April 25, 2014

Thomas J. Ray, Manager,
US Licensing and Regulatory Support
Westinghouse Electric Company
5000 Ericsson Dr.
Warrendale, PA 15086

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION OF WESTINGHOUSE ELECTRIC COMPANY REPORT NO. 99900404/2014-202

Dear Mr. Ray:

On March 17 to March 21, 2014, 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," and 10 CFR Part 21, "Reporting of Defects and Noncompliance."

This inspection specifically evaluated WEC's testing of safety-related components 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.

During this inspection, the NRC staff evaluated implementation of WEC's commercial grade dedication program as it relates to the development of the Protection and Safety Monitoring System (PMS) and inspected on-going cabinet hardware testing and channel integration testing for the PMS, as well as cabinet hardware testing for the Diverse Actuation System. 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 2.5.01.04, 2.5.02.07d, 2.5.02.11, and 2.5.02.13. The NRC inspection team did not identify any findings associated with the ITAAC contained in Section 4 of the attachment to this report. This NRC inspection report does not constitute NRC endorsement of your overall quality assurance (QA), 10 CFR Part 21, or Regulatory Treatment of Non Safety Systems programs

Within the scope of this inspection, no violations or nonconformances were identified.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's Rules of Practice, a copy of this letter, its enclosures, and your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system, Agencywide Documents Access and Management System, which is accessible from the NRC Web site at http://www.nrc.gov/readingrm/adams.html. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If

personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material is withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

/RA/ G. Galletti for

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

Docket No.: 99900404

Enclosures:
1. Inspection Report No. 99900404/2014-202
   and Attachment

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."

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   and Attachment

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DATE	04/09/2014	04/10/2014	04/23/2014	04/25/2014

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

Docket No.:	99900404
Report No.:	99900404/2014-202
Vendor:	Westinghouse Electric Company 5000 Ericsson Dr. Warrendale, PA 15086
Vendor Contact:	Thomas J. Ray, Manager, US Licensing and Regulatory Support 412-374-5309 Email: raytj@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 17 - 21, 2014
Inspection Team Leader:	Greg Galletti, NRO/DCIP/EVIB
Inspectors:	Lisa Castelli, R-II/DCI/CIB1 Carl Jones, R-II/DCI/CIB1 Robert Mathis III, R-II/DCI/CIB1 William Roggenbrodt, NRO/DE/ICE1 Kenneth Mott, NRO/DE/ICE1
Approved by:	Richard A. Rasmussen, Chief Electrical Vendor Inspection Branch Division of Construction Inspection and Operational Programs Office of New Reactors

Enclosure

EXECUTIVE SUMMARY

Westinghouse Electric Company
99900404/2014-202

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, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 21, "Reporting of Defects and Noncompliance." The inspectors conducted this inspection at the WEC facility in Warrendale, PA, on March 17-21, 2014.

This inspection specifically evaluated WEC's inspection and testing of safety-related components for new construction commercial nuclear plants in the US. The inspectors reviewed the aspects of the vendor's inspection and testing of safety-related components, as well as WEC's commercial grade dedication program, and non-safety related Diverse Actuation System (DAS).
.
The following regulations served as the bases for this NRC inspection:

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

The inspectors used Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," dated July 15, 2013, IP 43004, "Commercial Grade Dedication," dated November 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.

Design

The inspectors determined that WEC's implementation of their policy and procedures for the dedication of commercial grade items satisfy the regulatory requirements set forth in Criterion III, "Design Control," Appendix B to 10 CFR Part 50 and 10 CFR Part 21. The inspectors also performed a comparison of design information for VC Summer and Vogtle and verified that the Protection and Safety Monitoring System (PMS) software requirements, including the Requirements/Definition phase for the PMS software life cycle, for VC Summer are the same as for Vogtle. No findings of significance were identified.

Inspection

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

Test Control

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 for the PMS system, as well as control of testing of the non-safety related DAS. No findings of significance were identified.

REPORT DETAILS

1. Design Control

Commercial Grade Item Dedication

a. Inspection Scope

The inspectors evaluated the supplier's implementation of aspects of their quality assurance (QA) program that were related to commercial-grade dedication (CGD) of Protection and Safety Monitoring System (PMS) system components.

The inspectors interviewed WEC personnel, conducted direct observations of dedication activities, and evaluated samples of commercial dedication instructions (CDI) to verify the instructions were developed in accordance with Nuclear Automation (NA) procedure NA 7.4. The reviews evaluated whether the CDIs adequately communicated requisite information, including safety functions, critical characteristics, verification methods, and requirements for documenting acceptance. In addition, the inspectors evaluated implementation of provisions for conducting commercial grade surveys, reporting of test/inspection anomalies and errors, and control of changes to dedication requirements.

The inspection samples included CGD activities related to the following components and services:

- ABB Ovation AC160 components and software
- (Components) QNX 4.25G Software for Generic Flat Panel Display Systems
- (Components) DIN Rail MTG Double Pole 12.0A breakers
- (Components) Second Generation Node Box for the Flat Panel Display
- (Services) Testing of PMS equipment electromagnetic compatibility (EMC)
- (Services) Assembly of PMS cabinet SV3-PMS-JD-S0EB1

The inspectors observed dedication activities in progress for DIN Rail MTG Double Pole 12.0A breakers (BKR 10074D64G05 Y) associated with work request 40500730. The work request, the governing dedication instruction, CDI 2789, and test procedure WNA-TP-04207-GEN were reviewed to verify specific testing requirements were implemented as specified. For example, the inspectors evaluated whether the technician implemented requirements to test current carrying capacity/time-current characteristics and to conduct actuation force measurements. The inspectors verified whether the technician completed the test data sheets as required, including recording all test equipment used during the tests.

