



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

March 13, 2019

Mr. Michael Corletti, Director
New Plant Technologies and Licensing
Cranberry Headquarters
1000 Westinghouse Drive
Cranberry Township, PA 16066

SUBJECT: NUCLEAR REGULATORY COMMISSION VENDOR INSPECTION REPORT OF
WESTINGHOUSE – NEW STANTON, NO. 99901043/2019-201

Dear Mr. Corletti:

On January 28 – February 1, 2019, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at Westinghouse's facilities in New Stanton, Pennsylvania. The purpose of this limited-scope routine inspection was to assess Westinghouse's compliance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," and selected portions of Appendix B, "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

This technically-focused inspection specifically evaluated Westinghouse's implementation of the quality activities associated with testing of safety-related components that comprise the uninterruptible power supply system for the AP1000 reactors currently under construction at Vogtle Units 3 and 4. This NRC inspection report does not constitute NRC endorsement of Westinghouse's overall quality assurance (QA) or 10 CFR Part 21 programs.

Based on the results of this inspection, the NRC inspection team found the implementation of your QA program met the requirements imposed on you by your customers or NRC licensees. No findings of significance were identified.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," the NRC will make available electronically for public

inspection a copy of this letter and its enclosure through the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System, which is accessible at <http://www.nrc.gov/reading-rm/adams.html>.

Sincerely,

/RA/

Kerri A. Kavanagh, Chief
Quality Assurance Vendor Inspection Branches 1 and 2
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Docket No.: 99901043

EPID No.: I-2019-201-0026

Enclosure:
Inspection Report No. 99901043/2019-201
and Attachment

SUBJECT: NUCLEAR REGULATORY COMMISSION VENDOR INSPECTION REPORT OF
WESTINGHOUSE – NEW STANTON, NO. 99901043/2019-201 Dated: 03/13/19

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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.: 99901034

Report No.: 99901034/2019-201

Vendor: Westinghouse – New Stanton
1000 Westinghouse Drive
New Stanton, PA 15672

Vendor Contact: Gregory T. Glenn, Licensing Principal Engineer
Licensing Inspections and Special Programs
Westinghouse Electric Company LLC
1000 Cranberry Woods Drive
Cranberry Township, PA 16066

Phone: (412) 374-6974

Email: glenngt@westinghouse.com

Nuclear Industry Activity: Westinghouse – New Stanton performs electromagnetic interference (EMI), radio frequency interference (RFI), and emissions testing of safety-related electrical equipment.

Inspection Dates: January 28 through February 1, 2019

Inspectors: Jeffrey Jacobson NRO/DCIP/QVIB-1 Team Leader
Aaron Armstrong NRO/DCIP/QVIB-1
Nicholas Savvoir NRO/DCIP/QVIB-1
Guillermo Crespo R-II/DCO/CIB2

Approved by: Kerri A. Kavanagh, Chief
Quality Assurance Vendor Inspection Branches 1 and 2
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Enclosure

EXECUTIVE SUMMARY

Westinghouse – New Stanton
99901034/2019-201

The U.S. Nuclear Regulatory Commission (NRC) staff conducted a vendor inspection at the Westinghouse facility located in New Stanton, PA, to verify that it had implemented an adequate quality assurance (QA) 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, “Domestic Licensing of Production and Utilization Facilities” and 10 CFR Part 21, “Reporting of Defects and Noncompliance.”

Translation of Technical Requirements

The NRC inspection team reviewed Westinghouse’s translation of the testing requirements for the electromagnetic interference (EMI), radio frequency interference (RFI), and emissions testing of the Gutor safety-related uninterruptible power supplies (UPSs) being supplied to the AP1000 units under construction at the Vogtle site. The inspection team verified that the technical requirements contained within the purchase specification were being properly translated into electromagnetic compatibility (EMC) Qualification Testing Procedures.

