September 7, 2012

Mr. Raul Terceno, Quality Manager
Wyle Laboratories
7800 Highway 20 West
Huntsville, AL 35806

SUBJECT: NUCLEAR REGULATORY COMMISSION VENDOR INSPECTION
REPORT NO. 99900905/2012-201 AND NOTICE OF NONCONFORMANCE

Dear Mr. Terceno:

From July 23 to 27, 2012, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at the Wyle Laboratories facility in Huntsville, Alabama. The purpose of this inspection was to review implementation of your quality assurance program in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," and 10 CFR Part 21, "Reporting of Defects and Noncompliance." This inspection specifically evaluated the quality assurance program as it pertains to Wyle's supply of testing services to support environmental qualification of components being supplied as part of the Westinghouse AP1000 reactor design. The enclosed report presents the results of this inspection. This NRC inspection report does not constitute NRC endorsement of your overall quality assurance (QA) or 10 CFR Part 21 programs.

The NRC inspectors determined that in general, Wyle was conducting testing in accordance with regulatory requirements. However, during this inspection, NRC inspectors found that the implementation of your QA program failed to meet certain NRC requirements imposed on you by your customers or NRC licensees. Specifically, the inspection team determined that in some instances, Wyle failed to implement measures to ensure effective design control, test control, and procurement practices. These deficiencies are cited in the enclosed Notice of Nonconformance (NON), and the enclosed inspection report describes in detail the circumstances surrounding them. In addition, two of the NONs concern issues that, if not corrected, may impact the ability of NRC licensees to meet applicable Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) from the AP1000 Design Control Document, Tier 1, Revision 19. The specific issues and applicable ITAAC are contained in Attachment 1.

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

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made

available to the Public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of yourresponse that deletes such information. If you request that such material is withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

***/RA/***

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

Docket No.: 99900905

Enclosures:
1. Notice of Nonconformance
2. Inspection Report No. 99900905/2012-201 and attachment

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 yourresponse 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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Docket No.: 99900905

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2. Inspection Report No. 99900905/2012-201 and attachment

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| **OFFICE** | NRO/DCIP/CEVB | R-II/DCI/CIB3 | NRO/DE/CIB | NRO/DCIP/CEVB |
| **NAME** | JJacobson | JHeisserer | TScarbrough | GGalletti |
| **DATE** | 09/06/2012 | 08/28/2012 | 08/30/2012 | 08/28/2012 |
| **OFFICE** | NRO/DCIP/CQAB | NRO/DCIP/CAEB | NRO/DCIP/CEVB | |
| **NAME** | LTrocine | TFrye | RRasmussen | |
| **DATE** | 08/29/2012 | 09/06/2012 | 09/07/2012 | |

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# NOTICE OF NONCONFORMANCE

Wyle Laboratories
7800 Highway 20 West
Huntsville, Alabama 35806

Inspection Report 99900905/2012-201
Docket No. 99900905

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted at the Wyle Laboratories facility in Huntsville, Alabama, on July 23 through 27, 2012, certain activities were not conducted in accordance with NRC requirements that were contractually imposed on Wyle by its customers or NRC licensees:

A. Criterion XI, "Test Control," for Appendix B to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 states that, "A test program shall be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. The test program shall include, as appropriate, proof tests prior to installation, preoperational tests, and operational tests during nuclear power plant or fuel reprocessing plant operation, of structures, systems, and components. Test procedures shall include provisions for assuring that all prerequisites for the given test have been met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions. Test results shall be documented and evaluated to assure that test requirements have been satisfied."

   Wyle Quality Assurance Manual, Section 11, "Test Control," states that the program for control of all testing activities affecting quality shall ensure that all testing demonstrates that items will perform according to established criteria. The manual also states that these testing activities shall be performed in accordance with written procedures, containing the requirements and acceptance limits to the design documents, instructions, procedures, and drawings associated with assigned projects.

   Contrary to the above, as of July 27, 2012, Wyle failed to implement measures to ensure that:

   1. All test requirements contained in the Westinghouse Electric Company Qualification plan were satisfied. Specifically, Wyle failed to identify a discrepancy between the Westinghouse Qualification Plan and the Wyle Qualification Plan associated with the time required to test the squib valves for sealing capability. The Westinghouse Qualification Plan, APP-PV70-VPH-001, specified testing of the sealing capability of the AP1000 squib valves for 15 minutes, while the Wyle Qualification Plan specified testing the sealing capability for 5 minutes;

   2. The test program designed for the QME 1 qualification of testing of 8-inch globe valves was not sufficient to ensure that valve would perform satisfactorily in service. Specifically, the Wyle Qualification Plan for 8-inch globe valves specifies partial stroke segments to be used during steam or water flow tests without justification that this test method demonstrates valve performance consistent with a continuous valve stroke.

   These issues have been identified as Nonconformance 99900905/2012-201-01.

B. Criterion VII, “Control of Purchased Material, Equipment, and Services,” of Appendix B to 10 CFR Part 50, states, in part, that, “Measures shall be established to assure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to the procurement documents. These measures shall include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products upon delivery.”

   Quality Directive (QD) IV-1, “Procurement of Safety-Related and Commercial Grade Materials, Services, and Instrumentation,” Revision H, dated July 8, 2011, defines the requirements for standard procurement of nuclear safety-related and commercial grade materials used in the technical operation of the laboratory. Section 3.0, “Purchase Requisition Review,” of QD IV-1, states, in part, that when commercial grade or off the shelf (OTS) catalog items are to be procured, the Wyle QA organization, shall review the purchase order to assure proper application of the technical and quality requirements, and shall perform a receipt inspection of the products to verify adequacy.

   Contrary to the above, as of July 27, 2012, Wyle failed to implement measures to assure that products were appropriately procured and examined upon receipt as required. Specifically, Wyle Purchase Order (PO) HSV0031500, dated April 5, 2004, used to procure the DaDiSP 2002 program used for safety-related testing was not developed, reviewed, or approved by the Wyle QA organization, nor was it examined by the QA organization upon delivery.

   This issue has been identified as Nonconformance 99900905/2012-201-02.

C. Criterion III, “Design Control,” of Appendix B, “Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, “Domestic Licensing of Production and Utilization Facilities,” states, in part, that, measures shall be established for the selection and review for suitability of application of materials, parts, equipment, and processes. The design control measures shall provide for verifying or checking the adequacy of design such as by the use of alternate or simplified calculational methods.

   Wyle Quality Directive (QD) III-3, “Software Development and Configuration Control,” Revision G, dated June 27, 2012, states, in part, that software procured commercially and used in safety-related applications is to be identified, controlled, and evaluated. Furthermore, as part of the evaluation, it shall be ensured that all calculations or macros are checked for accuracy by an alternate method(s), and the results of this activity shall be documented.

