

May 11, 2015

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 NO. 99900404/2015-204

Dear Ms. DiTommaso:

On March 23 to March 27, 2015, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the Westinghouse Electric Company (WEC) facility in Warrendale, PA. The purpose of the limited-scope inspection was to assess WEC's compliance with the provisions of selected portions of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," 10 CFR Part 21, Reporting of Defects and Noncompliance."

This inspection evaluated aspects of WEC's programs for the design, implementation, and testing of the Protection and Safety Monitoring System (PMS) systems for the Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3 currently under construction. The enclosed report presents the results of this inspection. This NRC inspection report does not constitute NRC endorsement of your overall quality assurance (QA) or 10 CFR Part 21 programs.

During this inspection, the NRC staff evaluated aspects of WEC's design and testing of safety-related components of the PMS associated with equipment qualification, fault tolerance and communications prioritization, and observed on-going channel integration testing for the PMS. 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 ITAACs 2.5.02.03, 2.5.02.07, 2.5.02.11, and 2.5.02.12.

The NRC inspectors identified three findings associated with the ITAAC contained in Section 4 of the attachment to this report. These findings are material to the ITAAC acceptance criteria, specifically, for ITAAC 2.5.02.07, in that WEC failed to identify all credible failures and perform adequate testing of isolation devices in the PMS. In addition, two findings material to ITAAC 2.5.02.03 were identified where WEC failed to demonstrate that PMS equipment can withstand electromagnetic interference (EMI), radio frequency interference (RFI), and electrostatic discharge (ESD) conditions that would exist before, during, and following a design basis accident without loss of safety function.

Please provide a written statement or explanation within 30 days from the date of this letter in accordance with the instructions specified in the enclosed Notice of Nonconformance (NON). We will consider extending the response time if you show good cause for us to do so.

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/*

Richard A. Rasmussen, Chief  
Electrical Vendor Inspection Branch  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Docket No.: 99900404

Enclosures:

1. Notice of Nonconformance
2. Inspection Report No. 99900404/2015-204  
and Attachment

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Richard A. Rasmussen, Chief  
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Letter to Sarah DiTommaso from Richard Rasmussen dated May 11, 2015.

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION OF WESTINGHOUSE  
ELECTRIC COMPANY REPORT NO. 99900404/2015-204

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## NOTICE OF NONCONFORMANCE

Westinghouse Electric Company  
5000 Ericsson Dr.  
Warrendale, PA 15086

Docket No 99900404  
Report No. 2015-204

Based on the results of a Nuclear Regulatory Commission (NRC) inspection conducted at the Westinghouse Electric Company LLC (WEC) facility in Warrendale, PA, on March 23-27, 2015, NRC inspectors determined that certain activities were not conducted in accordance with NRC requirements contractually imposed upon WEC by NRC licensees:

- A. Criterion III, "Design Control," of Appendix B to Title 10 of the *Code of Federal Regulations*, (10 CFR) Part 50 states, in part, that where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, it shall include suitable qualifications testing of a prototype unit under the most adverse design conditions.

Title 10 CFR 50.55a "Codes and Standards", Section (h)(3) "Protection and Safety Systems" states, in part, that applications for design approvals, design certifications, and combined licenses under Part 52 of Title 10, must meet the requirements for safety systems in Institute of Electrical and Electronics Engineers (IEEE) Std. 603-1991. Additionally, the AP1000 design control document commits to IEEE 384-1981, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," in order to comply with 10 CFR 50.55(h) and IEEE Std. 603-1991.

Contrary to the above, WEC failed to include suitable qualification testing of a prototype unit under the most adverse design conditions as required above. Specifically, IEEE 384-1981, states in part, that the capability of the device to perform its isolation function shall be demonstrated by qualification test. The qualification shall consider the levels and duration of the fault currents on the non-Class 1E side. However, WEC failed to determine the maximum current transients in the design of the system or demonstrate by qualification test that the maximum levels and duration of the credible short-circuit currents applied to the isolation device's non-Class 1E side would not degrade the operation of the circuit connected to Class 1E side of the device.

This issue has been identified as Nonconformance 99900404/2015-204-01.

- B. Criterion III, "Design Control," of Appendix B to 10 CFR Part 50 states, in part, that, "measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems and components."

WEC procedure, EQ-EV-75-GEN, "Alternate Cabinet Shielding Effectiveness Acceptance Criteria Development," Section 5.0, "Conclusions," provides acceptable shielding criteria to demonstrate that the cabinets used for the U.S. AP1000 PMS are qualified to withstand electromagnetic interference (EMI), radio frequency interference (RFI), and electrostatic discharge (ESD) conditions that would exist before, during, and following a design basis accident without loss of safety function. In cases where alternate cabinet qualification results are being used a combination of acceptance criteria including: frequency response, shielding effectiveness, and cabinet materials of construction shall be evaluated.

Contrary to the above, the NRC inspection team identified that WEC failed to meet the prescribed acceptance criteria defined in EQ-EV-75-GEN to demonstrate that the cabinets (Pentair) used for the U.S. AP1000 Plant Protection and Safety Monitoring System (PMS) were bounded by the Electromagnetic Compatibility (EMC) equipment qualification (EQ) testing performed on an alternate cabinet design (Corry) which formed the basis of WEC's acceptance of the Pentair cabinet design.

This issue has been identified as Nonconformance 99900404/2015-204-02.

- C. Criterion III, "Design Control," of Appendix B to 10 CFR Part 50 states, in part, that "measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems and components."

WEC 7.2, "Dedication of Commercial Grade Items," Section 7.2 states, in part, that "dedication activities required to ensure that a commercial grade item meets the quality and performance requirements specified for a SR [safety-related] application shall be described in the CDIs [commercial-grade dedication instructions]." In addition, Appendix H of WEC 7.2 describes the criteria to be used in the CDI and verified when utilizing a supplier which has obtained certification to ANSI/ISO/IEC 17025 from a U.S. accredited organization.

