April 5, 2016

Sarah DiTommaso, Manager
AP1000 Instrumentation & Control Licensing
Westinghouse Electric Company
5000 Ericsson Dr.
Warrendale, PA 15086

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION OF WESTINGHOUSE ELECTRIC COMPANY REPORT NUMBER 99900404/2015-201

Dear Ms. DiTommaso:

From October 20, 2014, through February 24, 2016, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the Westinghouse Electric Company (WEC) facility in Cranberry Township, PA. The purpose of the limited-scope inspection was to assess WEC's implementation of aspects of the WEC Human Factors Engineering (HFE) program to determine if it adequately complies with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," and Part 50, "Domestic Licensing of Production and Utilization Facilities."

This inspection specifically evaluated WEC's implementation of aspects of the HFE program associated with the HFE verification and validation activities including: Human-System Interface (HSI) Task Support Verification (TSV), HFE Design Verification (DV), and Integrated System Validation (ISV). These activities were associated with inspections, tests, analyses, and acceptance criteria (ITAAC) from Appendix C from the Combined License for Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3. Specifically, these activities were associated with ITAAC 3.2.00.01. The NRC inspectors did not identify any findings associated with the ITAAC contained in Section 4 of the attachment to this report.

The enclosed report presents the results of this inspection.

Within the scope of this inspection, no violations or non-conformances were identified.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's Rules of Practice, a copy of this letter, its enclosures, and your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system, Agencywide Documents Access and Management System, which is accessible from the NRC Web site at http://www.nrc.gov/readingrm/adams.html. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material is withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of

personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

/RA/

Terry W. Jackson, Chief
Quality Vendor Inspection Branch 1
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Docket No.: 99900404

Enclosure:
Inspection Report No. 99900404/2015-201
and Attachment

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U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NEW REACTORS
DIVISION OF CONSTRUCTION INSPECTION AND OPERATIONAL PROGRAMS
VENDOR INSPECTION REPORT

Docket No.:	99900404
Report No.:	99900404/2015-201
Vendor:	Westinghouse Electric Company 5000 Ericsson Dr. Warrendale, PA 15086
Vendor Contact:	Sarah DiTommaso, Manager AP1000 Instrumentation & Control Licensing Westinghouse Electric Company Email: ditomms@westinghouse.com
Nuclear Industry Activity:	Westinghouse Electric Company, LLC, located at 5000 Ericsson Drive, Suite 517, Warrendale, PA 15086, whose scope of supply includes but is not limited to safety-related design, fabrication, testing, and delivery of HFE design for the current US AP1000 plants under construction.
Inspection Dates:	October 20, 2014 – February 24, 2016
Inspection Team Leader:	Greg Galletti, NRO/DCIP/QVIB-1
Inspectors:	George Lipscomb, NRO/DCIP/ QVIB-1 Philip Natividad, NRO/DCIP/ QVIB-1 Lauren Kent, NRO/DCIP/COLB Paul Pieringer, NRO/DCIP/COLB James Kellum, NRO/DCIP/COLB Jacqwan Walker, NRO/DCIP/COLB Joseph DeMarshall, NRO/DCIP/COLB David Desaulniers, NRO/DCIP Brian Green, NRR/DRA/APHB R. Scott Egli, OCHCO/ADHRTD/TTC/RTTBA Gary Callaway, OCHCO/ADHRTD/TTC/RTTBA Mathew Emrich, OCHCO/ADHRTD/TTC/RTTBB Hyung Je, NRO/DE/ICE1 Robert Mathis III, R-II/DCI/CIB1 William Russell, OCHCO/ADHRTD/TTC/RTTBA Mike Fochtman, OCHCO/ADHRTD/TTC/RTTBB
Approved by:	Terry Jackson, Chief Quality Vendor Inspection Branch 1 Division of Construction Inspection and Operational Programs Office of New Reactors

Enclosure

EXECUTIVE SUMMARY

Westinghouse Electric Company
99900404/2015-201

The U.S. Nuclear Regulatory Commission (NRC) staff conducted this vendor inspection to verify that Westinghouse Electric Company, LLC (hereafter referred to as WEC), implemented an adequate Human Factors Engineering (HFE) program that complies with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," and Part 50, "Domestic Licensing of Production and Utilization Facilities." The inspectors conducted this inspection at the WEC facility in Cranberry Township, PA, from October 20, 2014 – February 24, 2016.

This inspection specifically evaluated WEC's implementation of aspects of the HFE program associated with the HFE verification and validation activities including: Human System Interface (HSI) Task Support Verification (TSV), HFE Design Verification (DV), and Integrated System Validation (ISV).

The following regulations served as the bases for this NRC inspection:

- 10 CFR 52.47
- 10 CFR 50.34(f)

The inspectors used Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," dated July 15, 2013, and IP 65001.23, "Inspection of Human Factors Engineering Verification and Validation ITAAC," dated December 22, 2014.

The information below summarizes the results of this inspection.

Task Support Verification

The inspectors determined that TSV activities were conducted in conformance with the implementation plan and includes verification that the information and controls provided by the HSI match the display and control requirements generated by the function-based task analyses and the operational sequence analyses. No findings of significance were identified in this area.

HFE Design Verification

The inspectors determined that the HFE design verification was conducted in conformance with the implementation plan and includes verification that the HSI design is consistent with the AP1000 specific design guidelines developed for each HSI resource. No findings of significance were identified in this area.

ISV Prerequisite Evaluation

The inspectors concluded that the implementation of WEC's programs to support ISV prerequisite activities including simulator factory acceptance testing (FAT), Protection and Safety Monitoring System (PMS) and Distributed Control Information System (DCIS) software integration and testing, implementation of corrective actions to identified issues, and simulator model development were conducted consistent with their administrative control, the

requirements in APP-OCS-GEH-320, “AP1000 Human Factors Engineering Integrated System Validation Plan” (GEH-320), and their licensing commitments. No findings of significance were identified.

ISV Design Evaluation

The inspectors concluded that the implementation of WEC’s programs to support ISV design evaluation activities including facility review; ISV test design, test procedures, and performance measures; crew selection and training; ISV scenario development; and pilot testing were conducted consistent with their administrative control, the requirements in GEH-320, and their licensing commitments. No findings of significance were identified.

ISV Performance Tests

The inspectors determined that the implementation of the ISV performance testing including scenario adequacy and completeness, simulator fidelity, and ISV team performance were conducted consistent with their administrative control, the requirements in GEH-320, and their licensing commitments. No findings of significance were identified.

ISV Testing and Analyses Evaluation

The inspectors determined that the implementation of the ISV testing and analysis activities including ISV analysis methods and ISV data analyses and interpretation were conducted consistent with their administrative control, the requirements in GEH-320, and their licensing commitments. No findings of significance were identified.

