

January 22, 2014

Mr. Rick Davis, Quality Manager  
Wyle Laboratories  
7800 Highway 20 West  
Huntsville, AL 35806

SUBJECT: NUCLEAR REGULATORY COMMISSION VENDOR INSPECTION OF WYLE  
LABORATORIES REPORT NO. 99900905/2013-201

Dear Mr. Davis:

On December 10 to December 12, 2013, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the Wyle Laboratories (Wyle) facility in Huntsville, Alabama. The purpose of this limited-scope inspection was to assess Wyle's compliance with 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."

This was a follow-up to the July 2012 NRC inspection that specifically evaluated the quality assurance (QA) program as it pertains to Wyle's supply of testing services to support the qualification of components being supplied as part of the AP1000 reactor design. In addition, the NRC inspectors evaluated the implementation of Wyle's corrective actions documented in your letter dated October 18, 2012, in response to NRC's Notice of Nonconformance documented in the NRC Inspection Report No. 99900905/2012-201, dated September 7, 2012. This inspection specifically evaluated Wyle's test control, design control, control of measuring and test equipment, corrective action response, and training and qualification of personnel for the AP1000. The enclosed report presents the results of the inspection. This NRC inspection report does not constitute the NRC endorsement of your overall QA program.

During this inspection, the NRC inspectors observed the functional qualification testing of the 14-inch squib valves in the 4<sup>th</sup> stage of the automatic depressurization system for the AP1000 reactor design. This test is associated with inspections, tests, analyses, and acceptance criteria (ITAAC) from Revision 19 of the certified AP1000 Design Control Document, Tier 1. Specifically, these activities were associated with ITAACs 2.1.2.8d.iii and 2.1.2.12a.iv. The NRC inspectors did not identify any findings associated with ITAAC contained in Section (4) of the attachment to this report with respect to Wyle activities. However, the NRC inspectors identified concerns related to satisfying the applicable ITAAC for the AP1000 squib valves.

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 (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response,

R. Davis

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(if applicable), should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material is withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

Sincerely,

*/RA/*

Edward H. Roach, Chief  
Mechanical Vendor Inspection Branch  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Docket No.: 99900905

Enclosure:

1. Inspection Report No. 99900905/2013-201  
and attachment

R. Davis

- 2 -

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Sincerely,

*/RA/*

Edward H. Roach, Chief  
Mechanical Vendor Inspection Branch  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Docket No.: 99900905

Enclosure:

- 1. Inspection Report No. 99900905/2013-201 and attachment

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

Docket No.: 99900905

Report No.: 99900905/2013-201

Vendor: Wyle Laboratories  
7800 Highway 20 West  
Huntsville, Alabama 35806

Vendor Contact: Mr. Rick Davis, Quality Manager  
416-716-4483  
rick.davis@wylelabs.com

Nuclear Industry Activity: Wyle Laboratories performs testing services to support the seismic, environmental, and functional qualification of safety-related components currently being supplied as part of the Westinghouse AP1000 design. Wyle Laboratories also performs testing services for NRC licensees and vendors that supply safety-related replacement components to U.S. nuclear power plants.

Inspection Dates: December 10-12, 2013

NRC inspectors: Raju Patel NRO/DCIP/MVIB Team Leader  
Tim Steadham R-II/DCI/CIB3  
Thomas Scarbrough NRO/DE/MEB

Approved: Edward H. Roach, Chief  
Mechanical Vendor Inspection Branch  
Division of Construction Inspection & Operational Programs  
Office of New Reactors

Enclosure

## EXECUTIVE SUMMARY

Wyle Laboratories  
99900905/2013-201

The U. S. Nuclear Regulatory Commission (NRC) staff conducted this limited scope vendor inspection to verify that the Wyle Laboratories, (Wyle), 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." This inspection specifically evaluated Wyle's corrective actions in relation to NRC Inspection Report (IR) 99900905/2012-201. The NRC inspectors reviewed test control, control of measuring and test equipment, corrective actions, and training and qualification of personnel at Wyle specific to the functional qualification testing of the 14-inch squib valves in the 4<sup>th</sup> stage of the automatic depressurization system (ADS) of the Westinghouse Electric Corporation (WEC) AP1000 reactor design. The NRC conducted this inspection at Wyle's facility in Huntsville, AL.

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

- Appendix B to 10 CFR Part 50

The NRC inspectors used Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," dated July 15, 2013, IP 35034, "Design Certification Testing Inspection," dated January 27, 2010, and IP 65001.E, "Inspection of the ITAAC-Related Qualification Program," dated August 19, 2008.

The results of the inspection are summarized below.

### Test Control

The NRC inspection team observed the functional test of the AP1000 4<sup>th</sup> stage ADS 14-inch squib valve at Wyle associated with inspections, tests, analyses, and acceptance criteria (ITAAC) in the certified AP1000 DCD, Tier 1, incorporated in the combined licenses of Vogtle Electric Generating Plant, Units 3 and 4, and Virgil C. Summer Nuclear Station, Units 2 and 3. The inspection team concluded that the 14-inch Squib Valve Flow Test Explosive Charge and the 14-inch Squib Valve Flow Test were performed in according to qualification test specifications. Preliminary test results indicated that the test(s) were successful. At the time of the inspection, a detailed evaluation of the valve test results and internal inspection of the valve and actuator with independent quality assurance verification by Wyle and WEC had not yet been performed to determine the applicability of the test results in supporting completion of ITAAC 2.1.2.12a.iv. The NRC inspectors observed the Post-Test Shear Cap Flow Area and found that the measurement of the valve flow area following the test did not appear to meet the requirement in ITAAC 2.1.2.8d.iii. No findings of significance related to Wyle test control activities were identified. However, as previously identified in NRC IR 99900080-2012-201, dated June 6, 2012, an observation related to satisfying the applicable ITAAC for the AP1000 ADS squib valves still exists.

