of GEH-220. Therefore, the acceptance criterion quoted above is still met. Accordingly, the staff finds this change acceptable.

Change 18: Management titles

Change 18 states:

> Section 5.1, "Resource Assignment," is corrected to change the "OCS Product Manager" to "HF Manager" (in multiple sections) to be consistent with the current organizational structure.

Acceptance Criterion 2.4.2(2) in NUREG-0711 states:

> *Organizational Placement and Authority*—The primary HFE organization(s) or function(s) within the organization of the total program should be identified, described, and illustrated.

Staff Evaluation: Section 18.2.2.2, "Organizational Placement and Authority," of the AP1000 design certification describes the organization of the human system interface design team and its relation to the AP1000 design organization in Figure 18.2-2 of the design certification. This section also states:

> The structure of the organization may change, but the functional nature of the human system interface design team is retained through the change. The human system interface design team consists of an instrumentation and control system manager, advisors/reviewers team, core human system interface design team, and human system interface technical lead.

The staff finds that the proposed change is consistent with the design certification statements because the functional elements in the description above are being maintained. Accordingly, the staff finds this change acceptable.

Change 19: Changed definition of independent verifier, added reference

Change 19 states:

> Section 5.1, "Resource Assignment," and Glossary: Changed the definition of "Independent verifier" and included a reference to NSNP 3.3.3, "Design verification by Independent Review or Alternate Calculations."

Staff Evaluation: The use of independent verification within the task support verification activity is not addressed in NUREG-0711. The proposed definition of independent verifier continues to add additional assurance that the design verification process, as previously approved by the staff, is implemented effectively. Accordingly, the staff finds this change acceptable.

Change 20: Clarification of verification scope

Change 20 states:

> Section 5.2, "Personnel Requirements and Techniques," is clarified by changing "HSI resources" to "item" since in some cases the objects to be verified are not HSI resources, but systems/equipment.

Staff Evaluation: This change clarifies the original intent of the procedure and establishes consistency between sections. The change does not affect the scope, objectives, or method of performance of the task support verification plan. Accordingly, the staff finds this change acceptable.

Change 21: HED process

Change 21 states:

> The information regarding the HED process has been removed, since it exists in APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process."

Staff Evaluation: The staff verified that HED process information deleted from GEH-220 exists in GEH-420 and that proper citation was included in GEH-220. The scope, objectives, and method of performance of HED resolution has not changed. The interface between the task support verification and the HED resolution process is now more clearly defined. Accordingly, the staff finds this change acceptable.

Change 22: Discrepancy documentation

Change 22 states:

> Section 5.4, "Human Factors Discrepancy Form Requirements," is revised to update the details and the example of discrepancy worksheet in Section 5.4 and Appendix A to reflect the current Task Support Verification form in the HF Tracking System.

Acceptance Criterion 2.4.3(3) in NUREG-0711 states in part that the integration of design activities should be identified.

Staff Evaluation: This change provides a description of a computer-based entry and tracking system for the Human Factors Discrepancies. Additional guidance is provided to personnel conducting the task support verification for completing the HFE discrepancy form. These changes clarify the scope of the task support verification plan but do not affect its objectives or method of performance. Accordingly, the staff finds this change acceptable.

Change 23: HED process

Change 23 states:

> Section 5.5, "Deliverables," is clarified related to discrepancy resolution. This change is the result of HED resolution being removed from APP-OCS-GEH-220 and included in APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process."

Staff Evaluation: The staff verified that HED process information deleted from GEH-220 exists in GEH-420 and that proper citation was included in GEH-220. The scope, objectives, and method of performance of HED resolution has not changed. The interface between the task support verification and the HED resolution process is now more clearly defined. Accordingly, the staff finds this change acceptable.

Change 24: Editorial changes

Change 24 states:

> There are several other minor editorial changes in sections not expressly listed above. These changes make the document clearer and have no effect on the objectives and scope of the task support verification plan.

Staff Evaluation: The editorial changes in GEH-220 were reviewed. They were all confirmed to have no effect on the scope, objectives, or method of performance of the task support verification plan previously approved by the staff. Accordingly, the staff finds these changes acceptable.

3.3 Evaluation of Changes to HFE Integrated System Validation Plan (APP-OCS-GEH-320) (LAR 13-10)

Change 1: Updated bibliography

Change 1 states:

> "Bibliography" updated document revision numbers for APP-OCS-GEH-120, APP-OCS-GEH-220, APP-OCS-GEH-420, and APP-OCS-GEH-520. This change also updates other revision numbers, as required, to be in line with current approved documents. APP-GW-GJP-150, Revision 0, is added to the Bibliography. Updates are also provided for APP-PMS-T5-001 (Proprietary), Revision 3; APP-OCS-J1R-220 (Proprietary), Revision 1; and APP-GW-GBH-361 (Proprietary), Revision 1 in the Reference section.

Staff Evaluation: This change adds updated revision numbers to multiple documents in the "Bibliography" and "Reference" sections for consistency, and to be in line with current approved documents associated with this procedure. These changes ensure administrative accuracy and provide access to supporting material. The changes do not modify the scope, objectives, or methods of performance of the ISV process. Accordingly, the staff finds this change acceptable.

Change 2: Post-V&V changes

Change 2 states:

> Section 1.1 "Background," added a description of the mechanism to deal with design and procedure changes after the ISV has been completed. Added a reference to APP-GW-G0Y-002, "AP1000 Configuration Management Plan," and WNA-PC-00005-WAPP, "AP1000 I&C Projects Configuration Management Plan."

Acceptance Criterion 11.4.4.2(6) in NUREG-0711 states, in part, that designs should be evaluated by repeating the appropriate analyses of the V&V. Portions of the ISV analysis should be conducted to provide reasonable assurance that the design is consistent with HFE guidelines.

Staff Evaluation: Post-V&V changes occur as a result of corrective actions for integrated system validation issues and system modifications. In both cases the GEH-320 changes specify that the design changes will be evaluated and re-verified through a subsequent HFE integrated system validation or as part of the plant startup HFE design verification. Both processes have been previously approved by the staff as part of the AP1000 design certification. The procedure references added to GEH-320 describe the process used to identify differences between the original HFE design and the current design and ensure that the integrated system validation is applied to the changes. Accordingly, the staff finds that this change ensures that post-V&V configuration changes will receive an integrated system validation that conforms to the acceptance criterion stated above and, therefore, is acceptable

Change 3: Task support and HSI design verification not complete before ISV

Change 3 states:

> Section 1.1, "Background," Figure 1.1-1, "AP1000 Verification and Validation Activities," revised; Section 1.5, "List of Exceptions from WCAP-15860," Item 3 added; and modifications to Section 3.1, "Number of Trial Replications," 2nd to last paragraph, to describe that the task support verification and design verification activities will not be complete prior to running ISV.