   Contrary to the above, as of July 27, 2012, Wyle failed to provide for verifying or checking for adequacy calculations within the DaDiSP software used for safety-related testing at the laboratory. Specifically, two calculations: (1) used to adjust the baseline pressure to account for test configuration, and (2) used to perform curve smoothing of the raw test data within the DaDiSP program on safety-related testing activities were not checked for accuracy by an alternate method(s), nor documented as required.

   These issues have been identified as Nonconformance 99900905/2012-201-03.

D. Criterion III, “Design Control, for Appendix B to 10 CFR Part 50 states, in part, that “The design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. The verifying or checking process shall be performed by individuals or groups other than those who performed the original design, but who may be from the same organization. Where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, it shall include suitable qualifications testing of a prototype unit under the most adverse design conditions. Design control measures shall be applied to items such as the following: reactor physics, stress, thermal, hydraulic, and accident analyses; compatibility of materials; accessibility for inservice inspection, maintenance, and repair; and delineation of acceptance criteria for inspections and tests.”

   Wyle Quality Assurance Manual, Section III, “Design Control,” states that design control measures shall be implemented to verify or check the adequacy of the design. The manual also states that these measures include the performance of design reviews, the use of alternate or simplified computations, or by performance of a suitable testing program, when applicable.

   Contrary to the above, as of July 27, 2012, Wyle failed to implement measures to verify or check the adequacy of the design. Specifically, Wyle Qualification Plans for calculating the valve factors and stem friction coefficients for motor operated valves did not include provisions to account for tolerances associated with instrument uncertainties. Consideration of such instrument uncertainties is necessary to ensure that the testing will envelope the most adverse design conditions.

   This issue has been identified as Nonconformance 99900905/2012-201-04.

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to Richard Rasmussen, Chief, Electrical Vendor Branch, Office of New Reactors, within 30 days of the date of the letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to a Notice of Nonconformance and should include for each noncompliance: (1) the reason for the noncompliance, or if contested, the basis for disputing the noncompliance; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid noncompliances; and (4) the date when your corrective action will be completed. Where good cause is shown, consideration will be given to extending the response time.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC’s document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by

10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection, described in 10 CFR 73.21.

Dated this 7th day of September 2012

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

| | |
|---|---|
| Docket No.: | 99900905 |
| Report No.: | 99900905/2012-201 |
| Vendor: | Wyle Laboratories.<br>7800 Highway 20 West<br>Huntsville, Alabama 35806 |
| Vendor Contact: | Mr. Raul Terceno, Quality Manager<br>416-207-5686<br>raul.terceno@wylelabs.com |
| Nuclear Industry Activity: | Wyle performs testing services to support the seismic and environmental qualification of safety related components currently being supplied as part of the Westinghouse AP1000 design. Wyle also performs testing services for NRC licensees and vendors who supply safety related replacement components to the U.S. nuclear operating fleet. |
| Inspection Dates: | July 23-27, 2012 |

| Inspectors: | | |
|---|---|---|
| Jeffrey Jacobson | NRO/DCIP/CEVB | Team Leader |
| Jamie Heisserer | R-II/DCI/CIB3 | |
| Greg Galletti | NRO/DCIP/CEVB | |
| Thomas Scarbrough | NRO/DE/CIB | |
| Leigh Trocine | NRO/DCP/CQABI | |

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

## EXECUTIVE SUMMARY

This inspection was performed as part of the U. S. Nuclear Regulatory Commission's (NRC's) overall strategy for inspecting targeted Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) related to the functional and type testing of safety related components being supplied by Westinghouse Electric Company (WEC) and their sub-suppliers as part of the AP1000 certified reactor design. The purpose of this inspection was to assess whether Wyle is adequately implementing the controls imposed on them by WEC and other customers with regard to the testing and qualification of safety related components for the AP1000, specifically, pyrotechnic-actuated (squib) valves and motor operated valves. Such testing is being performed in accordance with Title 10 to the *Code of Federal Regulations* (10 CFR) Part 50.49, Appendix B to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, and applicable industry standards as described in Revision 19 to the AP1000 Design Certification Document (DCD). The testing is required to demonstrate that components that perform a safety function can be relied upon to operate throughout their qualified life after exposure to design basis accident conditions, including radiation, thermal aging, pressure, temperature, humidity, and seismic vibration, as applicable. The qualification and function testing is also required to support closure of selective Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC), as described in Revision 19 of the AP1000 Design Control Document.

Wyle currently has two separate testing programs associated with the squib valves, one for the squib valve actuators, and one for the valves themselves. The team found Wyle's test program associated with the squib valve actuators appropriately captured the actuator design requirements. Also, the team verified that the accuracy and range of the pressure transducers being used by Wyle to measure the performance of the actuators were suitable for the application. The team also identified that the SPX requirement to perform a statistical analysis of the test data had not been translated into the test procedures or test specification. These issues will be considered for review during a future NRC inspection at WEC.

In reviewing the Wyle test program for the squib valve itself, the team found that the test set-up and design appropriately modeled the postulated accident conditions and that Wyle appropriately translated the design requirements. The team identified as a nonconformance that Wyle failed to address a discrepancy in the valve sealing capability requirements between the Westinghouse Qualification Plan and the Wyle Qualification. With the exception of the specific item discussed above, the team found that Wyle is planning and conducting valve tests consistent with the Westinghouse Qualification Plan and American Society of Mechanical Engineers QME-1-2007.

With respect to its review of instrumentation and data acquisition, the team found that the test records were complete and all data acquisition set-up activities were performed consistent with the requirements specified in the test procedures. In general, Wyle had identified and documented important test activities and had, as observed by the team, implemented those activities in accordance with the test plans and testing requirements.

The team identified two nonconformances where Wyle's software control program was not implemented consistent with regulatory requirements and with Wyle's own internal procedures. The first nonconformance concerned an example where Wyle failed to implement required procurement activities associated with the purchase of commercial software used in safety-related testing. The second nonconformance concerned Wyle's failure to perform alternate calculations as part of test software verification activities as required by the Wyle design control program.

During its review of motor operated valve testing, the team identified as a nonconformance Wyle's failure to clearly account for instrument uncertainties in the calculation of valve factors and stem friction coefficients. The team also identified as a nonconformance Wyle's lack of a documented justification for the performance of partial valve strokes during valve flow testing, since intermittent partial stroking of the valve could cloak problems with the valve that might exist during a continuous stroking cycle. These issues, if not corrected, may impact the ability of NRC licensees to meet applicable Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) from the AP1000 Design Control Document, Tier 1, Revision 19.

Lastly, the team concluded that Wyle's test anomaly and corrective actions processes were in compliance with Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50 and were implemented in accordance with applicable Wyle policies and procedures.

