

May 18, 2012

Mr. Paul Russ, Director
AP1000 Licensing Programs
CWHQ-1 512B
Westinghouse Electric Company
1000 Westinghouse Dr.
Cranberry Township, PA 16066

SUBJECT: NRC INSPECTION REPORT NO. 99901043/2012-201 AND NOTICE OF
NONCONFORMANCE

Dear Mr. Russ:

From April 9 to April 13, 2012, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at the Westinghouse Electric Company (WEC) facility in New Stanton, PA. The purpose of the technically-focused, 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." Additionally, the inspection assessed conformance to Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," Revision 1, issued October 2003, as committed to in the AP1000 Design Control Document, Tier 2, Revision 19.

This technically-focused inspection specifically evaluated Westinghouse's implementation of quality activities associated with Electromagnetic Interference (EMI)/Radio-Frequency Interference (RFI) testing and the procurement of associated testing services for the AP1000 Diverse Actuation System (DAS). The enclosed report presents the results of the inspection. This NRC inspection report does not constitute NRC endorsement of your overall quality assurance (QA) program.

During this inspection, NRC inspectors found that implementation of your QA program failed to meet certain NRC requirements contractually imposed on you by your customers or NRC licensees. Specifically, the inspection team determined that Westinghouse was not implementing aspects of its procurement, supplier control, and testing control programs consistent with regulatory requirements. These nonconformances are cited in the enclosed notice of nonconformance (NON). The enclosed inspection report describes the circumstances surrounding these nonconformances in detail. Even though the NRC inspection did not identify issues in all areas reviewed, the number of deficiencies identified is not indicative of a fully effective QA program. In the response to the enclosed NON, Westinghouse should document the results of the extent of condition and determine if there are any effects on other AP1000 components and testing activities.

Some of the issues identified by the NRC inspection team are inspections, tests, analyses, and acceptance criteria (ITAAC) related, and as such, without appropriate resolution, may impact the ability to demonstrate the ITAAC has been met.

Please provide a written explanation or statement within 30 days of this letter in accordance with the instructions specified in the enclosed 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` accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/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 Branch
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Docket No.: 99901043

Enclosures:

1. Notice of Nonconformance
2. Inspection Report 99901043/2012-201

Some of the issues identified by the NRC inspection team are inspections, tests, analyses, and acceptance criteria (ITAAC) related, and as such, without appropriate resolution, may impact the ability to demonstrate the ITAAC has been met.

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

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NOTICE OF NONCONFORMANCE

Westinghouse Electric Company
1000 Westinghouse Dr.
New Stanton, PA 15672

Docket Number 99901043
Inspection Report No. 99901043/2012-201

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted April 9–13, 2012, of activities performed at the Westinghouse Electric Company (Westinghouse) facility in New Stanton, PA, it appears that certain activities were not conducted in accordance with NRC requirements that are contractually imposed upon Westinghouse by your customers or by NRC licensees.

- A. Criterion IV, "Procurement Document Control," 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," states, in part, that "measures shall be established to assure that applicable regulatory requirements, design bases, and other requirements which are necessary to assure adequate quality are suitably included or referenced in the documents for procurement of material, equipment, and services."

WEC 7.5, "Control of Purchased Items and Services," Revision 3, Section 6.2.3, requires that appropriate quality requirements, including applicable qualified suppliers list requirements, be included or specified in procurement packages.

Contrary to the above, as of April 13, 2012, Westinghouse failed to include required commercial-grade survey-specified quality restrictions in multiple purchase orders (POs) for Washington Laboratory, Ltd. (WLL) testing services as required by WEC 7.5. Specifically, Westinghouse failed to include the purchase requirement that WLL use the quality assurance (QA) program audited and approved by Westinghouse and notify Westinghouse of any changes to the WLL QA program in PO Nos. 4500423116, 4500428675, and 4500423138.

This issue has been identified as Nonconformance 99901043/2012-201-01.

- 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.
 - 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.
 - Design changes, including field changes, shall be subject to design control measures commensurate with those applied to the original design and be approved by the organization that performed the original design, unless the applicant designates another responsible organization.

WEC 7.3, "Commercial Grade Surveys," Revision 1, Section 7.1.2.1, states, "for each critical characteristic identified, team members shall evaluate the supplier's controls through observation of work activities, review of acceptance criteria, interviews of supplier personnel, verification that procedures and instructions are in place that define the controls."

Section 7.2 also states, "A commercial grade survey shall be performed by quality personnel, supplemented by Engineering, Supply Management and/or other participants as necessary to conduct an effective evaluation."

Additionally, Section 7.4 states, "Commercial Grade Surveys shall be conducted at least triennially, and the supplier's performance shall be evaluated annually, in accordance with WEC 7.1."

Westinghouse Commercial Dedication Instruction (CDI)-3865, "Commercial Grade Dedication," Revision 1, Section E.2, specifies acceptance criteria for critical characteristic "Personal Qualification," which states, in part, "test lab personnel training to perform EMC [electromagnetic compatibility] testing to applicable military standards (MIL) and commercial standards shall be documented periodically. Test lab personnel training to use calibrated test equipment shall be documented periodically." Additionally, the acceptance criteria for critical characteristic "Performance Test" states, in part, "WLL test procedures are compliant with applicable and military standards for setup and testing [International Electrotechnical Commission] IEC 61000-4-2." Furthermore, the acceptance criteria for critical characteristic "Quality System" states, in part, "WLL ACLASS certificate for electrical testing will be evaluated as a recurring activity."