REPORT DETAILS

1. Task Support Verification (ITAAC 3.2.00.01a)

   a. Inspection Scope

      The inspectors reviewed APP-OCS-GER-220, "HFE Task Support Verification," which is the results summary report for the task support verification (TSV) activity, and concluded that TSV was conducted in conformance with the implementation plan, APP-OCS-GEH-220, “AP1000 Human Factors Engineering Task Support Verification Plan.” Specifically, the inspectors confirmed that the report documented that TSV had been performed for each of the human-system interface (HSI) resources and operation and control centers (OCS) listed in the implementation plan. By sampling the names and qualifications of the personnel who performed the TSV and the design work for each of the controls, alarms, and indications on the minimum inventory list and finding that TSV and design work were performed by different personnel, the inspectors concluded that TSV had been performed by independent reviewers as required by the implementation plan.

      The inspectors also confirmed that the report included verification that the information and controls provided by the HSI match the display and control requirements generated by the function-based task analyses and the operational sequence analyses. The inspectors verified that any exceptions were documented as human engineering discrepancies (HEDs) in accordance with the implementation plan, and the inspectors also noted that there were relatively few HEDs that resulted from TSV when compared to the relatively large number of controls, indications, and alarms that were analyzed. Finally, the inspectors also concluded that the HEDs were documented with sufficient detail so that design personnel will understand the issue and be able to determine appropriate actions during the HED resolution process.

   b. Observations and Findings

      No findings of significance were identified in this area.

   c. Conclusion

      The inspectors determined that TSV activities were conducted in conformance with the implementation plan and included verification that the information and controls provided by the HSI match the display and control requirements generated by the function-based task analyses and the operational sequence analyses. No findings of significance were identified in this area.

2. HFE Design Verification (ITAAC 3.2.00.01b)

   a. Inspection Scope

      The inspectors reviewed APP-OCS-GER-120, "AP1000 HFE Design Verification Report," which is the results summary report for the design verification (DV) activity, and concluded that the HFE design verification was conducted in conformance with the implementation plan, APP-OCS-GEH-120, “Human Factors Engineering Design Verification Plan.” Specifically, the inspectors confirmed that the report documented that

each of the HSI resources and OCS listed in the implementation plan were evaluated during DV against the HFE design guidelines identified in the implementation plan. By sampling the names and qualifications of the personnel who performed the DV and the design work for the primary and secondary dedicated safety panels and finding that DV and design work were performed by different personnel, the inspectors concluded that DV had been performed by independent reviewers as required by the implementation plan.

Additionally, the report includes verification that the HSI design is consistent with the AP1000 specific design guidelines developed for each HSI resource. The inspectors reviewed the results of the DV for the primary safety display panel (PDSP) and found that there were no instances where the PDSP design failed to conform to the applicable HFE guidelines. The inspectors also reviewed the results of the DV for the alarm presentation system and found that the exceptions were documented as HEDs in accordance with the implementation plan. The inspectors also noted that there were relatively few HEDs that resulted from DV when compared to the relatively large number of HSI resources and OCS that were analyzed. Finally, the inspectors also concluded that the HEDs were documented with sufficient detail so that design personnel will understand the issue and be able to determine appropriate actions during the HED resolution process. The inspectors noted that Appendix B of the results summary report documented instances where DV was deferred either because the verification must be performed in the as-built plant or because the detailed design documentation lacked sufficient detail to perform the DV. For instances where the DV was deferred because of insufficiently detailed design documentation, the inspectors noted that the DV will be performed following the upgrade to the next baseline configuration. The inspectors also concluded that the performance-based ISV included the HSI resources in the main control room for which DV was deferred and therefore provided a means of verifying whether or not these HSI resources support safe operation of the plant for the current baseline configuration.

b. Observations and Findings

No findings of significance were identified in this area.

c. Conclusion

The inspectors determined that the HFE design verification was conducted in conformance with the implementation plan and includes verification that the HSI design is consistent with the AP1000 specific design guidelines developed for each HSI resource. No findings of significance were identified in this area.

3. ISV-Prerequisite Evaluation (3.2.00.01c.i)

a. Inspection Scope

The inspectors were provided an overview of the WEC Automation Field Services (WEC-AFS) ISV prerequisite activities and configuration change-management workflow processes that included (1) WEC-AFS Request for Engineering Change (REC) and Temporary-REC and (2) WEC-AFS RRAS Issue Tracking System (RITS), which are systems that capture both design change and testing/implementation corrective action issues. WEC-AFS reviews these issues in order to assure that any such identified

prerequisite issues are either deferred to post-ISV Baseline 8, or resolved in Baseline 7.8.2 used for the ISV engineering evaluation.

WEC-AFS directed their Change Control Board (CCB) and I&C System Leads and additionally a multidisciplinary HFE/ISV Triage Team to analyze the RECs and RITS for applicability to ISV. Changes that were determined to be required prerequisites were implemented as part of Baseline 7.8.2 in order to have the simulator sufficiently complete to begin ISV. The analysis of issues that were deferred to Baseline 8 are documented in LTR-NA-WAPP-14-177, "Integrated System Validation Impact from Issues Identified as a Result of PMS Channel Integration Testing," (LTR-177) related to Protection and Safety Monitoring System (PMS) Channel Integration Testing (CIT) issues, LTR-183 (Distributed Control Information System (DCIS) Level 3 issues), and LTR-193 (Simulator factory acceptance testing (FAT) issues). The inspectors reviewed a sample of issues from each letter to confirm that the WEC evaluation provided adequate justification for any deferment decisions to assure there was no potential impact on the conduct of the ISV. The inspection review for each of these areas is summarized in the following sub-sections.

The inspectors also noted that GEH-320 provides for identification and documentation of any simulator model deficiencies that would be documented as a RITS and evaluation to determine if the issue was a simulator design issue, which could affect the results of the previously completed Simulator FAT, or other AP1000 plant design issues requiring evaluation through the CAPAL process. During the ISV trials witnessed by the inspectors and subsequent inspection of the ISV results evaluation process, the inspectors verified that issues with the simulator modeling or performance were identified and documented in accordance with the requirements of GEH-320.

Finally, the inspectors had an opportunity to discuss configuration management of the simulators used to perform the ISV and the training simulators at Vogtle Units 3 & 4 and V.C. Summer Units 2 & 3 with WEC and the licensees to verify that they had a systematic method of sharing deficiencies, fixes, patches, and revisions to the simulators. No findings of significance were identified.

PMS CIT Testing

a. Inspection Scope

The inspectors reviewed LTR-NA-WAPP-14-177, its revised version LTR-NA-WAPP-15-003, and a sample of RITS identified in the letters. Although all of the 17 RITS listed in the letter may have originally been intended to be deferred until after ISV testing, approximately half (9 of 17) were listed in the letter as completed and closed out as already resolved prior to the ISV. The inspectors agreed with the WEC-AFS ISV Triage Team's analysis that the issues only result in a more challenging scenario to operators, which is therefore conservative for ISV purposes, or were unlikely to be included in the ISV scenarios, and therefore would not affect operator response times during scenarios.