## REPORT DETAILS

This inspection was performed as part of the U. S. Nuclear Regulatory Commission's (NRC's) overall strategy for inspecting targeted Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) related to the functional and type testing of safety related components being supplied by Westinghouse Electric Company (WEC) and their sub-suppliers as part of the AP1000 certified reactor design. The purpose of this inspection was to assess whether Wyle is adequately implementing the controls imposed on them by WEC and other customers with regard to the testing and qualification of safety related components for the AP1000, specifically, pyrotechnic-actuated (squib) valves and motor operated valves. Such testing is being performed in accordance with Title 10 to the *Code of Federal Regulations* (10 CFR) Part 50.49, Appendix B to 10 CFR Part 50, and applicable industry standards as described in Revision 19 to the AP1000 Design Certification Document (DCD). The testing is required to demonstrate that components that perform a safety function can be relied upon to operate throughout their qualified life after exposure to design basis accident conditions, including radiation, thermal aging, pressure, temperature, humidity, and seismic vibration, as applicable. Among the types of qualification testing reviewed by the NRC inspection team were specific tests that simulate design basis accident environments, functional testing, and thermal aging. The team also reviewed selected analyses performed by Wyle associated with the qualification testing.

1. Squib Valves – (ITAACs 2.1.2.4.12.a.iv, 2.2.3.4.7.a.i and 2.2.3.4.12.a.i)

WEC has taken overall responsibility for oversight of the equipment qualification program for the 8-inch and 14-inch squib valves being supplied as part of the AP1000 reactor. As stated in the WEC generated "AP1000 Squib Valve Equipment Qualification Test Plan," APP-PV70-VPH-001, Revision 0, dated 11/2011, the qualification program involves four separate testing programs: actuator qualification testing, electromagnetic interference testing of the actuators, seismic testing of both the actuators and the valves, and functional testing of the actuators and valves per American Society of Mechanical Engineers (ASME) QME-1. For this inspection, the NRC inspection team focused on selected aspects of the actuator qualification program and on the QME-1 functional qualification testing of the actuators and valves, as described in Westinghouse Purchase Order 4500312821, dated 7/30/2009.

1.1 Qualification Testing of Squib Valve Actuator Assemblies

a. Inspection Scope

The team reviewed the Wyle program developed to demonstrate qualification of the squib valve explosive actuator assemblies, which are being tested separate from the actual valve assemblies. The actuator assemblies consist of an explosive cartridge containing a mix of powder and granular explosives, a bridge wire initiator which receives the electrical signal to actuate the valve and provides the initial explosive gas sufficient to ignite the explosives contained in the cartridge, an electrical feed thru assembly which connects to the initiator, and the electrical connector and cable assembly which connects to the feed thru on one end and the plant protection system cabling on the other. The actuator qualification program is being conducted in accordance with Institute of Electrical and Electronics Engineers (IEEE) 323-1974, IEEE 344-1987, and IEEE 382-1996 and includes radiation exposure, thermal aging, vibration aging, seismic testing, pressurization cycle test, and design basis accident simulation testing.

There are three types of explosive cartridge assemblies used in the squib valves, those for 8" low pressure (LP), 8" high pressure (HP), and 14" automatic depressurization system (ADS)

valves. The explosive actuator testing program at Wyle consists of a lot of 11, 8" LP samples and a lot of 9, 14" ADS samples. The basis for not testing any 8" HP samples is contained in a Westinghouse evaluation performed in accordance with IEEE 382 that will be considered for review during a future NRC inspection at WEC. The testing program consists of radiation, thermal aging, vibration aging, seismic testing, pressurization cycle testing, and design basis accident simulation. After each stage of the testing program, two sample cartridge assemblies (one from each lot) are test fired into a closed volume testing chamber. In addition, after each stage of the test program, a current is applied to one of the untested cartridges from each lot to ensure the "no fire" capability of the cartridge meets performance specifications.

During the inspection, the team focused its review on Wyle's analysis to determine thermal aging requirements, the adequacy of the instrumentation being used during the qualification testing, establishment of appropriate test acceptance criteria, the adequacy to which the testing models actual plant conditions, and the adequacy to which the testing methods are sufficient to detect all realistic potential performance degradations in the tested equipment.

The team also reviewed the purchase order from Wyle to Steris Corporation for gamma irradiation of electrical connectors to verify that the applicable quality, technical, administrative, regulatory, and reporting requirements, including applicability of 10 CFR Part 21, were specified. The team reviewed the Nuclear Industry Assessment Committee (NIAC) audit of Steris and Wyle's supplier evaluation documentation to verify the supplier's capability to supply the service in accordance with the applicable standards and regulations.

b. Observations and Findings

Thermal Aging

IEEE 323 requires specimens be thermally aged to replicate the expected end of life state of the equipment being qualified. Rather than actually aging equipment for a time period equal to that of its qualified life, IEEE 323 allows for the exposure of equipment to elevated temperatures for a shorter time period. The relationship between the required aging time and temperature is governed by the material properties of the equipment being tested and can be calculated using the Arrhenius equation. For equipment that is required to operate following an accident, both the equipment's exposure to the normal installed environment plus exposure to the accident environment is required to be considered when determining the thermal aging profiles. Using this Westinghouse provided information on the expected normal and accident equipment environments, along with information on the activation energies for each type of non-metallic material used in the cartridge assemblies, Wyle calculated thermal aging times for each of the sub-assemblies. The thermal aging times were based upon the lowest activation energy for the group of materials being tested, which resulted in some materials being aged beyond what would have been required had each material been aged separately. The team identified this to be a conservative approach.

During the inspection, the team questioned Wyle's practice of excluding from consideration certain materials that were determined to be age insensitive. Specifically, the team questioned the validity of removing from consideration the polyetheretherkeratone (PEEK) material (a type of plastic) which is utilized in the connector and feed thru assemblies. Even though this PEEK material had a lower activation energy than the other materials being considered, it was eliminated from the thermal aging analysis based upon the fact that it was calculated to have a an expected life in excess of 25 times the required qualified life of the equipment. Wyle stated to the inspection team that this practice of excluding such materials was not contained in any

industry standard but was a Wyle developed practice that had been proceduralized and used for many years. The team concluded that the approach seemed reasonable given the actual function of the PEEK material in question, the source data contained in the Wyle files on the PEEK material, and Wyle experience testing PEEK material as part of previous unrelated equipment qualification testing.

As part of the above review the team questioned the basis for the normal and abnormal environment temperatures provided by Westinghouse which were inputs into the thermal aging analysis. Westinghouse provided APP-RCS-M3C-072," Revised AP1000 ADS 14-inch Squib Valve Thermal Analysis", 7/21/2011, Revision 0, which was used to calculate the expected normal temperature at the squib valve cartridges for the 14 ADS valves. This calculation was based upon an expected normal containment temperature of 120°F and an expected inlet fluid temperature to the valve of 437°F. This inlet fluid temperature is significantly less than the normal reactor coolant operating temperature of approximately 610°F. The temperature reduction is based upon the design of the piping to the squib valve from the reactor coolant hot leg which contains a cold trap feature which in part prevents recirculation of coolant thru this line which is dead headed at the squib valve. The resulting calculated temperature at the squib valve actuator for the 14" valve was 181°F. The team concluded that the methodology utilized appeared reasonable.