The acceptance criteria in Sections 11.4.2.2, "HSI Task Support Verification," and 11.4.2.3, "HFE Design Verification," of NUREG-0711 include the task support verification and design verification criteria.

Staff Evaluation: The criteria in NUREG-0711 do not restrict the timing of task support and design verifications (that is, whether these processes are done before or after ISV). In addition, the licensee is still committed to conducting the HSI task support and design verification along with the ISV process. All HEDs are addressed in accordance with the HED process described in GEH-420, including re-verification and re-validation, where required. Accordingly, the staff finds this change acceptable.

Change 4: Reference description update

Change 4 states:

> Section 1.2 "Purpose," is being revised to update the description of the contents of APP-OCS-GEH-321, "AP1000 Human Factors Engineering Integrated System Validation Scenario Information." The new description of APP-OCS-GEH-321 shows that the scope of the simulator and scope of simulator testing were removed from APP-OCS-GEH-321. This information is in APP-STS-T5-001, "AP1000 Full Scope Training Simulator Test Plan."

Criterion 11.4.3.2.2 in NUREG-0711 acknowledges that ANSI/ANS-3.5-1998 is consistent with the criteria in this section, and that it can be used as a guide.

Staff Evaluation: GEH-320 includes GEH-321 by reference. GEH-320 has an enhanced description of the scope and content of APP-OCS-GEH-321. It also includes by reference APP-STS-T5-001, which now describes the simulator scope and simulator testing, information that was originally in GEH-321. These changes relocate information, provide appropriate references in GEH-320, increase the detail provided on simulator testing, and maintain the original information that the staff used to demonstrate conformance to the acceptance criterion stated above. Accordingly, the staff finds this change acceptable.

Change 5: Local Control Station (LCS) V&V

Change 5 states:

In Section 1.3, “Scope,” changes were made to clarify the description regarding the inclusion of local control stations in ISV.

Acceptance Criterion 11.4.3.2.4(1), “Scenario Definition,” in NUREG-0711 states in part:

> The operational conditions selected for inclusion in the validation tests should be developed in detail so they can be performed on a simulator. The following information should be defined to provide reasonable assurance that important performance dimension are addressed and to allow scenarios to be accurately and consistently present for repeated trials:
>
> - Communication requirements with remote personnel

Staff Evaluation: The change clarifies that bidirectional communications between the MCR and the LCS operators (or any other entity outside of the control room) are included in the control room ISV. Other LCS activities are not included. The remote shutdown workstation is not included in the definition of local control station. The HSIs associated with this workstation are validated as part of the control room ISV. Other risk-important human actions performed outside the control room are validated independently from the control room ISV. Accordingly, the staff finds that this change conforms to the criterion and is acceptable.

Change 6: Simulator testing

Change 6 states:

> Section 2, “ISV Facility,” is being changed to clarify the use of ANSI/ANS-3.5.

Criterion 11.4.3.2.2 in NUREG-0711 acknowledges that ANSI/ANS-3.5-1998 is consistent with the criteria in this section, and that it can be used as a guide.

Staff Evaluation: The licensee commits to use ANSI/ANS-3.5-1998 as a basis for the scope, fidelity, and functionality of the simulator model and the development of the simulator testing plan. The testing plan will ensure that the simulator is tested to the equivalent extent that ANS/ANSI-3.5-1998 prescribes. Accordingly, the staff finds this change to be acceptable.

Change 7: Use of additional locations for ISV

Change 7 states:

> Section 2, “ISV Facility,” is being changed to state that there is a potential to use the Training Development Simulator (TDS) in addition to, or in place of, the Engineering Development Simulator (EDS) for running ISV.

Acceptance Criterion 11.4.3.2.2(9) in NUREG-0711 states that the test beds “should be verified for conformance to the tested characteristics” identified in criteria one through eight of the same section before validation is conducted.

Staff Evaluation: The licensee states that along with the “dedicated, purpose built facility,” the training development simulator and/or one of the AP1000 Training Facilities (at a utility) can be

used to conduct the ISV. The licensee also states that the facilities will be tested according to their simulator test plan (see Change 4 above). This ensures that each facility conforms to the tested characteristics described in the acceptance criterion stated above. Accordingly, the staff finds this change acceptable.

Change 8: Use of Licensee's AP1000 training facility for ISV

Change 8 states:

> Section 2, "ISV Facility," is being changed to provide for the potential use of an AP1000 Training Facility at a Licensee's site for performing ISV Pilot Testing.

See Change 7 above.

Change 9: Remote Shutdown Workstation description correction

Change 9 states:

> Section 2.1, "Physical Scope and Fidelity," corrects an inaccurate description of the operation of the Remote Shutdown Workstation (RSW) switches.

Staff Evaluation: This is a technical correction to the functionality description that does not affect the scope, objectives, and method of performance of the integrated system validation. Accordingly, the staff finds this change acceptable.

Change 10: Simulator testing reference change (software)

Change 10 states:

> Section 2.3, "Simulator Testing," is being revised to change the reference from WCAP-16096, "Software Program Manual for Common Q Systems," Revision 1, to APP-PMS-T5-001, "AP1000 Protection and Safety Monitoring System Test Plan," Revision 3.

Criterion 11.4.3.2.2(3) in NUREG-0711 states that "a high degree of functional fidelity in the HSIs" should be represented.

Staff Evaluation: The APP-PMS-T5-001 document provides updated and more detailed information about the different levels of software testing and about the software that has completed a Channel Integration Test (CIT) that will be used in the ISV simulator. The licensee also revised the second bullet reference in Section 2.3 of APP-GW-GBH-361 to maintain consistency with the latest I&C documentation. The level of detail in Section 2.3 of GEH-320 remains unchanged. The staff concludes the change is acceptable because the detail added enhances the process previously approved by the staff in GEH-320, Revision D. The integrated system validation process continues to conform to the acceptance criterion stated above.

Change 11: Simulator testing reference change (test plan)

Change 11 states:

> Section 2.3 “Simulator Testing,” is being revised to delete a cross-reference to APP-OCS-GEH-321 for details on simulator testing, and replace it with reference APP-STS-T5-001, “AP1000 Full Scope Simulator Test Plan.”