Contrary to the above, WEC failed to establish adequate measures for the selection and review for suitability of criteria to verify the critical characteristic for calibration of measuring and test equipment used for EMC testing services for U.S. AP1000 PMS. Specifically, for CDI-4064, EMC testing services that were performed by Keystone Compliance, LLC, Specifically, WEC failed to identify appropriate acceptance criteria, such as scope of the calibration lab's current certification and any technical requirements, such as accuracies, tolerances, and ranges of measuring and test equipment to be used, in order to verify that the equipment used for the EMC testing of PMS was appropriately calibrated.

This issue has been identified as Nonconformance 99900404/2015-204-03.

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Chief, Electrical Vendor Inspection Branch, Division of Construction Inspection and Operational Programs, Office of New Reactors, within 30 days of the date of the

letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to a Notice of Nonconformance" and should include for each noncompliance: (1) the reason for the noncompliance, or if contested, the basis for disputing the noncompliance; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid noncompliance; and (4) the date when your corrective action will be completed. Where good cause is shown, the NRC will consider extending the response time.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System, which is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it 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 be withheld, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (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."

Dated this the 11th day of May 2015.

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

Docket No.: 99900404

Report No.: 99900404/2015-204

Vendor: Westinghouse Electric Company  
5000 Ericsson Dr.  
Warrendale, PA 15086

Vendor Contact: Sarah DiTommaso, Manager  
AP1000 Instrumentation & Control Licensing  
Westinghouse Electric Company  
5000 Ericsson Dr.  
Warrendale, PA 15086  
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 not limited to safety-related design, fabrication, testing, and delivery of the Protection and Safety Monitoring System and the non-safety Diverse Actuation System instruments and controls products to the current US AP1000 plants under construction.

Inspection Dates: March 23 - 27, 2015

Inspection Team Leader: Greg Galletti, NRO/DCIP/EVIB

Inspectors: Lisa Castelli R-II/DCI/CIB1  
Theodore Fanelli R-II/DCI/  
Robert Mathis R-II/DCI/CIB1  
Philip Natividad NRO/DCIP/EVIB  
Stacy Smith NRO/DCIP/EVIB  
Pauline Braxton RII/DCI/CIB1  
Alfredo Matos-Marin R-II/DCI/CIB1

Approved by: Richard A. Rasmussen, Chief  
Electrical Vendor Inspection Branch  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors



## **EXECUTIVE SUMMARY**

Westinghouse Electric Company  
99900404/2015-204

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 quality assurance program that complies with the requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, and "Domestic Licensing of Production and Utilization Facilities," 10 CFR Part 21, "Reporting of Defects and Noncompliance." The inspectors conducted this inspection at the WEC facility in Warrendale, Pennsylvania, on March 23 - 27, 2015.

This inspection specifically evaluated aspects of WEC's design and testing of safety-related components of the Protection and Safety Monitoring System (PMS) for new construction commercial nuclear plants in the US associated with equipment qualification, fault tolerance, and communications prioritization ITAACs 2.5.02.03, 2.5.02.07, 2.5.02.11, and 2.5.02.12.

With respect to ITAAC 2.5.02.12, the inspectors observed attributes and elements associated with implementation of the PMS software management plan (SMP), software configuration management plan (CMP), and software verification & validation plan (VVP). These attributes are observed and assessed for each inspection involving ITAACs 2.5.02.11 and 2.5.02.14.

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

- Appendix B to 10 CFR Part 50
- 10 CFR Part 21
- 10 CFR 50.55a

The inspectors used Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," dated July 15, 2013, and IP 65001.22, "Inspection of Digital Instrumentation and Control (DI&C) System/Software Design Acceptance Criteria (DAC)-Related ITAAC," dated December 19, 2011.

The information below summarizes the results of this inspection.

### **PMS Test Control (ITAAC 2.5.02.11d, 2.5.02.12)**

The inspectors determined that WEC's implementation of their policy and procedures for control of testing of portions of the PMS satisfy the regulatory requirements set forth in Criterion XI, "Test Control," Appendix B to 10 CFR Part 50. The inspectors determined that future inspections of ITAAC 2.5.02.11c and 2.5.02.11d will be necessary to determine if the testing tasks for the software integrity level 4 were adequate to address the complete set of software requirements for the PMS. No findings of significance were identified.

#### PMS Baseline (BL) 8 Hardware Upgrade (ITAAC 2.5.02.11c, 2.5.02.11d, 2.5.02.12)

The inspectors concluded that the in-process BL8 hardware modifications for the U.S. AP1000 were being controlled and implemented consistent with the regulatory requirements of Criterion III, "Design Control" and Criterion VII, "Control of Purchases Material, Equipment & Services." No findings of significance were identified.

#### PMS Fault Tolerance and Data Communication Design (ITAAC 2.5.02.07)

The inspectors identified that WEC did not adequately implement the requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50 associated with aspects of qualification testing of PMS isolation devices. The NRC inspection team issued Nonconformance 99900404/2015-204-01, for WECs failure to establish appropriate and comprehensive qualification testing associated with the credible peak currents at the isolation devices and therefore did not demonstrate that most adverse current transients applied to the isolation device's non-Class 1E side would not degrade the operation of the circuit connected to the isolation device's Class 1E side.

#### PMS Equipment Test Report Review (ITAAC 2.5.02.03)

The inspectors reviewed the program policies and procedures and testing results reports related to the Electromagnetic Compatibility (EMC) testing for the PMS Equipment Qualification (EQ). The inspectors identified that WEC did not adequately implement the requirements of Criterion III, "Design Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50 for EMC testing associated with the AP1000 PMS EQ.

The NRC inspection team issued Nonconformance 99900404/2015-204-02 for WEC's failure to demonstrate that PMS equipment for the U.S. AP1000 can withstand electromagnetic interference (EMI), radio frequency interference (RFI), and electrostatic discharge (ESD) conditions that would exist before, during, and following a design basis accident without loss of safety function.