### Control of Testing Equipment

The NRC inspectors concluded that Wyle's control of test equipment were adequate to meet the requirements of Criterion XII, "Control of Measuring and Test Equipment," of Appendix B to 10 CFR Part 50. No findings of significance were identified.

### Implementation of Corrective Actions

The NRC inspectors concluded that Wyle's corrective actions in response to the four Notices of Nonconformance from IR 9990905/2012-201, 9990905/2012-202, 9990905/2012-2019990905/2012-202, 9990905/2012-204 were adequate. No findings of significance were identified.

### Training and Qualification of Personnel

The NRC inspectors concluded the qualification records included the necessary education, on-the-job training, examinations and annual vision examination for specific method and level for which the individual was qualified, and that the records were current. No findings of significance were identified.

## REPORT DETAILS

### 1. Test Control

#### a. Inspection Scope

As a follow-up to the Nuclear Regulatory Commission (NRC) inspection at Wyle in July 2012, the NRC inspectors reviewed qualification plans, test procedures, test setup, test data, and test reports to ensure that applicable NRC regulations, applicable inspections, tests, analyses, and acceptance criteria (ITAAC), and Westinghouse Electric Corporation (WEC) requirements and documents were being adequately addressed for the QME-1 functional qualification testing of the AP1000 14-inch squib valves. The NRC inspectors reviewed Wyle's test logs for the 14-inch squib valve flow test, receipt inspection documentation, and calibration records for the instrumentation used during the testing, and observed the 14-inch full-flow functional qualification testing. The NRC inspectors reviewed Wyle's WLTP56415, "Qualification Plan for QME-1-2007 Qualification of 8" & 14" Squib Valve for Westinghouse Electric," Revision A, dated July 29, 2013, and Wyle's test procedure WTP57622-02, "QME-1 Testing of a 14"-2500# Squib Valve," Revision A, dated December 4, 2013, for consistency with the requirements specified in WEC qualification test plan APP-PV70-VPH-001, and the American Society of Mechanical Engineers (ASME) Standard QME-1-2007. The NRC inspectors reviewed WEC APP-PV70-VPH-001, "AP1000 Squib Valve Equipment Qualification Test Plan," Revision 3, dated October 10, 2013 and found that the qualification program includes functional testing of the actuators and valves per ASME QME-1-2007. The NRC inspectors reviewed the QME-1 functional qualification testing of the 14-inch squib valve, as described in WEC Purchase Order Number (No.) 4500312838 (through Change Notice 8), dated December 3, 2013.

#### Test Configuration

The NRC inspectors performed walk-downs of the test setup (including the control room) for actuation and flow testing of the 14-inch automatic depressurization system (ADS) squib valve to verify that the (1) test configuration was consistent with the test plans and procedures, (2) test activities were consistent with written instructions, and (3) personnel were knowledgeable of the test requirements. The NRC inspectors observed that there was adequate straight pipe upstream and downstream of the flow meter to obtain accurate results. The piping arrangement for the test included a fluid trap prior to the squib valve similar to the arrangement planned for the as-built configuration of the AP1000 plant. The NRC inspectors also reviewed location of the pressure and temperature sensors on the test piping and valve. The NRC inspectors observed that the test setup for the 14-inch squib valve was not designed to model the mounting arrangement when installed in the plant; however, WEC indicated that the firing load and fluid reaction load will be addressed as part of the piping analysis. The NRC inspectors found that the test set-up and design at Wyle appropriately modeled the postulated accident conditions for the valve.

#### 14-inch Squib Valve Explosive Charge

During the inspection at Wyle in July 2012, the NRC inspectors reviewed the Wyle program developed to demonstrate qualification of the squib valve explosive actuator assemblies, in preparation for the AP1000 14-inch squib valve flow test planned at that

time. During this inspection, the NRC inspectors observed that the cartridge installed in the AP1000 14-inch squib valve was properly identified and contained an explosive charge equivalent to 80% of full loading. The NRC inspectors further reviewed the manufacturer of the squib valves (WEC subcontractor, SPX Copes Vulcan (SPX)), Quality Assurance (QA) records: i) Certification of Cartridge Loading, dated December 11, 2013, that specified the cartridge part number, charge serial number, and applicable explosive charge mass; ii) SPX drawing D-400967, "14-inch ADS Squib Valve Cartridge Housing Assembly," Revision 9, dated June 7, 2011, with specific required explosive charge mass; and iii) the 14-inch ADS Squib Valve Cartridge Assembly Data Package, that included the certificate of conformance and associated commercial-grade dedication documents for the valve assembly. Further, the NRC inspectors reviewed a copy of the data sheet from Universal Propulsion Company (UPCO), the explosive charge manufacturer, to verify the specific cartridge part number and serial numbers with the explosive charge mass. The NRC inspectors then reviewed a photograph provided by Wyle of the cartridge housing assembly affixed to the 14-inch squib valve that showed the part number and the serial number of the explosive charge, and observed that they matched with the part number and the serial number of the explosive charge in the SPX data sheet and Certificate of Cartridge Loading.