The inspectors interviewed responsible personnel and reviewed applicable documents as it relates to ISV prerequisite activities to ensure that PMS CIT adequately supports the execution of ISV-related test scenarios. The inspectors reviewed Configuration Management Release Reports (CMRR) to identify configuration items associated with

PMS CIT. Test Configuration Records (TCR) were reviewed to ensure that procedures to execute testing were specified and that items used during the testing were included in the current CMRR. The inspectors also reviewed PMS design specifications and test plans to confirm that the scope of the PMS CIT adequately supports verifying the functionality of the PMS. Specifically, the inspectors reviewed PMS CIT test procedures, test datasheets, and test reports for the Reactor Trip (RT) functions to verify that the integration of the application software with the production hardware meets all applicable PMS requirements. The RITS documents generated as a result of the testing of the RT functions for the PMS CIT were reviewed to ensure that corrective actions were properly identified and completed. RT functions, as well as all RITS generated for issues during development of PMS baselines, are analyzed and dispositioned during subsequent baseline regression testing/analysis.

b. Observations and Findings

No findings of significance were identified in this area.

c. Conclusion

The inspectors determined that WEC reviewed PMS CIT testing results, and adequately identified, documented, and evaluated issues for impact on ISV implementation, and subsequently performed ISV activities consistent with the requirements in GEH-320 and their licensing commitments.

DCIS Software Testing

a. Inspection Scope

The inspectors compared the list of the DCIS Level 3 tests described in Section 2.5.1 of APP-PLS-T5-001, “Plant Control System/Data Display and Processing System Test Plan,” revision 1, to the list in Appendix A of the LTR-183 and verified the set of tests evaluated and documented in LTR-183 was consistent with the required testing described in APP-PLS-T5-001. The inspector also reviewed all ISV-relevant DCIS Level 3 test reports for completion and verified that identified issues were adequately described and evaluated for impact on ISV implementation.

b. Observations and Findings

No findings of significance were identified in this area.

c. Conclusion

The inspectors determined that WEC reviewed DCIS level 3 testing results, and adequately identified, documented, and evaluated issues for impact on ISV implementation, and subsequently performed ISV activities consistent with the requirements in GEH-320 and their licensing commitments.

The Simulator FAT

a. Inspection Scope

The inspectors reviewed the process and documentation for simulator FAT testing conducted from February through May 2014. The inspectors compared the testing performed and verified that the testing met the requirements of GEH-320 and APP-STS-T5-001, "AP-1000 Full Scope Training Simulator Test Plan," Revision 3.

The inspectors reviewed the "Roadmap from ISV prerequisites to Vogtle Simulator Release" flowchart, including three internal WEC ISV prerequisite assessment letters that described issues identified during the various ISV prerequisite activities and WEC staff's evaluation of the potential impact of those issues on the subsequent performance of the ISV. The inspectors also reviewed problems identified and corrective actions taken throughout the prerequisite timeframe. This review included issues from the simulator FAT.

b. Observations and Findings

The inspectors reviewed LTR-NA-WAPP-14-193, "Subject: Integrated System validation from Issues Identified as a Result of Simulator Factory Testing," dated September 29, 2014, and noted in several cases, that issues identified were described as being very infrequent, although the actual RITS associated with those issues characterized them as being more common or even frequent. This mischaracterization could have allowed for items to be inappropriately deferred for resolution until after the ISV. Additionally the inspectors noted that for an issue related to control rod motion, if during the ISV this issue presented itself, the proposed resolution would allow for the simulator to be paused. This action would result in a significant deviation from the requirements described in GEH-320, which limited the conditions under which the simulator may be frozen during the trials. Based on these observations, the WEC staff issued a CAPAL (ID 100054339), dated October 22, 2014, to document these items. During subsequent inspection weeks, the NRC inspectors did verify that the WEC staff addressed the issues through the release a revision of LTR-NA-WAPP-14-193 and conducted the ISV trials in accordance with the requirements of GEH-320. No findings of significance were identified.

c. Conclusion

The inspectors determined that WEC performed simulator testing in accordance with the requirements described in APP-STS-T5-001 and adequately identified, documented, and evaluated issues for impact on ISV implementation and subsequently performed ISV activities consistent with the requirements in GEH-320 and their licensing commitments.

Corrective Action Program Implementation for Identified Simulator Issues

a. Inspection Scope

The inspectors reviewed implementation of corrective actions for current and previously identified simulator issues. Specifically, the inspectors reviewed a sample of previously identified RITS issues from the PMS CIT, FAT, as well as DCIS Level 3 testing. The inspectors evaluated whether resolutions appropriately addressed the problem and, if

the issue was not corrected, an appropriate justification was provided for the issue not impacting the ISV. Additionally, the inspectors observed several ISV scenarios and crew debriefs. The inspectors noted that all significant simulator, procedural, and crew performance issues were captured by WEC for further evaluation and disposition.

The inspectors reviewed WEC's procedures for the HED resolution process and its work instruction for the Human Factors Tracking System. Inspectors found these to be adequate procedures for initiating, prioritizing, and tracking HEDs found during ISV activities.

b. Observations and Findings

No findings were identified in this area.

c. Conclusion

The inspectors determined that the implementation of WEC's corrective action program was performed consistent with their administrative control, the requirements in GEH-320, and their licensing commitments.

Integration of PMS, DCIS, and Simulator Software and Hardware

a. Inspection Scope

The inspectors interviewed WEC personnel regarding the integration of the PMS and DCIS with the simulator as it was configured and used for the ISV evaluation to gain understanding of the processes used to perform the integration and methods used to capture and disposition identified differences between the HSI running on Ovation Workstations and the PMS and DCIS controllers in the simulator.

The actual plant software for both PMS and DCIS were migrated and interfaced with the simulator's custom thermodynamic plant model using specialized tools provided by GSE, the simulator vendor. The migrated PMS and DCIS code, as translated from Common-Q and from Ovation, was created for the simulator with WEC's "Simulator Common Q Migration Tool" for safety-related PMS code and "DCS Logic Migration Tool" for non-safety-related DCIS code. These migrations operate in an executive module of the simulator, which provides for the coordination of their activities when interfacing with the underlying simulated plant model. The inspectors reviewed WEC's software release records for these migration tools, as well as associated test reports and a listing of associated RITS. No findings were identified with the software release records or test report documents.