Acceptance Criterion 11.4.3.2.2(9) in NUREG-0711 states that the test beds “should be verified for conformance to the tested characteristics” identified in criteria one through eight of the same section before validation is conducted.

Staff Evaluation: APP-STS-T5-001, “AP1000 Full Scope Training Simulator Test Plan,” provides the detailed information related to testing the readiness of the simulator before the ISV activities. This testing ensures that the simulator used for ISV conforms to the criterion stated above. The testing plan has been separated into a new document and this document is appropriately included by reference in GEH-320. This change does not affect the scope, objectives, or method of performance of the ISV plan. Accordingly, the staff finds this change acceptable.

Change 12: Decrease in scenario numbers

Change 12 states:

> Section 3.1, “Number of Trial Replications,” and Section 3.2, “Trial Assignment and Scheduling,” are being updated to reflect the change in the number of scenarios, the number of crews, and the resulting changes in trial assignments and scheduling.

This change relates to two criteria. The first is Criterion 11.4.3.2.4(1) in NUREG-0711, which includes requirements for operational conditions that should be addressed in the scenarios. The second is the Criterion in Section 11.4.3.2.6.1, “Coupling Crews and Scenarios,” of NUREG-0711, which provides the acceptance criteria for Scenario Assignment and Scenario Sequencing to ISV crews.

Staff Evaluation: Criterion 11.4.3.2.4(1) in NUREG-0711 does not specify a minimum (or maximum) number of scenarios; therefore, the number of scenarios conducted during ISV is not important. What is important is that the content of the scenarios is sufficient to address all elements identified in the criterion. GEH-320 continues to state that scenarios will reflect this guidance. No changes were made to the method for sampling the operational conditions or the requirements for the content of the scenarios. Accordingly, the staff finds this portion of the change acceptable.

With regard to the Criteria in Section 11.4.3.2.6.1, the licensee provided changes for the crew assignment and scenario sequencing. The reduction in crew still conforms to the criteria. Each crew will perform more scenarios than previously planned, but the characteristics of scenarios continue to be balanced across the crews, and the order of presentation of the scenarios to the crews remains balanced. Accordingly, the staff finds this portion of the change acceptable.

Change 13: Pilot Testing

Change 13 states:

> Section 3.3 “Pilot Testing,” is being updated to include the testing of data recording techniques.

Acceptance Criterion 11.4.3.2.6.5(1) in NUREG-0711 states in part that a pilot study should be conducted before the ISV so that the adequacy of data collection methods can be assessed.

Staff Evaluation: This change permits a readiness assessment of the data-recording techniques for each scenario. This change adds greater specificity to the pilot testing activity while maintaining conformance to the NUREG-0711 criterion. Accordingly, the staff finds this change acceptable.

Change 14: Pilot testing

Change 14 states:

> Section 3.3 “Pilot Testing,” is being updated to allow support for the ISV pilot testing using personnel from the utilities.

Acceptance Criterion 11.4.3.2.6.5(2) in NUREG-0711 states in part that if possible, participants who will operate the integrated system in the validation tests should not be used in the pilot study.

Staff Evaluation: While additional personnel are being used to complete pilot testing, the licensee states that these people will not be eligible to become ISV participants. Also, they will be directed not to divulge scenario information to anyone outside of the ISV preparation team. This plan conforms to the acceptance criterion stated above. Accordingly, the staff finds this change to be acceptable.

Change 15: ISV subject training

Change 15 states:

> Section 4.1, “Subjects,” and Section 4.1.1, “Selection,” are being changed to revise the description of ISV test subjects’ training to ensure that their training is in line with the actual training that the test subjects/operators-in-training would have received at the time of ISV. This includes adding a statement that the [1] test subjects may receive their AP1000 simulator-based training at a site other than the EDS or TDS, [2] deleting the statement that the test subjects may include individuals who have partially completed the Senior Reactor Operator (SRO) Instructor Certification Program (i.e., they would have completed the entire course), and [3] adding a statement that licensee-trained operators who had received AP1000 classroom and simulator-based training other than the SRO Instructor Certification Program could also serve as ISV test subjects.

Criterion 11.4.3.2.6.4(1) in NUREG-0711 states:

> Participant training should be of high fidelity; i.e., highly similar to that which plant personnel will receive in an actual plant. The participants should be trained to ensure that their knowledge of plant design, plant operations, and use of the HSIs and procedures is representative of experienced plant personnel. Participants should not be trained specifically to perform the validation scenarios.

Staff Evaluation: The licensee proposed three changes in Change No. 15. The first change is related to the test subjects receiving AP1000 simulator training at facilities other than the Engineering Development Simulator. The NUREG-0711 criterion quoted above does not restrict training to the ISV simulator; therefore, this change is acceptable.

The second change deletes a statement that the test subjects could be those who had partially completed the licensee's SRO instructor certification program. This is acceptable because Section 4.1 now says that the test subjects will include those who have completed this program. This allows participants with a greater level of experience to participate in the testing and more closely aligns with Criterion 11.4.3.2.6.4(1). Accordingly, the staff finds this change to be acceptable.

The third change adds licensee-trained operators who have not taken SRO Instructor Certification Training as ISV participants. These participants receive AP1000 classroom and simulator-based training in a training program accredited by INPO. Experienced plant personnel are being used and their experience is supplemented with training specific to AP1000 which has been developed following the same INPO training guidance as utility training programs follow. This conforms to the above criterion. Accordingly, the staff finds this change to be acceptable.

Change 16: Deletion of duplicate training information

Change 16 states:

> Section 4.1.3 "Training," deletes duplicate information that was also included in Sections 4.1 and 4.1.1.

Staff Evaluation: The staff verified that the information deleted from Section 4.1.3 exists in Sections 4.1, and 4.1.1. The scope, objectives, and method of performance of ISV have not changed. Accordingly, the staff finds this change acceptable.

Change 17: ISV observers

Change 17 states:

> Section 4.2, "Observers," is being revised to also allow ISV observers who are not independent of the project.

Staff Evaluation: It is important for the V&V activity to limit bias that may affect the process results. By including observers who are knowledgeable of the plant's design and operations,

there is a potential for this type of observer to provide biased feedback (or perhaps overlook an issue). However, the staff believes the benefit of adding personnel experienced with the plant design's subtleties outweighs the potential for bias. This is because, among other things, experienced personnel can identify important human behavioral issues that may not be recognized by the independent observers.