Adequacy of Testing Scope

The NRC inspection team reviewed the overall scope of the EMC testing program as imposed upon Westinghouse through the Gutor contract documents for the equipment under test (EUT). In particular, the inspection team assessed whether the testing program scope was sufficient to ensure adequate power quality from the output of the UPS system. This was of specific focus for the team since NRC Regulatory Guide (RG) 1.180 (the RG being used to perform the testing) was primarily written for testing of instrumentation and control equipment, as opposed to power generating equipment such as the Gutor UPS equipment.

During the inspection, Westinghouse provided the team with data taken from factory acceptance testing of the inverters at Gutor, as well as additional information provided subsequent to the inspection that clarified the acceptability of the UPS system outputs with regard to the downstream power quality requirements of the connected equipment. This additional information addressed both low and high frequency conducted emissions from the inverters. Based upon the information provided both during and subsequent to the inspection, the inspection team determined that the overall scope of the EMC testing program was adequate to ensure the proper operation and compatibility (from an EMC perspective) of the Gutor UPS equipment with interfacing equipment.

Test Control

The NRC inspection team reviewed Westinghouse’s policies and implementing procedures that govern the implementation of its testing activities to determine compliance with the regulatory requirements in Criterion XI, “Test Control,” of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed a sample of job orders and laboratory procedures to verify that the applicable customer specifications were translated correctly into job orders, procedures and work instructions for the EUT. Only conducted emissions testing was scheduled to be performed during the week of the inspection. No findings of significance were identified.

Control of Measuring and Test Equipment

The NRC inspection team reviewed Westinghouse's policies and implementing procedures that govern the implementation of its measuring and test equipment (M&TE) program to determine compliance with the requirements of Criterion XII, "Control of Measuring and Test Equipment," of Appendix B to 10 CFR Part 50. The NRC inspection team observed that the M&TE had the appropriate calibration stickers and current calibration dates, including the calibration due date. The NRC inspection team verified calibrated M&TE in the Westinghouse facility and reviewed the procurement methods used by Westinghouse for calibration and testing services for equipment used for the AP1000 battery charger, inverter and rectifying transformer. No findings of significance were identified.

REPORT DETAILS

1. Design Control

a. Inspection Scope

The NRC inspection team reviewed Westinghouse's policies and implementing procedures that govern the Design Control program to determine compliance with the requirements of Criterion III, "Design Control" of Appendix B to 10 CFR Part 50. The NRC inspection team also discussed the Design Control program with Westinghouse management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

Translation of Technical Requirements

The inspection team reviewed Westinghouse's translation of the testing requirements specified by Gutor (the equipment manufacturer) for the EMI, RFI, and emissions testing of the Gutor safety-related UPSs being supplied to the AP1000 units under construction at the Vogtle site into the applicable test procedure, "EMC Qualification Test Procedure for the Battery Charger (DC01), Inverter (DU01), and Regulating Transformer (DT01)" (EQ-TP-457-APP)." The inspection team also reviewed associated purchase orders and purchase order revisions from Gutor to Westinghouse for the testing. As stated in the AP1000 Design Control Document DCD, paragraph 3D.4.1.2, "The AP1000 equipment qualification program employs methods consistent with the recommendations of RG 1.180, where applicable." Conformance with RG 1.180 is also listed in Table 1.9-1 of the DCD. The team reviewed the Westinghouse developed test plans to ensure they met the requirements contained within RG 1.180 and the associated equipment design specifications. RG 1.180, endorses (with some exceptions) the detailed testing requirements contained in MIL-STD-416E for the EMC testing.

Among the tests required by MIL-STD-416E are requirements for testing power lead conducted emissions (CE) at both low and high frequencies from 30 Hz to 2 MHz; electromagnetic radiated emissions (RE) from 30 Hz to 100 kHz; and magnetic and electric field emissions from 2 MHz to 1 GHz. Conducted emission levels are determined by measuring the current present on each input power lead and ensuring that equipment connected to the power bus does not corrupt power quality (i.e., introduce distortions in the voltage waveforms). In preparing for the inspection, the inspection team also reviewed the technical basis for the electromagnetic operating envelope, military and international standards guidance comparisons, and information associated with conducted susceptibility along interconnecting signal lines presented in NUREG/CR-6431, NUREG/CR-5609, and NUREG/CR-6782. The inspection team also reviewed the basis for the allowance certain exemptions contained in CE 101 and CE 102 for meeting specified emissions limits. The inspection team noted that while RG 1.180 endorses MIL-STD-416E as a means of demonstrating EMC qualification requirements, the guidance also cautions that the application context be properly understood and does not preclude supplemental testing from being performed as necessary.