Based on its review of documents for the cartridge housing assembly, the NRC inspectors determined that the cartridge housing assembly was an 80% loaded cartridge in accordance with the qualification test specification, and that Wyle had verified the installation of the cartridge with the proper explosive charge mass.

#### Functional Test Activities

The NRC inspectors observed pre-test activities and associated records to verify that the displayed calibrated unit parameters for pressure and temperature were within required tolerances displayed on the data acquisition system. The NRC inspectors observed Wyle personnel performing signal integrity verification activities, including input/output continuity checks on test instruments on the test fixture. The NRC inspectors observed Wyle's use of turbine control system (TCS) for Windows data acquisition software as part of the pre-test activities. The NRC inspectors observed the Wyle control room operator and technicians in the field enter input values and observed them verify readings consistent with test requirements in Appendix H, Functional Testing Test Setup, Table 4 of the Wyle qualification plan.

#### 14-inch Squib Valve Flow Test

The NRC inspectors observed the flow test of the AP1000 14-inch squib valve in support of its functional qualification using the ASME QME-1-2007 standard to satisfy ITAAC 2.1.2.12a.iv. The NRC inspectors observed that the flow test was conducted using calibrated equipment that was traceable to known standards and within their calibration frequency and range of use. The NRC inspectors found that the preliminary test results indicated that the valve opened upon initiation of the squib valve actuation signal in an acceptable time period, and allowed flow that met the acceptance criteria at the system temperature and pressure specified in Wyle test procedure WTP57622-02 consistent with the WEC qualification test plan APP-PV70-VPH-001. The NRC inspectors visually inspected the actuated valve and found no adverse effects from the valve actuation and resulting steam flow. In addition, the NRC inspectors observed that all bolting and lock



wires were in place and that no significant galling or damage could be observed in the valve's assembled condition.

#### Post-Test Shear Cap Flow Area

Following the flow test, the NRC inspectors observed that the end of the shear cap had been removed cleanly by the piston upon valve actuation. However, the NRC inspectors noted that the cap opening had a small extended lip around the top half of the shear cap. Upon review of an initial measurement of the post-test shear cap flow area, the NRC inspectors found the vertical diameter to be slightly smaller than the horizontal diameter indicating that the shearing operation had caused the cap to be slightly oval in shape. Wyle then conducted a detailed measurement of the shear cap flow area with QA independent observation. At the conclusion of the inspection, Wyle made precise area measurements using a clay mold of the post-test shear cap flow area.

#### Squib Valve End Load Qualification

The NRC inspectors found that Wyle's qualification plan WLTP56415 did not require end load qualification for the AP1000 squib valves by ASME Standard QME-1-2007. ASME QME-1-2007 refers to valves that isolate blowdown flow when discussing end load qualification because the use of valves to open to blow down a reactor coolant system in new plants was not contemplated when ASME QME-1 was prepared. In this instance, the application of ASME QME-1-2007 does not address the unique service requirement for the 14-inch squib valves to blow down the reactor coolant system in the AP1000 reactor to demonstrate their safety-related design-basis capability. As a result of this discussion, Wyle agreed to revise the qualification plan WLTP56415 to specify that end load qualification for the AP1000 squib valves will be addressed by WEC per its equipment qualification methodology. Wyle provided an approved markup of WLTP56415 that is currently undergoing revision with the appropriate reference to the Westinghouse evaluation of end load qualification for the AP1000 squib valves.

#### Qualification Plan and Test Procedure

The NRC inspectors reviewed Wyle's WLTP56415, "Qualification Plan for QME-1-2007 Qualification of 8" & 14" Squib Valve for Westinghouse Electric," Revision A, dated July 29, 2013, and Wyle's test procedure WTP57622-02, "QME-1 Testing of a 14"-2500# Squib Valve," Revision A, dated December 4, 2013, for consistency with the requirements specified in WEC qualification test plan APP-PV70-VPH-001, and the ASME Standard QME-1-2007. The NRC inspectors found that Wyle had addressed the specific items related to the 14-inch squib valve flow test identified during the 2012 inspection. The NRC inspectors verified Wyle's qualification plan and test procedure were consistent with the WEC qualification and ASME Standard QME-1-2007 requirements.

#### b. Observations and Findings

Based on the preliminary test results and observations, the NRC inspectors found that the AP1000 14-inch squib valve flow test at Wyle was successful such as to allow a detailed evaluation of the test results and internal inspection of the valve and actuator be independently verified by Wyle and WEC in accordance with QA program requirements

to determine the applicability of the test results in supporting completion of ITAAC 2.1.2.12a.iv.