Unlike the calculation noted above for the normal operating temperature, the temperature provided by Westinghouse for use in the thermal aging analysis to account for the contribution due to abnormal operating conditions was based solely on the expected temperature of the containment atmosphere (in this case, 250°F). The team questioned whether this approach was conservative as the actual expected valve temperature during the postulated abnormal conditions would be a factor of both the inlet fluid temperature to the valve and the ambient environment. Even though the team determined that the temperature used to calculate the abnormal contribution to the thermal aging analysis may not have been conservative, the team considered this to be insignificant as the relative time the actuator would be exposed to abnormal operating conditions would be minimal when compared to the time at normal environmental conditions.

Instrument Accuracy

As described previously, to test the performance output of the cartridge assembly, sample test specimens are attached to a closed volume testing apparatus and fired after each stage of the qualification testing program. The testing apparatus, firing circuitry test box, and associated pressure transducers were supplied to Wyle by Westinghouse for use during this test program. Firing the cartridges into this closed volume creates a pressure/time curve that can be trended to look for performance degradation of the cartridges, as the cartridges are exposed to the simulated environmental conditions during the qualification program. The team reviewed and verified the suitability of the instrumentation being used to measure and record this pressure/time signature curve. During the test firings, the output of the cartridges is measured using dynamic pressure transducers that provide for a very quick response time. The team verified that the accuracy and range of the transducers was suitable for the application.

Acceptance Criteria

After each phase of the testing program, one sample from each of the two cartridge lots is fired and the resulting pressure/time curve is evaluated against acceptance criteria that are contained in the qualification plan. The acceptance criteria specify a minimum and maximum allowable

pressure and a maximum allowable time to achieve peak pressure. These values were provided to Wyle and are contained in the Westinghouse, "AP1000 Squib Valve Equipment Qualification Test Plan," EQ-TP-222-APP, Revision 0, dated 11/2011. The acceptance criteria contained in the WEC report were provided to WEC by SPX, the manufacturer of the squib valves, and are contained in SPX Corporation Test Report and Evaluation 11.1.317, dated 8/1/2011, Revision 0. In this report, SPX provided the acceptance criteria, but also indicated that meeting these acceptance criteria by themselves will not be sufficient and that an additional analysis will be required to statistically establish that the desired confidence can be achieved with respect to the suitability of the cartridge performance. The team identified that the need to perform this additional analysis was not described in the Westinghouse test plan. This issue will be considered for review during a future NRC inspection at WEC.

c. Conclusion

The team reviewed Wyle's calculation of thermal aging times and found the methodology used to be acceptable. The team verified that the accuracy and range of the transducers being used by Wyle was suitable for the application. The team identified that the SPX requirement to perform a statistical analysis of the test data had not been translated into the test procedures or test specification. This issue will be considered for review during a future NRC inspection at WEC.

1.2 QME Qualification Testing of Squib Valves

a. Inspection Scope

The team reviewed qualification plans, test procedures, test setup, test data and test reports to ensure that applicable NRC regulations, applicable ITAAC, and Westinghouse requirements and documents were being adequately addressed for the QME qualification testing of the squib valves. The team reviewed Wyle test logs for the planned 14-inch squib valve test, receipt inspection documentation, and calibration records for the instrumentation to be used during the testing. The team also reviewed corrective action documentation, including a Wyle Notice of Anomaly prepared in response to an issue identified during this inspection.

b. Observations and Findings

The team reviewed the flow testing to be performed at Wyle of a 14-inch squib valve to be used in the AP1000 ADS, including incorporation of proper testing requirements and adequacy of test design to simulate design-basis conditions. The team reviewed Wyle Qualification Plan WLTPL56415, dated 10/26/2010, Revision 0 and Test Procedure WTP57622-02, dated 4/12/2012 for consistency with the requirements specified in Westinghouse Qualification Plan APP-PV70-VPH-001 and ASME QME-1-2007. With the exception of the specific items discussed below, the team found that Wyle is planning and conducting valve tests consistent with the Westinghouse 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.

Wyle Qualification Plan WLTPL56415 states that the objective of the plan is to present the philosophy, methodologies, and approach to qualify the 8-inch and 14-inch AP1000 squib valves per the intent of ASME QME-1-2007. The Wyle Qualification Plan specifies the implementation of the Wyle QA Program for the qualification activities, including the provisions in Appendix B to 10 CFR Part 50. The qualification plan discussed the consideration of the

provisions in ASME QME-1-2007 with respect to seismic modal testing, end load qualification, functional testing, environmental qualification, sealing capability, and submergence testing. For example, Wyle had conducted seismic modal testing to demonstrate the fundamental frequencies of the 14-inch squib valve were greater than 33 Hz.

Modeling of Accident Conditions

The team reviewed Wyle Test Report WTR56976-02 which described the results of a preliminary flow test to establish the system response parameters in preparation for the QME-1 flow test of the 14-inch squib valve. The report indicated that the preliminary test achieved a 240 lbm/second flow rate at an approximate system pressure of 185 psig through the open 14-inch squib valve. This pretest predicted that the actuation and flow test for the QME-1 qualification of the 14-inch squib valve would satisfy the acceptance criterion for minimum flow of 188 lbm/second at 185 psig.

The team performed walk-downs of the test setup for actuation and flow testing of the 14-inch ADS squib valve. 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 team reviewed the locations of pressure and temperature sensors on the test piping, and observed calibration checks for several sensors. The team identified that adjustments were made to the planned flow test to provide open testing at the maximum credible fluid pressure. In addition, a subsequent flow test will be performed at the appropriate fluid pressure to demonstrate that the flow rate satisfies the acceptance criterion. The team observed that the test setup for the 14-inch squib valve is 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. Overall, the team found that the test set-up and design at Wyle appropriately modeled the postulated accident conditions for the valve.

Translation of Design Requirements

The team found that Westinghouse Qualification Plan APP-PV70-VPH-001 specified testing of the sealing capability of the AP1000 squib valves for 15 minutes while the Wyle Qualification Plan specified testing the sealing capability for 5 minutes. The team identified that Wyle had not previously identified or documented this discrepancy between the Westinghouse and the Wyle Qualification Plan and Test Procedure. In response to the team's questions, Wyle prepared Notice of Anomaly 003, dated 7/25/2012, and verified that a minimum of 5 minutes was the correct requirement as per ASME QME-1-2007 (Section QV-7431). In addition, Westinghouse prepared Corrective Action Issue Report #12-208-M012, dated 7/26/2012, that specified the need to revise the Westinghouse Qualification Plan. The team verified that on 5/18/2012, Wyle completed an acceptable sealing capability test and demonstrated zero leakage for 6 minutes.