The NRC inspection team reviewed, Westinghouse's translation of the EMC Qualification Test Procedure technical requirements into work instruction guidelines (EQ-WI-CE101-EMC, EQ-WI-CE102-EMC, EQ-WI-RE101-EMC, EQ-WI-RE102-EMC). The inspection team

reviewed calibration technical requirements, applicable emissions testing frequency ranges, limits, bandwidth and time measurements for frequency sweeps. Requirements also included calculations of signal generator drive level, target limits, logarithmic equations, and correction factors. The NRC inspection team also interacted with the Westinghouse product engineering group to review the implementation of Westinghouse's receipt inspection requirements for the equipment under test, including functional tests. The inspection team reviewed deviations, anomalies, and any modifications to the test instructions to ensure that they were appropriately evaluated and dispositioned.

Adequacy of Testing Scope

The NRC inspection team reviewed the overall scope of the EMC testing program as imposed upon Westinghouse through the Gutor contract documents. In particular, the inspection team assessed whether the testing program scope was sufficient to ensure adequate power quality from the output of the UPS system. The inspection team determined that the guidance contained in RG 1.180 was primarily written for testing of instrumentation and control equipment. While portions of the RG appear appropriate for testing power generating equipment such as the Gutor UPS equipment, some additional analysis and/or testing to account for the actual safety functions of the equipment under test would also be required to account for safety functions not covered by the RG, particularly with regard to emissions testing. Specifically, RG 1.180 is written primarily for performing emissions testing on equipment that acts as a load on the electrical system. In contrast, the safety function of the UPS system under test at Westinghouse actually serves as a power source. This distinction becomes significant when looking at the RG requirements for emissions testing, as the referenced standards only provide guidance for testing of the power inputs to the equipment under test. The referenced standards do not address testing of the power outputs of the equipment under test, for example, the output from the inverter which supplies safety-related electrical power to the alternating current (AC) safety buses.

The team raised this issue with Westinghouse during the inspection and asked whether there was any other testing or analyses that had been performed (or was planned) to address the power quality of the UPS system inverter outputs. Specifically, whether the design specification required that testing or analyses be performed to verify that any noise generated by the UPS system itself would be below the tested susceptibility limits of the connected downstream safety-related equipment (such as the protection and safety monitoring system (PMS)).

During the inspection, Westinghouse provided the team with data taken from factory acceptance testing of the inverters at Gutor. This testing confirmed that the total harmonic distortion (THD) of the inverter output was below the Westinghouse Design Specification requirements of 5% THD or 3% distortion for a single harmonic. The measurements were taken at full load and showed a THD of no greater than .8% for the one data sheet reviewed. Subsequent to the inspection, Westinghouse provided additional information that further clarified the acceptability of the UPS system outputs with regard to the downstream power quality requirements of the connected equipment. This additional information addressed both low and high frequency conducted emissions from the inverters.

The inspection team also reviewed the Westinghouse testing procedures to be used for performing the susceptibility tests, including the associated work instructions which were

based on IEC 61000 Series and MIL-STD-461E standards endorsed by RG 1.180. These work instructions cover:

- susceptibility of equipment to static electricity discharges
- immunity of equipment to radiated electric fields in the radio frequency range
- performance of equipment subjected to repetitive fast transient (bursts) on supply, signal and control ports
- performance of equipment when subjected to high-energy disturbances on the power and interconnection lines
- performance of equipment when subjected to magnetic fields at power frequency, pulse magnetic fields, and damped oscillatory magnetic fields
- performance of equipment when subjected to non-repetitive damped oscillatory transients (ring wave) occurring in low-voltage power, control and signal lines
- performance of electrical and electronic equipment with the application of common mode disturbances to power supply, control, signal, and communication ports.