Additionally, NUREG-0711 does not provide criteria for who can, or should, be observers of the ISV tests. It does, however, provide criteria in the Data Analysis and Interpretation Section (11.4.3.2.7) of NUREG-0711 for an independent verification of the data analyses, which the licensee commits to in GEH-320, Section 7.2, "Analysis and Interpretation." This activity allows the discovery of inconsistencies and bias during the ISV activities. Accordingly, the staff finds this change acceptable.

Change 18: Editorial changes

Change 18 states:

> Corrected typographical error in Section 4.2, "Observers," as follows:
>
> The ISV observer data will be collected using structured tools comprising the scenario observer guides in APP-OCS-GEH-321, Appendix B (Bibliog 1), and the post-trial questionnaires (see Appendix C and D of this report) and debriefings (see Appendix F of this report).

This change revises the appendix references in Section 4.2.

Staff Evaluation: The editorial changes in GEH-320 were reviewed. They were all confirmed to have no effect on the scope, objectives, or method of performance of the task support verification plan previously approved by the staff. Accordingly, the staff finds these changes acceptable.

Change 19: Added reference

Change 19 states:

> Section 5.1.1, "Events," is being changed to add a necessary reference to APP-OCS-GLR-001, "AP1000 Post-Accident Risk-Important Human Actions Summary Report."

Section 11.4.1.2.1 of NUREG-0711 describes sampling dimensions that define the scope of V&V activities. Acceptance Criterion 11.4.1.2.1(2) states that all risk-important human actions should be included in the sample.

Staff Evaluation: APP-OCS-GLR-001 provides updated and more detailed information regarding the post-accident risk-important human actions in line with the latest plant design and operating procedures. The list of risk-important human action remains unchanged. Accordingly, the staff concludes that the change is acceptable because additional task detail does not change the process previously approved by the staff in GEH-320, Revision 2. The design verification process continues to conform to the acceptance criterion stated above.

Change 20: Procedure V&V

Change 20 states:

> Section 5.1.2, "Procedures," includes a new paragraph clarifying that the validation of procedures to be performed prior to ISV will be performed by the Westinghouse Operations Procedures Group. The change also provides an additional clarifying statement that the final validation of the procedures conducted by the utilities will not be complete at the time of ISV.

Criterion 9.4(6) in NUREG-0711 states in part that all procedures should be verified and validated.

Staff Evaluation: The procedures used in the ISV will be verified and validated by Westinghouse. This conforms to the acceptance criterion and is expedient because Westinghouse has firsthand knowledge of the HFE and system designs, created the procedure style guide, and designed the computer-based procedure function and format.

The second part of the change acknowledges the potential for procedures to change between the ISV and startup and provides for a final verification of these changes before fuel load. Section 13.5.2 of NUREG-0711 addresses procedure requirements as they shift away from design development and into an operating program. Accordingly, the staff finds this change is acceptable.

Change 21: Added reference

Change 21 states:

> Section 5.1.2, "Procedures" adds a reference to APP-GW-GJP-150, "Operating Procedures Verification and Validation."

Staff Evaluation: This change ensures administrative accuracy and provides for access to supporting material. This change does not affect the design verification process as originally approved and is acceptable.

Change 22: Scenario scope change

Change 22 states:

> Section 5.1.3 "Complications," is being changed to remove references to task walkthroughs and maintenance trials utilizing manufactured equipment.

Section 11.4.1.2.1, "Sampling Dimensions," of NUREG-0711 contains three criteria that list operating conditions addressed within scenarios.

Staff Evaluation: NUREG-0711 does not address task walkthroughs and maintenance trials within the acceptance criteria describing scenario sampling dimensions. These criteria do describe ancillary tasks (which include maintenance, test, inspection, and surveillance (MTIS)

activities that interface with the control room) which continue to be addressed within the scope of ISV. The specific MTIS tasks are listed in GEH-321 as part of the scenario descriptions. The original intent of including tasks that are actually performed by operations personnel has been preserved. Accordingly, the staff finds this change acceptable.

Change 23: ISV crew turnover

Change 23 states:

> Section 5.2.1 "General Procedure and Documentation," is being revised to allow more time for the crew to familiarize themselves with the plant conditions prior to starting a simulated scenario.

Section 11.4.3.2.6.2(2) of NUREG-0711 states that the test procedures should minimize the opportunity for tester expectancy bias or participant response bias.

Staff Evaluation: Before the start of an ISV scenario, the plant is in a steady-state condition while the crew familiarizes themselves with plant conditions. The familiarization period is likened to a crew turnover period at operating plants. In reality, crew turnovers are allowed to last as long as needed to ensure that the operators understand the current plant conditions. In addition, a steady-state simulator provides no clues as to what scenario will come next. Therefore, the staff believes that by allowing as much time as needed for the crew to familiarize themselves with plant conditions actually models operating practices more closely. Accordingly, the staff finds this change acceptable.

Change 24: Use of computers for recording questionnaire results

Change 24 states:

> Section 6.2, "Methods," is being changed to use computers to collect questionnaire results.

A portion of criterion 11.4.3.2.6.2(1) in NUREG-0711 provides guidance for maintaining ISV test record files such as crew and scenario details.

Staff Evaluation: The criterion noted above does not limit data collection to one medium over the other (paper or computer/digital, etc.). In addition, the change described by the licensee will provide a number of benefits, including data replication, portability, and control. Accordingly, the staff finds this change acceptable.

Change 25: Retesting of HEDs

Change 25 states:

> Section 7.3, "Addressing HEDs and Re-Test Requirements," is being revised to add a retest option for when the HED resolution is relatively straightforward, providing additional flexibility for retesting of HEDs.

Acceptance Criterion 11.4.4.2(6) in NUREG-0711 states, in part, that design solutions generated from HED resolution should be evaluated by repeating the appropriate analyses of the V&V.

Staff Evaluation: In Section 7.3, the licensee provides examples of retest options for design changes of various complexities. These examples provide reasonable assurance that retesting will be determined based on design complexity and impact on other HSIs. The criterion cited above acknowledges that the "appropriate" retest should be applied. Accordingly, the staff finds this change acceptable.

The licensee also included a revision to the first paragraph in Section 7.3. The revised paragraph clarifies that all of the HEDs are entered into the tracking system, not just the Priority 1 and 2 HEDs. This establishes consistent direction between GEH-320 and GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process." Accordingly, the staff finds this change acceptable.

Change 26: Re-addition of deleted information

Change 26 states:

> Section 6.2, "Methods," and Appendix A, "Post-Trial Questionnaire for Subjects," Section A.2, are being changed to include two of the eight workload measurement factors that were deleted in a previous revision of GEH-320.