Contrary to the above, as of April 13, 2012:

- Westinghouse failed to conduct an effective technical evaluation of commercial grade survey WES2011-121, Revision 1. Specifically, Westinghouse did not designate a technical specialist to evaluate technical issues that affect critical characteristics. As a result, two examples were identified in which verification of critical characteristics was deficient according to acceptance criteria designated in CDI-3865. Specifically:
 - Westinghouse failed to properly verify the critical characteristic "Performance Test" by not ensuring that WLL test procedures were compliant with applicable military standards. Specifically, WLL procedure ETP01398 was not in compliance with standards.
 - Westinghouse failed to properly verify critical characteristic "Test Report" through special inspection. Specifically, EMC Test Report #WILL 12274-01 was found to be missing design data requirements specified in EMC standard IEC 61000-4-3, including operating conditions of equipment under test (EUT), rate of sweep of frequency, dwell time, and frequency steps.
- Westinghouse failed to provide adequate documentation for periodic evaluation of WLL's ACLASS certificate for electrical testing.
- Westinghouse failed to properly verify critical characteristic "Personal Qualification" through commercial-grade survey WES-2011-121, which ensured

that implementation of required training of personnel at WLL was acceptable. Specifically, WLL personnel performing tests onsite were not adequately qualified and trained under applicable testing procedures.

These issues have been identified as Nonconformance 99901043/2012-201-02.

- C. AP1000 Design Control Document, Tier 2, Revision 19, has a commitment to conform to Regulatory Guide (RG) 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control [I&C] Systems," Revision 1, issued October 2003.

RG 1.180 states, in part, that "Criterion III, 'Design Control,' Criterion XI, 'Test Control,' and Criterion XVII, 'Quality Assurance Records,' of Appendix B, 'Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,' to 10 CFR Part 50 establish practices to confirm that a design fulfills its technical requirements." In addition, RG 1.180 states, in part, "The practices endorsed in this regulatory guide apply to both safety-related I&C systems and non-safety-related I&C systems whose failures can affect safety functions."

Criterion XI, "Test Control," states, in part, "Test results shall be documented and evaluated to assure that test requirements have been satisfied."

Contrary to the above, as of April 13, 2012, Westinghouse failed to document and evaluate a test anomaly to ensure that the design test configuration requirements were being met for the diverse actuation system. Specifically, Westinghouse failed to record in the test log that the test configuration was modified to satisfy the testing acceptance criteria. Additionally, there was no documented evidence detailing how the test configuration was modified and evaluated to ensure that the original design requirements were still being met.

This issue has been identified as Nonconformance 99901043/2012-201-03.

- D. AP1000 Design Control Document, Tier 2, Revision 19, has a commitment to conform to RG 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," Revision 1, issued October 2003.

RG 1.180 states in part that, "Criterion III, 'Design Control,' Criterion XI, 'Test Control,' and Criterion XVII, 'Quality Assurance Records,' of Appendix B, 'Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,' to 10 CFR Part 50 establish practices to confirm that a design fulfills its technical requirements." In addition, RG 1.180 states, in part, "The practices endorsed in this regulatory guide apply to both safety-related I&C systems and non-safety-related I&C systems whose failures can affect safety functions."

Criterion XI, "Test Control," states, in part, "A test program shall be established to assure that all testing required to demonstrate that structures, systems and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents."

Contrary to the above, as of April 13, 2012, Westinghouse failed to ensure that the requirements of RG 1.180 were met during testing. Specifically, Westinghouse failed to: perform a separate analysis of the sensitive frequencies, document and ensure that the EUT was tested within its operating and climate conditions, and ensure that the cabling requirements specified for calibration were captured in the calibration procedure as required by International Electrotechnical Commission (IEC) 61000-4-3 as referenced in RG 1.180.

This issue has been identified as Nonconformance 99901043/2012-201-04.

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 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 noncompliances; 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 document system, 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 withholding of such material, 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 18th day of May 2012.

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

Docket No.: 99901043

Report No.: 99901043/2012-201

Vendor: Westinghouse Electric Company
1000 Westinghouse Dr.
New Stanton, PA 15672

Vendor Contact: Mr. Ronald Wessel
Principal Engineer, AP1000 COL Licensing Support
Phone: 412-374-4023
wesselrp@westinghouse.com

Background: The Westinghouse Electric Company–New Stanton facility provides engineering and testing services, including environmental testing, for the AP1000 pressurized-water reactor design.

Inspection Dates: April 9–13, 2012

Inspection Team Leader: George Lipscomb, NRO/DCIP/CEVB

Inspectors: Aaron Armstrong, NRO/DCIP/CMVB
Shavon Edmonds, NRO/DCIP/CEVB
Eugene Huang, NRO/DCIP/CEVB
Denise Terry-Ward, RG-II/DCI/CIB1

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

EXECUTIVE SUMMARY

Westinghouse Electric Company
99901043/2012-201

The U.S. Nuclear Regulatory Commission (NRC) conducted this vendor inspection to verify aspects of Westinghouse Electric Company's (Westinghouse) implementation of their quality assurance (QA) program required by 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." The inspection team also assessed activities performed by Westinghouse to meet the AP1000 certified design commitment to Regulatory Guide (RG) 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," Revision 1, issued October 2003, and its referenced standards, military standard (MIL-STD)-461E, "Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment," and the International Electrotechnical Commission (IEC) 61000 series for equipment electromagnetic emissions and susceptibility.