The review of these instructions was conducted to verify that the scope of testing was adequate to address the effects of EMI/RFI and power surges on the safety-related battery chargers, regulating transformers and inverters.

b. Findings and Observation

No findings of significance were identified in regard to Westinghouse's translation of the emissions testing technical requirements.

c. Conclusions

The inspection team verified technical requirements contained within the purchase specification were being properly translated into EMC Qualification Testing Procedures. The inspection team also determined that the overall scope of the EMC testing program was adequate to ensure the proper operation and compatibility (from an EMC perspective) of the Gutor UPS equipment with interfacing equipment. No findings of significance were identified.

2. Test Control

a. Inspection Scope

The NRC inspection team reviewed Westinghouse's policies and implementing procedures that govern its testing activities to determine compliance with the regulatory requirements in Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50. The NRC inspection team also discussed the test control program with Westinghouse management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

Conducted and Radiated Emissions test review and setup

The NRC inspection team reviewed the physical test setup for conducting tests under Westinghouse's EQ-WI-CE101-EMC work instruction. The work instruction provides guidance on the measurement of low frequency conducted emissions testing and

establishes the basis for testing electrical equipment to verify that electric field emissions from the equipment under test that do not exceed specified requirements. This work instruction incorporated the essential details of the CE101 conducted emissions testing contained within MIL-STD-461E. The inspection team verified that the Westinghouse test engineer had MIL-STD-461E readily available when performing the work. The inspection team also verified that the work instruction was appropriate for measuring the electric field emissions from the EUT's power input leads, ensuring compliance with the specified requirements suggested by the RG 1.180.

The NRC inspection team also reviewed the test setup of Westinghouse's EQ-WI-CE102-EMC work instruction that performs the high frequency conducted emissions testing per MIL-STD-461E, CE102. The work instruction established the basis for testing electrical equipment to verify that electromagnetic emissions from the EUT meet the specified requirements of RG 1.180. The CE102 portion of Work Instruction EQ-WI-CE102-EMC tests the high-frequency conducted emissions for the frequency range of 10 kHz to 10 MHz to ensure the amount of conducted interference on power leads and returns are limited. The test is applicable to both AC and DC power leads of the EUT.

In addition, the NRC inspection team reviewed Work Instruction EQ-WI-RE101-EMC for performing magnetic field radiated emissions testing per MIL-STD-461E, RE101. This work instruction establishes the basis for testing electrical equipment to verify that magnetic-field radiated emissions do not exceed the specified requirements of RG 1.180. RE101 tests the radiated magnetic fields and covers the frequency range of 30 Hz to 100 kHz. The NRC inspection team also reviewed Work Instruction EQ-WI-RE102-EMC for performing electric field radiated emissions testing per MIL-STD-461E, RE102. This work instruction established the basis for testing electrical equipment for radiated electric fields that covers the frequency range of 2 MHz to 10 GHz. RE102 is applicable to equipment and subsystem enclosures, as well as all interconnecting leads. RE102 demonstrate that electric field emissions from the equipment under test do not exceed the specified requirements in RG 1.180.

b. Findings and Observation

No findings of significance were identified.

c. Conclusions

The inspection team verified test control and work instructions requirements were being properly controlled for EMC Qualification work. No findings of significance were identified.

3. Control of Measuring and Test Equipment

a. Inspection Scope

The NRC inspection team reviewed Westinghouse's policies and implementing procedures that govern the M&TE program to determine compliance with the requirements of Criterion XII, "Control of Measuring and Test Equipment," of Appendix B to 10 CFR Part 50. The NRC inspection team also discussed the M&TE program with Westinghouse management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

For a sample of M&TE selected, the NRC inspection team observed that the M&TE had the appropriate calibration stickers and current calibration dates, including the calibration due date. The NRC inspection team also observed that the M&TE had been calibrated, adjusted, and maintained at prescribed intervals prior to use. In addition, the calibration records reviewed by the NRC inspection team indicated the as-found and as-left conditions, accuracy required, calibration results, calibration dates, and the due dates for recalibration. Furthermore, the NRC inspection team also verified that when M&TE equipment is found to be out of calibration, Westinghouse generates an out-of-tolerance report and initiates an investigation to identify items that have been accepted using this equipment since the last valid calibration date and to perform an extent of condition review.