The team determined that Wyle's failure to identify the discrepancy in the sealing capability requirements between the Westinghouse Qualification Plan and the Wyle Qualification Plan as a nonconformance with respect to the document control provisions in 10 CFR Part 50 Appendix B and the Wyle QA Manual. This issue was identified as one example of Nonconformance 99900905/2012-201-01.

The team identified that Westinghouse Qualification Plan APP-PV-VPH-001, specified that the valves to be tested as part of the QME testing program would be mated with explosive cartridges loaded to 80% of the nominal charge, thus attempting to show that the valves could operate as required even if some loss of explosive force were to occur due to

environmental/aging effects or due to the variability that exists within the explosive forces generated by a given cartridge or the actual forces required to operate a given squib valve. Since testing the valves with an 80% loaded cartridge was seen by the inspection team as critical attribute of the overall testing program, the team requested documentation to verify that the cartridge affixed to the 14" test valve actually was an 80% versus 100% loaded cartridge.

As a result of the team's questions, WEC provided documentation from the cartridge manufacturer, Goodrich, to demonstrate that the cartridge affixed to the 14" valve, was in fact, loaded to 80%. Upon review of this documentation, the team identified that the part numbers for the 8" and 14" valves were transposed on the Certificate of Conformance (C of C) supplied by Goodrich. SPX was notified of this discrepancy during the inspection and provided a revised C of C for the team's review. The team also identified discrepancies in certain SPX drawings which provided the specifications for the actual amount of granular and powder explosives that should be contained in each of the 80% and 100% charges. While the team was eventually able to conclude that the cartridge affixed to the 14" valves was in fact an 80% loaded cartridge, resolution of the drawing discrepancies will be considered for review during a future NRC inspection at SPX or WEC.

The team also identified a few other aspects of the QME-1 qualification program that are still incomplete and discussed these with the WEC representatives that were supporting the inspection. First, the team indicated that upon completion, the QME-1 qualification of the AP1000 squib valves will need to address the full range of credible fluid pressure and temperature conditions for the valve's safety functions. In addition, the team identified that program will need to address seismic qualification of the piston assembly, end loading of the valves (by analysis), and specific acceptance criteria for production valves. WEC representatives stated that these issues will be addressed in the QME-1 Qualification Report. WEC also indicated that QME-1 qualification of the AP1000 squib valves will include testing of the squib valves under high temperature and pressure conditions and that additional lot acceptance testing will be performed on the explosive charges, shear caps and tension bolts. The lot acceptance testing will be performed at ambient temperature and pressure conditions.

c. Conclusions

Overall, the team found that the test set-up and design at Wyle appropriately modeled the postulated accident conditions for the valve and that Wyle had appropriately translated design requirements. The team determined that Wyle's failure to identify the discrepancy in the sealing capability requirements between the Westinghouse Qualification Plan and the Wyle Qualification Plan was a nonconformance with respect to the document control provisions in 10 CFR Part 50 Appendix B and the Wyle QA Manual. This issue was identified as one example of Nonconformance 99900905/2012-201-01.

While the team was unable to observe a planned actuation and flow test of the 14-inch ADS squib valve during the inspection because the test was re-scheduled to a later date to address a test failure during lot acceptance testing at SPX, the team considered that sufficient information was obtained during the inspection to evaluate the capability of Wyle to conduct qualification testing of AP1000 squib valves consistent with the Westinghouse Qualification Plan and ASME QME-1-2007. With the exception of the specific item discussed above, the team found that Wyle is planning and conducting valve tests consistent with the Westinghouse 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.

1.3 Control of Testing Equipment

a. Scope

The team reviewed policies and procedures associated with the control of the equipment being utilized by Wyle to perform the functional testing of the squib valves. The review included the functional test set-up, data acquisition systems, software and hardware configuration control, software verification and validation (V&V) activities, control of measurement and test instrumentation, and sub-supplier oversight, as applicable. In addition, the team performed a walk-down of the test configuration set up (including control room) for the testing of the 14" squib. The team assessed whether the test configuration was consistent with the test plans and procedures, whether the Wyle team was performing test activities consistent with those written instructions, whether the Wyle team was knowledgeable of the test requirements.

b. Findings and Observations

b.1 Calibration of Test Equipment

The team reviewed a sample of inspection and testing equipment being utilized at Wyle to ensure that the equipment was being properly calibrated and controlled. The specific instruments sampled were associated with the functional testing of the 14" squib valves for the AP1000. The team confirmed the instruments were calibrated and appropriate for the range of operation for the test. The NRC team reviewed the Wyle Instrument Sheet and confirmed that all equipment was identified, recorded, and confirmed to be within the calibration date range. The team confirmed that the calibration range was also consistent with the actual use of the equipment.

Additionally, the inspection team reviewed the calibration laboratory accreditation documentation for Wyle's calibration laboratory and external calibration services associated with the test equipment, including documentation detailing each laboratory's scope of supply capability. The team confirmed that the laboratory accreditation covered the ranges of parametric values, such as voltage, current, and resistance for which the test equipment was being used. The team confirmed that traceability to the National Institute of Standards and Technology calibration standards was provided, and that all test and inspection equipment used for the observed inspection and pre-test activities was controlled, documented, and current with respect to the calibration requirements. For external calibration services, the team also verified that the calibration laboratories were on Wyle's approved supplier list. The team confirmed that all test instrumentation was appropriate for the test use and was capable of measuring to the precision required in the test plan.

The team reviewed a sample of out of tolerance reports and associated evaluations to verify if previous inspection or test results were affected. The team also reviewed a sample of calibration extension requests to verify if they were being controlled in accordance with Wyle Quality Directive XII-1, Control of Measuring and Test Equipment. The quality directive allows extensions of calibration due dates of up to 10 days for the purpose of completing tests that are in progress. If an extension is requested for period that is longer than ten days, the project engineer is required by QD XII-1 to submit a justification memorandum for approval to the quality assurance manager and the calibration laboratory supervisor. The team identified four examples of extension requests that did not have the required justification memorandum. In three out of the four cases, the equipment was out of calibration. However, in each of those cases, the out of calibration condition did not affect the results of the testing performed using the

Measuring and Test Equipment (M&TE) and as such, this failure constitutes a violation of minor significance and is not subject to formal enforcement action.

b.2 Data Acquisition

For the Squib valve testing being conducted, Wyle is using an Optim Electronics MEGADAC data acquisition system and TCS Data Acquisition software. This hardware/software configuration has been previously used extensively by Wyle for testing of valves and other specimens in their safety-related valve and high-flow test facilities. The current configuration consisted of a combination of processors, logic boards, software and associated circuitry. The team observed a test configuration consisting of: Main software components: TCS V 3.4.0, PsFunc.dll V 3.1.8.8, and Pseudo Equation user4 (for performance of differential pressure flow calculations); and major hardware components: processor, voltage channel, current clamp, switch, pressure transducers and thermocouples. In addition to TCS software, a second commercial software product DaDiSP was used to perform data tabulation, graphic presentation, and limited data analysis.