This technically focused inspection specifically evaluated Westinghouse's implementation of quality activities associated with electromagnetic interference/radio frequency interference (EMI/RFI) qualification testing of Westinghouse AP1000 diverse actuation system (DAS) and the procurement of associated testing services from subcontractor Washington Laboratories, Ltd. (WLL). The DAS is a nonsafety-related system that initiates a reactor trip, actuates selected functions, provides plant information to the operator, and is associated with inspection, test, analysis, and acceptance criteria (ITAAC) No. 2.5.01.03d. This inspection was conducted at Westinghouse's testing facility in New Stanton, PA.

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

- Appendix B to 10 CFR Part 50
- Regulatory Guide 1.180

The inspectors used Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," dated April 25, 2011, and IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated April 25, 2011.

No other NRC inspections of Westinghouse–New Stanton have occurred in the last 5 years.

The results of this inspection are summarized below.

Procurement

Based on the issuance of Nonconformance 99901043/2012-201-01 for failure to ensure that technical and quality requirements are suitably included or referenced in the documents for procurement, the inspectors determined that Westinghouse's procurement process for EMI/RFI testing services does not satisfy the regulatory requirements set forth in Appendix B to 10 CFR Part 50.

Supplier Oversight

The NRC inspection team concluded that Westinghouse is not effectively implementing its commercial-grade dedication program for EMI/RFI testing services consistent with the regulatory requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50. The NRC inspection team identified Nonconformance 99901043/2012-201-02 for failure to appropriately use inspection and commercial supplier survey acceptance methods to provide reasonable assurance that commercial-grade services provided by its subcontractor WLL, were acceptable.

Diverse Actuation System EMI/RFI Testing

The NRC inspection team concluded that Westinghouse has not adequately demonstrated to date that the inprocess data generated for the report required to close out ITAAC 2.5.01.03d when completed will adequately satisfy all required regulatory elements described in International Electrotechnical Commission (IEC) 61000-4-3, MIL-STD-461E, and RG 1.180. Based on the sample of testing observed, the NRC inspection team determined that the following nonconformances and ITAAC-related issue need to be resolved and assessed to be in compliance with the commitment in the AP1000 Design Control Document, Tier 2, Revision 19, to conform to RG 1.180:

- The NRC inspection team identified Nonconformance 99901043/2012-201-03 for Westinghouse's failure to document and evaluate a modification to the test configuration resulting from a test anomaly to ensure that the original design requirements have been satisfied in accordance with Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50.
- The NRC inspection team also identified Nonconformance 99901043/2012-201-04 for Westinghouse's failure to ensure that the EMI/RFI testing of the DAS met various technical requirements of RG 1.180, in accordance with Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50.
- WEC self-identified an ITAAC-related issue to verify and validate the simulation input and output software and the advanced logic system test and calibration tool software to ensure that the data recorded for all applicable EUT is properly calibrated and meets the predetermined acceptance values. Resolution of this issue is being tracked by Unresolved Item 99901043/2012-201-05.

REPORT DETAILS

1. Procurement

a. Inspection Scope

The U.S. Nuclear Regulatory Commission (NRC) inspection team reviewed Westinghouse Electric Company (Westinghouse) procurement processes to verify compliance 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." Specifically, the inspection evaluated the effectiveness of Westinghouse to ensure requirements were contractually passed to Washington Laboratories, Ltd. (WLL) for electromagnetic interference/radio frequency interference (EMI/RFI) qualification testing services for the Westinghouse AP1000 diverse actuation system (DAS). The inspectors selected a sample of purchase orders (POs), associated qualified suppliers list (QSL) entries, and received products from WLL for evaluation.

b. Observations and Findings

b.1 Purchasing Requirements

Section 4.3, "Procurement," of the Westinghouse quality management system (QMS) describes the process and controls established to ensure purchased items and services meet applicable technical and quality requirements, and WEC 7.5, "Control of Purchased Items and Services," provides details in regards to control of purchased items and services. As required by these procedures, technical and quality requirements identified during commercial-grade supplier survey activities are annotated in the QSL so that applicability of requirements can be evaluated during the procurement process. These items are required to be passed down in purchase orders.

A sample of three POs to WLL, including associated commercial-grade dedication (CGD) survey, and supply audit evaluation summary (SAES) documents, were evaluated to verify appropriate controls for technical and quality requirements for EMI/RFI testing services. The inspectors noted commercial-grade supplier survey WES-2011-121 contained the following purchase requirements: that WLL use the quality assurance (QA) program audited and approved by Westinghouse and that WLL notify Westinghouse of any changes to the QA program. However, the inspectors found that the purchase requirements were not included in any of the WLL POs or SAESs evaluated. This issue is considered more than minor because 1) it indicates a Westinghouse process deficiency used to control both technical and quality requirements for purchases to be dedicated, the extent of which is unknown, and 2) four of the five CGD critical characteristics for EMI/RFI testing activities relied on the WLL programmatic quality controls, which, as a result of this deficiency, were never contractually imposed by Westinghouse.

Failure to assure technical and quality requirements are suitably included or referenced in the documents for procurement is cited as Nonconformance 99901043/2012-201-01.

Westinghouse created Issue Report #12-101-M044, dated April 10, 2012, and Issue Report #12-101-M015, dated April 11, 2012, related to this issue.

b.2 Receipt of Products

The NRC inspection team selected three POs to WLL for verification of receipt of product for EMI/RFI testing services. The inspectors learned that the primary PO deliverable in each case was a test report. The inspectors also noted that the test report was a CGD critical characteristic identified in EMI/RFI Commercial Dedication Instruction (CDI) 3865, which used the inspection and test method of acceptance.