The NRC inspection team performed a walk-down of Westinghouse's testing laboratory to observe that M&TE were labeled, handled, and stored in a manner that indicated the calibration status of the instrument and ensured its traceability to calibration test data. The NRC inspection team observed the calibration of a M&TE for EMC/EMI testing equipment and confirmed that the M&TE and program for the test equipment was performed in accordance with Westinghouse's applicable procedures.

The NRC inspection team discussed the M&TE program with Westinghouse's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that Westinghouse is implementing its M&TE program in accordance with the regulatory requirements of Criterion XII of Appendix B to 10 CFR Part 50. No findings of significance were identified.

4. Entrance and Exit Meetings

On January 28, 2019, the NRC inspection team discussed the scope of the inspection with Ms. Jill Monahan, Manager, Licensing and other members of Westinghouse's management and technical staff. On February 1, 2019, the NRC inspection team presented the inspection results and observations during an exit meeting with Mr. Gary Brassart, Vice President, Instrumentation and Controls and other members of Westinghouse's management and technical staff. The attachment to this report lists the attendees of the entrance and exit meetings, as well as those individuals whom the NRC inspection team interviewed.

ATTACHMENT

1. Entrance/Exit Meeting Attendees

| Name | Title | Affiliation | Entrance | Exit |
|------------------|--|--------------|----------|------|
| Jeffrey Jacobson | Inspection Team Leader | NRC | X | X |
| Aaron Armstrong | Inspector | NRC | X | X |
| Nicholas Savvoir | Inspector | NRC | X | X |
| Guillermo Crespo | Inspector | NRC | X | X |
| Gary Brassart | Vice President, Instrumentation and Controls | Westinghouse | | X |
| Greg Glenn | Licensing Engineer | Westinghouse | X | X |
| Brian Schleger | Licensing Engineer | Westinghouse | X | X |
| Mark Demaglio | Principal Electrical Engineer | Westinghouse | X | X |
| Jill Monahan | Licensing Manager | Westinghouse | X | X |
| Lyn Little | Quality Manager | Westinghouse | X | X |
| Dave Matteo | QO Manager | Westinghouse | X | X |
| Quang Nguyen | Director, Nuclear Systems Products and EQ | Westinghouse | X | X |
| Keegan Foster | Electrical Engineer | Westinghouse | X | |
| Jennifer Moon | Principal Engineer, Qualifications | Westinghouse | X | X |
| Louis Jesso | Principal Engineer, Qualifications | Westinghouse | X | X |
| Curt Castell | Vogtle Site Representative | Westinghouse | X | X |

| | | | | |
|---------------|-----------------------|--------------|---|---|
| Pavel Trypak | Quality Assurance | Westinghouse | X | X |
| Steve Packard | Quality Assurance | Westinghouse | X | X |
| Lisa Manning | Quality Assurance | Westinghouse | X | |
| John Fisher | Gutor Project Manager | Westinghouse | X | X |

2. INSPECTION PROCEDURES USED

- Inspection Procedure (IP) 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012.
- IP 43002, "Routine Inspections of Nuclear Vendors," dated January 27, 2017

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

None.

