



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

July 30, 2018

Jill S. Monahan, Manager, Licensing  
Inspections and Special Programs  
Westinghouse Electric Company  
1000 Westinghouse Drive  
Cranberry Township, PA 16066

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION OF WESTINGHOUSE  
ELECTRIC COMPANY REPORT NUMBER 99900404/2017-202

Dear Ms. Monahan:

On January 9-11, February 26 - March 2, and June 20-22, 2018, the U.S. Nuclear Regulatory Commission (NRC) inspectors 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 related to Integrated System Validation (ISV). These activities include inspections, tests, analyses, and acceptance criteria (ITAAC) from Appendix C from the Combined License for Vogtle Units 3 and 4. Specifically, these activities were associated with 3.2.00.01c.ii (Index No. 742) and 3.2.00.01d (Index No. 743).

The enclosed report presents the results of this inspection.

Within the scope of this inspection, no violations or non-conformances were identified. The NRC inspectors did not identify any findings associated with the ITAAC contained in Section 4 of the attachment to this report.

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 (if applicable), 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 Assurance Vendor Inspection Branch-1  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Docket No.: 99900404

Enclosure:  
Inspection Report No. 99900404/2017-202  
and Attachment

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION OF WESTINGHOUSE  
ELECTRIC COMPANY REPORT NUMBER 99900404/2017-202

Dated: July 30, 2018

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\*via e-mail

NRO-002

|             |            |                    |              |           |
|-------------|------------|--------------------|--------------|-----------|
| <b>OFC</b>  | NRO/DCIP   | RII/DCO            | RES/DRA      | NRO/DCIP  |
| <b>NAME</b> | GGalletti* | LCastelli*         | AD'Agostino* | MScheetz* |
| <b>DATE</b> | 07/26/18   | 07/25/18           | 07/25/18     | 07/23/18  |
| <b>OFC</b>  | RES/DRA    | NRR/DRA            | NRO/DCIP     |           |
| <b>NAME</b> | SFleger*   | DKi*               | BGreen*      |           |
| <b>DATE</b> | 07/25/18   | 07/20/18           | 07/25/18     |           |
| <b>OFC</b>  | NRO/DCIP   | NRO/DCIP           | NRO/DCIP:BC  |           |
| <b>NAME</b> | LNist*     | JGaslevic (Acting) | TJackson     |           |
| <b>DATE</b> | 07/24/18   | 07/30/18           | 07/30/18     |           |

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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.: 99900404/2017-202

Vendor: Westinghouse Electric Company  
1000 Westinghouse Drive  
Cranberry Township, PA 16066

Vendor Contact: Jill S. Monahan  
Manager, Licensing Inspections and Special Programs  
Westinghouse Electric Company  
Email: monohajs@westinghouse.com

Nuclear Industry Activity: Westinghouse Electric Company, LLC, located at 1000 Westinghouse Drive Cranberry Township, PA, whose scope of supply includes but is not limited to safety-related design, fabrication, testing, and delivery of Human Factors Engineering design for the current US AP1000 plants under construction.

Inspection Dates: January 9-11, 2018, February 26 - March 2, 2018,  
June 20-22, 2018

Inspection Team Leader: Greg Galletti, NRO/DCIP/QVIB-1

Inspectors: Lauren Nist, NRO/DCIP/HOIB  
Maurin Scheetz, NRO/DCIP/HOIB  
Victoria Huckabee, NRO/DCIP/HOIB  
Amy D'Agostino, RES/ DRA/HFRB  
Stephen Fleger, RES/DRA/HFRB  
DaBin Ki, NRR/DRA/APHB  
Brian Green, NRO/DCIP/HOIB  
Lisa Castelli, RII/DCO

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

Enclosure

## **EXECUTIVE SUMMARY**

Westinghouse Electric Company  
99900404/2017-202

The U.S. Nuclear Regulatory Commission (NRC) inspectors 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, on January 9-11, 2018, February 26 - March 2, 2018, June 20-22, 2018.