The inspectors noted that the simulator does not use the identical Ovation hardware that the as-built plant will use, and therefore the Ovation hardware is emulated and configured based on the plant Ovation database. The inspectors reviewed a sample of the Ovation process control software emulation as it was automatically generated using Westinghouse's proprietary tool. The auto-generated code interfaces with the simulator's software to allow proper storage of "state" variables and includes auto-generated documentation to allow reverse tracing of what code is responsible for the Ovation database functional emulation. Having the Ovation emulation executing in

synchronization with the fluid models prevents introducing any system-control interface latencies in the simulation and provides for capture of all internal state information.

b. Observations and Findings

No findings were identified in this area.

c. Conclusion

The inspectors determined that the implementation of WEC's programs for integration of PMS, DCIS, and simulator software and hardware, were conducted consistent with their administrative control, the requirements in GEH-320, and their licensing commitments.

Simulator Model Review

a. Inspection Scope

The inspectors reviewed several aspects of the modeling used for three fluid systems (the Condensate System, Startup Feedwater System, and Passive CoreCooling System). The inspectors also reviewed the application of the simulator tool, JTopMeret, which is used for the design of the majority of the fluid systems modeled. In addition to reviewing the simulator model, the inspectors reviewed the plant data provided to the vendor by Westinghouse, discussed the fluid system models with the simulator vendor's staff, and reviewed the final design document created by the simulator vendor.

The inspectors verified, through a sampling of nodes and flowpaths, that each was individually configured based on the process flow diagrams that Westinghouse had provided to the vendor. The simulator design had more nodes than the process flow diagrams and calculations, and the vendor explained how the data was interpolated to configure the larger number of nodes in the simulator design. The plant design process flow diagram information was interpolated and used to develop detailed simulator models. The methods used were consistent with common industry practices.

b. Observations and Findings

Based on the review, the inspectors identified three issues in the models that should be evaluated for potential effects on simulator fidelity. These include:

i. The startup feed-water pump discharge cavitating venturis are not modeled to prevent pump run-out. Under conditions of low steam-generator pressure the startup feedwater pumps may model pump run-out while the plant design would not.

ii. The Passive Core Cooling System accumulators, core makeup tank outlets and Normal Residual Heat Removal System injection lines are arranged into common nodes such that the restricting flow orifices cannot be modeled to not affect accumulator flow.

iii. Temperature variations in the reference legs of level instruments inside containment are not modeled. Adverse containment conditions should affect these instruments such that the reference leg heating would most likely occur much faster than heating of the bulk of the water within these tanks.

These issues were discussed with WEC staff, and RITs (51315, 51316, and 51317) were generated to evaluate these modeling issues. No findings of significance were identified in this area.

c. Conclusion

The inspectors concluded that the implementation of WEC's program regarding the development and implementation of the simulator model was consistent with their ISV program plan and simulator design guideline. Issues identified during the review were adequately captured for evaluation by WEC consistent with their issue identification and resolution process. No findings of significance were identified.

d. ISV-Prerequisite Evaluation Conclusion

The inspectors concluded that the implementation of WEC's programs to support ISV prerequisite activities including FAT, PMS and DCIS software integration and testing, implementation of corrective actions to identified issues, and simulator model development were conducted consistent with their administrative control, the requirements in GEH-320, and their licensing commitments. No findings of significance were identified.

4. ISV Design Evaluation (3.2.00.01c.i)

ISV Facility

a. Inspection Scope

The inspectors verified that the ISV facility, which included the main control room (MCR) simulator, diverse actuation system (DAS) panel mockup, and remote shutdown workstation (RSW) mockup, met the main control room scope, fidelity, and capabilities described in GEH-320 and APP-OCS-J1-002, "Human System Interface Design Guidelines," (Style Guide).

Specifically, the inspectors verified that significant differences between the ISV facility and the reference design documentation were documented; that the ISV facility met the high-level criteria described in Sections 2.1 through 2.3 of GEH-320; and the ISV facility met detailed mandatory guidelines described in the Style Guide.

The Style Guide criteria that were sampled included:

Section	Title	Sample Size
5	Visual Display Hardware	13 of 26 (at least 1 criterion from each subsection)
6	System Design Features	4 of 16 criteria including the 2 “Event Log” criteria
7	Controls and User Interaction	10 of 30 criteria
8	Display, Organization, Navigation, and Windows	10 of 37 criteria
9	Information Presentation	30 of 113 criteria distributed equally across 11 subsections
11	Color and VDU displays	Criteria R1.250 and 251
12	Display of Safety Parameters	Criteria R1.256 and 258
13	Computerized Alarm Presentation System	12 of 57 criteria (two from each subsection)
15	Large Screen Displays	4 of 14 criteria
19	Controls	5 of 22 criteria
20	Displays	5 of 29 criteria
23	Labeling	5 of 20 criteria

b. Observations and Findings

No findings of significance were identified in this area.

c. Conclusion

The inspectors concluded that the implementation of WEC’s program regarding the ISV design evaluation was consistent with their ISV program plan and HSI design guideline. No issues of significance were identified.

5. ISV Test Design, Test Procedures, and Performance Measures (3.2.00.01c.i)

a. Inspection Scope

The inspectors reviewed the ISV schedule that identified the crews that performed the scenarios and the sequence of the scenarios and verified that requirements in GEH-320 were adequately addressed including scenario repetition, scenario sequencing, crew availability, and crew turnover. The inspectors noted that a detailed scenario trial assignment and scenario trial order had been established that addressed the scheduling factors.

The team reviewed one scenario package and determined that all the information requirements listed in GEH-320 were adequately addressed. During scenario performance, the inspectors verified that the information required by GEH-320 was present and used appropriately during the simulation, including for example, the observer guides.

The inspectors also verified that the four questionnaires described in GEH-320 were being used and that these questionnaires contained the material described in GEH-320. The inspectors noted that an additional questionnaire was administered to capture items from the observers for use by the interim evaluation team. The inspectors reviewed the data captured to date by these questionnaires and confirmed meaningful data was being provided for important criteria such as workload and situational awareness. The inspectors confirmed the questionnaires were administered at the end of each scenario that they observed.

The inspectors evaluated three scenarios and verified that the pass/fail and performance-related acceptance criteria were identified in accordance with GEH-320. The inspectors observed the Westinghouse ISV team applied these performance criteria as scenarios were being performed. No discrepancies were identified.

b. Observations and Findings

No findings of significance were identified in this area.

c. Conclusion

The inspectors concluded that the ISV test design, testing procedures, and performance measures were adequately identified and documented, and implemented in accordance with the requirements of the GEH-320. No findings of significance were identified.

Selection and Training of Test Crew Members

a. Inspection Scope

The inspectors reviewed the selection and training of ISV crew members from Vogtle and V.C. Summer and confirmed the requirements of GEH-320 were satisfied. The inspectors reviewed the training and qualification records for a sample of the ISV participants and confirmed that the individuals passed all of the exams associated with the cold license initial training program. The inspectors confirmed that none of the ISV crew participants had participated in pilot or shakedown training as shown on the Shakedown, Pilot and ISV Full Resource Schedule.

b. Observations and Findings

No findings of significance were identified in this area.

c. Conclusion

The NRC inspectors determined that the individuals who participated as test crew members in the ISV test trials met the training and experience criteria of GEH-320. No findings of significance were identified.