The staff confirmed that GEH-320, Revision 2, had been revised to include what was deleted in a previous revision. The changes made are consistent with what was originally approved by staff. Accordingly, the staff finds this change acceptable.

3.4 Evaluation of Changes to HFE Discrepancy Resolution Process (APP-OCS-GEH-420) (LAR 13-18)

Change 1: Updated Bibliography

Change 1 states:

> "Bibliography" is updated for document revision numbers for APP-OCS-GEH-120, APP-OCS-GEH-220, APP-OCS-GEH-320, and APP-OCS-GEH-520. Updated other revision numbers as required in line with current approved documents. NSNP 3.3.3 is changed to WEC 3.3.3 in the Reference section.

Staff Evaluation: This change adds updated revision numbers to multiple documents in the "Bibliography" and "Reference" sections for consistency, and to be in line with current approved documents associated with this procedure. These changes ensure administrative accuracy and provide access to supporting material. The changes do not modify the scope, objectives, or methods of performance of the ISV process. Accordingly, the staff finds this change acceptable.

Change 2: Changed definition of independent verifier, added reference

Change 2 states:

> "Glossary of Terms" and Section 2.8, "Verifying HED Solutions," are revised to reflect the changed definition of Independent Verifier and add a new reference. This is a change to be consistent with WEC 3.3.3. The definition change and the addition of a new reference are made to be in conformance with current Westinghouse Electric Company procedures regarding the personnel requirements for design verification activities.

Staff Evaluation: The use of independent verification within the HED resolution activity is not addressed in NUREG-0711. Any use of independent verification would add additional assurance that the HED resolution process, as previously approved by the staff, is implemented effectively. Accordingly, the staff finds this change acceptable.

Change 3: Human Factors Tracking System, added reference

Change 3 states:

> Section 2.1, "General Process"; Section 2.4, "Human Factors Tracking System"; and Section 2.5, "The Analysis of the Cumulative Effects of Priority 1 and Priority 2 HEDs," are revised to change the "HFE design issue tracking database" to the "Human Factors Tracking System" and updated the bibliography to WNA-WI-00207-WAPP, "Human Factors Tracking System Work Instruction," to reflect the instruction used to update the Human Factors (HF) Tracking System. The HF Tracking System is the SmartPlant Foundation (SPF) system used to track HEDs identified during HFE V&V activities. This is an administrative change.

Acceptance Criterion 2.4.4(1) in NUREG-0711 states

> Availability ─ A tracking system should be available to address human factors issues that are (a) known to the industry (defined in the Operating Experience Review element, see Section 3) and (b) identified throughout the life cycle of the HFE aspects of design, development, and evaluation. Issues are those items that need to be addressed at some later date and thus need to be tracked to provide reasonable assurance that they are not overlooked. It is not necessary to establish a new system to track HFE issues that is independent from the rest of the design effort. An existing tracking system may be adapted to serve this purpose (such as a plant's corrective action program, CAP).

Staff Evaluation: This proposed change includes the use of a tracking system that maintains the functions identified in the acceptance criterion quoted above. Accordingly, the staff finds this change acceptable.

Change 4: HFE personnel titles

Change 4 states:

> Section 2.1, “General Process”; Section 2.2, “Prioritization”; Section 2.6, “Analyzing and Resolving Priority 1 and Priority 2 HEDs”; and Section 2.7, “Analyzing and Resolving Priority 3 HEDs,” are revised to change “HFE Design Engineer” to “HFE Specialist” in order to align with the current Westinghouse organizational structure.

Staff Evaluation: The change is administrative and is not associated with any review criteria. Accordingly, the staff finds this change acceptable.

Change 5: Addition of procedures, training, and staffing as possible HED resolutions

Change 5 states:

> Section 2.1, “General Process”; Section 2.6, “Analyzing and Resolving Priority 1 and Priority 2 HEDs”; and Section 2.8, “Verifying HED Solutions,” are changed to note that HEDs may involve HSI design, OCS, operator training, operating procedures, or staffing and work organization aspects. This is a clarification to reflect that HEDs not only involve design changes but may also result in changes to operating procedures, operator training, and/or staffing and work organization aspects.

Criterion 11.4.4.2(5) in NUREG-0711 addresses design solutions as a means for HED resolution.

Staff Evaluation: The regulatory guidance specifically addresses design solutions because these solutions typically must be verified and/or validated to be consistent with the preceding HFE analyses. The proposed change includes other common methods used to address HEDs and supplements what is listed in the existing regulatory guidance. The staff recognizes that a design solution may not be the best way to address an HED and concludes that this change provides a more complete description of the options available to provide HED resolutions that will maximize human performance. Accordingly, the staff finds this change acceptable.

Change 6: Management titles

Change 6 states:

> Section 2.2, “Prioritization,” and Section 2.8, “Verifying HED Solutions,” are revised to change the “OCS Product Manager” to “Human Factors Manager” in order to align with the current Westinghouse organizational structure.

Review Criterion 2.4.4(4) in NUREG-0711 states that “tracking procedures should describe individual responsibilities for issue logging, tracking and resolution, and resolution acceptance.”

Staff Evaluation: This change is administrative in nature and continues to identify individual responsibilities for HED tracking in accordance with the acceptance criterion. Accordingly, the staff finds this change acceptable.

Change 7: Assignment of HEDs to appropriate groups

Change 7 states:

> Section 2.6, "Analyzing and Resolving Priority 1 and Priority 2 HEDs," is revised to clarify that the HFE specialist assigns the HEDs to the relevant groups responsible for the design, operator training, operating procedures, and staffing and work organization aspects in order for them to identify the most appropriate HED resolution. The cognizant groups such as design, operator training, operations procedures, or staffing are responsible for resolving the HEDs. This change clarifies that the HFE Specialist is responsible for assigning the HEDs to the relevant group(s) and is not responsible for determining the resolution. The resolution is the responsibility of the cognizant group.

Review Criterion 2.4.4(4) in NUREG-0711 states that "tracking procedures should describe individual responsibilities for issue logging, tracking and resolution, and resolution acceptance."

Staff Evaluation: The changes clarify the responsibility of the HF specialist and identify the groups responsible for HED resolutions. The proposed change clearly indicates the parties responsible for assigning HEDs to be resolved and for resolution of HEDs. Section 2.4 and the associated references continue to provide a description of how HEDs will be logged and tracked. Staff determined that these changes did not affect the content, scope, or methodology of the HED resolution process as previously approved. Accordingly, the staff finds this change acceptable.