Based on preliminary measurements of the flow area of the AP1000 14-inch squib valve following the test at Wyle, the NRC inspectors performed a calculation of the area of the approximate ellipse of the post-test shear cap flow area, and found that the measured valve flow area did not appear to meet the 67 inch<sup>2</sup> requirement for the 4<sup>th</sup> stage ADS squib valve specified in ITAAC 2.1.2.8d.iii. The NRC inspectors determined that further analysis was needed to determine whether the 67 inch<sup>2</sup> flow area requirements for the 4<sup>th</sup> stage ADS squib valves specified in ITAAC 2.1.2.8d.iii were satisfied.

c. Conclusions

The NRC inspectors determined that the set-up, design, and performance of the flow test at Wyle appropriately modeled the postulated accident conditions for the AP1000 14-inch squib valve and that Wyle's planning and conducting of the functional qualification test of the 14-inch Squib Valve was consistent with the WEC qualification plan and ASME QME-1-2007 as accepted in RG 1.100 (Revision 3) to demonstrate the design-basis capability of squib valves for use in the AP1000 reactor. The NRC inspectors concluded that Wyle is implementing its test control program in accordance with the regulatory requirements of Criterion XI, "Test Control," of Appendix B to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50. Based on the samples reviewed, the NRC inspectors determined that Wyle's test control was adequate to meet the requirements committed to in their test control documentation.

Based on the preliminary test results and observations, the NRC inspectors determined that a detailed evaluation of the valve test results and internal inspection of the valve and actuator in accordance with QA program requirements may be implemented in support of completion of ITAAC 2.1.2.12a.iv. However, the NRC inspectors determined that the valve post-test flow area measurements revealed that the 67 in<sup>2</sup> flow area requirements for the 4<sup>th</sup> stage ADS squib valves specified in ITAAC 2.1.2.8d.iii cannot be satisfied without further analysis.

No findings of significance related to Wyle's test control activities were identified.

**2. Control of Testing Equipment**

a. Inspection Scope

The NRC inspectors reviewed policies and procedures associated with the control of the equipment being utilized by Wyle to perform the functional testing of the squib valves to verify compliance with the requirements of Criterion XII, "Control of Measuring and Test Equipment," of Appendix B to 10 CFR Part 50. The NRC inspectors reviewed calibration records for a sample of measurement and test equipment used during the functional qualification testing and discussed the Measuring and Test Equipment (M&TE) program with Wyle's management and technical staff. In addition the NRC inspectors reviewed data acquisition systems, software and hardware configuration control, and software V&V activities.

### Calibration of Test Equipment

The NRC inspectors reviewed a sample of eight inspection and testing instruments to verify that the equipment was being properly calibrated and controlled. The specific instruments sampled were associated with the functional testing of the 14-inch squib valve. The NRC inspectors confirmed the instruments were calibrated and appropriate for the range of operation for the test. The NRC inspectors reviewed the Wyle Instrument Sheet and confirmed that all equipment was identified, recorded, and verified to be within the calibration frequency and the calibration range. The NRC inspectors confirmed that all test instrumentation was appropriate for the test use and was capable of conducting measurements to the precision required in the test plan.

### Data Acquisition

For the squib valve testing, Wyle used an Optim Electronics MEGADAC data acquisition system and TCS Data Acquisition software. This hardware/software configuration was previously used extensively by Wyle for testing valves and other specimens in their safety-related valve and high-flow test facilities. The configuration consisted of a combination of processors, logic boards, software and associated circuitry. In addition to TCS software, a second commercial software product, DADiSP, was used to perform data tabulation, graphic presentation, and limited data analysis.

The NRC inspectors observed that the Optim Electronics MEGADAC data acquisition system for the high-flow test facility was located in an access controlled air-conditioned enclosure on the test rig. The team verified that the sub-components of the system were adequately labeled and calibration information was present for each piece of equipment. Electronic leads were labeled and routed in such a manner to facilitate ease of identification, access, and maintenance. The team reviewed the calibration records for six Optim MEGADAC unit input cards and confirmed that the calibration data was accurate and the cards were within their calibration period. The team confirmed, through observation of the test configuration setup trial runs, that the system was capable of performing required data acquisition functions in accordance with the test requirements.

### Software Verification and Validation

The NRC inspectors reviewed the V&V package of DADiSP2002 software "Dedication Report for DADiSP 6.5 Builds 04 and 05," dated January 21, 2013, and noted that it included the validation of macros developed by Wyle for common use based on the "Date Modified," property of the file.

The NRC inspectors reviewed the dedication activities associated with Badger Flowmeter Version 1.02, and confirmed that it was treated as safety-related software and was subject to full software V&V by the Wyle staff consistent with procedure QD III-3. The NRC inspectors confirmed that this software was identified on the most current approved software list, dated October 24, 2013. The NRC inspectors reviewed the software V&V report "Badger Differential Pressure Flowmeter Program Version 1.02," dated July 9, 2012, and confirmed that the V&V activities were consistent with the requirements of QD III-3. These activities included, in part, identification of the functions and calculations required to be verified, methods to be used to perform the verification, and hand calculations to verify calculations produced equivalent results.

Each V&V activity was documented in the test report, and were performed in accordance with the Wyle QA program requirements.

b. Observations and Findings

No findings of significance were identified.

c. Conclusions

The NRC inspectors determined that test records were completed as required and that data acquisition set-up activities were performed consistent with the requirements specified in the test procedures. The NRC inspectors concluded that Wyle is implementing its M&TE program in accordance with the regulatory requirements of Criterion XII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspectors also determined that Wyle is implementing its policies and procedures associated with the M&TE program. No findings of significance were identified.