ISV Test Scenarios

a. Inspection Scope

The inspectors reviewed the list of scenarios to verify that the operational conditions identified in the sampling process were included within the scenarios. The inspectors determined that the scenarios were complete and that all requirements of GEH-320 were addressed. Significant detail was provided in describing the various elements of the scenarios. Additionally, the NRC inspectors reviewed the ISV test scenarios and the ISV training scenarios and determined that the ISV test scenarios were sufficiently different than the scenarios used in crew training as required by GEH-320.

b. Observations and Findings

No findings of significance were identified in this area.

c. Conclusion

The inspectors concluded that the scenarios conformed to the GEH-320 requirements and the scope and detail of the scenarios provided reasonable assurance that they would be effective in supporting the evaluation of the HFE design. No findings of significance were identified in this area.

Pilot Testing

a. Inspection Scope

The inspectors observed one scenario performed as part of the pilot program. The scenario consisted of a steam generator tube rupture and a reactor trip. The inspectors also observed the scenario critique conducted by the ISV observation team with the crew. The inspectors reviewed the list of scenarios and verified that the operational conditions identified in the sampling process were included within the scenarios. The inspectors also reviewed the contents of one scenario description and verified that it was consistent with the requirements described in GEH-320. Finally, the inspectors reviewed the training material and roster for the training conducted for the observers to verify the objectives and methods to be used were adequately defined.

b. Observations and Findings

The inspectors noted that the pilot scenario was run without issue or unexpected complications. The crew performed as expected, and there was adequate information in the scenario guide to properly administer the scenario for the intended purposes of the ISV.

However, during the scenario, the NRC inspectors noted that the ISV observers, concerned with being intrusive, did not enter the controls area to gain a more detailed understanding of the operator's actions and use of the HSI. The observers did have binoculars that gave them a limited or narrow view, and they did move along the control room perimeter on occasion. Additionally, the NRC inspectors noted that the scenario observers appeared to be more focused on evaluating operator performance rather than HSI effectiveness. During the observation of the critique, the ISV observers only

provided one comment, which was unrelated to the scenario objectives. Based on the inspector's observations, the vendor issued a Corrective Action Program and Learning system (CAPAL ID 100054444, dated October 22, 2014) to evaluate the training for the human factors ISV observers. The NRC inspectors, in follow-up observations during the actual ISV performance tests, noted that no findings of significance were identified regarding observer performance.

c. Conclusion

The inspectors concluded that the pilot scenarios conformed to the controlling procedure requirements and the scope and depth of the scenarios provided reasonable assurance that they would be effective in supporting the effectiveness of the HFE design. No findings of significance were identified.

d. ISV Design Evaluation Conclusion

The inspectors concluded that the implementation of WEC's programs to support ISV design evaluation activities including facility review; ISV test design, test procedures, and performance measures; crew selection and training; ISV scenario development; and pilot testing were conducted consistent with their administrative control, the requirements in GEH-320, and their licensing commitments. No findings of significance were identified.

6. ISV Performance Tests (3.2.00.01c.i)

a. Inspection Scope

The inspectors reviewed the applicable sections of GEH-320 that contain the acceptance criteria associated with ISV scenario performance. The NRC inspectors evaluated a sample of these criteria, including scenario adequacy and completeness, simulator fidelity, and ISV team performance to verify that they were adequately addressed during implementation of the scenario development and implementation.

Scenario Adequacy/Completeness

The inspectors verified the following elements were addressed in the ISV scenarios:

i. Specific initial conditions – The inspectors verified the ISV scenarios contained initial conditions sufficiently specific that the operator briefings completed prior to running the scenario would provide the operators with the needed understanding of the plant configuration. The team also verified the initial conditions were sufficiently specific that the scenario could be initiated from the same conditions each time it was repeated.

ii. Events (e.g., failures) to occur and their initiating conditions – The inspectors verified that a diverse set of events were included in the ISV scenarios. This included simple, limited scope component failures to complex, beyond design basis events. The team also verified there were scenarios that addressed normal events such as plant startup and that the scenarios included events during various modes of operation.

iii. Precise definition of workplace factors, such as environmental conditions – The inspectors verified that abnormal work place factors such as noise level, control room temperature and lighting were addressed in accordance with the WEC control procedure and that specific conditions were defined in the scenario for when and how the condition was established.

iv. Staffing objectives – The inspectors verified that the scenarios addressed maximum and minimum staffing levels. Scenarios expected to have high operator workloads were verified to use the minimum staffing level.

v. Precise specification of what, when and how performance data are to be collected and stored – The inspectors verified each scenario contained direction on collecting performance data. During the performance of the scenarios selected for observation the inspectors verified the data collection conformed to the scenario requirements.

vi. Performance measures and acceptance criteria clearly identified – The inspectors verified that each scenario contained pass/fail criteria (criteria that identifies safety issues or the need to repeat a scenario) and diagnostic criteria (criteria that identify potential improvements in the control room HFE design).

vii. Risk-important human actions – The inspectors verified that all risk-important human action were included in the set of scenarios selected for performance during the ISV.

Simulator Fidelity

The inspectors verified the simulator testing requirements of GEH-320 were implemented. The inspectors also confirmed through observations completed during the four inspection periods that the simulator ran the ISV scenarios without freezing or introducing significant modeling errors that would compromise the HSI testing.

ISV Team Performance

The ISV was performed at WEC using the Engineering Evaluation Simulator over a period of four months. The inspectors selected a sample of scenarios to observe based on maximizing the observation of scenarios containing important human actions and/or complex operational challenges while still providing a diverse set of scenarios including a plant startup.

The ISV team was comprised of four operating crews that responded to the scenarios being run on the simulator and a set of observers that provided for independent observation of the validation exercises. The NRC inspectors verified the operating crew had completed the training and experience requirements stated in GEH-320. The team verified that a diverse group of observers were used as stated in GEH-320. Through observation of the post-scenario critiques the inspectors verified that data collection forms were completed in accordance with GEH-320 and that the debriefing sessions were interactive and provided a complete discussion of the challenges faced during the scenario. The team also independently identified control room design challenges and verified these challenges were included in the ISV team's results.

b. Observations and Findings

No findings of significance were identified.

c. ISV Performance Tests Conclusions

The inspectors determined that the implementation of the ISV performance testing including scenario adequacy and completeness; simulator fidelity; and ISV team performance; were adequately controlled throughout the performance of the ISV testing. No findings of significance were identified.