In addition, the NRC inspection team issued Nonconformance 99900404/2015-204-03 for WEC's failure to establish appropriate measures to assure services purchased through a subcontractor were adequately evaluated. Specifically, WEC failed to identify appropriate acceptance criteria, such as scope of the calibration lab's current certification and any technical requirements, such as accuracies, tolerances, and ranges of measuring and test equipment to be used, in order to verify that the equipment used for the EMC testing of PMS was appropriately calibrated.

## REPORT DETAILS

### 1. PMS Test Control

#### PMS Channel Integration Testing (CIT) (ITAAC 2.5.02.11d, 2.5.02.12)

##### a. Inspection Scope

The inspectors observed ongoing PMS testing for Vogtle Unit 3, specifically baseline 7.8.2 (BL7.8.2) CIT of PMS Input/Output (I/O) Channel Accuracy per section 9.5.5.1 of the PMS Test Plan (APP-PMS-T5-001). The inspectors interviewed responsible engineers and reviewed applicable test procedures and data sheets.

Inspectors also reviewed CIT regression test documentation as previously completed for V.C. Summer Unit 2 (VS2) for PMS software baseline 7.8.2. The regression documentation was a summary of the PMS Replacement and Automation Services Issue Tracking System (RITS) and design changes that were completed and analyzed for CIT regression re-tests. These tests are required for CIT prior to System Integration Testing (SIT). Inspectors reviewed documents to verify that testing anomalies identified during the VS2 I/O Channel Accuracy CIT, did not re-occur during the observed Vogtle 3 testing.

Inspectors also reviewed several RITS which required a change to the PMS software baseline for resolution. This PMS change was completed for VS2 (and all PMS BL7.8.2) and evaluated for CIT regression testing as noted in section 3.1 of VS2-PMS-T1P-050 Revision 2, and VS2 retesting was completed satisfactorily as documented in Section 3 of VS2-PMS-T2R-018, Revision 1.

##### b. Observations and Findings

No findings of significance were identified.

##### c. Conclusion

The inspectors determined that WEC's implementation of their policy and procedures for control of testing satisfy the regulatory requirements set forth in Criterion XI, "Test Control," Appendix B to 10 CFR Part 50. No findings of significance were identified.

#### PMS CIT/SIT Testing Results Reports Review (ITAAC 2.5.02.11d, 2.5.02.12)

##### a. Inspection Scope

The NRC inspection team assessed the WEC processes for design control, test control, software development, and software verification and validation for safety-related analysis code and safety-related software to verify regulatory compliance.

The team reviewed samples of test plans, test procedures, test reports, work instructions, RITS, Corrective Action Program and Learning System issues (CAPALs),

and interviewed WEC personnel to determine the adequacy of the in-process and completed work design and testing activities.

The Vogtle and V.C. Summer AP1000 licensing bases require the implementation of specific software lifecycle processes and activities for the PMS design control and for test control. The design bases requires that the test control activities and portions of the design control activities are assigned to the verification and validation (V&V) organization. The V&V organization creates the test plans and procedures and implements them. The V&V test plan (APP-PMS-T5-001) Section 9.5 "Channel Integration Test (CIT)," described the CIT as functional testing to verify the integration of the released software with the deliverable hardware. The inspectors reviewed plans and procedures implemented on software revision BL7.8.2 and determined that another revision BL8 would be released and regression testing would be performed.

b. Observations and Findings

b.1 Completed CIT Procedures and Reports

The inspectors reviewed test reports for CIT procedures associated with the Reactor Trip System (VS2-PMS-T2R-007), the Engineered Safety Features (VS2-PMS-T2R-008), the Integrated Logic Processor Component Logic (VS2-PMS-T2R-009), and the Qualified Data Processing System (VS2-PMS-T2R-010) to determine the completeness of the test case definitions. The inspectors noted that the CIT did not address the complete set of software requirements specified for the PMS. WEC indicated that additional software requirements testing and verification will be completed as part of ITAAAC 02.05.02.11c. The inspectors determined that future inspections of ITAAC 2.5.02.11c and 2.5.02.11d will be necessary to determine if the testing tasks for the software integrity level 4 were adequate to address the complete set of software requirements for the PMS.

b.2 Completed CIT Regression Testing

The inspectors reviewed CIT regression test report (VS2-PMS-T2R-050) previously completed for V.C. Summer Unit 2 (VS2). The regression testing evaluated the changes in the two releases of installed software as specified by VS2-PMS-T7X-007, "V.C. Summer Unit 2 AP1000 Protection and Safety Monitoring System Channel Integration Test Configuration Record." These were software releases installed on December 12, 2013, and on April 22, 2014, respectively. Inspectors verified that testing anomalies documented from the 2013 software version did not re-occur during the observed Vogtle 3 testing of the 2014 software version. The inspectors determined that anomalies described in RITS 35397, 34637, 38805, 29800, and 33347 were addressed by WEC. These RITS tracked anomalies with signal quality and error handling by the PMS.

The inspectors determined that future inspections of ITAAC 2.5.02.11c and 2.5.02.11d will be necessary (as noted above for forthcoming software BL8) to determine if the testing tasks for the software integrity level 4 were adequate to address the complete set of software requirements for the PMS.

c. Conclusion

The NRC inspection team concluded that WEC is implementing its policies and procedures that govern design control, test control, software development, and software V&V. Further inspection is required to conclude that the requirements for software integrity level 4 software processes are consistent with the regulatory requirements of Criterion III, "Design Control" and Criterion XI, "Test Control," in Appendix B to 10 CFR Part 50. No issues of significance were identified.

PMS BL8 Hardware Upgrade (ITAAC 2.5.02.11c, 2.5.02.11d, 2.5.02.12)

a. Scope

The inspectors discussed the hardware modification process and status for the U.S. AP1000 generic BL8 hardware modifications for the PMS with WEC personnel. WEC identified the activities and processes that implement the hardware changes. These activities include: (1) issuing Design Change Proposals (DCP) and Engineering & Design Change Reports (E&DCRs), (2) incorporating changes into the System Design Specification, (3) issuing Engineering Change Orders (ECO) to update hardware drawings, and (4) updating cabinet hardware via Production Orders (PPO) and Quality Notifications (QN).