This inspection specifically evaluated WEC's implementation of aspects of the HFE program associated with the HFE verification and validation activities associated with Integrated System Validation (ISV). These HFE activities are associated with Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) 3.2.00.01c.ii (Index No. 742) and 3.2.00.01d (Index No. 743), which are listed in the combined licenses for Vogtle Units 3 and 4.

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.

### ITAAC 3.2.00.01c.ii (Index No. 742), Demonstrate Capability to Manage Evolutions and Events

The inspectors determined through direct observation of ISV re-test activities, including dynamic testing on test and full-scope simulators, that the operating crews were capable of adequately completing the pass/fail criteria for all of the re-test scenario trials. The inspectors determined the corrective actions were adequately implemented and appropriate ISV re-test requirements were met which demonstrate that the main control room (MCR) operators can perform the plant operations as described in ITAAC 3.2.00.01c.ii (Index No. 742). Therefore, ITAAC 3.2.00.01c.ii (742) has been satisfactorily addressed. No findings of significance were identified.

### ITAAC 3.2.00.01d (Index No. 743), HFE Design Issue Resolution Verification

The inspectors determined WEC's implementation of the HFE Design Issue Resolution Verification processes was adequately implemented in accordance with the plans and procedures governing those processes. The inspectors concluded that compensatory measures, including Human System Integration (HSI) Design modifications, were adequate to resolve significant HSI issues based on observed ISV re-test activities and review of design

documentation including the final ISV Test Report. The inspectors concluded that justifications for remaining Human Engineering Deficiencies (HEDs) and HED issues to be deferred for resolution in the as-built plant, or deferred for future licensee evaluation, were appropriate. Therefore, ITAAC 3.2.00.01d (743) has been satisfactorily addressed. No findings of significance were identified.

## REPORT DETAILS

### 1. ITAAC 3.2.00.01c.ii (Index No. 742), Demonstrate Capability to Manage Evolutions and Events

#### Background

NRC Inspection Report 99900404/2016-206, dated December 9, 2016, (ADAMS Accession No. ML16336A244), the inspectors noted that one of the primary objectives of the ISV was to demonstrate the main control room (MCR) operators can safely operate the plant. This is accomplished by using a simulator to run a series of scenarios that include a wide variety of operational conditions the plant could experience. These scenarios have pass/fail criteria associated with them to distinguish when major challenges in operating safely might exist. These challenges are evaluated to determine underlying problems, and then corrective actions are taken. The corrective actions are then retested to verify the scenarios can be successfully performed. This process is defined by GEH-320 and GEH-420.

Based on the NRC inspection activities during the initial ISV testing, the inspectors determined that several scenarios, including a plant startup scenario, did not pass their pass/fail criteria for at least one or more of the scenario trials. The inspectors concluded the ISV successfully identified challenges to operating safely, but those challenges must be resolved before the more general conclusion on the ability to safely operate the plant can be made. Therefore, ITAAC 3.2.00.01c.ii (Index No. 742) could not be completed until the corrective actions (i.e., HED resolution plans) were implemented and appropriate retest requirements met in order to conclude that the test and analysis results demonstrate that the MCR operators can perform the plant operations as described.

#### a. Inspection Scope

##### ISV Re-test Activities

The inspectors reviewed the applicable sections of GEH-320, "AP1000 Human Factors Engineering Integrated System Validation Plan," Revision 6, dated January 2015, and Revision 7, dated February 2018 that contained the acceptance criteria associated with ISV re-testing activities, and evaluated a sample of these criteria, including those specifying re-test requirements, scenario content, ISV team performance, and performance measures to verify that they were adequately implemented.

##### Re-test Requirements and Scenario Content

The inspectors selected a sample of scenarios to observe based on maximizing the observation of scenarios conducted to verify changes implemented to address Risk Important Human Actions (RIHA) time failures were effective. Additionally, scenarios were selected that provided the opportunity to observe the effectiveness of complex changes made to resolve HEDs. The inspectors confirmed that the minimum number of ISV re-test trials were implemented and scenario content was consistent with the requirements of GEH-320, Section 7.3, "Addressing HEDs and Re-Test Requirements."