**3. Corrective Action**

a. Inspection Scope

The NRC inspectors reviewed the implementation of Wyle's follow-up actions in response to NRC Notice of Nonconformance (NON) 99900905/2012-201-01, 99900905/2012-201-02, 99900905/2012-201-03, and 99900905/2012-201-04. The NRC inspectors reviewed the associated Wyle Corrective Action Program Issue Reports and the resultant commitments to implement specific corrective actions. The NRC inspectors reviewed a sampling of procurement documents issued subsequent to implementation of the corrective actions to verify the issues resulting in the NON have not recurred. The NRC inspectors also reviewed procurement documents issued prior to the NRC issuance of the NON, and verified that Wyle's extent of condition review recognized, evaluated, and corrected all similar issues associated with procurement documents, in addition to the specific examples the NRC had identified. The NRC inspectors reviewed procedural changes and training plans that WEC has established as a barrier to prevent recurrence. The attachment to this inspection report lists the documents reviewed by the NRC inspectors.

NON 99900905/2012-201-01 item 1

The NRC inspectors reviewed the documentation that provided objective evidence for the completion of the corrective action taken and interviewed the responsible Wyle personnel. The NRC inspectors reviewed Wyle's qualification plan WLTP56415, and test procedure WTP57622-02, and WEC APP-PV70-VPH-001, to ensure both Wyle and WEC documents specified the sealing capability leakage test acceptance criteria consistent with the ASME QME-1-2007 QV-7431, "Sealing Capability." The NRC inspectors confirmed Wyle's qualification plan and test procedure and WEC's qualification plan adequately translated the sealing capability leakage test acceptance criteria consistent with the ASME QME-1-2007 QV-7431.

NON 99900905/2012-201-01 item 2

The NRC inspectors reviewed the documentation that provided objective evidence for the completion of the corrective action taken and interviewed the responsible Wyle personnel. The NRC inspectors reviewed Wyle's Test Report WLTR57873-6, "Test Report for QME-1 Testing on an 8" Class 1530# Globe Valve for Flowserve," Revision 0, dated March 20, 2013. The test report described the testing of the 8-inch flow-over-the-seat balanced globe valves using partial stroke segments for tests under steam conditions and water conditions. In the opening direction, the valve was tested from fully closed to 35% open to identify the maximum thrust in the open direction. After this initial partial stroke, Wyle conducted additional partial strokes until the valve was fully open. For both the steam and water tests, the test data indicated that the maximum thrust was achieved early during the opening stroke, and the required thrust had decreased significantly prior to reaching the 35% open position.

The NRC inspectors observed that Wyle had justified the use of a partial open stroke to determine the valve factor for the opening stroke of these 8-inch flow-over-the-seat balanced globe valves. For the closing stroke, the fluid flow assisted in closing the valve for both the steam and water tests. The test data indicated that the required thrust levels were low because of the flow assistance during the closing stroke. As a result, the NRC inspectors found that Wyle provided adequate justification for the use of partial stroke segments for the flow testing of the 8-inch flow-over-the-seat balanced globe valves. Although Wyle's response to the NON referenced experience with typical gate or globe valves during GL 89-10 testing, the team indicated to Wyle personnel during the inspection that valve testing experience has revealed significant differences in valve performance based on the valve type and its operating conditions. Therefore, the NRC inspectors noted to Wyle that gate valves or other design globe valves will require specific justification for the use of partial stroke testing because valve design and the flow application can have a significant impact on the performance of the valve during opening and closing strokes.

NON 99900905/2012-201-02

The NRC inspectors reviewed the documentation that provided objective evidence for the completion of the corrective action taken and interviewed the responsible Wyle personnel. The NRC inspectors determined that Wyle appropriately trained their staff and revised procedure QD III-3 to include the software dedication improvements as discussed in their reply. The NRC inspectors reviewed Wyle's V&V package for DADiSP2002 software, "Dedication Report for DADiSP 6.5 Builds 04 and 05." The dedication report documented the safety function, identification of critical functions and calculations to be verified, methods to be used to perform the verification, and alternate calculations to verify the DADiSP2002 software calculations produce equivalent results and the technical evaluation. Additionally, as part of the DADiSP2002 software dedication, Wyle documented the QA acceptance, receipt, and installation of DADiSP2002 software.

NON 99900905/2012-201-03

The NRC inspectors reviewed the documentation that provided objective evidence for the completion of the corrective action taken and interviewed the responsible Wyle personnel. The NRC inspectors reviewed Wyle's QD III-3, and noted that Revision H

now includes the use of form WH-1641 (or equivalent). The NRC inspectors reviewed the two calculations contained in test report No. WTRP57428, "PWR Owners Group Jet Impingement Testing from A 2" Nozzle," dated March 1, 2012, which were the subject of this nonconformance. The NRC inspectors determined that Wyle's dedication of DADiSP software adequately demonstrated the validity of both calculations. Specifically, the NRC inspectors determined that the functions used for both calculations were verified through alternate calculation methods during the verification and DADiSP validation.