Change 8: Post-verification HEDs

Change 8 states:

> Section 2.8, "Verifying HED Solutions," was changed to add a description concerning the mechanism to deal with design and procedure changes post-HED resolution. References to APP-GW-G0Y-002, "AP1000 Configuration Management Plan," and WNA-PC-00005-WAPP, "AP1000 I&C Projects Configuration Management Plan," were added to assess and maintain the validity of the HED resolution results against subsequent changes.
>
> In AP1000, HEDs are identified from HF V&V only. Any issues from the design stage are termed "HF General Items," and tracked via the same formal Human Factors Tracking System, with the same Work Instruction (i.e., WNA-WI-00207-WAPP, Revision 0, "Human Factors Tracking System Work Instruction"). This tracking system addresses human factors issues that are identified throughout the lifecycle of AP1000. It is just a difference in terminology.

This change applies to two NUREG-0711 review Criteria: 2.4.4(1) and 11.4.4.2(6). Criterion 2.4.4(1) in NUREG-0711 states that "A tracking system should be available to address human factors issues that are… (b) identified *throughout the life cycle of the HFE aspects of design, development and evaluation*" {emphasis added}.

Staff Evaluation: The proposed change specifies that HEDs will be generated and tracked during and after the V&V process. This strategy more closely matches the intent of NUREG-0711 by explicitly providing a process to explain how to handle those HEDs that arise after the submittal of the HFE Resolution Verification Report. The licensee also tracks issues generated before V&V and refers to them as "HF General Items."

Additionally, Section 18.2.4 of DCD Revision 19 states:

> A tracking system is used to address human factors issues that are known to the industry and/or identified throughout the life cycle of the human factors engineering/human system interface design, development, and evaluation. The tracking system enables the documentation and tracking of issues that need to be addressed at some later date.

By tracking "HF General Items" and HEDs, the licensee ensures that the HFE related issues are identified and tracked throughout the lifecycle as indicated in Section 18.2.4 of the DCD. Therefore, the staff finds that this change is in accordance with Criterion 2.4.4(1)(b).

Criterion 11.4.4.2(6) in NUREG-0711 states, in part, that "designs should be evaluated by repeating the appropriate analyses of the verification and validation. Portions of the HFE design verification analysis should be conducted to provide reasonable assurance that the design is consistent with HFE guidelines."

Staff Evaluation: Post-verification changes occur as a result of corrective actions for integrated system validation issues and system modifications. In both cases, the changes being made to GEH-420 specify that the design changes will be evaluated and re-verified through a subsequent HFE design verification or as part of the plant startup HFE design verification. Both processes have been previously approved by the staff as part of the AP1000 design certification. The new procedure references added to GEH-420 describe the process used to identify differences between the original HFE design and the current design and ensure that the design verification is applied to the changes. Accordingly, the staff finds that this change ensures that post-verification design changes will receive a design verification that conforms to the acceptance criterion stated above.

The staff finds that acceptance Criteria 2.4.4(1) and 11.4.4.2(6) in NUREG-0711 are met and therefore this change is acceptable.

<u>Change 9: Minor editorial changes</u>

Change 9 states**:**

> There are several other minor editorial changes in sections not expressly listed above. These changes make the document more clear and have no effect on the objectives and scope of the Human Factors Engineering Discrepancy Resolution Process.

Staff Evaluation: The editorial changes in GEH-420 were reviewed. These changes were all confirmed to have no effect on the scope, objectives, or method of performance of the HED resolution process previously approved by the staff.

Substantial reorganization and edits (more than "minor editorial change") were found regarding justification of HEDs and addressing HEDs needing design changes for resolution in Section 2.6 "Analyzing and Resolving Priority 1 and Priority 2 HEDs" (paragraphs 3 and 4). Staff determined that these changes did not affect the content, scope, or methodology of the HED resolution process as previously approved.

The nature of other editorial changes does not alter the way the plan meets any review criteria. Accordingly, the staff finds these changes acceptable.

Substantive Changes Identified As "Minor Editorial Changes" In LAR 13-012

Change 10: Tracking, Analyzing and Resolving Priority 3 HEDs (See Criterion 3 last paragraph)

Section 2.7, "Analyzing and Resolving Priority 3 HEDS," and Section 2.2, "Prioritization," contain information regarding changes to the treatment of Priority 3 HEDs.

Two NUREG-0711 review criteria apply to this change. Criterion 2.4.4 addresses the HFE Issues Tracking system and Criterion 11.4.4.2(4) addresses the documentation of HED evaluations.

Staff Evaluation: Section 2.7 of GEH-420 indicates that all HEDs will be tracked and documented. Section 2.2 implies that some low-priority HEDS may be escalated. This treatment of HEDs is more conservative than the originally approved process. This change meets Criterion 2.4.4 by actually lowering the threshold referred to in 2.4.4(3). Documenting additional HEDs is consistent with Criterion 11.4.4.2(4). Therefore, the staff finds these changes acceptable.

3.5 Evaluation of Changes to Plant Startup HFE Design Verification Plan (APP-OCS-GEH-520) (LAR 13-19)

Change 1: Updated Bibliography

Change 1 states:

> "Bibliography" is updated for document revision numbers for APP-OCS-GEH-120, APP-OCS-GEH-220, APP-OCS-GEH-320, and APP-OCS-GEH-420. Updated other revision numbers, as required, in line with current approved documents. APP-OCS-GGR-110, Revision 1, "AP1000 Technical Support Center and Emergency Operations Facility Workshop," Westinghouse Electric Company LLC (Proprietary); NUREG-0654, Rev. 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," U.S. Nuclear Regulatory Commission, March 2002; and NUREG-0696, "Functional Criteria for Emergency Response Facilities," U.S. Nuclear Regulatory Commission, February 1981, are added to the bibliography list.

Staff Evaluation: This change adds updated revision numbers to multiple documents in the "Bibliography" and reference sections for consistency and to be in line with current approved

documents associated with this procedure. These changes ensure administrative accuracy and provide access to supporting material. The changes do not modify the scope, objectives, or methods of performance of the ISV process. The documents added to the bibliography provide additional information or add missing references but do not change the previously approved plant startup HFE design verification process. Accordingly, the staff finds this change acceptable.

Change 2: Independent reviewer

Change 2 states:

> "Glossary of Terms" is revised to reflect the changed definition of Independent Verifier and add a new reference.

Staff Evaluation: The use of independent verification within the startup design verification activity is not addressed in NUREG-0711. The proposed definition of independent verifier and the added reference that explains independent reviewer responsibilities adds additional assurance that the startup design verification process, as previously approved by the staff, is implemented effectively. Accordingly, the staff finds this change acceptable.