The inspectors selected a delivered WLL test report as a sample for evaluation. The inspectors learned that the format and content of the test report was representative of all WLL EMI/RFI reports. The inspectors found multiple examples of technical data required by the MIL and IEC standards missing from the test report. Specific examples and more details on this issue can be found in the CGD program section of this report (see Section 2.b.3, "Test Report,").

There were no other observations or findings of significance noted in this area.

c. Conclusions

Based on the issuance of Nonconformance 99901043/2012-201-01 for failure to assure technical and quality requirements are suitably included or referenced in the documents for procurement, the inspectors determined that Westinghouse's procurement process for EMI/RFI testing services does not satisfy the regulatory requirements set forth in Appendix B to 10 CFR Part 50.

2. Supplier Oversight

a. Inspection Scope

The NRC inspection team reviewed Westinghouse's commercial-grade dedication program and the implementation related to the EMI/RFI testing performed on the DAS system to determine if supplier controls were in compliance with the requirements of Appendix B to 10 CFR Part 50. Specifically, the inspection team evaluated the effectiveness of Westinghouse dedication activities to ensure proper oversight of their subsuppliers. The inspectors selected a sample of commercial-grade surveys, audits, and evaluations performed by Westinghouse to provide periodic inspection and verification of control processes of subsuppliers.

b. Observations and Findings

Westinghouse performs commercial-grade surveys in support of the dedication services of its subsupplier WLL. The inspectors reviewed samples of surveys of WLL for EMI/RFI testing services and found three examples in which Westinghouse failed to ensure that each critical characteristic was properly verified by special inspection or survey methods. These instances are discussed in detail as follows:

b.1 Effectiveness of Survey

CDI-3865 specifies acceptance criteria for each critical characteristic for EMI/RFI testing services provided by WLL. It also designates which dedication acceptance method is used to verify that each characteristic was properly implemented. WEC 7.3, Section 7.2,

states, "A commercial grade survey shall be performed by quality personnel, supplemented by Engineering, Supply Management and/or other participants as necessary to conduct an effective evaluation." During an interview of the auditor who performed survey WES-2011-121 of WLL, it was determined that a pre-job brief was conducted with engineering before onsite survey activities began in lieu of actually using engineering to support the survey. The auditor indicated that no technical specialist was needed onsite because only a programmatic review of WLL quality program was to be conducted with no verification of implementation.

According to WES-2011-121, "Commercial Grade Survey of WLL," dated July 14, 2011, the evaluation criteria for critical characteristic "Performance Test" stated that test and calibration procedures were reviewed to assess the performance of previous electromagnetic compatibility (EMC) testing activities conducted by WLL. During an interview with engineering staff who conducted the pre-job brief, it was determined that there was no official review of WLL technical procedures.

The inspectors identified two failures that were a direct result of the lack of engineering involvement during onsite survey activities. One failure was that the acceptance criteria for critical characteristic "Performance Test" states, "WLL test procedures are compliant with applicable and military standards for setup and testing (IEC 61000-4-2)." The inspectors noted examples in which WLL procedures ETP01398 were not in compliance with the standards (see Section 3.b.5 of this report). The other failure involves the lack of data in the test report and is described in Section 2.b.3, "Test Report."

The inspectors noted an additional example in which a critical characteristic was found to be unacceptable according to acceptance criteria designated in CDI-3865. The acceptance criteria for critical characteristic "Quality System" states that "WLL ACLASS certificate for electrical testing will be evaluated as a recurring activity". According to CDI-3865 and various interviews with the staff, the current ACLASS certification of WLL was to be checked when personnel from WLL arrived onsite to perform EMC testing activities. The NRC inspection team determined that Westinghouse could not provide adequate documentation for recurring evaluation of WLL's current ACLASS certificate for electrical testing.

These failures are examples listed in Nonconformance 99901043/2012-201-02.

Westinghouse created Issue Report #12-103-M020 related to these issues.

b.2 Personnel Qualification

The NRC inspection team reviewed the WLL training qualification matrix, ADM04208.RV2, dated April 3, 2009, to ensure that personnel were properly trained to perform EMI/ RFI testing activities. The NRC inspection team witnessed the WLL employee performing EMI/RFI testing activities on the DAS system during the NRC inspection. It was determined that the WLL employee performing onsite testing activities was not adequately qualified since the employee was not trained to the following procedures: MIL-STD-461E, IEC 61000-4-3, and CISPR 11. It was noted that WEC failed to verify critical characteristic "Personal Qualification" by means of commercial-grade survey WES-2011-121, which should have ensured that implementation of required training of personnel at WLL was performed.

This failure is an example listed in Nonconformance 99901043/2012-201-02.

Westinghouse created Issue Report #12-102-M007 related to this issue.

b.3 Test Report

The NRC inspection team reviewed samples of the WLL EMI/RFI test report data to ensure that the correct design data and test conditions were properly documented. CDI-3865, Revision 1, identifies the “test report” as a critical characteristic and specifies that input data be recorded in the WLL test report. WLL Report No.12274-01, “EMI/RMC Test Report for the Westinghouse Electric Company–EA01 AC Distribution Panel,” Revision 1, was found to be missing required data, including operating conditions of EUT, rate of sweep of frequency, dwell time, field intensity, and frequency steps. The missing test data are a requirement per standard IEC 61000-4-3, Section 8, “Test Procedures,” and Section 6.2, “Calibration of Field.”