#### NON 99900905/2012-201-04

The NRC inspectors reviewed the documentation that provided objective evidence for the completion of the corrective action taken and interviewed the responsible Wyle personnel. The NRC inspectors reviewed Wyle test report WLTR57873-6, that discusses uncertainties during testing of the 8-inch balanced globe valves. Wyle determined the combined uncertainty of the valve factor based on the uncertainties for thrust measurement, packing load, pressure measurements, and its data acquisition system. The NRC inspectors found that Wyle had evaluated the uncertainties of the valve parameters determined during valve flow tests and had included the uncertainties in its recommended valve factor in the example calculation provided for the 8-inch globe valves.

#### b. Observations and Findings

No findings of significance were identified.

#### c. Conclusion

The NRC inspectors concluded that Wyle is implementing its corrective action program in accordance with the regulatory requirements of Criterion XVI of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspectors also determined that Wyle is implementing its policies and procedures associated with the CAR program. The NRC inspection team determined that Wyle's corrective actions with respect to the above NONs were adequate to address the previously identified findings. No findings of significance were identified.

### 4. Training and Qualification of Personnel

#### a. Inspection Scope

The NRC inspectors reviewed various policies, implementing procedures, and records that govern Wyle's training and qualification to verify compliance with Criterion II, "Quality Assurance Program," of Appendix B, "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Wyle's QD II-2, "Engineering, Verification, Quality Assurance, and Testing Personnel Qualification Program," Revision J, effective December 15, 2009, describes the training and qualification requirements for Wyle personnel.

The NRC inspectors verified that Wyle has programs in place to address the training and qualification of personnel performing activities that affect quality. The programs include

procedures that incorporate appropriate training and qualification practices. The NRC inspectors reviewed qualification records for a sample for 5 Wyle employees who were involved in the functional qualification testing of squib valves. The NRC inspectors confirmed the qualification records included the necessary education, on-the-job training, examinations and annual vision examination for specific method and Level for which the individual was qualified, and that the records were current.

b. Observations and Findings

No findings of significance were identified.

c. Conclusions

The NRC inspectors concluded that Wyle is implementing its training and qualification program in accordance with Criterion II of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspectors also determined that Wyle is implementing its policies and procedures associated with its training and qualification programs. No findings of significance were identified.

5. Exit Meeting

On December 12, 2013, the NRC inspectors presented their inspection scope and findings during an exit meeting with Mr. Keith Wilson, Wyle Eastern Operations Vice President, and Wyle management and engineering personnel.

**ATTACHMENT**

1. **ENTRANCE/EXIT MEETING ATTENDEES AND INDIVIDUALS INTERVIEWED**

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Tom Brewington	Sr. Director, Nuclear	Wyle	X	X	
Keith Wilson	Vice President Testing & Engineering East	Wyle	X	X	
E. Reilly Schum	Engineering Manager, EQ and TPQ	Wyle	X	X	
Greg Mason	Manager, Nuclear Business Development	Wyle	X	X	
Rick Davis	Quality Assurance /Safety Manager	Wyle	X	X	X
Steven M. Felice	Calibration Manager	Wyle			X
Brenda Morse	Quality Assurance Technician/Level III	Wyle			X
John B. Hardy, PE	Sr. Instrumentation and Controls Engineer	Wyle	X	X	X
Serge M'Sadoques	Sr. Project Engineer, Nuclear Testing Services	Wyle	X	X	X
Ralph D. Yeardley, PE	Sr. Principal Engineer, Nuclear Testing Services	Wyle	X	X	X
Ronald P. Wessel	Principal Engineer, AP 1000 Licensing	WEC	X	X	X
Raju B. Patel	Inspection Team Leader	NRC	X	X	
Thomas Scarbrough	Senior Mechanical Engineer	NRC		X	
Tim Steadham	Inspector	NRC	X	X	

2. **INSPECTION PROCEDURES USED**

- Inspection Manual Chapter (ICM) 2507, "Construction Inspection Program Vendor Inspections," dated October 3, 2013
- IP 35034, "Design Certification Testing Inspection," dated January 27, 2010
- IP 43002, "Routine Inspections of Nuclear Vendors," dated July 15, 2013
- IP 65001.E, "Inspection of the ITAAC-Related Qualification Program," dated August 19, 2008



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

Item Number	Status	Type	Description	Applicable Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) from AP1000 Design Control Document, Tier 1, Revision 19
99900905/2009-201-01	Closed	NON	Criterion XII	N/A
99900905/2012-201-01	Closed	NON	Criterion XI	Example 2 Only 2.1.2.12a.i, 2.2.2.11a.i 2.3.2.11a.i 2.3.6.12a.i.
99900905/2012-201-02	Closed	NON	Criterion VII	N/A
99900905/2012-201-03	Closed	NON	Criterion III	N/A
99900905/2012-201-04	Closed	NON	Criterion III	2.1.2.12a.i, 2.2.2.11a.i 2.3.2.11a.i 2.3.6.12a.i.

### 4. INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA

The U.S. Nuclear Regulatory Commission (NRC) inspectors identified the following inspections, tests, analyses, and acceptance criteria (ITAAC) related to components being tested by Wyle. At the time of the inspection, Wyle was involved in functional qualification testing of the 14-inch squib valves in the 4<sup>th</sup> stage of the automatic depressurization system (ADS) for the AP1000 reactor design. For the ITAAC listed below, the NRC inspectors reviewed Wyle's quality assurance controls in the areas test control, control of measuring and test equipment, and corrective actions. The ITAAC's design commitment 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 NRC inspectors did not identify any findings associated with the ITAAC identified below.