## Training and Qualification

The inspectors noted that the ISV re-test staff was comprised of operating crews that responded to the simulator scenarios, a set of observers that provided for independent observation of the ISV re-test activities, and additional ISV staff that supported the conduct of the re-test trials and participated in post-trial debrief activities and issue evaluations.

The inspectors reviewed Letter ND-18-0105 from Mark Rauckhorst, Executive Vice President, Plant Vogtle 3&4, Southern Nuclear Operating Company; to George Koucheravy, WEC Site Director, Vogtle 3&4; dated January 25, 2018, which listed the qualifications of the operating crew members. The inspectors verified that the operating crew members met the training and experience requirements stated in GEH-320, Section 4.1.1, "Selection." The inspectors also verified that a diverse group of observers were used, as stated in GEH-320, Section 4.2, "Observers." Additionally, the inspectors verified that the ISV staff included those personnel listed in GEH-320, Section 4.3, "ISV Staff."

The inspectors reviewed the gap training for design modifications that affected the plant HSI and operating practices provided to the crew members participating in the ISV re-test activities between the initial ISV Baseline 7 and the current ISV re-test Baseline 8. This included "read and sign" training of a description of the expected impact on operators, and a sample of slide packages related to systems that have been modified, including technical drawings and references to relevant design and analysis documents. The crews used in the ISV re-test activities did not participate in the initial ISV testing, but all had completed the gap training prior to participating in the ISV re-test activities.

## ISV Re-test Shakedown Observations

The inspectors selected a sample of scenarios that did not meet pass/fail criteria during the initial ISV testing, including reactor start-up and manual ADS actuation, and observed scenario shakedown activities performed by an ISV crew to confirm that the re-test scenarios were adequate and the testbeds performed as expected prior to pilot testing. For the shakedown activities, the ISV crew consisted of individuals that had not previously tested on these scenarios. The inspectors observed that the crew was capable of performing the actions necessary to control the plant evolutions and noted the HSI modifications to the Rod Control System and Alarm System prioritization, in response to identified HEDs from the initial ISV testing, were effective.

In addition, the inspectors observed several demonstrations on a test simulator that were modified to incorporate the changes to the HSIs associated with rod control and alarm prioritization. The inspectors also discussed HSI modifications implemented with the HSI design team, and reviewed LTR-OPB-WAPP-16-034, "Domestic AP1000 ISV Alarm Analysis Report," which documented the alarm display analysis collected during the initial AP1000 ISV testing, to confirm that the design activities were performed in accordance with WEC's policies and procedures for design changes.



### ISV Re-test Scenario Observations

The team observed three different simulator scenarios, including two scenarios each for Crews A and B, and one additional for Crew A, for a total of five simulator trials. These scenarios provided a good opportunity to observe the crews interacting with a wide range of HSI features and provided reasonable evidence that significant changes to address HEDs identified during initial ISV were effective. This included observation of HSI and RIHAs of interest identified during the January 2018 inspection.

The inspectors confirmed that the Westinghouse Electric Company's (WEC) ISV observer team collected data in accordance GEH-320. The inspection team witnessed two instances where the operating crew asked questions about procedures prior to or during scenario activities. In both cases, the ISV observation team reacted appropriately, by minimizing the interaction and by not providing the crew with information that could bias the test results. The inspection team discussed this observation with the ISV staff and corrections were made to ensure that future instances did not occur.

The inspectors observed the post-scenario critiques and verified that data collection forms were completed in accordance with GEH-320 and the debriefing sessions were interactive and provided a complete discussion of the many challenges faced during the scenario. The ISV observation team and operating crew provided feedback to the designers regarding a variety of HF characteristics of the design including: workload, situation awareness, usability, and other subjective suggestions for improvement. The data provided by the operating crew and the ISV observation team was recorded using computerized surveys. The verbal debrief session was audio recorded and notes were taken. The inspectors also independently identified HSI challenges and verification of these challenges were included in the ISV team's result and were noted to be relatively minor in nature.