The inspectors interviewed WEC personnel and observed in-process BL8 hardware modifications associated with the addition of component interface modules. The inspectors sampled completed BL8 inspection activities including receipt inspection documentation and QN's associated with BL8 production orders. The inspectors verified that adequate QC oversight activities were completed and adequately documented. The inspectors reviewed test plans and test results reports for a sample of hardware modifications associated with BL8.

b. Observation and Findings

No findings of significance were identified.

c. Conclusion

The inspectors concluded that the in-process BL8 hardware modifications for the U.S. AP1000 were being controlled and implemented consistent with the regulatory requirements of Criterion III, "Design Control" and Criterion VII, "Control of Purchases Material, Equipment & Services." No findings of significance were identified.

## 2. PMS Fault Tolerance and Data Communication Design (ITAAC 2.5.02.07)

### a. Inspection Scope

The inspectors reviewed PMS design and testing documentation and interviewed responsible personnel to verify the appropriate use of design parameters and the appropriate translation of design requirements into qualification tests. The inspectors also conducted reviews to ensure that the required qualification of Systems, Structures, and Components (SSCs) were completed in accordance with regulatory requirements, design specifications, approved procedures, and industry standards.

The inspectors specifically reviewed design specifications, qualification reports, and test reports associated with Class 1E isolation devices to ensure that measures were in place to prevent credible faults from propagating into the PMS from non-safety systems. Inspectors assessed the design and capabilities of the isolation devices with fused protection to determine whether qualification and testing activities adequately demonstrated that the safety function of the PMS would not be adversely impacted.

The inspectors also reviewed testing documentation and industry standards associated with the use of fiber-optic cables as an isolation barrier to determine whether the current testing strategy was appropriate to ensure adequate protection of the PMS. The inspectors reviewed corrective action documents addressing the submittal of a request for departure from the testing requirements contained in Institute of Electronic and Electrical Engineering (IEEE) 384-1981 to adopting the position of IEEE 384-2008 which states that the inherent electrical isolation characteristics of fiber-optic circuits meet the testing requirements of the IEEE standard and testing is not required.

### b. Observations and Findings

The inspectors noted that in order to comply with 10 CFR 50.55a(h), "Protection and safety systems" and IEEE 603-1991, "Criteria for Safety Systems for Nuclear Power Generating Stations," Section 5.6.3 "Independence Between Safety Systems and Other Systems," the AP1000 Design Control Document (DCD) committed to using IEEE 384-1981, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits." The DCD, Appendix 1A, "Conformance With Regulatory Guides" takes an exception to the endorsement of IEEE 384-1974 by Regulatory Guide (RG) 1.75 Revision 2 and states, in part, that "RG 1.75 endorses IEEE Std. 384-74 (Reference 23) which has been superseded by a later revision, IEEE Std. 384-81 (Reference 24). It is the later version that is used for the referenced purposes."

IEEE 603-1991, Section 5.6.3 "Independence Between Safety Systems and Other Systems," states, in part, that the safety system design shall be such that credible failures in and consequential actions by other systems, as documented in Section 4.8 of the design basis (failures in non-safety-related systems) shall not prevent the safety systems from meeting the requirements of this standard. Furthermore, IEEE 603-1991, Section 5.6.3.1(2) "Interconnected Equipment" subsection "Isolation," states, in part, that no credible failure on the non-safety side of an isolation device shall prevent any portion of a safety system from meeting its minimum performance requirements.

In addition, Standard IEEE 384-1981 Section 7.2.2.1 "Isolation Devices" subsection "General," states, in part, that the maximum credible voltage or current transient applied to the device's non-Class 1E side will not degrade the operation of the circuit connected to the device Class 1E or associated side below an acceptable level; and that shorts, grounds, or open circuits occurring in the non-Class 1E side will not degrade the circuit connected to the device Class 1E or associated side below an acceptable level. The capability of the device to perform its isolation function shall be demonstrated by qualification test. The qualification shall consider the levels and duration of the fault currents on the non-Class 1E side.

The inspectors noted that the test report, APP-PMS-VPR-002, Section 6.2, "Test Conditions," subsection 6.2.1, "Common Mode" stated, in part, "the fault current applied during testing was 50A..., this test current setting is somewhat arbitrary." Further, the test report, Appendix B, "Transverse Fault Test Methodology Rationale," states, in part, "the adiabatic region is beyond the fault current capabilities of Westinghouse test equipment, which is limited to 60A." The test report specified the maximum available short circuit currents are approximately 40,000 amperes at the batteries for the Direct Current (DC) system but it did not reference an available fault current for the Alternating Current (AC) system. The fuses used in the isolation devices specified (on the fuse peak let-thru current vs. available current curves) that they allowed AC peak let-thru currents ranging from approximately 250 to 2000 amperes. No objective evidence was available establishing the magnitudes of the DC peak let through currents, which could be greater than the AC currents. The inspectors noted that the maximum current transients in the design of the system were not determined by WEC, and the effects of the credible peak currents at the isolation devices was not tested as specified by IEEE 384-1981, Section 7.2.2.1 "Isolation Devices" subsection "General." Consequently, the qualification test did not demonstrate that most adverse current transients applied to the isolation device's non-Class 1E side would not degrade the operation of the circuit connected to the device Class 1E. This finding is material to ITAAC 2.5.02.07 acceptance criteria, as documented in Section 4 of the attachment to this report.

This issue has been identified as Nonconformance 99900404/2015-204-01.

c. Conclusion

The inspectors identified that WEC did not adequately implement the requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50 associated with aspects of qualification testing of PMS isolation devices. The NRC inspection team issued Nonconformance 99900404/2015-204-01, for WECs failure to establish appropriate and comprehensive qualification testing associated with the credible peak currents at the isolation devices and therefore did not demonstrate that most adverse current transients applied to the isolation device's non-Class 1E side would not degrade the operation of the circuit connected to the isolation device's Class 1E side.