Based on the preliminary test results and observations, the NRC inspectors determined that the 67 in<sup>2</sup> flow area requirements for the 4<sup>th</sup> stage ADS squib valves specified in ITAAC 2.1.2.8d.iii cannot be satisfied without further analysis.

ITAAC	Design Commitment	Acceptance Criteria
2.1.2.8d.iii (34)	8.d) The RCS provides automatic depressurization during design basis events.	The flow area through each fourth-stage ADS valve is $\geq 67$ inch <sup>2</sup>
2.1.2.12a.iv (56)	12.a) The automatic depressurization valves identified in Table 2.1.2-1 perform an active safety-related function to change position as indicated in the table.	A test report exists and concludes that each squib valve changes position as indicated in Table 2.1.2.-1 under design conditions

## 5. Documents Reviewed

### Specifications, Test Plans, Procedures, and Drawings

- Wyle Quality Assurance (QA) Manual, Revision 3, dated March 31, 2009
- Section 16, "Corrective Action," of Wyle QA Manual, Revision 3, effective March 31, 2009
- Quality Directive (QD) II-2, "Engineering, Verification, Quality Assurance, and Testing Personnel Qualification Program," Revision J, effective December 15, 2009
- QD III-3, "Software Development and Configuration Control," Revision H, dated October 18, 2012
- QD V-1, "Instructions, Procedures, and Certification Reports," effective June 8, 2012
- QD XI-1, "Test Control Program," Revision M, effective June 18, 2012
- QD XII-1, "Control of Measuring and Testing Equipment," Revision S, effective October 25, 2013
- QD XIV-1, "Receiving Inspection," Revision J, dated August 8, 2012
- QD XV-2, "Notice of Anomaly," Revision G, effective March 31, 2009
- QD XVI-1, "Corrective Action Program," Revision F, effective March 31, 2009
- Wyle Nuclear Environmental Qualification Engineering Procedure -409, "The Wyle Third Party Qualification/Dedication Process," Revision H, effective February 9, 2011
- Wyle Qualification Plan, WLTP56415, "Qualification Plan for QME-1-2007 Qualification 8" & 14" Squib Valve for Westinghouse Electric Company," Revision A, dated July 29, 2013
- Wyle Test Procedure, WTP57622-02, "QME-1 Testing of an 14"-2500# Squib Valve," Revision A, dated December 4, 2013
- Appendix G, "Sealing Capability," to Wyle Test Procedure WTPR57622-01 for 14-inch Squib Valve Sealing Test, Rev A, dated December 4, 2013
- Westinghouse Electric Corporation (WEC) APP-GW-G1-002, "AP1000 Plant Equipment Qualification Methodology," Revision 3, dated March 26, 2012
- WEC APP-GW-VP-010, "Equipment Qualification Methodology and Documentation Requirements for AP1000 Safety-Related Valves and Valve Appurtenances," Revision 2, dated April 2010
- WEC APP-PV70-VPH-001, "AP1000 Squib Valve Equipment Qualification Test Plan," Revision 3, dated October 10, 2013
- WEC Design Specification APP-PV70-Z0-001, "Squib (Pyrotechnic Actuated) Valves, ASME Boiler and Pressure Vessel Code, Section III Class 1," Revision 5, dated July 26, 2013
- WEC Data Sheet APP-PV70-Z0R-001, "PV70 Squib (Pyrotechnic Actuated) Valves, ASME Section III Class 1, Data Sheet Report," Revision 7, dated June 1, 2012
- WEC APP-PV70-Z0Y-001, "Plant and System Transients Applicable to PV70 Valves," Revision 1, dated August 1, 2011
- WEC APP-GW-GD-013, "AP1000 Standard Drawing Format for Squib (Pyrotechnic Actuated) Valves," Revision 1, dated October 15, 2010
- WEC APP-PVK-V6-002, "14" Squib Valve Class 2500 Weld Neck Flange," Revision 0, dated November 15, 2010
- WEC APP-PV70-V0-001, "14-inch Squib (Pyrotechnic Actuated) Valve Envelope Drawing," Revision 4, dated March 5, 2012
- WEC APP-PV98-Z0-001, "Pyrotechnic Actuator for ASME Boiler and Pressure Vessel Code, Section III Class 1 Squib Valves (PV79)," Revision 1, dated March 30, 2011

- WEC APP-PV70-V2-001, "Squib Valve Connector Assembly," Revision 2, dated May 17, 2013
- SPX Drawing for "14-inch ADS Squib Valve Cartridge Housing Assembly," Revision 9, dated June 7, 2011

#### Purchase Orders

- WEC Purchase Order 4500312821 ASME QME-1 testing of AP1000 Squib Valve (PV70), Change Notices 1 to 8 dated December 3, 2013