The inspectors examined the commercial software dedication requirements associated with the QNX Release 4.25, Patch G software for safety system Flat Panel Displays. The associated dedication instruction, CDI 3806, was reviewed to determine whether the instruction identified the safety function of the software, critical characteristics for dedication, and verification methods necessary to complete the dedication process. The inspectors evaluated whether specified critical characteristics included attributes such as performance characteristics, supplier technical and quality capabilities, software configuration controls, and failure management. In addition, the inspectors reviewed the results of a completed commercial grade software dedication documented in report

WNA-CD-00018-GEN to determine whether the dedication activities implemented the requirements of the CDI. The inspectors evaluated the adequacy of provisions for error reporting, software design and change control, and software QA.

The inspectors also observed in-process dedication inspection activities performed by WEC personnel of commercial grade services that had been contracted to a sub-supplier for the assembly of PMS system cabinet SV3-PMS-JD-S0EB1. The inspectors verified whether the applicable dedication instruction, CDI-4057, was in use at the work station. The inspectors evaluated whether dedication activities implemented the specified verifications of critical characteristics, including product identification and configuration control, by verifying information contained in procurement records, receipt inspection records, and a QA surveillance report. The inspectors also observed whether dedication activities properly documented dedication results in the Quality Data Packages and implemented corrective action tracking and controls for a contingent nonconformance.

The inspectors evaluated changes to program procedures to determine whether significant changes to program guidance had occurred since previous Nuclear Regulatory Commission (NRC) inspections.

Documents and records reviewed for this inspection scope are listed in the attachment.

b. Observations and Findings

No findings of significance were identified.

c. Conclusions

Based on the inspection samples reviewed, the NRC inspection team determined that the supplier implemented its policies and procedures that govern dedications of commercial grade items and services consistent with the regulatory requirements of Criterion III, “Design Control,” and Criterion VII, “Control of Purchased Material, Equipment, and Services,” of Appendix B to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50. No findings of significance were identified.

Southern Nuclear Company (Vogtle)/SCANA (VC Summer) PMS Software Requirements Comparison Evaluation

a. Inspection Scope

The PMS Software Requirements/Definition Phase was previously inspected by the NRC and documented in Inspection Reports 0500025 & 26/2012-009, 0500025 & 26/2013-003, and 0500025 & 26/2013-004 for Southern Nuclear Company’s Vogtle AP1000 Units 3&4. The NRC determined, during those previous inspections, that certain activities and documentation associated with the completion of the Software Requirements/Definition Phase of the Software Life Cycle for the PMS did not meet certain regulatory requirements as described in the previous NRC Notices of Violations. In response to those NOVs, the licensee had identified and initiated various corrective actions to address those deficiencies.

The inspectors interviewed WEC personnel and reviewed site specific plant documentation for both Vogtle and VC Summer to identify and evaluate the differences in the software requirements between the two sites. The site-specific documentation reviewed for the Vogtle site included WNA-RL-03189-SV0, "Vogtle AP1000 Protection and Safety Monitoring System Software Configuration Management Release Report," Revision 8, August 2013 and SV0-PMS-J0R-001, "Vogtle AP1000 Protection and Safety Monitoring System Requirements Traceability Matrix," Revision 1, August 2013. The VC Summer site-specific document review included WNA-RL-03929-VSG, "V.C. Summer AP1000 Protection and Safety Monitoring System Software Configuration Management Release Report," Revision 1, August 2013.

b. Observations and Findings

The inspectors interviewed WEC engineering management and the software requirements lead and was informed that the software requirements for Vogtle and VC Summer were the same with no differences. The inspectors were directed to review site-specific configuration management release records (CMRR) for each site to support the fact that no differences exist in software requirements between Vogtle and VC Summer. The inspectors were also informed that only one Requirements Traceability Matrix (RTM) exist for the AP1000 design and an additional RTM will not be generated for the VC Summer site.

The inspectors verified during the review of Vogtle's CMRR, WNA-RL-03189-SV0, that Vogtle's functional and PMS system designs are identical to the Westinghouse's standard AP1000 plant. The inspectors noted that the Vogtle CMRR explicitly stated examples of comparisons between the two plant CMRRs and in several instances the VC Summer's CMRR directs readers to the Vogtle's CMRR for further information relevant to the Summer requirements.

c. Conclusions

Based on interviews and document reviews, the inspectors determined that the PMS software requirements for VC Summer are the same as for Vogtle. Consequently, the activities and documentation for the Requirements/Definition phase for the PMS software life cycle for VC Summer is also the same as Vogtle. No additional site-specific inspection of the PMS Requirements/Definition Phase for VC Summer is warranted. No findings of significance were identified.

2. Inspection

a. Inspection Scope

The inspectors reviewed inspection policies and procedures to determine if WEC's controls were in compliance with the regulatory requirements of Criterion X, "Inspection," of Appendix B to 10 CFR Part 50. In addition, the inspectors discussed the inspection program with WEC inspection personnel responsible for implementation, reviewed documented results of completed inspections, and observed inspections performed as part of the ongoing nuclear-related fabrication and testing activities, including receipt and in-process inspections to verify inspection program implementation.

Receiving Inspection

The inspectors evaluated procedure WEC NA 10.1.3, “Inspections,” Revision 3, dated March 29, 2013, and WNA-IG-00314-GEN, “Nuclear Automation Global Instrumentation & Control Production: Receiving Process for Material Needing Inspection,” Revision 1, dated January 2013, that describes the process for performance of receipt, in-process, and final inspection activities at WEC, to verify the procedures were utilized by WEC staff during the conduct of receipt and in-process inspection activities.