This failure is an example listed in Nonconformance 99901043/2012-201-02.

Westinghouse created Issue Report #12-104-M022 related to this issue.

c. Conclusions

Based on the issuance of Nonconformance 99901043/2012-201-02, the inspectors determined that Westinghouse’s current CGD and supplier control processes for WLL EMI/RFI testing activities do not satisfy the regulatory requirements set forth in Appendix B to 10 CFR Part 50.

3. Diverse Actuation System EMI/RFI Testing

a. Inspection Scope

The NRC inspection team reviewed the implementation of the following areas in relation to the DAS EMI/RFI testing to verify the commitment in the AP1000 Design Control Document, Tier 2, Revision 19, to conform to Regulatory Guide 1.180, “Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems,” Revision 1, issued October 2003. The RG references MIL-STD-461E and the applicable IEC standards depending on the specific type of EMI/RFI testing to be done.

- Flowdown of requirements:
The NRC inspection team reviewed Westinghouse AP1000 EQ [equipment qualification] Methodology documentation and the DAS test plan to determine if the documents are in compliance with the regulatory requirements.
- Equipment under test configuration and verification:
The NRC inspection team reviewed the applicable Westinghouse procedures used to document the process between the design configurations of the DAS cabinet to the equipment under test (EUT) configuration.
- Measuring and test equipment calibration:
The NRC inspection team reviewed applicable sections of Westinghouse’s QA

program and lower-tier procedures along with a sample of calibration records to determine if there were appropriate controls of measuring and test equipment (MT&E) used to perform the DAS EMI/RFI qualification tests.

- **Data collection:**
The NRC inspection team reviewed the applicable Westinghouse and WLL procedures to confirm that the adequacy and implementation of the data collection process followed the guidelines in the military standard (MIL) and IEC standard for EMI/RFI qualification tests.
- **Compliance with standards:**
The NRC inspection team interviewed Westinghouse and WLL staff responsible for the inprocess EMI/RFI qualification tests for inspections, tests, analysis, and acceptance criteria (ITAAC) 2.5.01.03d to determine if the implementing procedures and data collected reflected the requirements of RG 1.180, MIL-STD-461E, and IEC 61000-4-3.

b. Observations and Findings

b.1 Flowdown of Requirements

The AP1000 EQ Methodology document is Westinghouse's top-tier document that contains the overall guidelines for equipment qualifications criteria, methods, and codes for the EMC testing for the AP1000 project. It also provides the EMC criteria for the DAS qualification. The DAS type test qualification requirements are performed to demonstrate that the AP1000's safety-related equipment meets or exceeds the safety function of the plant through its design or qualified life.

Test procedure, "AP1000 EMC Test Procedure for the Diverse Actuation Systems (DAS)," APP-DAS-VPP-001, Revision 0, defines the testing requirements contained in MIL-STD-461E, IEC 61000 standards, and regulatory positions of RG 1.180 for conducted and radiated emissions testing. Procedure APP-DAS-VPP-001 contained the verbatim requirements from MIL-STD-461E, IEC 61000, and RG1.180. The translation of technical requirements from the standards and RG 1.180 to the APP-DAS-VPP-001 procedure met the regulatory requirements for the DAS test plan and procedures. The NRC inspection team observed implementation of test procedure IEC 61000-4-3 and RS 103 for the DAS cabinet described in Section 3.b.5 of this report.

b.2 Equipment under Test Configuration and Verification

The NRC inspection team reviewed APP-DAS-T1-502, "Diverse Actuation System Equipment Qualification Unit Configuration and Test Specification," which is the procedure that explains that the EUT cabinet was configured to envelop the three different design switch configurations of the DAS. Westinghouse personnel stated that there would be a reconciliation calculation added to the final equipment qualification report that would provide justification on how the EUT cabinet configuration encompassed all the installed DAS design switch configurations when testing of the EUT was completed.

Since the reconciliation calculation is needed to determine if the EUT cabinet configuration encompasses the DAS design as required by RG 1.180, appropriate

resolution of this item will be necessary to meet the ITAAC. A note will be added to the NRC's CIPIMS database to highlight the reconciliation calculation for the DAS as one item for potential NRC follow-up action.

WNA-TP-03918-WAPP, "Diverse Actuation System Equipment Qualification Unit Cabinet Hardware Test Procedure," was used to verify if the hardware configuration was set up according to the test configuration determined by Westinghouse. This procedure, completed on February 13, 2012, was performed during the preparation of the EUT DAS cabinet for EMI/RFI testing. Step 9.2.23.1 of WNA-TP-03918-WAPP was used to verify that when a circuit breaker is opened, no voltage was present at the points specified. The observed test result was documented at -21Vdc and Westinghouse personnel noted during the procedure that this test anomaly would be captured in the test log, which would be later incorporated into the final equipment qualification report. The NRC inspection team noted that the test anomaly was not captured in the test log, nor was there any documentation on the evaluation and steps taken to resolve the anomaly. Upon discussion with the test engineer, the NRC inspection team noted that the original test configuration was modified and a portion of the configuration was de-energized to resolve the test anomaly; however, there was no evaluation or justification to determine if the test configuration modification encompassed the original design requirements.

Failure to document and evaluate the test anomaly and associated change in test configuration to ensure that the original test configuration requirements were still being met has been cited as Nonconformance 99901043/2012-201-03.