#### Calibration Certificates

- Certificate No. 01585:13766641120, Omega Thermocouple Probe, M&TE ID 01585, TC-A2, dated April 22, 2013, due April 22, 2014
- Fluke Calibration Certificate for SPRT, Fluke/Hart Scientific 5699-S PRT Probe, M&TE ID 04863, S/N 0475, dated February 08, 2011, due February 08, 2014
- Certificate No. 02725:1378906750, Omega Thermocouple Probe, M&TE ID 02725, TC-A5, dated September 11, 2013, due September 11, 2014
- Certificate No. 02727:1378907659, Omega Thermocouple Probe, M&TE ID 02727, TC-A4, dated September 11, 2013, due September 11, 2014
- Certificate No. 0350:1377696079, Omega Thermocouple Probe, M&TE ID 03501, TC-A3, dated August 28, 2013, due August 28, 2014,
- Certificate No. 04592:137888093, Hart Scientific Calibrator, M&TE ID 04592, dated September 11, 2013, due September 11, 2014
- Certificate No. 01442:1331719490, Fluke Current Clamp, M&TE ID 01442, dated October 11, 2013, due April 9, 2014
- Certificate No. 01555:1335254341, Honeywell Pressure Transducer, M&TE ID 01555, dated November 21, 2013, due November 21, 2014
- Certificate No. 01556:1335254341, Honeywell Pressure Transducer, M&TE ID 01556, dated October 24, 2013, due April 24, 2014
- Certificate No. 01572:1342690486, Honeywell Pressure Transducer, M&TE ID 01572, dated August 29, 2013, due March 1, 2014
- Certificate No. 02340:1334748473, Sensotec Pressure Transducer, M&TE ID 02340, dated December 3, 2013, due June 3, 2014
- Certificate No. 117167:1317711213, Optim Input Card, M&TE ID 117167, dated August 8, 2013, due August 8, 2014
- Certificate No. 117168:1317711213, Optim Input Card, M&TE ID 117168, dated August 8, 2013, due August 8, 2014
- Certificate No. 117169:1317711213, Optim Input Card, M&TE ID 117169, dated August 8, 2013, due August 8, 2014
- Certificate No. 117170:1317711213, Optim Input Card, M&TE ID 117170, dated August 8, 2013, due August 8, 2014
- Certificate No. 117171:1317711001, Optim Input Card, M&TE ID 117171, dated August 8, 2013, due August 8, 2014
- Certificate No. 117172:1317711213, Optim Input Card, M&TE ID 117172, dated August 8, 2013, due August 8, 2014
- Exelon Power Labs Certificate of Calibration No. 0010775891 for WEC Squib Firing System, M&TE ID No. 1096, Model No. 4006, dated September 12, 2013, due September 12, 2014

## Other

- Wyle Post-Test Shear Cap dimensional measurement report dated December 12, 2013
- Wyle Instrumentation Equipment Sheet for Job No. T57622.01, for 14-inch Squib valve Functional test, approved December 11, 2013
- Wyle Receiving Inspection Report for the 14-inch squib valve, serial No. 0920-164450-7-1, for Job No. T57622.01, receipt dated December 6, 2013
- Wyle Receiving Inspection Report for 6 cartridge housing assemblies, P/N 400966-2 S/Ns. 000021 & 000022, P/N 399896-2, S/Ns. 000026 & 000027 and P/N 400967-2, S/Ns. 000036 & 000037, received on December 9, 2013
- Wyle Pre-Job Brief Checklist for Wyle Job No. T57622 for Westinghouse QME-1, 14-inch squib valve, performed on December 9, 2013
- Wyle V&V package for DADiSP2002 software, "Dedication Report for DADiSP 6.5 Builds 04 and 05," dated January 21, 2013
- Wyle Test Report WLTR57873-6, "Test Report for QME-1 Testing on an 8" Class 1530# Globe Valve for Flowserve," Revision 0, dated March 20, 2013
- Wyle Qualification Record for John Hardy, Software Engineer, Level II, re-qualified on March 9, 2012
- Wyle Qualification Record for Serge M'Sadoques, Engineer, Level II, re-qualified on dated July 15, 2013
- Wyle Qualification Record for Adam C. Casey, Instrumentation Test Specialist, Level II, re-qualified on August 13, 2013
- Wyle Qualification Record for James Collins, Test Specialist, Level II, re-qualified on dated March 9, 2012
- Wyle Qualification Record for Michael Fromhold, Electronics Technician, Level II, re-qualified on January 23, 2012
- Wyle Qualification Record for Chris Timnon, Instrumentation/Test Specialist, Level II, re-qualified on February 3, 2011
- Wyle Qualification Record for Byron Butler, Test Specialist, Level II, re-qualified on April 13, 2013
- SPX 14-inch ADS Squib Valve Cartridge Assembly Data Package, Part No. 400967-2 Serial Nos. 0036 and 0037, dated December 4, 2013
- UPCO Data Sheet 1 for Cartridge Assembly UTAS P.N 17399300-1, 2, 3 for SPX PN 400967-1, 2, 3, Lot # UCO13J001-003, S/N 0036 and 0037 dated September 28, 2013
- SPX Certificate of Cartridge Loading for P/N 400967-2, S/Ns 000036 and 000037 UCO013J001-003, dated December 11, 2013

## Corrective Action Requests

- Wyle Corrective Action Request (CAR) No. 13-004, dated December 10, 2013
- CAR No. 13-006, dated December 12, 2013