The inspectors observed WEC quality control receipt inspection personnel utilizing the procedural instructions to identify and control purchased items. Specifically, the inspectors observed the receipt personnel examining item/component configuration, item dimensions, physical characteristics, and markings and/or identifications of received materials and equipment. The inspectors observed receipt personnel inspecting packages and components and material identification and markings in order to segregate and properly route and/or store safety-related equipment from non-safety related equipment, as well as mark and route equipment and/or material that needed further services such as CGD. The inspectors observed the receipt inspection personnel update the package and receipt equipment and database management system (EDMS), and the systems applications and products (SAP) database tracker system, with package receipt date, condition of items received, confirmation of correct or expected product identification markings observed, as well as other applicable physical package or material characteristics such as color and/or amount of items/product/components received.

In-Process Inspection

The inspectors, observed in-process inspection activities associated with the steel wire ties utilized for grounding of safety system field cables and display consoles located in the main control room. Staff observed WEC personnel perform quality control inspection in accordance with “Quality Control Instruction” (QCI) – 308, Revision 6, dated December 2013, and CGD in accordance with “Commercial Grade Dedication Instruction” – 4554, Section C.

The inspectors observed qualify control (QC) personnel implementing the QCI and CDI instructions to verify that the steel wire ties were the correct product received by verifying that the database listing and description of purchased steel wire ties were in fact what QC personnel had received. QC personnel also explained, discussed, and demonstrated how, before performing any further quality control processes or CDI, they would, per instruction, go into the EDMS and review for any pending or completed product engineering change orders or new product or updated QC process (i.e., new CGD processes) revisions before starting QC control process on applicable equipment.

The inspectors observed QC personnel perform CDI process for steel wire ties which included, in addition to other processes, a physical inspection and applying specified measuring tools to verify correct product physical dimensions.

Non-Conformance Implementation

The inspectors questioned QC in-processing personnel about procedures and actions they would perform if the observed component and/or material did not conform to the

database description of what the purchased product should physically resemble or how the purchased product should operate. WEC personnel demonstrated that their process for receipt inspection would have them update the SAP database with their non-conformance findings and additional instructions would be used for developing a non-conformance finding and performing an evaluation to determine if a 10 CFR Part 21 notification would be necessary.

Quality Control Receipt Personnel Qualifications

The inspectors spoke with receipt and inspection personnel to verify that special processes were being performed by qualified personnel and that they were following qualified procedures in accordance with their applicable quality control programs. Staff also reviewed QC personnel qualification and training records of QC member who performed CDI of steel wire ties.

b. Observations and Findings

No findings of significance were identified in this area.

c. Conclusions

The inspectors determined that the implementation of WEC's programs for control of inspection activities were consistent with the regulatory requirements of Criterion X of Appendix B to 10 CFR Part 50. No findings of significance were identified.

3. Test Control

a. Inspection Scope

PMS Channel Integration Test/System Integration Test

The inspectors reviewed WEC's policies and procedures governing the implementation of its test program, observed in-process testing, and interviewed responsible test personnel to verify compliance with Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50. Specifically, the inspectors reviewed test procedures and observed in-process testing in relation to the PMS Integrated Logic Processor (ILP) Channel Integration Test (CIT) and the PMS Cabinet Indications and Status CIT to ensure applicable testing and regulatory requirements were adequately addressed.

The inspectors reviewed test procedures APP-PMS-T1P-009, "AP1000 Protection and Safety Monitoring System Integrated Logic Processor Component Logic Channel Integration Test Procedure," Revision 2, March 2014, and APP-PMS-T1P-019, "AP1000 Protection and Safety Monitoring System Cabinet Indications and Status Channel Integration Test Procedure", Revision 3 and their associated test data sheets to verify the inclusion of test personnel qualification, test objectives, instructions necessary to achieve test objectives, test setup, identified acceptance criteria, and provisions for recording test results, including any observed deficiencies, their resolution, and any necessary retesting. The inspectors interviewed responsible testing personnel to verify that testing was conducted in accordance with the applicable test procedure, personnel were adequately qualified, and there was sufficient knowledge of the process for handling test deviations and anomalies.

The inspectors observed in-process CIT of PMS panels VS2-PMS-JD-ILCA01, VS2-PMS-JD-ILCA02, and VS2-PMS-JD-ILCA03, to ensure testing was being conducted in accordance with the identified test procedure and associated test data sheets including observing test personnel load Standard Input/Output Simulator (SIOS) test control files that are being used to test the signal logic paths for the PMS components. The inspectors observed integrated logic tests for PMS components for Channel/Division A including the pressurizer heater load center circuit breakers, Core Makeup Tank (CMT) discharge isolation valves, containment isolation valves, Passive Residual Heat Removal Heat Exchanger (PRHR HX) control valve, and Fourth Stage Automatic Depressurization System (ADS) Depressurization Valve. The inspectors also reviewed functional logic diagrams to verify that test control files were developed with the proper PMS inputs for the identified expected outputs.

The inspectors also observed in-process CIT/System Integration Test (SIT) of PMS panels VS2-PMS-JD-MTCA01 and VS2-PMS-JD-SOEA01 to ensure testing was being conducted in accordance with the identified test procedure and associated test data sheets. The inspectors witnessed test setup activities including the configuration of a frequency generator to simulate feedback from a reactor coolant pump and setting up the test system for system integration test mode as required by the test procedure/data sheet for the specific test cases observed. The inspectors observed testing in relation to cabinet indication and status for reactor trip matrix fault alarms on the maintenance test panel and the board alarm indications for the sequence of events panel. The test data sheets were reviewed to verify documentation of equipment calibration information, test results, and acceptance criteria being met.