Change 3: Timing of startup design verification

Change 3 states:

> Section 1.1.3, "Process Strategy," is revised in the last paragraph as a clarification. Once plant construction is complete and equipment is installed, HFE verification at plant startup can start. HFE verification at plant startup does not have to wait until testing and preparation for plant startup is underway, although it is clarified that some verification activities need functioning equipment. Language is added at the end of this section concerning the plant conditions under which startup verification implementation activities may begin.

Acceptance Criterion 12.4.6 (2) in NUREG-0711 states that the final (as-built in the plant) HSIs, procedures, and training should be compared with the detailed design description to verify that they conform to the design that resulted from the HFE design process and V&V activities.

Staff Evaluation: This change retains the concept that final as-built-in-the-plant HSIs, procedures, and training are the focus of the startup design verification. Timing of the verification depends on the functionality of the design being verified and the change preserves this relationship. Accordingly, the staff finds this change acceptable.

Change 4: Specific verification requirements

Change 4 states:

> In Section 1.2.2, "List of Design Features Requiring Verification," the following revisions are made: 1) adds language to the first paragraph and bullet 1 to clarify that the scope encompasses design verification and task support verification aspects that could not previously be verified; 2) changes "i.e." to "e.g." at bullet 1f

as a clarification (this clarification illustrates that there may be other cases which are related to maintainability); 3) adds clarification note at the end of bullet sections 1 and 2 concerning the scope of the verification and notes that the independent verifier may add to, or refine, the scope at their discretion; 4) changes the references to an HFE issue tracking system to the term "Human Factors Tracking System" at item 3 and in other sections (this is an update about the tool used to track HEDs identified during HFE V&V; the Smart Plant Foundation (SPF) HF Tracking System is the system tool that will be used); and 5) adds a local action involved in the risk-important task to "deactivate the PMS division involved in a fire," and adds a reference to APP-OCS-GLR-001, "AP1000 Post-Accident Risk-Important Human Actions Summary Report," in item 4 ("deactivate the PMS division involved in a fire" is a second local action involved in the risk-important human actions).

Staff Evaluation: For change 4.1, acceptance Criterion 12.4.6 (1) in NUREG-0711 states in part that aspects of the design that were not addressed in V&V should be evaluated using an appropriate V&V method. Change 4.1 reinforces this guidance. Accordingly, the staff finds the change acceptable.

For change 4.2, Section 1.2.2, "List of Design Features Requiring Verification," of GEH-520 provides a list of design elements that were not verified as part of the V&V process. From this list, change 4.2 clarifies the scope of "maintainability" and thus helps ensure the completeness of the startup verification. Accordingly, the staff finds this change acceptable.

Change 4.3 allows the independent reviewer to add to or refine the scope of the startup verification. This change provides additional assurance that items needing verification but unintentionally omitted from the list can be included in an efficient manner. GEH-520 prescribes the minimum actions needed to support the staff's safety conclusion. Adding additional scope or clarifying existing scope does not change the staff's safety conclusion. Accordingly, the staff finds this change acceptable.

For change 4.4, acceptance Criterion 2.4.4(1) in NUREG-0711 states,

> Availability - A tracking system should be available to address human factors issues that are (a) known to the industry (defined in the Operating Experience Review element, see Section 3) and (b) identified throughout the life cycle of the HFE aspects of design, development, and evaluation. Issues are those items that need to be addressed at some later date and thus need to be tracked to provide reasonable assurance that they are not overlooked. It is not necessary to establish a new system to track HFE issues that is independent from the rest of the design effort. An existing tracking system may be adapted to serve this purpose (such as a plant's corrective action program, CAP).

Change 4.4 alters the name of the HED tracking system, but a tracking system is still being used that maintains the functions described in the acceptance criterion quoted above, and therefore this acceptance criterion is met. Accordingly, the staff finds this change acceptable.

For change 4.5, Section 11.4.1.2.1 in NUREG-0711 describes sampling dimensions that define the scope of V&V activities. Acceptance Criterion 11.4.1.2.1(2) states that all risk-important human actions should be included in the sample. Change 5 ensures that a complete list of local

risk-significant actions is provided. APP-OCS-GLR-001 provides updated and more detailed information regarding the post-accident risk-important human actions in line with the latest plant design and operating procedures. The list of risk-important human action remains unchanged. Accordingly, the staff concludes that the change is acceptable because additional task detail does not change the process previously approved by the staff in GEH-520, Revision B. The plant startup HFE design verification process continues to conform to the acceptance criterion stated above.

Change 5: TSC and EOF design verification

Change 5 states:

> Section 1.2.3, "Limitation of Scope" clarifies that the TSC and EOF are not within the scope of plant startup HFE design verification.

Staff Evaluation: The TSC was deleted from the scope of verification at plant startup because it is not in the scope of the Westinghouse HF program. The EOF has never been in the scope of this verification. The as-built HFE design verification for both centers is accomplished through drills and exercises in accordance with NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants" (ADAMS Accession No. ML040420012), and NUREG-0696, "Functional Criteria for Emergency Response Facilities." This strategy is documented in the Safety evaluation for the Summer COL application. Accordingly, the staff finds the change acceptable.

Change 6: Design verification acceptance criteria, HED resolution

Change 6 states:

> In Section 2, "Verification Process," examples of human factors guideline references for verification are added from the bibliography section as a clarification in the first paragraph. The phrase "as-built plant," in lieu of the word "latest," is added at the end of the third paragraph to clarify that verification at plant startup is based on the as-built design. It also changes the wording on the HED resolution process in the last paragraph and moves the last sentence to the beginning of Section 3.1. This change deletes language about division of responsibility between the utility and Westinghouse in the resolution of HEDs identified during the design verification at plant startup. Division of responsibility will be dealt with at a future date by project management. In any case, all HEDs identified during the HFE verification at plant startup will be formally documented in the associated report and addressed by resolution or justification.

Acceptance Criterion 12.4.6 (2) in NUREG-0711 states that the final (as-built in the plant) HSIs, procedures, and training should be compared with the detailed design description to verify that they conform to the design that resulted from the HFE design process and V&V activities.

Staff Evaluation: The added references contain the detailed design descriptions used as acceptance criteria for the startup design verification. By including these references in GEH-520, the licensee has clarified the source of detailed design descriptions used as

acceptance criteria for the as-built design verification. This improves conformance to the acceptance criterion stated above. Accordingly, the staff finds this change acceptable.

Acceptance Criterion 12.4.6 (3) in NUREG-0711 states that all HFE-related issues documented in the issue tracking system should be verified as adequately addressed.