4. DOCUMENTS REVIEWED

Drawings:

APP-1222-CE-001, Rev. 1 Auxiliary Building Area 2 Division A Electrical Cabinets anchor bolt locations Room 12201-Plan at 82'-6". IDS equipment plant locations

APP-1222-CE-002, Rev. 2 Auxiliary Building Area 1 Division D Electrical Cabinets anchor bolt locations Room 12205-Plan at 82'-6". IDS equipment plant locations

APP-1222-CE-003, Rev. 2 Auxiliary Building Area 2 Division C Electrical Cabinets anchor bolt locations Room 12203-Plan at 82'-6". IDS equipment plant locations

APP-1222-CE-004, Rev. 2 Auxiliary Building Area 2 Division C Electrical Cabinets anchor bolt locations Room 12207-Plan at 82'-6". IDS equipment plant locations

APP-1212-CE-007, Rev. 6 Auxiliary Building Area 2 Electrical Cabinets anchor bolt locations Room 12113-Plan at 66'-6". IDS equipment plant locations

Procedures:

APP-GW-G1-002, Revision 5, October 21, 2016, "AP1000 Equipment Qualification Methodology"

EQ-TP-457-APP/APP-IDS-VPP-001 AP1000 Revision 0, December 2018 "Electromagnetic Compatibility (EMC) Qualification Test Procedure for the Battery Charger (DC01), Inverter (DU01), and Regulating Transformer (DT01)"

W2-9.8-100, "Control of Inspection, Measuring, & Test Equipment," Revision 1, dated December 13, 2016

EQ-WI-CE101-EMC, "Guidelines for Performing Low Frequency Conducted Emissions Measurements in Accordance with MIL-STD-461E, CE101," Revision 1, dated January 2019

EQ-WI-CE102-EMC, "Guidelines for Performing High Frequency Conducted Emissions Measurements in Accordance with MIL-STD-461E, CE102," Revision 1, dated January 2019

EQ-WI-RE101-EMC, "Guidelines for Performing Magnetic Field Radiated Emissions Measurements in Accordance with MIL-STD-461E, RE101," Revision 0, dated June 2018

EQ-WI-RE102-EMC, "Guidelines for Performing Electric Field Radiated Emissions Measurements in Accordance with MIL-STD-461E, RE102," Revision 0, dated November 2018

EQ-TP-457-APP, Rev. 0 (APP-IDS-VPP-001, Rev. 0) –EMC Qualification Test Procedure for Battery Charger (DC01), Inverter (DU01), and Regulating Transformer (DT01).

EQ-WI-002-EMC, Rev. 0 Guidelines for Performing Electrostatic Discharge (ESD) Testing in Accordance with IEC 61000-4-2, dated: February 2016 (not a requirement of U.S. NRC Regulatory Guide (RG) 1.180).

EQ-WI-003-EMC, Rev. 0 Guidelines for Performing Radiated Susceptibility Testing in Accordance with IEC 61000-4-3, dated: August 2018.

EQ-WI-004-EMC, Rev. 0 Guidelines for Performing Electrical Fast Transient Testing in Accordance with IEC 61000-4-4, dated: July 2018.

EQ-WI-005-EMC, Rev. 0 Guidelines for Performing Surge Immunity Testing in Accordance with IEC 61000-4-5, dated: July 2018.

EQ-WI-006-EMC, Rev. 0 Guidelines for Performing High Frequency Conducted Susceptibility Testing in Accordance with IEC 61000-4-6, dated: January 2019.

EQ-WI-008-EMC, Rev. 0 Guidelines for Performing Power Frequency Magnetic Field Immunity Testing in Accordance with IEC 61000-4-8, dated: January 2016.

EQ-WI-009-EMC, Rev. 0 Guidelines for Performing Pulse Magnetic Field Immunity Testing in Accordance with IEC 61000-4-9, dated: January 2016.

EQ-WI-010-EMC, Rev. 0 Guidelines for Performing Damped Oscillatory Magnetic Field Immunity Testing in Accordance with IEC 61000-4-10, dated: January 2016.

EQ-WI-012-EMC, Rev. 0 Guidelines for Performing Ring Wave Immunity Testing in Accordance with IEC 61000-4-12, dated: July 2018

EQ-WI-013-EMC, Rev. 0 Guidelines for Performing Immunity to Harmonics and Inter-harmonics in Accordance with IEC 61000-4-13, dated: February 2016.