The inspectors reviewed an example from the WEC Repair, Replacement and Automation Services (RRAS) Issue Tracking System (RITS) item RITS-33702, that was identified by the WEC independent verification and validation (IV&V) group to assure issues identified by IV&V were being adequately captured and dispositioned. The specific example was identified during the code review for the local coincidence logic (LCL) engineered safety features processor module that affected the regression analysis required to be conducted for that module.

Diverse Actuation System Cabinet Hardware Testing

The inspectors reviewed WEC's procedure governing the implementation of the test program for the Diverse Actuation System (DAS) and observed in-process testing to verify compliance with the QA requirements for the regulatory treatment of non-safety systems (RTNSS). The AP1000 Design Control Document, Revision 19 defines the QA requirements for RTNSS in Table 17.1. The inspectors reviewed APP-GW-GAM-200, "AP1000 Quality Requirements for RTNSS Systems, Structures and Components", Revision 2, dated May 2009, to evaluate the QA guidelines for the DAS.

Specifically, the inspectors, observed portions of the in-process testing being conducted for the V.C. Summer Unit 3 DAS processor cabinets 1 and 2 and the squib valve controller (SQV) cabinet. The inspector's observed APP-DAS-T1P-200, DAS Cabinet Hardware Test (CHT), Revision 3, dated December 2013 and APP-DAS-T1D-200, "Diverse Actuation System Cabinet Hardware Test Datasheets," Revision 3, dated December 2013. In addition, the inspectors reviewed the test procedure to ensure it aligned with the test datasheets.

The inspectors reviewed APP-GW-GBH-361, “Westinghouse AP1000 Integrated I&C Test Strategy”’, Revision 1, dated July 2013 to assess whether the CHT was in compliance with the strategy document. The inspectors noted that the CHT is performed to demonstrate basic functionality of cabinet wiring, power and input output operation.

The inspectors evaluated procedure APP-DAS-T5-001, “DAS Test Plan”, Revision 1, dated August 2012 that describes the DAS test program and defines the activities to be performed for the factory and qualification testing. The inspectors witnessed the pre-job briefing for the VC Summer Unit 3 DAS CHT which consisted of the DAS project manager, DAS lead engineer and DAS lead technicians, among others. The inspectors noted that it was conducted in accordance with the DAS Test Plan, covered safety items, and ensured the test prerequisites had been completed.

The Inspectors noted that the DAS Test Plan requires the configuration of the equipment under test (EUT) to be documented in accordance with WEC NA 11.03, “Test Configuration” revision. 4, dated July 13, 2012 which describes the process for documenting configuration information associated with a test activity. The inspectors evaluated NA 11.03 specially, the required elements that shall be included or referenced by the test configuration record. The inspectors reviewed WNA-TC-01011-VS3, “DAS CHT Test Configuration Record,” Revision 0, dated March 2014, and verified these elements were documented in the record for the EUT, specifically the test procedure, test data sheets and test tools. Additionally, the inspectors noted that the test configuration record was documented at the EUT. The inspectors noted the test configuration record referenced use of a test box for the CHT. The test box is used during the CHT to simulate signals initiating from the main control room that will be verified in subsequent levels of testing. The inspectors walked through the test box qualification and acceptance testing documentation with the DAS lead test engineer to ensure that the signals generated by the test box were routed to the correct test box outputs. Specifically, the inspectors observed how the wiring and logic drawings were used to develop the test box and determine the routing of the signals from the test box.

The inspectors reviewed the WNA-RL-03937-VS3, “VC Summer Unit 3 AP1000 DAS Configuration Management Release Report,” (CMRR) Revision 0, dated March 2014, to confirm that the configuration items used as a basis for the CHT were identified, specifically the test plan, test procedures and test data sheets, system design specification, system design requirements, and system functional requirements and logic diagrams. The inspectors reviewed the guidance in WNA-WI-00223-WAPP, “Release Process Work Instruction,” Revision 1, dated August 2013, which defines the process for generating a CMRR. The inspectors noted that prior to issuing CMRR; a readiness review shall be conducted via a readiness review checklist. The inspectors confirmed that a DAS V.C. Summer readiness review was conducted and documented prior to issuing the CMRR for the DAS channel hardware testing.

The inspectors observed portions of the DAS CHT for the SQUIB Relay Energization Testing. This portion of the DAS CHT verifies the applicable output relay contacts are energized when an arming signal is generated by the Manual ESF control switch located on the remote DAS control panel (RDCP). During testing of the arming signal generated by closing the In-Containment Refueling Water Storage Tank manual switch at the RDCP the contact closure test acceptance criteria was not met. The inspectors observed the lead test technician stop work and notify the lead test engineer. The inspectors observed that all corrective actions for the test anomaly were in accordance

with the test guidelines outlined in the DAS CHT. The test engineer in accordance with WEC procedures, created a RITS (Issue ID# RITS36892) tracking description, "DAS VS3 CHT: Loose wires on TDDO101 normally open contacts," to record relevant details related to the execution of the test and to record testing anomalies in the test log for anomaly tracking and resolution.

Qualifications of Diverse Actuation System Test Personnel

The QA design process for the DAS test plan, APP-DAS-T5-001, Revision 1, Section 11.2, states that test team members shall be trained on the current WEC quality policies and procedures and that they shall receive any AP1000 specific training required. It also states that all training shall be documented and maintained. Further, the test plan states that test team members shall receive training or follow applicable user guides for tools used during the testing of the DAS.