### 3. PMS Equipment Test Report Review (ITAAC 2.5.02.03)

#### Electromagnetic Compatibility Testing for the PMS Equipment Qualification

##### a. Inspection Scope

The NRC inspection team reviewed the equipment qualification (EQ) of the PMS, and specifically that the equipment can withstand electromagnetic interface (EMI), radio frequency interference (RFI), and electro-static discharge (ESD) conditions that would exist during and following a design basis accident to verify performance of its safety function for the time required in accordance with the acceptance criteria defined in ITAAC 2.5.02.03. U.S. NRC RG 1.180, Revision 1, allows for the use of various standards as an acceptable method for EMC testing of safety systems. The team reviewed evaluations comparing the testing performed using the various standards to the requirements of the U.S. NRC RG 1.180 to ensure consistency and validity.

The following qualified PMS equipment was reviewed:

- nuclear instrumentation system production cabinet,
- source range and intermediate auxiliary panels, and
- two PMS Common Q based cabinets.

The team reviewed the test specification, verified that the specifications were correctly translated to the EMC test procedures, and that the testing was performed and recorded in accordance with WEC's EQ methodology documented APP-GW-G1-002.

##### Test Specifications

The NRC inspection team reviewed the environmental compatibility test criteria for the AP1000 PMS Nuclear Instrumentation System Mild Environment Equipment Qualification Unit Configuration and Test Specification, APP-PMS-T1-503, Revision 1, to verify that the identified testing was in conformance with the requirements of U.S. NRC RG 1.180. Specifically, the team verified that the basic EMC type test requirements for emissions, susceptibility and surge withstand capability, were identified and adequately translated into the EMC Test Procedure, APP-PMS-VPP-001, Revision 1. In addition, the team reviewed the NIS qualification unit specification to assess whether a representative sample of the source, intermediate, and power range signals were specified for monitoring.

##### Control of Design Changes

The NRC inspection team verified the processes WEC used to ensure hardware changes made to PMS did not invalidate EMC EQ testing. Specifically, the team verified that engineering and design change coordination reports, as defined by APP-CGW-GAP-420, Revision 8, included appropriate controls to determine if a design change could invalidate previous EQ testing. The inspections reviewed E&DCR APP-PMS-GEF-082, Revision 0, for the addition of internal cables to accommodate



hardware modifications associated with selected sub-components within the PMS system.

In addition, the inspectors sampled engineering change order (ECO) 12-01246 to verify that it did not invalidate the AP1000 PMS equipment qualification documented in APP-PMS-VPY-002, Revision 1.

b. Observations and Findings

The NRC team's review included hardware modifications up to APP-ISIP-J0R-007, Revision 8 (BL7.8) of PMS, but noted that as a result of baseline changes set forth in APP-ISIP-J0R-008, Revision 2 (BL8.2), WEC was currently in the process of determining how hardware changes in BL8.2 effect the AP1000 PMS qualification basis.

Similarity Analysis

The NRC inspection team reviewed APP-PMS-VBR-003, "Equipment Qualification Summary Report for PMS Cabinets and NIS Auxiliary Panels for Use in the AP1000 Plant," Revision 2, to verify that the AP1000 PMS cabinets were able to withstand EMI/RFI and ESD conditions that would exist during and following a design basis accident. Section 4.5, "Hardware Differences Reconciliation (EMC)," stated, in part, that "the hardware being provided for Sanmen Unit 1 and Vogtle Unit 3 were sufficiently represented by components included in the EQ program." The NRC inspection team noted that for EMC qualification; only Corry cabinets were qualified by testing (China specific AP1000). The Pentair cabinets used for the U.S. AP1000 projects were tested as empty cabinets to show equivalent shield effectiveness to the Corry cabinets.

EQ-TP-138-GEN, "Electromagnetic Compatibility Test Plan and Procedure for Cabinet Shielding Effectiveness Evaluations," describes the plan, procedures, and requirements necessary to demonstrate that alternate cabinets can be used to house instrumentation and control I&C equipment which has already been qualified for EMC Corry 7221 without being requalified for EMC. Section 1.1, "Objectives," states, in part, that alternate cabinets must demonstrate shielding effectiveness of electrical fields that is equivalent to or better than that provided by the Corry cabinet for the frequency points of interest. It also states, in part, that the details of the requirements are developed and documented in EQ-EV-75-GEN, "Alternate Cabinet Shielding Effectiveness Acceptance Criteria Development." Section 5.0, "Conclusions" states the following:

- For all frequencies below 400MHz, the alternate cabinet shielding (Pentair) should envelop that of the Corry 7221 cabinet in both vertical and horizontal polarizations to ensure emissions and incoming RFI is suppressed. In cases where the alternate (Pentair) cabinet shielding does not envelope the 7721 shielding in these frequency ranges, the alternate cabinet shielding shall be 40 dB or greater.
- "Magnetic field shielding effectiveness need not be performed below 30 MHz provided the alternate cabinets are constructed from sufficient similar material to the current standard cabinet."

EQ-QR-126, "Standard Pentair Seismic Cabinet," Revision 0, dated February 12, 2012, provided test results that showed that shielding measurements of the Pentair 21497 cabinet were generally equivalent to or better than the shielding effectiveness of the 7221 (Corry) cabinets. However, when the NRC team reviewed the horizontal and vertical door data comparison figures, it was noted that the Pentair cabinets did not provide equivalent or better shielding measurements in all cases, and there was no justification provided for acceptance of these conditions. The NRC noted that the figures did not meet the above criteria, and no justification was provided for acceptance of these conditions to ensure emissions and incoming RFI were suppressed in the Pentair cabinets. In addition, the inspection team noted that there was no documented evaluation to discuss how the materials for the two cabinets were equivalent in regard to EMC properties since the Corry cabinets were constructed from ASTM A1008 CY Type B cold rolled steel and the Pentair cabinets were constructed from ASTM A1011 CS Type B hot rolled steel. This finding is material to ITAAC 2.5.02.03 acceptance criteria, as documented in Section 4 of the attachment to this report.