The inspectors verified that test results were being evaluated in accordance with GEH-320, Section 7.1, "Raw Data Processing," and their administrative control Procedure WNA-WI-00560-WAPP, "Human Factors Integrated System Validation Work Instruction," Revision 5, Section 5.4.2, "Daily Trial Results Process", during observations of daily assessment briefs. In addition, the inspectors reviewed the daily comments identified during the debrief session to confirm the notes were adequately capturing the salient issues discussed.

The inspectors did not observe any apparent failures of pass/fail criteria or failures to meet the diagnostic criteria during the simulator testing or debrief sessions.

### ISV Re-test Results Review

The inspectors reviewed the contents of APP-OCS-GER-420, "AP1000 Human Factors Engineering Integrated System Validation Report," Revision 0, dated June 2018, and verified that the report contains the appropriate scenarios selected for ISV re-test in accordance with the results of the initial ISV testing as documented in APP-OCS-GER-320, "AP1000 Human Factors Engineering Integrated System Validation Report," Revision 3, dated October 2016. In addition, the inspectors confirmed that the GER-420 report documented the results of the February 2018 ISV re-test activities and

were consistent with the inspectors observations of the five scenarios sampled during those re-test activities, including evaluation of the pass/fail criteria and all diagnostic criteria for each scenario.

b. Observations and Findings

No findings of significance were identified.

c. Conclusions

The inspectors determined through direct observation of ISV re-test activities, including dynamic testing on test and full-scope simulators, that operating crews were capable of adequately completing the pass/fail criteria for all of the re-test scenario trials. The inspectors determined corrective actions were adequately implemented and appropriate ISV re-test requirements were met which demonstrate the operating crews can perform the plant operations as described in ITAAC 3.2.00.01c.ii (Index No. 742). Therefore, ITAAC 3.2.00.01c.ii (742) has been satisfactorily addressed. No findings of significance were identified.

2. ITAAC 3.2.00.01d (Index No. 743), HFE Design Issue Resolution Verification

Background

In NRC Inspection Report 99900404/2016-206, dated December 9, 2016, (ADAMS Accession No. ML16336A244), the inspectors noted that all of the Priority 1 HEDs were addressed with a resolution plan that includes modifying one or more aspects of the integrated system (i.e., no Priority 1 HEDs were justified to remain as-is in the final design). Additionally, the inspectors noted that Priority 2 and 3 HEDs were evaluated and in some cases, the inspectors found the resolution plans for certain Priority 1-3 HED's were still under development and that further inspection to confirm that WEC had completed issue resolution implementation and verification activities in accordance with GEH-420 and GEH-320 was warranted.

a. Inspection Scope

Human System Integration (HSI) Design Modifications

The inspectors reviewed a sample of HSI design changes resulting from evaluation of the Human Engineering Deficiencies (HEDs) identified from the initial ISV test activities. The inspectors interviewed members of the vendor's Human Factors Engineering (HFE) design team and discussed important features intended to resolve HEDs. The HFE design team presented static images of a sample of HSI features when appropriate to illustrate the changes. The inspectors found that design changes were reasonable, and they were likely to improve the conditions which triggered the HED. The inspectors observed no apparent bias to justify HED results rather than implement design changes, and all Priority 1 HEDs had compensatory measures identified. In addition, the inspectors confirmed that as part of the vendor's process used to review HSI changes, an evaluation to confirm adequate use of the vendor's HSI Style Guide was performed and documented.