Westinghouse created Issue Report #12-102-M075 to address this issue.

b.3 Measuring and Test Equipment Calibration

The NRC inspection team interviewed Westinghouse personnel on the methods of M&TE for Westinghouse and WLL. The NRC inspection team performed direct observation on the following six MT&E test equipment samples, which included calibration certificates, to verify that the MT&E used for the EMI/RFI qualification tests were appropriately controlled:

- Fluke 287 "Multimeter," Serial #13640061
- Calibration certificate, Exelonpowerlabs, ID Number WSG000500977
- Fluke 712 "RTD Process Calibrator," Serial #1016060
- Calibration certificate, Exelonpowerlabs, ID Number 800657
- Fluke 190-104 "ScopeMeter," Serial #18351802
- Calibration Results by Washington Laboratories, LTD, for Westinghouse Semi-Anechoic Chamber, dated December 22, 2011

No issues of significance were identified in this area.

b.4 Data Collection

The NRC inspection team discovered that the advanced logic system (ALS) test and calibration tool (ATCT) is an integral part of the DAS system test for measuring, monitoring, and testing equipment. The ATCT software is used to calibrate and verify that the standard input/output simulator software (SIOS) measures and records the correct data. Westinghouse is relying on the data from the SIOS during the EMC testing of the EUT to determine if the results are acceptable.

The NRC inspection team noted that Westinghouse self-identified that there had been no verification or validation of the software used for the DAS EMC-type testing. Since the SIOS and ATCT software were not verified or validated, the NRC inspection team cannot determine if the test data results are valid.

The NRC inspection team is opening an Unresolved Item (URI) to review Westinghouse's evaluation on the software used for the DAS EMC type testing to determine if there is a finding. URI 99901043/2012-201-05.

Westinghouse Issue Report #12-100-M019, dated April 9, 2012, is related to this issue.

b.5 Compliance with Standards

The NRC inspection team directly observed a sample of two inprocess EMI/RFI qualification tests performed on the DAS equipment for ITAAC 2.5.01.03d. The two test samples are as follows:

- "Electromagnetic Compatibility (EMC)" performed to the following procedures: IEC 61000-4-3, WLL procedure ETPP01398, and Westinghouse procedure APP-DAS-VPP-001
- "Radiated Susceptible" performed to the following procedures: MIL-STD-461E and Westinghouse procedure APP-DAS-VPP-001

During the above inprocess qualification tests, the NRC inspectors verified that the following procedural elements have been implemented, satisfied, verified, and recorded.

- test parameters and initial conditions
- test acceptable criteria
- all test prerequisites
- test facility environmental conditions
- formal test procedure revisions
- test anomalies (unanticipated events and conditions) and their disposition
- test instrumentation range, accuracy, and uncertainty (if applicable) were appropriate for the test

- test procedure sequence was followed or deviations were adequately evaluated and documented
- test data is reduced to a format facilitating design certification of the component or design feature
- test results are compared with previously determined performance criteria
- test deficiencies are clearly identified and appropriate corrective action has been proposed, reviewed, and completed
- evaluations were reviewed and approved by responsible test engineer or management and submitted to the design organization for final approval

The NRC inspection team randomly selected EUT, such as antennas, cables, grounding connections, shielded enclosure, circuit breakers, power supplies, switches, multimeters, scope meters, resistance temperature detector (RTD) process calibrators, and other miscellaneous components to validate that the test set up complied with the established requirements.

The NRC inspection team discovered that WLL's test procedure ETP01398, "Immunity Test Procedure for IEC 61000-4-3," RV2, Section 2, did not comply with the requirements of IEC 61000-4-3 as follows:

- IEC 61000-4-3 states, "The EUT shall be tested within its operating and climate conditions." The Washington Lab procedure records the testing temperature and humidity, but there are no acceptance criteria nor is the information verified at any point to ensure that the test conditions meet the design operating and climate conditions for the DAS cabinet as required.
- IEC 61000-4-3 states, "The sensitive frequencies (e.g., the clock frequency) shall be analyzed separately." A separate analysis was not performed by Westinghouse nor was there any documented evidence that a future analysis would be performed.
- IEC 61000-4-3 states, "This calibration is valid for all EUTs whose individual faces (including any cabling) can be fully enclosed by the "uniform area." WLL's procedure states, "This calibration is valid for all EUTs whose individual face can be fully enclosed in the uniform area." Cabling is not captured or considered in WLL's calibration procedure ETP01398 as required; however, in the qualification test observed, the calibration did happen to include cabling in the "uniform area."

Failure to meet the requirements of RG 1.180 during EMI/RFI testing has been cited as Nonconformance 99901043/2012-201-04.

c. Conclusions

The NRC inspection team determined that a review of the reconciliation calculation that will be incorporated into the final equipment qualification report to justify that the EUT test configuration envelops the three design switch configurations is needed to validate

EMC testing. The NRC inspection team also determined that verification and validation of all applicable software used for the DAS EMC testing is required to ensure regulatory requirements are met.

Based on the two nonconformances identified above, the NRC inspection team determined that Westinghouse is not in compliance with the commitment in the AP1000 Design Control Document, Tier 2, Revision 19, to conform to RG 1.180 for EMI/RFI testing.

4. Inspections, Tests, Analyses, and Acceptance Criteria

The NRC inspection team identified the following ITAAC related to EMI/RFI testing. The ITAAC is referenced in this section for future use by the NRC staff during the ITAAC review process. Although the ITAAC relates to the topics discussed in this inspection report, this report by no means constitutes that the ITAAC have been met or fully inspected by the NRC.