The inspectors reviewed the training records of one of the DAS hardware cabinet test team lead technicians for compliance to WEC's DAS qualifications. The review of training records demonstrated that the test team lead had an appropriate educational background that was consistent with the DAS hardware cabinet test activities being performed under APP-DAS-T1P-200, DAS Cabinet Hardware Test Procedure. The training records also contained current, ongoing, and past system training received, wiring and cable certification courses taken and passed, as well as WEC in-house training and exams provided for simple electricity and electrical network analysis concepts.

b. Observations and Findings

PMS Channel Integration Test/System Integration Test

With respect to the AP1000 PMS Integrated Logic Processor Component Logic Channel Integration Test, the inspectors verified that the test allowed simulated inputs from the SIOS, a LabVIEW environment to be connected to, and simulate a signal through the input wiring of the bistable control cabinet, containing the bistable process logic and LCL processors. The simulated signal would then pass through to the integrated logic cabinet via high speed links, to the ILPs, and the PMS's priority logic modules, the Component Interface Module (CIM) subsystem.

The inspectors verified, through discussions with the vendor's test personnel, that the test would be considered satisfactorily complete once it was determined that signal continuity and proper signal functionality was demonstrated for all evaluated signals under test through the output of the CIM sub-system, namely the proper operation of the K1 and K2 output relay contact sets of the CIM subsystem.

The inspectors noted that the vendor considered this test as partially satisfying ITAAC 2.5.02.07d, which states that, "The PMS ensures that the automatic safety function and the Class 1E manual controls both have priority over the non-Class 1E soft controls." The inspectors noted that this test verified the logic of the safety system input signals to the CIM priority module, but did not specifically address a portion of the ITAAC 2.5.02.07d regarding the verification of the safety system signals having priority over the non-Class 1E soft controls, since no signal input from the non-Class 1E controls were

being supplied during this test. Completion of the ITAAC will require additional testing of the system when integration with the non-Class 1E controls is achieved.

Overall, the inspectors determined that the PMS CIT/SIT acceptance testing that was observed by the inspectors was being performed, assessed, evaluated and documented in a controlled manner. Personnel conducting the testing were knowledgeable of test plan and documentation requirements, and had demonstrated test control procedure attributes.

No findings of significance were identified in this area.

Diverse Actuation System Cabinet Hardware Testing

The inspectors determined that the observed DAS CHT testing was being performed, assessed, evaluated and documented in a controlled manner. Personnel conducting the testing were knowledgeable of test plan, documentation requirements, and demonstrated test control procedure attributes.

The inspectors determined that the DAS QC corrective action procedures were being followed and implemented throughout the DAS CHT phase and that test personnel were knowledgeable of these procedures. The inspectors determined during the DAS CHT that conditions adverse to quality were properly identified and were either corrected or that the process to correct adverse quality had been initiated in accordance with procedures. The inspectors also found that the DAS CHT corrective action records observed were adequate to furnish identifiable and retrievable evidence of activities affecting quality and met other requirements prescribed by WEC's QC record management program such as informing other applicable departments of the noted adverse quality.

The inspectors determined, for the records reviewed, the DAS CHT and in-processing receipt personnel were adequately qualified.

No findings of significance were identified in this area.

c. Conclusions

The inspectors determined that the implementation of WEC's programs for control of testing activities were consistent with the regulatory requirements of Criterion XI of Appendix B to 10 CFR Part 50. The inspectors also determined that the implementation of WEC's programs for control of testing activities for the DAS were consistent with the RTNSS. No findings of significance were identified.

4. Entrance and Exit Meetings

On March 17, 2014, the inspectors presented the inspection scope during an entrance meeting with Mr. Jan Dudiak, Vice President, New Plant Automation, of WEC, and other WEC personnel. On March 21, 2014, 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:

Name	Affiliation	Entrance	Exit	Interviewed
Jan Dudiak	AFS	X	X	
Larry Erin	WEC-RQE	X	X	
Kyra Durinsky	WEC-AFS	X	X	X
Nicole Stadelman	WEC-AFS	X	X	
Dale Harmon	WEC	X	X	
Veronica Alberino	WEC			X
Richard Paese	WEC-NPP	X	X	X
Sarah DiTomasso	WEC	X	X	
Bob Hirmanpour	SNC	X	X	X
Warren Odess-Gillett	WEC	X	X	X
Pietro Porco	WEC-AFS	X	X	X
Jason Perine	WEC-AFS	X	X	X
Stephanie Seager	WEC-AFS	X	X	
Pavel Tyrpak	WEC-AFS	X	X	
Brian Bedford	WEC	X	X	
Michael Shaffer	WEC-AFS	X	X	
Ken Lunz	WEC-AFS	X	X	
John Wiessmann	WEC-AFS	X	X	X
Chris Srock	WEC-AFS	X	X	
Wes Vaughn	SNC	X		
Thomas Ray	WEC-NPP	X	X	
Robert Lane	WEC-NPP	X		
Bob Phillips	WEC	X	X	
Steve Radamski	WEC	X	X	
Dan Harris	WEC	X	X	
Harold Maguire	WEC	X	X	
Ryder Thompson*	SCE3G	X	X	
Robert Sutter*	SNC	X	X	
Kristina Honomichl*	SNC	X	X	
S. Channarasappa	WEC			X
S. Dlugolenski	WEC	X	X	X
W. Miller	WEC	X	X	X
John Faulkner	WEC-AFS		X	
John Strong*	WEC-NPP		X	
James Flowers*	SNC	X	X	
Michael Vox*	SNC		X	
Stephen Packard*	WEC-AFS	X	X	
John Zuemie*	WEC-NPP		X	
Samual Adams*	SNC	X		
Susan Mullen	WEC			X
Gregory Glenn	WEC			X
Matthew Slavic	WEC			X
Mark Schoming	WEC			X
Ross McGrady	WEC			X

Name	Affiliation	Entrance	Exit	Interviewed
Rose Wang	WEC			X
Robert Cortese	WEC			X
Greg Galletti	NRC	X	X	
Carl Jones	NRC	X	X	
Kenneth Mott	NRC	X	X	
Lisa Castelli	NRC	X	X	
Robert Mathis III	NRC	X	X	
William Roggenbrodt	NRC	X		

*Participated by conference call

2. INSPECTION PROCEDURES USED:

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

IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated November 2013

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

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

The U.S. Nuclear Regulatory Commission (NRC) inspection team 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 PMS CIT and DAS Factory Acceptance Testing (FAT) for the AP1000 reactor design. For the ITAAC listed below, the inspectors reviewed WEC's 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 did not identify any findings associated with these ITAAC during this inspection.