### Bench Testing Activities

The inspectors reviewed the results of eighteen bench tests of HSI changes which would not have been readily observed during scenario testing. The bench testing spanned the course of several days and covered all HEDs identified in Appendix N, "Additional Testing," of Document APP-OCS-GEH-324, "HFE ISV Retest Scenario Information," Revision 1. The tests observed by the inspectors included sixteen static and two dynamic tests. The inspectors noted that the process was systematic and employed an Independent Verifier, a Human Factors (HF) Specialist, and an operator who was qualified to participate in ISV activities as an operating crew member, but was not currently scheduled to participate in a scenario testing. The inspectors observed the process was consistent with Procedure APP-OCS-GEH-420 "AP1000 Human Factors Engineering Discrepancy Resolution Form" and WNA-WI-00411-WAPP, "Human Engineering Discrepancy Process Work Instruction," Revision 2, dated August 2015.

### HED Prioritization and Resolution

The inspectors reviewed procedures for documenting HEDs and conducting data analysis of the ISV retest results. Specifically, the inspectors reviewed GEH-320, GEH-420, Work Instruction 00411, and Work Instruction 00560 and confirmed the process as described in these procedures and work instructions were adequately implemented by the WEC ISV staff.

The inspectors reviewed a sample of 30 issues identified during the initial ISV test activities, including HEDs of all priority levels (Priority 1-3), and the proposed resolutions to each HED including any compensatory action or deferral of resolution until completion of the as-built plant and justifications for each.

The inspectors did not observe any cases where an issue was identified to be resolved using a non-conservative method. Most of the HEDs reviewed had an associated compensatory action (i.e., changes to design, procedures, and/or training). The inspectors were able to successfully trace references to appropriate engineering documents which contained design changes and supporting analysis. The inspectors noted that all Priority 1 HEDs had associated compensatory actions, and these compensatory actions appeared reasonable and likely to improve the issue. All were sufficiently documented to clearly identify reasonable solutions. When multiple possible solutions were considered for resolution, a clear rationale for the final decision was documented.

The inspectors also reviewed Appendix B of GER-420, which contained a listing of "new findings" identified during ISV re-testing activities, and determined these new findings were limited in number, were of low significance, and would not necessitate further testing. The inspectors confirmed these new findings were assessed in accordance with the plans and procedures governing these activities. The inspectors reviewed the raw data from post scenario debrief surveys and determined there was no significant operational consequence for any of the HED items.

### HED Tracking

The inspectors reviewed the processes for tracking HEDs scheduled for resolution in the as-built plant to confirm it was consistent with applicable procedures and the approved

implementation plan. Specifically, the inspectors reviewed the open HEDs in SmartPlant, the credited HED tracking tool. The inspectors found the only items that remain open were those scheduled to be resolved in the as-built plant and consisted primarily of environmental factors, tuning, space-related issues, and RIHA times observed in physical space outside the MCR that will be conducted in the as-built plant configuration. The inspectors also reviewed the list of items delayed to completion of the as-built plant and found them to be limited in number and appropriate for the scope of that testing. The inspectors confirmed that all Priority 1 HEDs were able to be closed during the 2018 re-test activities.

a. Observations and Findings

No findings of significance were identified.

b. Conclusions

The inspectors determined WEC's implementation of the HFE Design Issue Resolution Verification processes had been adequately implemented in accordance with the plans and procedures governing those processes. The inspectors concluded that compensatory measures, including HSI design modifications, were adequate to resolve significant HSI issues based on observed ISV re-test activities and review of design documentation, including the final ISV Test Report. The inspectors concluded that justifications for remaining HEDs and HED issues were to be resolved in the as-built plant or deferred for future licensee evaluation where appropriate. Therefore, ITAAC 3.2.00.01d (743) has been satisfactorily addressed. No findings of significance were identified.

Entrance and Exit Meetings

On January 9, 2018, the inspectors presented the inspection scope during an entrance meeting with Mr. Gary Brassart, Vice President, Global Instrumentation and Controls, of WEC, and other WEC personnel. On July 27, 2018, the inspectors presented the inspection results during an exit meeting with Ms. Jill S. Monahan, Manager, Licensing Inspections and Special Programs, and other WEC personnel.