This issue has been identified as Nonconformance 99900404/2015-204-02.

#### Dedication of Calibration of M&TE used for EMC Testing Services

The NRC inspection team reviewed commercial grade dedication instruction (CDI) 4064 for EMC testing services performed by Keystone Compliance, LLC. WEC identified the control of measuring and test equipment (M&TE), calibrated by sub supplier Liberty, as a critical characteristic for the EMC testing in CDI-4064. The NRC noted that WEC accepted this critical characteristic by reviewing that the sub supplier, Liberty, had a certification from an accredited organization. However, WEC procedure 7.2 allows two methods to dedicate calibration services, (1) a survey of the commercial grade calibration service or (2) use of an alternate method when utilizing a supplier with ANSI/ISO/IEC 17025 certification from a U.S. accredited organization with specific criteria requirements. These requirements include the scope of the calibration lab's current certification and any technical requirements, such as accuracies, tolerances, and ranges of measuring and test equipment to be used. WEC was not able to provide documentation to show that these specific requirements were verified. Specifically, WEC could not show that the measuring and test equipment used for the EMC testing of the PMS was appropriately calibrated. In addition, WEC failed to identify appropriate acceptance criteria or provide sufficient documentation to verify that the equipment used for the EMC testing was appropriately calibrated by Liberty. This finding is material to ITAAC 2.5.02.03 acceptance criteria, as documented in Section 4 of the attachment to this report.

This issue has been identified as Nonconformance 99900404/2015-204-03.

#### c. Conclusion

The inspectors identified that WEC did not adequately implement the requirements of Criterion III, "Design Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50 for EMC testing associated with the AP1000 PMS EQ.

The NRC inspection team issued Nonconformance 99900404/2015-204-02 for WEC's failure to provide an adequate similarity analysis to show that the Pentair cabinets were bounded by the EMC EQ of the Corry cabinets. Specifically, WEC failed to demonstrate that PMS equipment for the U.S. AP1000 can withstand EMI/RFI and ESD conditions that would exist before, during, and following a design basis accident without loss of safety function.

Additionally, the NRC inspection team issued Nonconformance 99900404/2015-204-03 for WEC's failure to establish appropriate measures to assure services purchased through a subcontractor were adequately evaluated. Specifically, WEC failed to adequately verify critical characteristics and identify adequate acceptance criteria during commercial grade dedication of services performed by Keystone for EMC services related to the PMS EQ.

#### 4. Entrance and Exit Meetings

On March 23, 2015, the inspectors presented the inspection scope during an entrance meeting with Mr. Jan Dudiak, Director, Automation and Field Services, of WEC, and other WEC personnel. On March 27, 2015, the inspectors presented the inspection results during an exit meeting with Mr. Jan Dudiak, Director, Automation and Field Services, 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>
Jan Dudiak	WEC-AFS	X	X	
Dave Jarosh	WEC		X	
Dale Harmon	WEC	X	X	X
Gregory Glenn	WEC-AFS			X
Sarah DiTomasso	WEC	X	X	X
Bob Hirmanpour	SNC	X	X	X
Warren Odess-Gillett	WEC	X		X
Pietro Porco	WEC-AFS	X	X	X
Suresh Channarasappa	WEC-AFS	X	X	X
Ron Wessel	WEC	X	X	X
J. Mark Schoming	WEC	X		
Frank Nedwidek	WEC	X		
Michael Shaffer	WEC-AFS		X	X
Ken Lunz	WEC-AFS	X	X	X
John Wiessmann	WEC-AFS	X	X	X
Chris Srock	WEC-AFS		X	
Wes Vaughn	SNC	X	X	X
Frank Nedwidek	WEC-AFS			X
Rick Paese	WEC	X	X	
Eric Kunz	WEC-AFS			X
Dan Harris	WEC	X	X	
John Faulkner	WEC-AFS			X
Dino Copetas	WEC-AFS			X
James Doyle	WEC			X
Fred Bednar	WEC			X
Stephen Packard	WEC-AFS	X	X	
James Vandzura	WEC			X
Mark DeMaglio	WEC			X
Jeff Gates	WEC			X
Paul Russ	WEC	X	X	
Andrew Brine	WEC			X
Bob Cortese	WEC	X		X
Nicole Stadelman	WEC-AFS			X
Don Behnke	WEC		X	
Mike Rubin	WEC		X	
Michael Klinuex	WEC	X	X	
Murat Uzman	WEC	X		X
John Couture	WEC		X	
Christina Saxon	SNC		X	
Matt Shakun	WEC	X	X	
Mark Stofko	WEC	X	X	

Name	Affiliation	Entrance	Exit	Interviewed
Roger Constantina	WEC		X	
Ajay Tiwari	WEC		X	
John Zuemie	WEC		X	
Jeffrey Hydeman	WEC		X	
Bob Philips	WEC		X	
Hane Blanc	WEC		X	
Jerry Monoy	SCANA		X	X
Miguel Vallarta	WEC	X	X	X
Chris Whitfield	SNC	X	X	X
Brian Bedford	WEC	X	X	X
George Roberts	WEC	X	X	
Darryl Muetzel	WEC	X	X	X
Doug McConahy	WEC			X
David Malarik	WEC			X
Robert Lane, Sr.	WEC	X	X	X
Lavis Jesso	WEC	X	X	X
Tom McLaughlin	WEC-AFS			X
Greg Galletti	NRC	X	X	
Lisa Castelli	NRC	X	X	
Robert Mathis III	NRC	X	X	
Philip Natividad	NRC	X		
Theodore Fanelli	NRC	X	X	
Pauline Braxton	NRC	X	X	
Alfredo Matos-Marin	NRC	X	X	
Stacy Smith	NRC	X	X	