EQ-WI-016-EMC, Rev. 0 Guidelines for Performing Immunity Testing to Conducted, Common Mode Disturbances in Accordance with IEC 61000-4-16, dated: January 2019

Test Deviation Forms:

IDS-001 dated January 22, 2019
IDS-002 dated January 26, 2019
IDS-003 dated January 27, 2019
IDS-004 dated January 28, 2019
IDS-005 dated January 29, 2019
IDS-006 dated January 29, 2019
IDS-007 dated January 29, 2019
IDS-008 dated January 31, 2019
IDS-009 dated January 31, 2019

Misc.

LTR-EQ-18-1, "2018 EMC Equipment Calibration Documentation," Revision 3, dated January 16, 2019

LTR-EQ-19-1, "2019 EMC Equipment Calibration Documentation." Revision 1, dated January 16, 2019

Calibration 800920, Amplifier Research Attenuator, dated December 20, 2017

Calibration 800927, Horn (large), dated November 26, 2018

Calibration 40000950, Agilent Technologies Function Generator, December 20, 2017

Project Letters: WEC_GUT_000010 WEC_GUT_000011

PO 4500442610, February 21, 2012 (Westinghouse Cranberry to Gutor)

PO 4500096766, October 11, 2018 (Gutor to Westinghouse New Stanton)

MIL-STD-416E, August 20, 1999 "Department of Defense Interface Standard Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment"

RG 1.180, Revision 1, October 2003, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems"

Procurement Change IR-2019-641

Curtiss-Wright 4500426010-105-A EMC Test Requirements Outline for Gutor Electronic PLC Battery Charger, Inverter and Bypass Stabilizer Transformer, Test Procedure No. Q1216.4 Revision 1, April 26, 2017

APP-DC01-Z0-001_R9 - Design Specification for Class 1E 250 VDC Battery Chargers for System IDS

APP-DT01-Z0-010_R8 - Design Specification for Class 1E Regulating Transformers

APP-DU01-Z0-001_R7 - Design Specification for Class 1E Inverters, Static Transfer and Manual Bypass Switches for IDS system

APP-GW-GAH-030 R9 - Quality Assurance Requirements for Safety Related Components/Services of Standard AP1000 Plants

ML11171A500 June 21, 2011 Revision 19, "Westinghouse AP1000 Design Control Document"

NUREG/CR-6782, August 2003, "Comparison of U.S. Military and International Electromagnetic Compatibility Guidance (NUREG/CR-6782, ORNL/TM-2001/140)"

NUREG/CR-5609, August 2003, "Electromagnetic Compatibility Testing for Conducted Susceptibility Along Interconnecting Signal Lines (NUREG/CR-5609, ORNL/TM-13705), August 2003

NUREG/CR-6431, January 2000, "Recommended Electromagnetic Operating Envelopes for Safety-Related I&C Systems in Nuclear Power Plants (NUREG/CR-6431)"

Gutor Test Report #1120086301, dated 12/7/2018.

Gutor Test Data Sheet for Inverter Load Test, Document # 4A-11200086301/39GB, for inverter serial #1120086301.

5. ACRONYMS AND ABBREVIATIONS

| | |
|--------|---|
| CE | Conducted Emissions |
| CFR | Code of Federal Regulations |
| DC | Direct Current |
| EMC | Electromagnetic Compatibility |
| EMI | Electro Magnetic Interference |
| EUT | Equipment Under Test |
| IDS | Class 1E DC and UPS System |
| IEC | International Electrotechnical Commission |
| LISN | Line Impedance Stabilization Network |
| PMS | Protection and Monitoring System |
| M&TE | Measuring and Test Equipment |
| NRC | U.S. Nuclear Regulatory Commission |
| PO | Purchase Order |
| QA | Quality Assurance |
| QAP | Quality Assurance Procedure |
| RE-101 | Radiated Emissions, Magnetic Field |
| RE-102 | Radiated Emissions, Electric Field |
| RF | Radio Frequency |
| RFI | Radio Frequency Interference |
| RG | Regulatory Guide |
| SWC | Surge Withstand Capability |
| THD | Total Harmonic Distortion |
| UPS | Uninterruptible Power Supply |