7. ISV Testing and Analyses Evaluation (3.2.00.01c.ii)

ISV Analysis methods

a. Inspection Scope

GEH-320 contains the ITAAC acceptance criteria associated with ISV analysis methods. From this procedure the inspectors identified the following two elements for evaluation:

(1) The degree to which convergent (i.e., consistent) results observed from different measurement techniques will be analyzed qualitatively and the results will presented in the ISV results report.

(2) When several HEDs are associated with a particular HSI resource, plant system, or function, an evaluation is performed to determine, as a group, the possible combined effects or any conflicts. The results of this analysis are used to assist in determining the most appropriate HED resolutions and the requirement for re-run or re-assessment.

The inspectors reviewed the ISV results described in GER-320 and WEC's analysis of the results to verify that its analysis methods conformed to GEH-320.

The team verified that the convergence analysis results were documented in GER-320 and that appropriate performance measure results were compiled and conclusions drawn on where the measures reinforced the existence of a problem. The inspectors also noted that the HEDs identified by the ISV provided substantial evidence that a detailed analysis was completed of the aggregate impact of the problems. The HEDs ranged from a single significant problem, such as failure of to meet a pass/fail criteria, to HEDs that documented the impact of multiple individual issues contributing to the more significant problem identified in the HED. The HEDs spanned subjects relating to human system interfaces, plant systems and functions. The analysis work that identified generic issues among the larger number of specific issues was found to be thorough, well-informed on operational impact, and exercised a conservative determination of the specific issue impact.

b. Observations and Findings

No findings were identified in this area

c. Conclusions

The inspectors determined that the implementation of WEC's convergent and aggregate impact analyses of the ISV data was consistent with the programmatic requirements contained in GEH-320.

Data Analysis and Interpretation (ITAAC 3.2.00.01c.ii)

a. Inspection Scope

The NRC inspectors reviewed APP-OCS-GER-320, "AP1000 Human Factors Engineering Integrated System Validation Report," Revision 0, dated October 2015 to verify that the analysis and interpretation of test results conformed to GEH-320. The inspectors confirmed that WEC analyzed the data collected during the ISV scenario trials in accordance with the method specified in GEH-320. The inspectors also verified that WEC identified HEDs when the acceptance criteria associated with the ISV performance measures were not satisfied. The inspectors also interviewed the WEC Principal Engineer & Domestic Human Factors and Operations Lead and the WEC Consulting Engineer & Technical Advisor, Systems Integration & Operator Interface Engineering, responsible for the analysis and interpretation of the ISV test results. During the interview, WEC provided examples of how the results of the data analysis were used to determine the extent and convergence of the results and to identify causes of HEDs, which will be an input to the HED resolution process.

b. Observations and Findings

No findings of significance were identified.

c. Conclusions

The inspectors determined that WEC's implementation of their procedures for data analysis and interpretation had been adequately implemented in accordance with the requirements of GEH-320.

d. ISV Testing and Analyses Evaluation Conclusions

The inspectors determined that the implementation of the ISV testing and analysis activities including ISV analysis methods and ISV data analyses and interpretation were conducted consistent with their administrative control, the requirements in GEH-320, and their licensing commitments. No findings of significance were identified.

8. Entrance and Exit Meetings

On October 20, 2014, the NRC inspection team presented the inspection scope during an entrance meeting with WEC personnel including Mr. David Howell, Vice President, WEC-AFS. On December 9, 2015, the NRC inspection team presented the inspection results during an exit meeting with Mr. Jan Dudiak, Director, WEC-AFS, and WEC personnel. On February 24, 2015, the NRC inspection team had a telephonic re-exit with Mr. Jan Dudiak, Director, WEC-AFS, and WEC personnel.

ATTACHMENT

1. PERSONS CONTACTED AND NRC STAFF INVOLVED:

Name	Affiliation	Entrance	Exit	Re-Exit	Interviewed
David Howell	WEC	X			
Jan Dudiak	WEC-AFS	X	X	X	
Chuck Lease	WEC-AFS	X	X	X	X
Steve Kersh	WEC-AFS	X	X	X	X
Greg Glenn	WEC	X	X	X	X
Sarah DiTommaso	WEC	X	X	X	X
Bob Hirmanpour	SNC	X	X	X	X
Casey Ericson	WEC				X
Robert Fuld	WEC		X	X	X
Pietro Porco	WEC	X			
Susan Mullen	WEC	X			
Patrick Conley	SNC	X			
Leo Chraska	WEC	X			
April Rice	SCE&G	X			
Mark Stofko	WEC	X			
Garrett Sanders	SCE&G	X			
Steve Packard	WEC	X			
Craig Reeder	WEC	X			
George Guzik	WEC	X			
Julie Reed	WEC	X			
Dale Harmon	WEC				X
Randy Miller	WEC-AFS				X
Robert Lane	WEC			X	X
Thomas Geer	WEC	X			
Paul Russ	WEC	X			
Rick Paese	WEC	X			X
Brian Bedford	WEC			X	
Craig Watson	WEC-AFS	X			X
Susan Fanto	WEC	X			
Catherine Sherbine	WEC	X			
John Ziemie	WEC	X			
Harry Putnam	WEC-AFS				X
Eric Pitschke	WEC-AFS	X			X
Adrian Fletcher	WEC		X		
Steve Radomski	WEC	X	X	X	
David Logue	SCE&G		X	X	
Jerry Money	SCE&G			X	
Nick Kellenberger	SCE&G			X	
Brock Wilbanks	SNC			X	
Wes Sparkman	SNC	X			
Quang Nguyen	WEC	X	X		
Jason Weathersby	SCE&G		X		
Mark Mamo	SNC			X	

Greg Cesare	WEC		X	X	
Bob Sutter	SNC	X		X	
Chuck Gellner	WEC		X	X	
Tom Rubenstein	WEC		X	X	
James George	WEC		X		
Leon Ray	SNC	X	X		
Megan Prieto	SNC		X		
Robert Lane	WEC		X		
Christopher Witfield	SNC		X		
Jan Harris	WEC		X		
Bob Peters	WEC	X			
Paul Hippely	WEC				X
Jack Cross	WEC				X
Alison Bursic	WEC				X
Tom McLaughlin	WEC				X
Steve Spadone	WEC				X
Dennis Spielmann	SNC				X
Paul Mothena	SCANA	X			X
Pat Leary	SCANA				X
Bob Magee	WEC				X
Nick Piplica	WEC				X
Ryan Hoover	WEC				X
Jason Betts	WEC				X
Rick Connoly	SNC	X			X
James Kellum	NRC	X	X		
Jacqwan Walker	NRC	X			
Joseph DeMarshall	NRC				
David Desaulniers	NRC				
R. Scott Egli	NRC	X			
Gary Callaway	NRC				
Hyung Je	NRC	X			
Robert Mathis III	NRC	X			
William Russell	NRC				
Mike Fochtman	NRC				
Greg Galletti	NRC	X	X	X	
George Lipscomb	NRC	X			
Philip Natividad	NRC	X	X		
Lauren Kent	NRC		X	X	
Paul Pieringer	NRC	X	X		
Dinesh Taneja	NRC				

2. INSPECTION PROCEDURES USED:

IP 43002, “Routine Inspections of Nuclear Vendors,” dated July 15, 2013

IP 65001.23, “Inspection of Human Factors Engineering Verification and Validation ITAAC,” dated December 22, 2014.