AP1000 Design Control Document, Tier 1, Revision 19	Table 2.5.1-4	ITAAC 3.d
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5. Entrance and Exit Meetings

On April 9, 2012, the inspectors presented the inspection scope during an entrance meeting with Mr. Tim Drouin, Westinghouse Director of Project Integration, and other Westinghouse personnel. On April 13, 2012, the inspectors presented the inspection results during an exit meeting with Mr. Gary Brassart, Westinghouse Vice President-Operational Excellence, and Chief Quality Officer, and other Westinghouse personnel.

ATTACHMENT

1. PERSONS CONTACTED AND NRC STAFF INVOLVED:

Name	Title	Affiliation	Entrance	Exit	Interviewed
Gary Brassart	VP, Operational Excellence and CQO	Westinghouse		X	
Paul Russ	Director, International AP1000 Licensing	Westinghouse		*	
Tim Drouin	Director of Project Integration	Westinghouse	*	X	
Dan Harris	Director, Field Services and Testing Operations	Westinghouse		X	X
Ron Wessel	Principal Engineer, Licensing	Westinghouse	X	X	X
Brian Gaia	Manager, EQ II	Westinghouse	X	*	X
Aaron Hatok	AP1000 Program Manager	Westinghouse		*	
Mike Canton	VOGTLE PM	Westinghouse		*	
Don Behnke	EQ PM	Westinghouse	X	X	
Suresh Channarasappa	Fellow Engineer, EQ	Westinghouse	X	X	X
Ashleigh Chicko	EQ Technical Editor	Westinghouse	X	X	
Laura Goossen	EQ Program Manager	Westinghouse	X	X	
John Mallory	Supplier Quality Engineer	Westinghouse	X	X	X
Larissa Marple	Lead EQ Engineer	Westinghouse	X	X	X
Frank Patula	EQ Engineer	Westinghouse	X	X	
Gary Ament	Manager, EQ I	Westinghouse	X		
Jennifer Moon	EQ Engineer	Westinghouse	X		X
April Lawrence	EQ Engineer	Westinghouse	X		
Steve Woodyard	QA Lead Auditor	Westinghouse			X
Alexander Broskey	Design Engineer	Westinghouse			X
Thien Ta	Test Operator	WLL			X
Justin Boukinght		SCANA		*	

Name	Title	Affiliation	Entrance	Exit	Interviewed
George Lipscomb	Inspection Team Leader	NRC	X	X	
Shavon Edmonds	Inspection Team Member	NRC	X	X	
Eugene Huang	Inspection Team Member	NRC		X	
Aaron Armstrong	Inspection Team Member	NRC	X	X	
Denise Terry-Ward	Inspection Team Member	NRC	X	X	

*attended via conference call

2. INSPECTION PROCEDURES USED:

IP 43002, "Routine Inspections of Nuclear Vendors"

IP 43004, "Inspection of Commercial-Grade Dedication Programs"

3. ITEMS OPENED, CLOSED, AND DISCUSSED:

<u>Item Number</u>	<u>Status</u>	<u>Type</u>	<u>Description</u>
99901043/2012-201-01	Opened	NON	App. B, Criterion IV
99901043/2012-201-02	Opened	NON	App. B, Criterion III
99901043/2012-201-03	Opened	NON	App. B, Criterion XI
99901043/2012-201-04	Opened	NON	App. B, Criterion XI
99901043/2012-201-05	Opened	URI	

4. DOCUMENTS REVIEWED:

Westinghouse Procedures

Westinghouse Quality Management System (QMS), Revision 6, April 8, 2011

WEC 6.1, "Document Control," Revision 4, effective January 1, 2012

WEC 6.2, "Training," Revision 0, effective November 3, 2008

WEC 7.1, "Supplier Qualification and Assessment," Revision 3, effective April 3, 2012

WEC 7.1, "Supplier Qualification and Assessment," Revision 2, effective February 8, 2010

WEC 7.2, "Dedication of Commercial Grade Items," Revision 1, effective August 3, 2009

WEC 7.3, "Commercial Grade Surveys," Revision 0, effective November 3, 2008

WEC 7.4, "Preparation of Commercial Dedications Instructions," Revision 2, effective December 30, 2011

WEC 7.5, "Control of Purchased Items and Services," Revision 3, effective November 1, 2010

WEC 12.1, "Control of Inspections, Measuring, and Test Equipment," Revision 2, effective November 18, 2011

NSNP 11.1, "Test Control," Revision 1, effective October 6, 2010

APP-DAS-T1-502, "Diverse Actuation System Equipment Qualification Unit Configuration and Test Specification," Revision 0, dated January 20, 2012

WNA-TP-03918-WAPP, "Diverse Actuation System Equipment Qualification Unit Cabinet Hardware Test Procedure," Revision 0, January 2012

WNA-TP-03816-WAPP, "DAS Equipment Qualification Preconditioning Specification," Revision 0, November 2011

WNA-TP-03918-WAPP, "Diverse Actuation Equipment Qualification Unit Cabinet Hardware Test Procedure," Revision 0, dated February 2012

EQ-TP-248-APP and APP-DAS-VPP-001, "AP1000 EMC Test Procedure for the Diverse Actuation System (DAS)," Revision 0, January 2012

Washington Lab Procedures

QA Manual ADM03703, "Management System Manual," Revision 4, dated October 16, 2008

ETP01398.RV2, "Washington Laboratory Immunity Test Procedure for IEC 61000-4-3," Revision 2, June 2010