2. INSPECTION PROCEDURES USED:

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

IP 60001.22, "Inspection of Digital Instrumentation and Control (DI&C) System/Software Design Acceptance Criteria (DAC)-Related ITAAC," dated December 19, 2011

IP 65001.E, "Inspection Of The ITAAC-Related Qualification Program," dated June 20, 2014

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

Item Number	Status	Type	Description	Applicable ITAAC
99900404/2015-204-01	opened	NON	Criterion III	2.5.02.07
99900404/2015-204-02	opened	NON	Criterion III	2.5.02.03
99900404/2015-204-03	opened	NON	Criterion III	2.5.02.03

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 testing activities including Protection and Safety Monitoring System (PMS) Channel Integration Testing (CIT) for the Vogtle Unit 3 AP1000 reactor design. For the ITAAC listed below, the inspectors reviewed WEC’s quality assurance (QA) controls in the areas of design control, test control, inspection, nonconforming materials parts and components, and corrective actions. 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 identified three findings associated with these ITAAC during this inspection.

This section of the inspection report focuses on the vendor’s implementation of aspects of their QA program for the activities affecting quality associated with the design and testing of the aspects of the AP1000 PMS. This included a review of completed PMS design and test program documentation addressing AP1000 2.5.02.07 signal isolation functions and ITAAC 2.5.02.03 related to aspects of plant component equipment qualification. In addition, the inspectors reviewed aspects of the vendor’s design control and testing processes associated with the PMS Generic AP1000 Baseline (BL) 7.8.0 CIT currently on-going for the Vogtle Unit 3 build. These activities are associated with ITAAC 2.5.02.11c and 2.5.02.11d as well as ITAAC 2.5.02.12.

With respect to ITAAC 2.5.02.12, the inspectors observed attributes and elements associated with implementation of the PMS Software Management Plan (SMP), Software Configuration Management Plan (CMP), and the Software Verification and Validation Plan (VVP). These attributes are observed and assessed for each inspection involving ITAACs 2.5.02.11 and 2.5.02.14.

<b>COL #</b>	<b>DCD#</b>	<b>Design Commitment</b>	<b>Component/Activity</b>
525	2.5.02.03	The Class 1E equipment, identified in Table 2.5.2-1, has electrical surge withstand capability (SWC), and can withstand the electromagnetic interference (EMI), radio frequency interference (RFI), and electrostatic discharge (ESD) conditions that would exist before, during, and following a design basis accident without loss of safety function for the time required to perform the safety function.	Reviewed the program policies and procedures, and testing results reports related to the Electromagnetic Compatibility Testing for the AP1000 Plant Protection and Safety Monitoring Equipment Qualification.  Opened Nonconformance 99900404/2015-204-02 for WEC's failure to provide an adequate similarity analysis to show that the Pentair cabinets were bounded by the EMC EQ qualification of the Corry cabinets.

<b>COL #</b>	<b>DCD#</b>	<b>Design Commitment</b>	<b>Component/Activity</b>
			Opened Nonconformance 99900404/2015-204-03 for WEC's failure to establish appropriate measures to assure services purchased through a subcontractor were adequately evaluated.
534	2.5.02.07a	The PMS provides process signals to the PLS through isolation devices.	Reviewed testing documentation for relay isolators with fused protection. Opened NON 99900404/2015-204-01 for failure to identify all credible failures and perform adequate testing of isolation devices.
535	2.5.02.07b	The PMS provides process signals to the DDS through isolation devices.	Reviewed Corrective Action documents to adopt IEEE 384-2008 for testing requirements for the use of fiber-optic cables.
538	2.5.02.07e	The PMS receives signals from non-safety equipment that provides interlocks for PMS test functions through isolation devices.	Reviewed testing documentation for relay isolators with fused protection. Opened NON 99900404/2015-204-01 for failure to identify all credible failures and perform adequate testing of isolation devices.
550	2.5.02.11	The PMS hardware and software are developed using a planned design process during hardware and software development phase, consisting of hardware and software design and implementation (subtask [c] of design commitment – system design and implementation)	Vogtle Unit 3 - Observed in-process channel integration testing of I/O. And reviewed policies and procedures related to testing.
550	2.5.02.11	The PMS hardware and software is developed using a planned design process which provides for specific design documentation and reviews during the following life cycle stages: (subtask [d] of design commitment – system integration and test phase)	Vogtle Unit 3 - reviewed policies and procedures and component test results related to BL8.0 component modifications.
551	2.5.02.12	The PMS software is designed,	Observed attributes and elements

COL #	DCD#	Design Commitment	Component/Activity
		<p>tested, installed, and maintained using a process which incorporates a graded approach according to the relative importance of the software to safety and specifies requirements for:</p> <ul style="list-style-type: none"> <li>a) Software management including documentation requirements, standards, review requirements, and procedures for problem reporting and corrective action.</li> <li>b) Software configuration management including historical records of software and control of software changes.</li> <li>c) Verification and validation including requirements for reviewer independence.</li> </ul>	<p>associated with implementation of the PMS SMP, software CMP, and software VVP. These attributes are observed and assessed for each inspection involving ITAACs 2.5.02.11 and 2.5.02.14.</p>



## 5. DOCUMENTS REVIEWED:

### Design Specifications, Plans, and Procedures

NA 4.44, "Engineering Drawing Creation and Change Process," Revision 7  
NA 4.38, "I&C Equipment Design/Equipment Qualification Process," Revision 2  
WEC 3.4.2, "Parts Change Evaluation," Revision 1