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED:

Item Number	Status	Type	Description	Applicable ITAAC
None				

4. INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA:

The U.S. Nuclear Regulatory Commission (NRC) inspectors identified the following ITAAC related to components being designed, manufactured, and tested at Westinghouse Electric Company (WEC). At the time of the inspection, WEC was involved in certain engineering analysis activities including ISV for the AP1000 reactor control room and remote shutdown panel design. For the ITAAC listed below, the inspectors reviewed WEC’s QA controls and implementation of the aspects of the WEC Human Factors Engineering Program Plan in the areas of TSV, DV, and ISV. The ITAAC design commitments referenced below are for future use by the NRC staff during the ITAAC closure process; the listing of these ITAAC design commitments does not constitute that they have been met and/or closed. The inspectors did not identify any findings associated with these ITAAC during this inspection.

This section of the inspection report focuses on the vendor’s implementation of aspects of their programs for HFE analysis activities associated with TSV, DV, and ISV. This included a review of on-going HFE program plan documentation addressing AP1000 ITAAC 3.2.00.01a, b, and c activities. Specifically the inspectors reviewed the implementation of the TSV, DV, and ISV to verify consistency with the design commitments and the acceptance criteria of ITAAC 3.2.00.01. The goal of these inspection activities is to examine the governing documents and samples of engineering activities that demonstrate the implementation of the design commitments and design attributes in order to provide a comprehensive inspection of specific aspects of the HFE program plan as stated in the ITAAC design commitments.

COL#	DCD#	Design Commitment	Component/Activity
739	3.2.00.01a	1. The HFE verification and validation program is performed in accordance with the HFE verification and validation implementation plan and includes the following activities: a) HSI Task support verification	The inspectors evaluated the TSV activities as documented in the TSV results report APP-OCS-GER-220, "HFE Task Support Verification,"
740	3.2.00.01b	1. The HFE verification and validation program is performed in accordance with the HFE verification and validation implementation plan and includes the following activities: b) HFE design verification	The inspectors evaluated the DV activities as documented in the DV results report APP-OCS-GER-120, "AP1000 HFE Design Verification Report"
741	3.2.00.01c.i	1. The HFE verification and validation program is performed in accordance with the HFE verification and validation implementation plan and includes the following activities: c) Integrated system validation (A report exists and concludes that: The test scenarios listed in the implementation plan for integrated system validation were executed in conformance with the plan and noted human deficiencies were addressed)	The inspectors evaluated the ISV through a combination of program implementation plan reviews, observation of ongoing ISV engineering activities and review of implementation of the ISV evaluation process. Including facility review; ISV test design, test procedures, and performance measures; crew selection and training; ISV scenario development; and pilot testing
742	3.2.00.01c.ii	1. The HFE verification and validation program is performed in accordance with the HFE verification and validation implementation plan and includes the following activities: c) Integrated system validation (A report exists and concludes that: The test and analysis results demonstrate that the MCR operators can perform the following: • Heat up and start up the plant to 100% power • Shut down and cool down the plant to cold shutdown • Bring the plant to safe shutdown following the specified transients • Bring the plant to a safe, stable state following the specified accidents)	The inspectors evaluated the ISV through a combination of program implementation plan reviews, observation of ongoing ISV engineering activities and review of implementation of the ISV evaluation process including scenario adequacy and completeness, simulator fidelity ISV team performance; ISV analysis methods; and ISV data analyses and interpretation.

DOCUMENTS REVIEWED:

- NA 4.37, “Configuration Management”, Revision 3, May 9, 2014
- WNA-PC-00005-WAPP, “AP1000 I&C Projects Configuration Management Plan”, Revision 4, November 2014
- WNA-PC-00032-WAPP, “AP1000 I&C Domestic Projects Configuration Management Plan”, Revision 3, August 2014
- LTR-NA-WAPP-14-183, “Integrated System Validation Impact from Issues Identified as a Result of DCIS Level 3 Testing”, September 26, 2014
- WNA-PD-00055-GEN, “Standard Integrated System Engineering Process”, Revision 2, October 2013
- WNA-IG-00109-GEN, “Configuration Management Implementation Guideline”, Revision 1, August 2013
- APP-PLS-T5-001, “Plant Control System/Data Display and Processing System Test Plan,” Revision 1, April 2013
- APP-OCS-GEH-320, “Human Factors Engineering Integrated System Validation Plan”, Revision 3, August 2013
- APP-GW-GBH-361, “Westinghouse AP1000 Integrated I&C Test Strategy”, Revision 1 (information use)
- LTR-NA-WAPP-14-177, “Integrated System Validation Impact from Issues Identified as a Result of PMS Channel Integration Testing”, dated September 29, 2014
- RITS 36303, 35447, 34637, 33347, 29800, 16308, 38805, 34670, 35225, 36418, 39468, 39468, 39633, 39748
- LTR-NA-WAPP-15-003, “Integrated System Validation Impact from Issues Identified as a Result of PMS Channel Integration Testing,” dated January 13, 2015
- LTR-NA-WAPP-15-004, “Integrated System Validation Impact from Issues Identified as a Result of DCIS Testing”, dated January 13, 2015
- LTR-NA-WAPP-15-005, “Integrated System Validation Impact from Issues Identified as a Result of Simulator Factory Testing,” dated January 13, 2015
- WNA-PC-00032-WAPP, “AP1000 I&C Domestic Projects Configuration Management Plan”, Revision 3, dated August 2014
- APP-PMS-T5-001, “AP1000 Protection and Safety Monitoring System Test Plan”, Revision 3, dated April 2013
- NA 4.19.9, “Issue Reporting and Resolution”, Revision 2, dated September 5, 2014
- WNA-WI-00180-WAPP, “Issue Tracking System Use”, Revision 2, dated November 2013
- WNA-RL-03929-VSG, “V.C. Summer AP1000 Protection and Safety Monitoring System Software Configuration Management Release Report Release 7.3.0 for Baseline VSG-ISIP-J0R-007 Rev 3,” Revision 2, dated December 2013
- APP-PMS-J4-020, “AP1000 System Design Specification for the Protection and Safety Monitoring System,” Revision 8, dated October 4, 2013
- WNA-RL-03189-SV0, “Vogtle AP1000 Protection and Safety Monitoring System Software Configuration Management Release Report Release 7.4.0 for Baseline SV0-ISIP-J0R-007 Rev 4,” Revision 9, dated December 2013
- VS2-PMS-T7X-007, V.C. Summer AP1000 Protection and Safety Monitoring System Channel Integration Test Configuration Record,” Revision 8, dated October 13, 2014
- WNA-RL-04293-SV0, “Vogtle AP1000 Instrumentation and Control Configuration Management Release Report Release 7.5.2 for Baseline SV0-ISIP-J0R-007, Revision 5,” Revision 2, dated October 2014