## ATTACHMENT

1. PERSONS CONTACTED AND NRC STAFF INVOLVED:

| <b>Name</b>       | <b>Affiliation</b> | <b>Entrance</b> | <b>Exit</b> | <b>Interviewed</b> |
|-------------------|--------------------|-----------------|-------------|--------------------|
| Gary Brassart     | WEC                | X               |             |                    |
| Jill Monahan      | WEC                | X               | X           |                    |
| Greg Glenn        | WEC                | X               | X           |                    |
| Amanda Miller     | WEC                | X               | X           |                    |
| Michael Moser     | WEC                | X               | X           |                    |
| Jim George        | WEC                | X               | X           | X                  |
| Ron Wessel        | WEC                | X               |             | X                  |
| Sarah DiTommaso   | WEC                | X               |             | X                  |
| Bob Hirmanpour    | SNC                | X               | X           | X                  |
| Robert Fuld       | WEC                | X               |             | X                  |
| Brock Wilbanks    | SNC                | X               | X           |                    |
| Chris Crefeld     | WEC                | X               | X           |                    |
| Steve Packard     | WEC                | X               |             |                    |
| Adrian Fletcher   | WEC                | X               | X           | X                  |
| Tom Arnette       | SNC                |                 | X           |                    |
| Dave Pepper       | WEC                | X               |             |                    |
| Greg Galletti     | NRC                | X               | X           |                    |
| Lisa Castelli     | NRC                | X               | X           |                    |
| Lauren Nist       | NRC                | X               | X           |                    |
| Brian Green       | NRC                | X               | X           |                    |
| Maurin Scheetz    | NRC                | X               |             |                    |
| Victoria Huckabee | NRC                | X               |             |                    |
| Amy D'Agostino    | NRC                | X               |             |                    |
| Stephen Fleger    | NRC                |                 |             |                    |
| DaBin Ki          | NRC                |                 | X           |                    |
| James Gaslevic    | NRC                |                 | X           |                    |

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:

| <b>Item Number</b> | <b>Status</b> | <b>Type</b> | <b>Description</b> | <b>Applicable ITAAC</b> |
|--------------------|---------------|-------------|--------------------|-------------------------|
| None               |               |             |                    |                         |

4. INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA (ITAAC):

The NRC inspectors identified the following ITAACs related to components being designed, manufactured, and tested at WEC. At the time of the inspection, WEC was involved in certain engineering analysis activities related to the 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 area of ISV. The ITAAC design commitments referenced below are for future use by the NRC inspectors 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 ISV. This included a review of on-going HFE program plan documentation addressing 3.2.00.01c.ii (Index No. 742) and 3.2.00.01d (Index No. 743). Specifically the inspectors reviewed the implementation of the ISV, including ISV re-test activities, to verify consistency with the design commitments and the acceptance criteria of the ITAACs. 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.

| <b>ITAAC Index No.</b> | <b>ITAAC Section No.</b> | <b>Design Commitment</b>   | <b>Inspections, Tests, Analyses</b>   | <b>Acceptance Criteria</b>  |
|------------------------|--------------------------|--|---|---|
| 742                    | 3.2.00.01c.ii            | <p>1. The HFE verification and validation program is performed in accordance with the HFE verification and validation implementation plan and includes the following activities:</p> <p>c) Integrated system validation</p>  | <p>c) (ii) Tests and analyses of the following plant evolutions and transients, using a facility that physically represents the MCR configuration and dynamically represents the MCR HSI and the operating characteristics and responses of the AP1000 design, will be performed:</p> <ul style="list-style-type: none"> <li>- Normal plant heatup and startup to 100% power</li> <li>- Normal plant shutdown and cooldown to cold shutdown</li> <li>- Transients: reactor trip and turbine trip</li> <li>- Accidents: <ul style="list-style-type: none"> <li>- Small-break LOCA</li> <li>- Large-break LOCA</li> <li>- Steam line break</li> <li>- Feedwater line break</li> <li>- Steam generator tube rupture</li> </ul> </li> </ul> | <p>c) (ii) A report exists and concludes that: The test and analysis results demonstrate that the MCR operators can perform the following:</p> <ul style="list-style-type: none"> <li>- Heat up and start up the plant to 100% power</li> <li>- Shut down and cool down the plant to cold shutdown</li> <li>- Bring the plant to safe shutdown following the specified transients</li> <li>- Bring the plant to a safe, stable state following the specified accidents</li> </ul> |
| 743                    | 3.2.00.01d               | <p>1. The HFE verification and validation program is performed in accordance with the HFE verification and validation implementation plan and includes the following activities:</p> <p>d) Issue resolution verification</p> | <p>d) An evaluation of the implementation of the HFE design issue resolution verification will be performed.</p>  | <p>d) A report exists and concludes that: HFE design issue resolution verification was conducted in conformance with the implementation plan and includes verification that human factors issues documented in the design issues tracking system have been addressed in the final design.</p>   |