Calibration Records

Certificate of Calibration #0010677094, RTD Calibrate Fluke 712, Serial #1016060, December 2011

Certificate of Calibration #0010667801, Multimeter Fluke 287, Serial #13640061, October 15, 2011

Calibration certificate, Exelonpowerlabs, ID Number: WSG000500977

Calibration certificate, Exelonpowerlabs, ID Number: 800657

Calibration Results by Washington Laboratories, LTD, for Westinghouse Semi-Anechoic Chamber, December 22, 2011

Issue Reports

Issue Report #12-100-M019, "AP1000 DAS EQ EMC Testing-Software Verification," April 9, 2012

Issue Report #12-102-M075, "AP1000 DAS EQ CHT Test Log Discrepancy," dated April 11, 2012

Issue Report #12-102-M043, "Incomplete Training/Testing Engineer," April 11, 2012

Issue Report #12-104-M022, "Washington Lab Report EMC Report Content," April 13, 2012

Issue Report #12-103-M020, "Incomplete Training/Testing Engineer," April 12, 2012

Issue Report #12-102-M007, "Lack of Verification of CDI Critical Characteristic," April 12, 2012

Procurement/Survey/Commercial-Grade Dedication Documents

CDI-3865, "Commercial Dedication Instruction for Washington Laboratories Ltd.," Revision 1, June 8, 2010

F.5.3, "Supplier Audit Plan" of WLL, Revision 1 (No date)

Commercial Grade Survey Report WES-2011-121 of Washington Laboratories, Ltd., August 9, 2011

Supplier Audit/Evaluation Summary of WLL F-7.1-2, Revision 1, July 14, 2011

Supplier Audit/Evaluation Summary of WLL F-6.3-2, Revision 1, May 5, 2006

Supplier Audit/Evaluation Summary of WLL F-6.3-2, Revision 1, August 6, 2007

Supplier Audit/Evaluation Summary of WLL F-7.1-2, Revision 0, June 11, 2010

Supply Audit/Evaluation Summary No.16844 for Washington Laboratories, Ltd., March 22, 2012

Supply Audit/Evaluation Summary No.16273 for Washington Laboratories, Ltd., undated (included in WES-2011-121)

Purchase Order (PO) No. 4500428675 to Washington Laboratories, Ltd. for "EMC Test MCR Transfer Panel," March 13, 2012

PO No. 4500423116 to Washington Laboratories, Ltd. for "EMC Test for AP1000 DAS," January 27, 2012

PO No. 4500423138 to Washington Laboratories, Ltd. for "EMC Testing DCIS Dual Controller," January 27, 2012

Miscellaneous Documents

WNA-GV-00165-GEN, "User Guide for the Standard I/O Simulator Software," Revision 2, August 2011

WNA-VR-00320-GEN, "Standard Input/Output Simulation Software Validation,"
Revision 2, September 2011

WNA-RL-00630-GEN, "Software Release Record for Standard Input/Output Simulator
DLL," Revision 2, August 29, 2011

Test Log from January 13, 2012–February 23, 2012, for WNA-TP-03918-WAPP,
"Diverse Actuation System Equipment Qualification Unit Cabinet Hardware Test
Procedure," Revision 0, January 2012

6002-00080, "ATCT-002 User's Manual," Revision A, June 1, 2011

Washington Laboratories Report No.12274-01, "EMI/RMC Test Report for the
Westinghouse Electric Company–EA01 AC Distribution Panel," Revision 1,
December 2, 2011

Washington Laboratories Report No.12274-01, "EMI/RMC Test Report for the
Westinghouse Electric Company–EA01 AC Distribution Panel," Revision 0,
November 29, 2011

IEC 61000-4-3, "Electromagnetic Compatibility (EMC)," International Electrotechnical
Commission (IEC), February 1995

MIL-STD-461E, "Requirements for the Control of Electromagnetic Interference
Characteristics of Subsystems and Equipment," Military Standard (MIL) Section RS103,
"Radiated Susceptibility, Electric Field, 2 MHz to 40 GHz," August 20, 1999

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.180, "Guidelines for
Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related
Instrumentation and Controls Systems," Revision 1, October 2003

5. ACRONYMS USED:

ALS	advanced logic system
ATCT	ALS Test and Configuration Tool
CDI	commercial dedication instruction
CEVB	Construction Electrical Vendor Branch
CFR	<i>Code of Federal Regulations</i>
CGD	commercial-grade dedication
CMVB	Construction Mechanical Vendor Branch
CIB1	Construction Inspection Branch 1
DAS	diverse actuation system
DCI	Division of Construction Inspection
DCIP	Division of Construction Inspection and Operational Programs
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EQ	equipment qualification
EUT	equipment under test
IEC	International Electrotechnical Commission
I/O	input/output

IP	inspection procedure
ITAAC	inspections, tests, analyses, and acceptance criteria
MIL	military standard
MT&E	measuring and test equipment
NON	notice of nonconformance
NRC	(U.S.) Nuclear Regulatory Commission
NRO	Office of New Reactors
PO	Purchase Order
QA	quality assurance
QMS	quality management system
QSL	qualified suppliers list
RG-II	Region II, U.S. Nuclear Regulatory Commission
RFI	radio frequency interference
RG	regulatory guide
RTD	resistance temperature detector
SAES	supply audit/evaluation summary
SIOS	standard input/output simulator software
URI	Unresolved Item
WEC	Westinghouse Electric Company
WLL	Washington Laboratories, Ltd.