The Optim Electronics MEGADAC data acquisition system for the high-flow test facility is located in an access controlled air-conditioned enclosure on the test rig. The hardware is fixed and restrained within the facility to minimize damage and to maintain configuration control and maintenance access. The team verified that the sub-components of the system were adequately labeled, and calibration information was present for each piece of equipment requiring such. Electronic leads were well labeled and routed in such a manner to facilitate ease of identification, access, and maintenance. The team reviewed the calibration records for the OPTIM MEGADAC unit and confirmed that the calibration data was accurate and the unit was within its calibration window. The team confirmed through observation of the test configuration setup trial runs, that the system was capable of performing its required data acquisition functions and performed in accordance with the test requirements. No findings of significance were identified.

b.3 Software Control

Software Procurement

Wyle Quality Directive (QD) IV-1, “Procurement of Safety-Related and Commercial Grade Materials, Services, and Instrumentation,” Revision H, dated July, 8, 2011, defines the requirements, organizational responsibilities, and direction for standard procurement of nuclear SR materials, commercial grade materials, consumables used in the technical operation of the laboratory, items, services, and instrumentation and calibration services.

The Directive requires POs to be reviewed and approved by the Wyle QA organization, to assure proper application of the technical and quality requirements to each purchase. These reviews are required to be documented on Wyle Form WH-1220, “Quality Assurance Requirements,” and are required to be retained as part of the final procurement package for the purchased item.

Section 3.0, “Purchase Requisition Review,” states, in part, that when commercial grade or off the shelf (OTS) catalog items are to be procured and no previous supplier record exists, a survey and audit do not necessarily need to be performed. However a certificate of conformance shall be required and a receipt inspection by the Wyle QA organization shall be performed when procuring commercial grade or OTS items.

The team reviewed Wyle purchase orders (PO) HSV0031500, dated April 5, 2004, and PO HSV0059311, dated March 12, 2012, from Wyle to DSP Development Corporation for procurement of the DADiSP 2002 software suite and on-going software technical support respectively. The team noted that the DADiSP 2002 software suite was procured as commercial software with no specific technical specifications defined in PO. Although the software was procured as a commercial OTS product, the procurement was not performed in accordance with QD directive IV-1, and the Wyle QA organization did not review and approve the PO prior to issuance as required. Based on further review, the team determined that the DaDiSP software was purchased using a Wyle office overhead account which bypassed the normal QA controls. As a result, the Wyle QA organization was not involved with the procurement, receipt inspection, or documentation of the software suite as required by the QA program description and associated quality directive. This issue has been identified as Nonconformance 99900905/2012-201-02.

Software Verification and Validation

The team reviewed Wyle QD III-3, Revision G, "Software Development and Configuration Control," dated June 27, 2012, which applies to the development, review, verification, validation, approval, and configuration control of safety-related and commercial software for use in safety-related services. The directive also covers aspects of software procurement, error reporting and corrective actions, and software retirement.

QD III-3, Section 8.0, "Procedure – Procurement of Software," requires in part, that software procured commercially and used in safety-related applications is to be identified, controlled, and evaluated. The evaluation shall establish software adequacy and periodic software error notifications and error analysis shall be accounted for as well. Section 11.0, of QD III-3, requires that spreadsheet software used in acquisition, processing, recording, and reporting lab/test data, and any math used in these and formula strings written by Wyle must work as expected. As part of the check/review, it shall be ensured that cells are locked, pre-determined setups are adequately controlled, and calculations checked by alternate method. Additionally, all macros used to perform calculations for data shall be checked for accuracy by an alternate method(s), and the results of this activity shall be documented.

The team reviewed test report No. WTRP57428, "PWR Owners Group Jet Impingement Testing from A 2" Nozzle," dated March 1, 2012, to gain an understanding of how the DaDiSP program would be used for the Squib valve testing; and to determine what, if any, analyses or calculations were performed within the DADiSP program, and how these were evaluated and controlled. Based on the test report, two calculations were performed within the DaDiSP program to facilitate data output graphical presentation based on test configuration conditions. First was an adjustment to the baseline pressure to account for a small offset due to standing water in the transducer connection line. This was accomplished through a calculation routine within the DADiSP program. A second adjustment was made to perform curve smoothing of the raw data due to the scatter of the data based on the number of data values taken (2000/second). The method used to perform this adjustment was a 100 point moving average data adjustment. The team confirmed that the Wyle staff had locked all DaDiSP cells prior to the test performance but was unable to identify that any alternative calculational methods were used to verify the accuracy of the data. This was discussed with the Wyle staff, and it was determined that contrary to the requirements of QD III-3, no alternate calculations were performed or documented. This was identified as Nonconformance 99900905/2012-201-03.

The team reviewed the V&V activities associated with the TCS for Windows, V3.4.0, Optim Electronics, test control software and confirmed that it was treated as safety-related software and was subject to full software V&V by the Wyle staff consistent with QD III-3. The team confirmed that TCS was controlled as safety-related software and is identified on the Current Approved Software List dated May 30, 2012.

The team reviewed the software V&V report "Quality Plan 1592VV01, Verification and Validation for OPTIM Electronics TCS for Windows Version 3.4.0 and PSFUNC.DLL Version B 3.1.8.5," dated November 16, 2001, 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 for data acquisition purposes, methods to be used to perform the verification, alternate methods including hand calculations, and use of a different software package to verify calculations produce equivalent results, and associated acceptance criteria. Each verification and validation activity was documented in the test report and all was performed in accordance with the Wyle QA program requirements. No findings of significance were identified.

b.4 Functional Test Activities

The team observed the Wyle staff performing signal integrity verification activities, including input/output continuity checks on the test instruments on the test fixture. The team observed the Wyle staff's use of TCS for Windows data acquisition software as part of the pre-test activities. The team noted that the Wyle control room operator and technicians in the field were entering input values and verifying readings consistent with test requirements in Appendix H Functional Testing Test Setup, Table 4. The field technician used a Fluke 714 thermocouple calibrator #4494 to enter or record temperature values which were then confirmed by the control room operator. Printouts of control room TCS screens were taken to record each instrument output vs. stimulus. The team confirmed, through a review of calibration records for the MEGADAC data acquisition system, that calibrations were performed and documented annually. The team reviewed a sample of the most recent calibration data for the system, and confirmed that the system was within its calibration and that the tests performed were consistent with the range of activities for the system.