COL #	DCD#	Design Commitment	Component/Activity
519	2.5.01.04	The DAS hardware and any software are developed using a planned design process which provides for specific design documentation and reviews during the following lifecycle stages (subtask [b] of design commitment - system test phase)	V.C. Summer Unit 3 DAS processor cabinets (PC) 1 and 2 and the squib valve controller (SQV) cabinet. The inspector's observed APP-DAS-T1P-200, DAS Cabinet Hardware Test (CHT), Revision 3, dated December 2013 and APP-DAS-T1D-200, "Diverse Actuation System Cabinet Hardware Test Datasheets," Revision 3, dated December 2013. Observed

COL #	DCD#	Design Commitment	Component/Activity
			portions of the DAS CHT for the SQUIB Relay Energization Testing. This portion of the DAS CHT verifies the applicable output relay contacts are energized when an arming signal is generated by the Manual ESF control switch located on the remote DAS control panel (RDCP)
537	2.5.02.07d	The PMS ensures that the automatic safety function and the Class 1E manual controls both have priority over the non-Class 1E soft controls.	VC Summer 2 CIT – Test Procedure APP-PMS-T1P-009, "AP1000 Protection and Safety Monitoring System Integrated Logic Processor Component Logic Channel Integration Test Procedure," Revision 2, March 2014. Observed in-process testing of PMS cabinets VS2-PMS-JD-ILCA01, VS2-PMS-JD-ILCA02, and VS2-PMS-JD-ILCA03 including witnessing the integrated logic tests for PMS components for Channel/Division A including the pressurizer heater load center circuit breakers, Core Makeup Tank (CMT) discharge isolation valves, containment isolation valves, Passive Residual Heat Removal Heat Exchanger (PRHR HX) control valve, and Fourth Stage ADS Depressurization Valve. The inspectors noted that this test verified the logic of the safety system input signals to the CIM priority module, but did not specifically address a portion of the ITAAC 2.5.02.07d regarding the verification of the safety system signals having priority over the non-Class 1E soft controls, since no signal input from the non-Class 1E controls were being supplied during this test. Completion of the ITAAC will require additional testing of the system when integration

COL #	DCD#	Design Commitment	Component/Activity
			with the non-Class 1E controls is achieved.
550	2.5.02.11	The PMS hardware and software are developed using a planned design process during the system integration and test phase for system hardware and software (subtask [d] of design commitment - system integration and test phase)	VC Summer 2 CIT/SIT – Test Procedure APP-PMS-T1P-019, “AP1000 Protection and Safety Monitoring System Cabinet Indications and Status Channel Integration Test Procedure”, Revision 3. Observed in-process testing of PMS cabinets VS2-PMS-JD-MTCA01 and VS2-PMS-JD-SOEA01 including witnessing testing in relation to cabinet indication and status for reactor trip matrix fault alarms on the maintenance test panel and the board alarm indications for the sequence of events panel.
552	2.5.02.13	The use of commercial grade computer hardware and software items in the PMS is accomplished through a process that specifies requirements for: a) Review of supplier design control, configuration management, problem reporting, and change control. b) Review of product performance. c) Receipt acceptance of the commercial grade item. d) Acceptance based on equipment qualification and software validation in the integrated system.	The inspection samples included CGD activities related to the following components and services: • ABB Ovation AC160 components and software • (Components) QNX 4.25G Software for Generic Flat Panel Display Systems • (Components) DIN Rail MTG Double Pole 12.0A breakers • (Components) Second Generation Node Box for the Flat Panel Display • (Services) Testing of PMS equipment electromagnetic compatibility (EMC) • (Services) Assembly of PMS cabinet SV3-PMS-JD-S0EB1 The inspectors observed dedication activities in progress for DIN Rail MTG Double Pole 12.0A breakers (BKR 10074D64G05 Y) associated with work request 40500730.

4. DOCUMENTS REVIEWED:

Quality Manuals, Plans, Specifications, and Procedures

- WNA-RL-03189-SV0, "Vogtle AP1000 Protection and Safety Monitoring System Software Configuration Management Release Report," Revision 8, August 2013
- SV0-PMS-J0R-001, "Vogtle AP1000 Protection and Safety Monitoring System Requirements Traceability Matrix," Revision 1, August 2013
- WNA-RL-03929-VSG, "V.C. Summer AP1000 Protection and Safety Monitoring System Software Configuration Management Release Report," Revision 1, August 2013
- Nuclear Automation (NA) 10.1.3, "Inspections," Revision 3, dated March 29, 2013
- NA 11.0.2, "Test Procedures," Revision 4, dated July 13, 2012
- NA 11.03, "Test Configuration", Revision 4, dated July 13, 2012
- NA 15.1, "Control of Nonconformances," Revision 13, dated September 2013
- NA 7.4, "Preparation of Commercial Grade Dedication Instructions (CDIs)," Revision 4, dated July 12, 2013
- WEC 7.1, "Supplier QA Program Qualification and Assessment," Revision 5.0, dated April 3, 2014
- WEC 7.2, "Dedication of Commercial Grade Items," Revision 2.0, dated July 18, 2013
- WEC 21.0, "Identification and Reporting of Conditions Adverse to Nuclear Safety," Revision 8, dated September 2013