GEH-520 continues to state that all HEDs will be justified or resolved. From a regulatory perspective, the licensee is responsible for this action because it is included within the ITAAC associated with the startup design verification. Assignment of resolution responsibilities is an internal licensee responsibility that is not addressed within regulatory guidance. Accordingly, the staff finds this change acceptable.

Change 7: Organization responsibilities

Change 7 states:

> In Section 3.1, "Personnel Requirements and Techniques," the term "HFE evaluation team" is changed in the first paragraph to "HF independent verifiers" and "HFE design engineers" is changed to "relevant responsible groups." These are corrections to update the roles and responsibilities in line with the intended process. Also clarified that the operating procedures and training information will be provided to the verifier. Adds the acronym "HF" in the second paragraph to the term "tracking system" to correctly identify the system as a dedicated system for tracking HF HEDs.

Acceptance Criterion 2.4.2(1) in NUREG-0711 states in part that the HFE team should be responsible for the oversight and review of all HFE design, development, test, and evaluation activities. Specific titles are not addressed. Acceptance Criterion 2.4.2(3) addresses composition of the team and is designed to ensure that a broad range of disciplines is available to support the integration of HFE into the control room design.

Staff Evaluation: This change clarifies responsibility for the startup HFE design verification by adding a statement that the Human Factor Manager is responsible for the activity. Independent human factors verifiers continue to complete the verification activity and, where needed, the responsible groups provide the necessary configuration and control documentation needed to verify the design. These changes keep members of the HFE team in positions responsible for the oversight and review of the startup verification. Accordingly, the staff finds this change acceptable.

Introducing the term "HF" provides more specificity on which tracking system is used. The tracking system for HEDs is not substantially changed and still conforms to acceptance Criterion 2.4.4(1) in NUREG-0711, which states, in part, that a tracking system will be available. Accordingly, the staff finds this change acceptable.

Change 8: Editorial changes

Change 8 states:

There are several other minor editorial changes in sections of APP-OCS-GEH-520. These changes make the document more clear and have no effect on the objectives and scope of the AP1000 Plant Startup Human Factors Engineering Design Verification Plan.

Staff Evaluation: The editorial changes in GEH-520 were reviewed. They were all confirmed to have no effect on the scope, objectives, or method of performance of the task support verification plan previously approved by the staff. Accordingly, the staff finds these changes acceptable.

3.6 Conclusions

The staff concludes that the changes proposed in License Amendment Requests 13-10, 13-16, 13-17, 13-18, and 13-19 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 implementation 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 GDC 18 in Appendix A to 10 CFR Part 50; Appendix D, "Design Certification Rule for the AP1000 Design," to 10 CFR 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants"; 10 CFR 50.34(f)(2)(ii);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 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. 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 (*Federal Register* (FR) notices published on May 28, 2013 (78 FR 31984 for LAR 13-10), November 12, 2013 (78 FR 67412 for LAR 13-16, 78 FR 67411 for LAR 13-17, and 78 FR 67413 for LAR 13-18 and 78 FR 67413 for LAR 13-19). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Under 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

Based on the considerations discussed above, the staff has concluded that there is reasonable assurance that (1) the proposed operation will not endanger public health and safety, (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 public health and safety. Therefore, the staff finds the changes proposed in this license amendment acceptable.

The LARs address changes to HFE Reports; where approval of these changes is provided; such approval is only applicable to VCSNS Units 2 and 3 and should not be interpreted as generic approval.

7.0 REFERENCES

1. South Carolina Electric & Gas Company's letter to U.S. Nuclear Regulatory Commission, "Request for License Amendment (LAR) 13-10: Revision to AP1000 Human Factors Engineering Integrated System Validation," March 13, 2013 (ADAMS Accession No. ML13074A731), supplemented by the letter dated October 3, 2013 (ADAMS Accession No. ML13281A366)

2. South Carolina Electric & Gas Company's letter to U.S. Nuclear Regulatory Commission, "License Amendment Request (LAR) 13-16: Revision to AP1000 Human Factors Engineering Design Verification Plan," dated September 25, 2013 (ADAMS Accession No. ML13270A068)

3. South Carolina Electric & Gas Company's letter to U.S. Nuclear Regulatory Commission, "License Amendment Request (LAR) 13-17: Revision to AP1000 Human Factors Engineering Task Support Verification Plan," dated September 25, 2013 (ADAMS Accession No. ML13270A096), and supplemented by a letter dated February 10, 2014 (ADAMS Accession No. ML14043A081)

4. South Carolina Electric & Gas Company's letter to U.S. Nuclear Regulatory Commission, "License Amendment Request (LAR) 13-18-Revision to AP1000 Human Factors Engineering Discrepancy Restoration Process," dated October 3, 2013 (ADAMS Accession No. ML13283A160)

5. South Carolina Electric & Gas Company's letter to U.S. Nuclear Regulatory Commission, "License Amendment Request (LAR) 13-19: Revision to AP1000 Plant Startup Human Factors Engineering Design Verification Plan," dated October 3, 2013 (ADAMS Accession No. ML13281A241), and supplemented by a letter dated June 6, 2014 (ADAMS Accession No. ML14157A309)

6. Virgil C. Summer Nuclear Station (VCSNS) Updated Final Safety Analysis Report (UFSAR), Revision 1, dated July 11, 2013 (ADAMS Accession No. ML13217A253)

7. U.S. Nuclear Regulatory Commission, “Human Factors Engineering Program Review Model,” NUREG-0711, Revision 2, dated February 2004 (ADAMS Accession No. ML12205A463)

8. 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)

9. Westinghouse Electric Company LLC, “AP1000 Human Factors Engineering Design Verification Plan,” APP-OCS-GEH-120, Revision 1, dated August 2013 (Proprietary)

10. Westinghouse Electric Company LLC, “Human Factors Engineering Task Support Verification Plan,” APP-OCS-GEH-220, Revision 1, dated August 2013 (Proprietary)

11. Westinghouse Electric Company LLC, “AP1000 HFE Integrated System Validation Plan,” APP-OCS-GEH-320, Revision 3, dated August 2013 (Proprietary)

12. Westinghouse Electric Company LLC, “AP1000 Human Engineering Discrepancy Resolution Process,” APP-OCS-GEH-420, Revision 1, dated August 2013 (Proprietary)

13. Westinghouse Electric Company LLC, “Plant Startup Human Factors Engineering Verification Plan,” APP-OCS-GEH-520, Revision 2, dated August 2013 (Proprietary)