The team visually inspected the test configuration and verified that the correct number of instruments, consistent with the test setup as defined in the test plan and procedures were in place and undergoing pre-test verification by the Wyle staff. The team confirmed that the test equipment was adequately labeled, including calibration information, and that all equipment reviewed was within the specified calibration due dates. The team observed pre-test activities and the 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 team reviewed the receipt inspection documentation associated with the squib valve and reviewed the pre-test check-off procedure.

No findings of significance were identified.

c. Conclusions

In conclusion, the inspection team found that the test records being used were completed as required, and all data acquisition set-up activities were performed consistent with the requirements specified in the test procedures. In general, Wyle had identified and documented

test activities and had, as observed by the team, implemented those activities in accordance with the test plans and testing requirements.

The NRC inspection team identified two nonconformances where Wyle's software control program was not implemented consistent with regulatory requirements and with Wyle's own internal procedures. Nonconformance 99900905/2012-201-02 concerned an example where Wyle failed to implement required procurement activities associated with the purchase of commercial software used in safety-related testing. Nonconformance 99900905/2012-201-03 concerned Wyle's failure to perform alternate calculations as part of test software verification activities as required by the Wyle design control program.

2. AP1000 Motor-Operated Valve Flow Testing – (ITAACs 2.1.2.4.12.a.i, 2.2.2.3.11.a.i, 2.3.2.4.11.a.i, 2.3.6.4.12.a.i)

a. Inspection Scope

Wyle is performing testing and qualification as required by ASME QME-1-2007 of certain motor operated valves that will be supplied as part of the AP 1000 design. Some of this testing is being performed at Wyle's facility in Huntsville, Alabama while other testing has been performed at the Wyle facility in San Bernardino, CA. During the inspection, the team reviewed motor operated valve (MOV) qualification plans, test procedures, test data and test reports to ensure that applicable NRC regulations, applicable ITAACs, and Westinghouse documents were being adequately addressed. T he team also reviewed the Wyle QA Manual, dated 3/31/2009, Revision 3, to ensure conformance to the quality assurance requirements contained in Appendix B to 10 CFR Part 50.

b. Observations and Findings

Use of Un-calibrated Quick Stem Sensors

On December 5-6, 2011, the NRC observed testing at the Wyle facility in San Bernardino, CA of 3" and 4" globe valves. The testing was designed to show the capability of the valves to close under full flow conditions at rated fluid pressure and temperature. During this testing, the NRC identified that the instrumentation being utilized by Wyle to measure the required stem thrust necessary to close the valves was not calibrated. Wyle was using a Teledyne "quick stem sensor" which had not been calibrated and did not have traceability back to a known calibration standard. Wyle stated that the quick stem sensor was provided by the valve vendor, Flowserve, and that their understanding was that Flowserve would be responsible for ensuring the accuracy of the readings obtained from that sensor. Since representatives from Flowserve, Westinghouse, and Southern Company were also witnessing the testing, this issue was brought to all participants' attention for resolution, since without valid calibration data, any data obtained from the quick stem sensor could not be used to support valve qualification as required by selected ITAACs.

During this inspection at Wyle - Huntsville, the team reviewed corrective actions taken in response to the previous NRC observation. The team identified that in addition to the valves that had been tested at San Bernardino, Wyle was also utilizing the quick stem sensor for measuring the thrust from another valve which was undergoing testing at Huntsville. During the testing of the valve at Huntsville, Wyle staff noticed that the thrust data for this valve appeared questionable, so Wyle called in the manufacturer of the quick stem sensor, Teledyne, to investigate the problem and also, to verify the accuracy of the sensors that had been installed

on the valves tested at San Bernardino. The sensors installed on the 3" and 4" globe valves were found to be within the stated manufacturer's tolerances, but the sensor affixed to the other valve was found to be significantly out of tolerance. For this sensor, the sensor was reattached, calibrated, and the data was retaken. Overall, Wyle's corrective actions to this specific issue were found to be adequate by the inspection team.

As a follow-on to the above issue, the team identified that the Wyle Qualification Plans for MOVs (for example, Test Procedure WLQP57873-4, dated 8/12/2011, Revision A), did not clearly specify whether or not the calculated values for valve factor and stem friction coefficients include or exclude instrument uncertainties. Consequently, it was not apparent whether these instrument inaccuracies would need to be considered later on by the valve vendor or licensees when they are performing analysis and testing to properly match motor actuators to specific valves, or alternatively, whether the instrument uncertainties were already accounted for in the Wyle calculated valve factors. The team found that Wyle's failure to clearly account for instrument uncertainties in the calculation of valve factors and stem friction coefficients is a nonconformance with respect to the design control provisions of Appendix B to 10 CFR Part 50 and the Wyle QA Manual. This issue was identified as Nonconformance 99900905/2012-201-04. This issue, if not corrected, may also impact the ability of NRC licensees to meet applicable ITAAC from the AP1000 Design Control Document, Tier 1, Revision 19. The ITAAC applicable to this issue are listed in the Table contained in Attachment 1.

Intermittent Partial Stroking of Valves During Testing

The team identified that Wyle Qualification Plan WLQP57873-6, dated 8/12, Revision A, for 8-inch globe valves, specifies partial stroke segments to be used during steam or water flow tests. The partial strokes are necessary as the Wyle test facility does not have sufficient capacity to stroke the valve continuously at rated temperature, flow, and pressure. Consequently, the testing needs to be performed in intervals in order to allow operators to re-charge the fluid supply at the test facility. The team found that the qualification plan did not provide written justification that this test method demonstrates valve performance consistent with a continuous valve stroke as intermittent partial stroking of the valve could cloak problems with the valve that might exist during a continuous stroking cycle.

The team identified that the absence of a documented justification for the performance of partial valve strokes during valve flow testing is a nonconformance with respect to the test control provisions in 10 CFR Part 50 Appendix B and the Wyle QA Manual. This issue was identified as one example of Nonconformance 99900905/2012-201-01. This issue, if not corrected, may also impact the ability of NRC licensees to meet applicable ITAAC from the AP1000 Design Control Document, Tier 1, Revision 19. The ITAAC applicable to this issue are listed in the Table contained in Attachment 1.

c. Conclusions

The team identified as Nonconformance 99900905/2012-201-04 Wyle's failure to clearly account for instrument uncertainties in the calculation of valve factors and stem friction coefficients. The team also identified as part of Nonconformance 99900905/2012-01 Wyle's lack of a documented justification for the performance of partial valve strokes during valve flow testing since intermittent partial stroking of the valve could cloak problems with the valve that might exist during a continuous stroking cycle.

With the exception of the two specific items discussed above, the team found that Wyle is planning and conducting MOV tests consistent with the Westinghouse Qualification Plan and ASME QME-1-2007 as accepted in RG 1.100 (Revision 3) to demonstrate the design-basis capability of MOVs for use in the AP1000 reactor.