Design Documents

- APP-GW-GLR-145, WCAP-17184-P, AP100 Diverse Actuation System Planning and Functional Design Summary Technical Report, Revision 2, dated July 2010
- APP-DAS-J4-001, "AP1000 Diverse Actuation System (DAS) System Design Specification," Revision 3
- APP-DAS-J4-004, "AP1000 Diverse Actuation System (DAS) System Design Requirements," Revision 4
- APP-DAS-J1-001, "AP1000 Diverse Actuation System (DAS) Functional Requirements," Revision 5
- APP-DAS-GEH-001, "AP1000 Diverse Actuation System Design Process," Revision 1, dated May 2010
- APP-DAS-J0R-001, "Diverse Actuation System Requirements Traceability Matrix," Revision 2, dated October 2013
- APP-DAS-J4-003, "Diverse Actuation System Sub-System Requirements Specification," Revision 5, dated September 2013
- WNA-PC-00006-WAPP, "Instrumentation and Control Projects Requirements Management Plan," Revision 2, dated June 2012
- APP-GW-GAM-200, "AP1000 Quality Assurance Requirements for RTNSS Systems, Structures, and Components," Revision 2, dated May 2009
- WNA-PD-00239-WAPP, "AP1000 I&C Diverse Actuation System," Revision 1, dated February 2012
- WNA-RL-03937-VS3, "V.C. Summer Unit 3 AP1000 Diverse Actuation System Configuration Management Release Report," Revision 0, dated March 2014
- APP-GW-GLR-145, "WCAP-17184-P, AP1000 Diverse Actuation System Planning and Functional Design Summary Technical Report," Revision 2, July 2010

- WNA-IG-00314-GEN, “Nuclear Automation Global Instrumentation & Control Production : Receiving Process for Material Needing Inspected ,” Revision 1, dated January 2013
- Engineering & Design Coordination Report (E&DCR) No. APP-DAS-GEF-004, “Incorporation of DAS Squib Valve Blasting Device,” Revision 8
- AP1000 Design Change Proposal (DCP), APP-GW-GEE-3001, “Modifications to Diverse Actuation System (DAS),” Revision 0, dated September 2011
- DCP APP-GW-GEE-1895, “Penetration Changes, DAS Upgrades & P&ID Room# Change Due To Aircraft Impact Assessment,” Revision 0, dated September 2010
- WNA-PV-00009-GEN, Software V&V Process for Common Q Safety Systems, Revision 9, March 2014
- WNA-PV-00054-WAPP, “AP1000 PMS Software V&V Plan,” Revision 2, dated July 2013
- WNA-WI-00223-WAPP, “Release Process Work Instruction” Revision 1, dated August 2013
- APP-DAS-G1-001, “Diverse Actuation System Design Basis document, Revision. 1, dated August 2012,
- NA 11.03 , “ Test Configuration”, Revision 4, dated July 13, 2012
- WNA-TC-01011-VS3, “DAS CHT Test Configuration Record,” Revision 0, dated March 2014
- WNA-RL-03937-VS3, “VC Summer Unit 3 AP1000 DAS Configuration Management Release Report” (CMRR) Revision 0, dated March 2014
- DAS V.C. Summer 3 CMRR Readiness Review Meeting Minutes, dated March 7, 2014

Commercial Grade Dedication Documents

- Commercial grade dedication instruction (CDI) 2625 for AC160 Nuclear Critical Components, Revision 19, August 05, 2013
- CDI-2789, DIN Rail Mounted Circuit Breaker,” Revision 24, dated February 20, 2014
- CDI-3722, “Second Generation Node Box,” Revision 13, dated June 17, 2013
- CDI-3806, QNX 4.25G Software for Generic Flat Panel Display Systems,” Revision 03, dated January 7, 2014
- CDI-4057, “Services Associated with Build to Print Electro-Mechanical Parts & Assemblies,” Revision 10, dated September 16, 2013
- CDI-4064, “Keystone Compliance, LLC – EMC and Product Safety Test Services,” Revision 04, dated August 24, 2013
- 00000-ICE-35444, “Commercial Grade Dedication Plan for the QNX Operating System for Common Q Applications,” Revision 01, dated August 13, 1999
- 00000-ICE-3722, “Commercial Grade Dedication Report for the QNX Operating System for Common Q Applications,” Revision 000, dated November 11, 1999
- WEC-12-94, “Internal Audit Report – Nuclear Automation, Commercial Dedication,” dated February 1, 2013
- WNA-CD-00018-GEN, “Commercial Dedication Report for QNX 4.25 for Common Q Applications,” Revision 06, dated January 9, 2014

Test Procedures and Documents

- APP-PMS-T1P-009, “AP1000 Protection and Safety Monitoring System Integrated Logic Processor Component Logic Channel Integration Test Procedure,” Revision 2, March 2014
- APP-PMS-T1P-009, “AP1000 Protection and Safety Monitoring System Integrated Logic Processor Component Logic Channel Integration Test Data Sheets,” Revision 2, March 2014