### Test Plans and Reports

APP-GW-GAP-420, "Engineering and Design Coordination Report," Revision 8, dated September 19, 2013  
APP-GW-G1-002, AP1000 Equipment Qualification Methodology, Revision 4, dated September 29, 2014  
APP-GW-E0-005, "AP1000 EMC Program," Revision 1  
APP-PMS-T1-502, "AP1000 Protection and Safety Monitoring System Equipment Qualification Unit Configuration and Test Specification," Revision 2  
APP-PMS-VPP-001, "Electromagnetic Compatibility Test Procedure for the AP1000 Plan Protection and Safety Monitoring System Equipment Qualification Cabinets," Revision 1  
APP-PMS-VPR-003, "AP1000 Plant Protection and Safety Monitoring System Electromagnetic Compatibility Qualification Report," Revision 1  
APP-PMS-VBR-003, "Equipment Qualification Summary Report for PMS Cabinets and NIS Auxiliary Panels for Use in the AP1000 Plant," Revision 2  
EQ-QR-126, "Standard Pentair Seismic Cabinet," Revision 0, dated February 12, 2012  
APP-PMS-VBR-002, "Equipment Qualification Data Package for PMS Cabinets and NIS Auxiliary Panels for Use in the AP1000 Plant," Revision 1, dated September 10, 2013  
APP-PMS-T1-503, "AP1000 Protection and Safety Monitoring System Nuclear Instrumentation System Mild Environment Equipment Qualification Unit Configuration and Test Specification," Revision 1  
APP-PMS-T5-001, "AP1000 Protection and Safety Monitoring System Test Plan," Revision 3, dated April 2013  
APP-PMS-T1P-018, "AP1000 Protection and Safety Monitoring System I/O Channel Accuracy Channel Integration Test Procedure," Revision 4, dated March 2015  
APP-PMS-T1D-018, "Protection and Safety Monitoring System I/O Channel Accuracy Channel Integration Test Data Sheets," Revision 4  
Nuclear Automation Issue Tracking System RITS 35397  
VS2-PMS-T1P-050, "V.C. Summer Unit 2 AP1000 PMS Channel Integration Regression Test Procedure," Revision 2, dated August 2014  
WEC 11.1, "Test Control," Revision 0.1  
WNA-WI-00427-GEN, "System Testing Pre-Job Brief Readiness Review Work Instruction," Revision 0, dated October 2013  
WNA-TP-03103, "Protection and Safety Monitoring System Equipment Qualification Test Monitoring Procedure," Revision 1, dated December 2012

## Miscellaneous Documents

Directive 2004/108/EC, dated December 15, 2004  
Directive 2006/95/EC, dated December 12, 2006  
Issue ID 100003183, "Licensing Basis Discrepancy," dated April 9, 2014  
Commercial Dedication Instruction (CDI) 4064, Keystone Compliance, LLC- EMC and Product Safety Test Services, Revision 4, dated August 24, 2013  
Commercial Dedication Instruction (CDI) 4064, Keystone Compliance, LLC- EMC and Product Safety Test Services, Revision 5, dated October 16, 2014  
Commercial Dedication Instruction (CDI) 4064, Keystone Compliance, LLC- EMC and Product Safety Test Facility, Revision 2, dated July 12, 2012  
1212-030E, Keystone Compliance-Standards Comparison Document, Revision 1, dated January 25, 2013  
LTR-EQ-13-35, Comparison of IEC 61000-4 Series Commercial Standards, dated March 15, 2013  
ECO-12-01246, Engineering Change Order Component Interface Module Hardware Procurement  
CAPAL Discrete Issue 100003940 "APP-PMS-T5-001 Non-Compliance with WEC 11.1," April 15, 2014  
CAPLAL 100151427, NA 4.38 EQ Checklist for AP1000 PMS  
Purchase Order 4500410624, Keystone Compliance

Inspection lot 003000345686, BCC DIV A Signal Cable, dated February 11, 2015  
Inspection lot 000000334028, HKP Wire no halogen 600V BLU 14 AWG, dated May 23, 2010  
Inspection lot 000000447634, component interface module, dated August 27, 2012  
Inspection lot 003000346472, phoenix contact, dated February 6, 2015  
Inspection lot 003000346574, receiver, fiber optic, dated February 13, 2015  
Nuclear Automation Issue Tracking System RITS 34637, 38805, 29800, 33347, 35397  
WEC 22.5, "Human Performance Program," Revision 2.0  
Human Performance Observation HPO 100170572

## Survey Reports

WES-2013-299-R, Supplier Commercial Grade Survey Report, dated December 5, 2013  
WES-2012-365-R, Supplier Commercial Grade Survey Report, dated January 24, 2013  
WES-2012-365-P, Westinghouse Commercial grade Survey Plan, dated November 9, 2012

## 6. ACRONYMS:

AC	Alternating Current
ADAMS	Agencywide Documents Access and Management System
AFS	Automation and Field Services
BL	Baseline
CAPAL	Corrective Action Program and Learning system
CDI	commercial grade dedication instruction
CFR	<i>Code of Federal Regulations</i>
CIT	channel integration testing
CMP	Software Configuration Management Plan
DAC	design acceptance criteria
DC	Direct Current
DCD	Design Control Document
DCIP	Division of Construction Inspection and Operational Programs
DI&C	Digital Instrumentation and Control
ECO	Engineering Change Orders
E&DCR	Engineering & Design Change Report
EMI	electromagnetic interference
ESD	electrostatic discharge
EQ	equipment qualification
EVIB	Electrical Vendor Inspection Branch
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input/Output
IP	inspection procedure
ITAAC	Inspections, tests, analyses, and acceptance criteria
IV&V	independent verification and validation
M&TE	measuring and test equipment
NA	Nuclear Automation
NON	Notice of Nonconformance
NRC	(U.S.) Nuclear Regulatory Commission
NRO	Office of New Reactors
PMS	Protection and Safety Monitoring System
PPO	Production Orders
QA	quality assurance
QC	quality control
QN	Quality Notifications
RFI	radio frequency interference
RG	Regulatory Guide
RITS	Replacement and Automation Services Issue Tracking System
SIT	system integration testing
SMP	Software Management Plan
SR	safety-related
SSC	Systems, Structures, and Components
U.S.	United States (of America)
VVP	Software Verification and Validation Plan
WEC	Westinghouse Electric Company