- WNA-RL-04591-VS2, “VC Summer Unit 2 AP1000 Protection and Safety Monitoring System Configuration Management Release Report Release 7.4.3 for Baseline VSG-ISIP-J0R-007, Rev.4,” Revision 3, October 2014
- RITS36420, “APP-PMS-T1D-007, RT Test Data Sheets need revised to incorporate redline changes,” dated March 05, 2014
- RITS 29800, “SIMOPS RCS 7F – LT200 bad quality,” dated July 17, 2013
- LTR-NA-WAPP-14-193, “Integrated System Validation Impact from Issues Identified as a Result of Simulator Factory Testing,” September 29, 2014
- Process diagram, “Roadmap from ISV Pre-Requisites to Vogtle Simulator Release,” October 20, 2014
- Process diagram, “AP1000 Design Change Process Flow,” October 20, 2014
- ISV-related PMS and DCIS Level 3 Test Reports Reviewed
- SV3-DDS-T1R-018, “Vogtle Unit 3 AP1000 Data Display and Processing System Security Profile Test Report”, Revision 1, September 2014
- APP-DDS-T1R-023, “AP1000 Data Display and Processing System Security Profile Test Report”, Revision 0, September 2014
- APP-DDS-T1R-039, “AP1000 Data Display and Processing System Integration Test Report”, Revision 2, September 2014
- SV3-PLS-T2R-003, “Vogtle Unit 3 AP1000 Digital Rod Control System (DRCS) Factory Acceptance Test Report”, Revision 1, September 2014
- SV3-PLS-T2R-015, “Vogtle Unit 3 AP1000 Digital Rod Position Indication (DRPI) System Factory Acceptance Test Report”, Revision 1, September 2014
- APP-PLS-T2R-190, “AP1000 Turbine Control and Protection System Test Report”, Revision 0, September 2014
- SV3-OCS-T2R-700, “Vogtle Unit 3 AP1000 Operation and Control Centers System OCS/PLS Point Verification Test Report”, Revision 2, September 2014
- APP-PLS-T2R-009, “AP1000 Plant Control System NSSS Level 3 Control Software Integration Test Report”, Revision 0, September 2014
- APP-PLS-T2R-012, “AP1000 Plant Control System Plant Maneuverability Level 3 Control Software Integration Test Report”, Revision 1, September 2014
- APP-PLS-T2R-008, “AP1000 Plant Control System Level 3 Control Software Integration Test Report”, Revision 0, September 2014
- SV3-PLS-T2R-001, “Vogtle Unit 3 AP1000 Site Specific Level 3 Integration Test Report”, Revision 1, September 2014
- APP-PLS-J7R-001, “AP1000 Plant Control System Thread Path Analysis Report”, Revision 0, September 2014
- APP-OCS-T2R-600, “AP1000 Operation and Control Centers OCS/PLS DSI/DSO Functional Test Report”, Revision 0, September 2014
- APP-OCS-T2R-034, “AP1000 Operation and Control Centers Display Layout Test Report”, Revision 5, September 2014
- APP-OCS-T2R-035, “AP1000 Operation and Control Centers Display Layout Test Report”, Revision 5, September 2014
- SV3-OCS-T2R-007, “Vogtle Unit 3 AP1000 Operation and Control Centers Display Layout Test Report”, Revision 4, September 2014
- APP-DDS-T1R-039, “AP1000 Data Display and Processing System Integration Test Report”, Revision 2, September 2014
- APP-PLS-T2R-010, “AP1000 Operations and Control Centers System Alarm Presentation System and Computerized Procedure System Test Report”, Revision 0, September 2014

- APP-OCS-T2R-038, “AP1000 Operation and Control Centers System Wall Panel Navigation System Test Report”, Revision 1, September 2014
- APP-OCS-T2R-037, “AP1000 Operation and Control Centers System Reactor Operator Peer Check System Test Report”, Revision 1, September 2014
- APP-PMS-T5-001, “AP1000 Protection and Safety Monitoring System Test Plan,” Revision 3, dated April 2013
- VS2-PMS-T7X-007, “V.C. Summer Unit 2 AP1000 Protection and Safety Monitoring System Channel Integration Test Configuration Record ,” Revision 8, dated October 13, 2014
- APP-PMS-T1P-007, “AP1000 Protection and Safety Monitoring System Reactor Trip Channel Integration Test Procedure,” Revision 2, dated February 26, 2014
- VS2-PMS-T2R-007, “V.C. Summer Unit 2 AP1000 Protection and Safety Monitoring System System-Level Reactor Trip Channel Integration Test Report,” Revision 1, dated September 5, 2014

6. ACRONYMS USED:

ADAMS	Agencywide Documents Access and Management System
CAPAL	Corrective Action Program and Learning system
CCB	Change Control Board
CFR	Code of Federal Regulations
CIT	Channel Integration Testing
CMRR	Configuration Management Release Record
DAC	Design Acceptance Criteria
DAS	Diverse Actuation System
DCIP	Division of Construction Inspection and Operational Programs
DCIS	Distributed Control Information System
DV	Design Verification
QVIB-1	Quality Assurance Vendor Inspection Branch 1
FAT	Factory Acceptance Testing
HED	Human Engineering Discrepancies
HFE	Human Factors Engineering
HSI	Human-System Interface
IP	Inspection Procedure
IR	Issue Report
ISV	Integrated System Validation
ITAAC	Inspections, tests, analyses, and acceptance criteria
MCR	Main Control Room
NA	Nuclear Automation
NON	Notice of Nonconformance
NOV	Notice of Violation
NRC	(U.S.) Nuclear Regulatory Commission
NRO	Office of New Reactors
OCS	Operation and Control Centers
PDSP	Primary Safety Display Panel
PRHR HX	Passive Residual Heat Removal Heat Exchanger
PMS	Protection and Safety Monitoring System
RRAS	Replacement and Automation Services
REC	Request for Engineering Change
RITS	Replacement and Automation Services (RRAS) Issue Tracking System

RSW	Remote Shutdown Workstation
RT	Reactor Trip
TCR	Test Configuration Record
TSV	Task Support Verification
U.S.	United States (of America)
WEC	Westinghouse Electric Company
WEC-AFS	Automation Field Services