- APP-PMS-T1P-019, “AP1000 Protection and Safety Monitoring System Cabinet Indications and Status Channel Integration Test Procedure,” Revision 3
- APP-PMS-T1D-019, “AP1000 Protection and Safety Monitoring System Cabinet Indications and Status Channel Integration Test Data Sheets,” Revision 4, dated January 2014
- APP-DAS-T1P-200, “AP1000 Diverse Actuation System Cabinet Hardware Test Procedure,” Revision 3, dated December 2013
- APP-DAS-T1D-200, “AP1000 Diverse Actuation System Cabinet Hardware Test Datasheets,” Revision 3, dated December 2013
- APP-GW-T5-001**,** “Instrumentation And Control Systems Design Validation and Integration Test Plan,” Revision 1, dated May 2013
- APP-DAS-T5-001, “Diverse Actuation System Test Plan,” Revision 1, dated August 2012
- APP-GW-T5-001**,** “Instrumentation And Control Systems Design Validation and Integration Test Plan ,” Revision 1, dated May 2013
- APP-DAS-T5-001, “Diverse Actuation System Test Plan,” Revision 1, dated August 2012
- EQ-TP-153-APP, “Electromagnetic Compatibility Test Procedure for the AP1000 Plant Protection and Safety Monitoring System Equipment Qualification Cabinets,” Revision 1, dated January 2013.
- Report 1103-023EA by Keystone Compliance, “AP1000 Plant Protection and Safety Monitoring System (PMS) Equipment Qualification Cabinets EMI/EMC Test Report,” Revision B, dated June 20, 2013
- WNA-TC-01011-VS3, “DAS CHT Test Configuration Record,” Revision 0, dated March 2014
- WNA-RL-03937-VS3, “VC Summer Unit 3 AP1000 DAS Configuration Management Release Report” (CMRR) Revision 0, dated March 2014
- WNA-TP-04207-GEN, “STD Safety Test Procedure for Circuit Breakers,” Revision 4
- APP-GW-GBH-361, “Westinghouse AP1000 Integrated I&C Test Strategy,” Revision 1, dated July 30, 2013
- APP-PMS-T5-001, “AP1000 PMS Test Plan,” Revision 1, dated December 2009
- APP-PMS-T5-001, AP1000 PMS Test Plan,” Revision 3, dated April 2013

<u>Corrective Action Documents</u>

- Issue Report (IR) 14-079-M059, “Validation Documentation of Test Setup for System Testing,” dated March 20, 2014
- IR 13-268-M055, “Completeness of Concept Phase IV&V Task-Concept Document Evaluation,” dated September 26, 2013
- IR 12-195-M064, “Investigate Possible Common Cause for IRs,” dated July 13, 2012
- IR 14-077-M048, “CRA-2013-155 – CDI Technical Evaluation Improvements,” dated March 18, 2014
- IR 14-077-M008**,** “CRA-2013-155; Lack of consistency between AP1000 SyDS and DAS design basis,” dated March 18, 2014
- Nuclear Automation Issue Tracking System (RITS), Issue ID# RITS36892; “DAS VS3 CHT: Loose wires on TDDO101 normally open contacts”
- RITS Issue ID# RITS36851, “Incorrect reference in Test procedure (T1P) Section 3.1.3 (typographical error)”

Miscellaneous Documents

- IEEE Standard 730-1998, “IEEE Standard for Software Quality Assurance Plans,” Institute of Electrical and Electronics Engineers, 1998
- IEEE Std. 1074-1995, "IEEE Standard for Developing Software Life Cycle Processes," 1995
- IEEE Standard 1012-1998, “IEEE Standard for Software Verification and Validation,” 1998
- Regulatory Guide 1.173, “Developing Software Life Cycle Processes for Digital Computer Software used in Safety Systems of Nuclear Power Plants,” dated September 1997
- Regulatory Guide 1.169, “Configuration Management Plans for digital Computer Software used in Safety Systems of Nuclear Power Plants,” 1997
- NUREG/CR-6101, “Software Reliability and Safety in Nuclear Reactor Protection Systems,” US Nuclear Regulatory Commission,” June 11, 1993

5. ACRONYMS USED:

ADAMS	Agencywide Documents Access and Management System
ADS	Automatic Depressurization System
CGD	commercial grade dedication
CFR	*Code of Federal Regulations*
CHT	cabinet hardware Testing
CIM	Component Interface Module
CIT	channel integration testing
CMRR	configuration management release record
CSI	CS Innovations, Inc.
DAC	design acceptance criteria
DAS	Diverse Actuation System
DCD	Design Control document
DCIP	Division of Construction Inspection and Operational Programs
DI&C	Digital Instrumentation and Control
EDMS	Equipment and Database System
EUT	equipment under test
EVIB	Electrical Vendor Inspection Branch
FAT	factory acceptance testing
FPGA	Field Programmable Gate Array
IEEE	Institute of Electrical and Electronics Engineers
ILP	Integrated Logic Processor
IP	inspection procedure
IR	issue report
ITAAC	Inspections, tests, analyses, and acceptance criteria
IV&V	independent verification and validation
M&TE	measuring and test equipment
MTP	maintenance and test panel
NA	Nuclear Automation
NON	Notice of Nonconformance
NOV	Notice of Violation
NRC	(U.S.) Nuclear Regulatory Commission
NRO	Office of New Reactors
PRHR HX	Passive Residual Heat Removal Heat Exchanger
PMS	Plant Monitoring System
PC	processor cabinet

PO	purchase order
QA	quality assurance
QC	quality control
RCDP	remote DAS control panel
RITS	Replacement and Automation Services (RRAS) Issue Tracking System
RTM	Requirements Traceability Matrix
RTNSS	regulatory treatment of non-safety systems
RWST	Refueling Water Storage Tank
SDP	software development plan
SIL	software integrity level
SIOS	standard input/output simulator
SIT	system integration testing
SLC	software life cycle
SLCM	software life cycle model
SOP	Standard Operation Procedures
SQAP	software quality assurance program
SQV	Squib Valve Controller
U.S.	United States (of America)
WEC	Westinghouse Electric Company