## 5. DOCUMENTS REVIEWED:

- APP-OCS-GEH-320, "AP1000 Human Factors Engineering Integrated System Validation Plan," Revision 6, dated January 2015
- APP-OCS-GEH-320, "AP1000 Human Factors Engineering Integrated System Validation," Revision 7, dated February 2018
- APP-OCS-GEH-324, "HFE ISV Retest Scenario Information," Revision 1, dated February 2018
- APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process," Revision 2, dated December 2014
- APP-OCS-GLR-320, "AP1000 Human Factors Engineering - HED Resolution Report," Revision 0, dated October 2016
- APP-OCS-GER-320, "AP1000 Human Factors Engineering Integrated System Validation Report," Revision 0, dated October 2015
- APP-OCS-GER-320, "AP1000 Human Factors Engineering Integrated System Validation Report," Revision 3, dated October 2016
- APP-OCS-GER-420, "AP1000 Human Factors Engineering Integrated System Validation Report," Revision 0, dated June 2018
- LTR-OPB-WAPP-16-034, "Domestic AP1000 ISV Alarm Analysis Report"
- WNA-WI-00411-WAPP, "Human Engineering Discrepancy Resolution Process Work Instruction," Revision 2, dated August 2015
- WNA-WI-00411-WAPP, "Human Engineering Discrepancy Resolution Process Work Instruction" Revision 4, dated April 2018
- WNA-WI-00560-WAPP, "Human Factors Integrated System Validation Work Instruction," Revision 5, dated December 2017
- HED Resolution Test Forms
- Multiple Replacement and Automation Services (RRAS) Issue Tracking System RITS
- Letter ND-18-0105 from Mark Rauckhorst, Executive Vice President, Plant Vogtle 3&4, Southern Nuclear Operating Company; to George Koucheravy, WEC Site Director, Vogtle 3&4; dated January 25, 2018



6. ACRONYMS USED:

|        |  |
|--------|--|
| ADAMS  | Agencywide Documents Access and Management System                |
| CFR    | Code of Federal Regulations                                      |
| DCIP   | Division of Construction Inspection and Operational Programs     |
| QVIB-1 | Quality Assurance Vendor Inspection Branch 1                     |
| HED    | Human Engineering Discrepancies                                  |
| HF     | Human Factors  |
| HFE    | Human Factors Engineering  |
| HSI    | Human-System Interface   |
| IP     | Inspection Procedure   |
| ISV    | Integrated System Validation                                     |
| ITAAC  | Inspections, Tests, Analyses, and Acceptance Criteria            |
| LAR    | License Amendment Request  |
| LOCA   | Loss of Coolant Accident   |
| MCR    | Main Control Room  |
| NRC    | (United States) Nuclear Regulatory Commission                    |
| NRO    | Office of New Reactors   |
| OCS    | Operation and Control Centers                                    |
| RIHA   | Risk Important Human Actions                                     |
| RITS   | Replacement and Automation Services (RRAS) Issue Tracking System |
| RRAS   | Replacement and Automation Services                              |
| U.S.   | United States (of America)                                       |
| WEC    | Westinghouse Electric Company                                    |