3. Test Anomalies / Corrective Actions

a. Inspection Scope

The team reviewed the implementation of Wyle's Quality Assurance (QA) program commitments and controls to verify compliance with Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50. The scope of the inspection included Wyle's QA program commitments and controls for test anomalies and corrective actions as they pertain to Wyle's testing of components being supplied to U.S. facilities with particular attention to the ongoing testing to support the environmental qualification of components being supplied as part of Westinghouse's AP 1000 design. Within the scope of the inspection, the NRC inspection team interviewed both Wyle and Westinghouse personnel and reviewed the Wyle policies, Quality Directives (QD), Corrective Action Requests (CAR), Notices of Anomaly (NOA), and other documents listed in the attachment to this report.

b. Observations and Findings

The NRC inspection team verified that procedures had been established and implemented for correcting conditions adverse to quality. The corrective action process provides a connection to 10 CFR Part 21 procedures, and Wyle staff members had knowledge of the QDs.

In accordance with QD XVI-1, Revision F, "Corrective Action Program," effective 03/31/09, Wyle utilized CAR forms to document discrepancies (including conditions adverse to quality), the applicable regulations, the investigative actions for determining the root causes, the remedial actions, the corrective actions taken to prevent recurrence, and whether the issues have the potential to be reportable in accordance with 10 CFR Part 21. CARs are also utilized to document the applicable reviews, verifications of implementation, closure dates, and approvals by responsible authorities.

In accordance with QD XV-2, Revision G, "Notice of Anomaly," effective 03/31/09, Wyle utilizes NOA forms to document anomalies, the applicable requirements, dispositions, comments, recommendations, and QA review. These forms are also used to document whether the issues are safety related, whether the issues have the potential to be reportable in accordance with 10 CFR Part 21, who has the responsibility to analyze anomalies and comply with 10 CFR Part 21, or whether a CAR is required.

The NRC inspection team noted that when subcontractors are used for repairs, engineering decisions, etc., a Wyle representative is assigned to follow the job. The Wyle representative would also be expected to submit any nonconforming reports and proposed corrective actions on behalf of the subcontractors.

The NRC inspection team reviewed Wyle Letter No. 593-P21-032010 to Westinghouse Electric Company, "Potential Part 21 on Design Basis Event (DBE) Jet Impingement Tests," dated 03/09/10 as well as CAR No. 10-001 issued 02/24/10, and noted that Wyle appropriately processed a potential 10 CFR Part 21 issue related to DBE jet pump impingement tests with 2-inch and 3-inch nozzles.

The NRC inspection team also reviewed Wyle's corrective actions associated with a previous NRC nonconformance issued in 06/09/09 (Nonconformance 99900905/2009-201-01, failure to implement test procedures to control measuring and test equipment as required) (ADAMS Accession No. ML091420552). Wyle replied to the Notice of Nonconformance via a letter dated 07/01/09 (ADAMS Accession No. ML092390485) and issued CAR-09-009 on 06/09/09. The NRC acknowledged Wyle's reply on 08/20/09 (ADAMS Accession No. ML092320328). Wyle revised the version of QD XII-1, "Control of Measuring and Testing Equipment," effective at the time of the event (Revision P) to assign applicable Engineering Department Manager responsibility for the coordination and review of out-of-tolerance conditions, and this revision carried forward to the current version of the QD (Revision R, effective 06/18/12). Wyle reformatted Form WH-1140, "Notification of Out-Of-Tolerance Condition," Revision 06/09, to support the changes in QD XII-1. Wyle updated the computerized Job History Tracking Report template to prompt the Project Engineer to sign-off and date the review performed on each job listed on the report, and Wyle QA requested that Engineering document the review of the out-of-tolerance record (Control No. 16-008). The NRC inspection team concluded that the corrective actions were appropriate to prevent recurrence, and Nonconformance 99900905/2009-201-01 is closed.

Conclusions

The NRC inspection team concluded that Wyle's test anomaly and corrective action processes comply with Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50 and were implemented in accordance with applicable Wyle policies and procedures. There were no findings of significance identified. Additionally, Nonconformance 99900905/2009-201-01 is closed.

## ***ATTACHMENT***

1. Entrance/Exit Meeting Attendees and Individuals Interviewed

| Name | Title | Affiliation | Entrance | Exit | Interviewed |
|---|---|---|---|---|---|
| N. Tom Boonarkat | Manager, Nuclear & Commercial Test Department | Wyle | | X | X |
| E. Reilly Schum | Manager, EQ and TPQ | Wyle | X | | X |
| Patrick W. Turrentine | Manager, Nuclear Testing Services | Wyle | X | X | X |
| Steven M. Felice | Calibration Manager | Wyle | | | X |
| Raul Terceno | Quality Assurance / Safety Manager, Lead Auditor | Wyle | X | X | 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 |
| Cameron Muelling | Project Engineer | Wyle | X | X | X |
| Ronald P. Wessel | Principal Engineer, AP 1000 Licensing | WEC | X | X | X |
| Jeffrey Jacobson | Inspection Team Leader | NRC | X | X | |
| Greg Galletti | Inspector | NRC | X | X | |
| Jamie Heisserer | Inspector | NRC | X | X | |
| Thomas Scarbrough | Inspector | NRC | X | X | |
| Leigh Trocine | Inspector | NRC | X | X | |

2. Inspection Procedures Used

- Inspection Manual Chapter (ICM) 2507, "Construction Inspection Program Vendor Inspections," dated 04/25/11
- Inspection Procedure (IP) 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated 02/13/12
- IP 35034, "Design Certification Testing Inspection," dated 01/27/10
- IP 43002, "Routine Inspections of Nuclear Vendors," dated April 25, 2011
- IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated April 25, 2011
- IP 65001.E, "Inspection of the ITAAC-Related Qualification Program," dated 08/19/08

3. List of Items Opened, Closed, and Applicable ITAAC

| 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 | Open | NON | Criterion XI | Example 2 Only<br>2.1.2.4.12.a.i,<br>2.2.2.3.11.a.i<br>2.3.2.4.11.a.i<br>2.3.6.4.12.a.i. |
| 99900905/2012-201-02 | Open | NON | Criterion VII | N/A |
| 99900905/2012-201-03 | Open | NON | Criterion III | N/A |
| 99900905/2012-201-04 | Open | NON | Criterion III | 2.1.2.4.12.a.i,<br>2.2.2.3.11.a.i<br>2.3.2.4.11.a.i<br>2.3.6.4.12.a.i. |

4. Documents Reviewed

Specifications, Test Plans, Procedures, and Drawings

- Calibration Procedure, MISC-CLAMPPROBE, "Metrology Gidep Calibration Procedure for Miscellaneous Clamp-On Current Probes," Revision 0, dated 09/21/06
- Calibration Procedure, MISC-PRESS, "Metrology Gidep Calibration Procedure for Pressure Transducers," Revision 1, dated 09/20/07
- Wyle Quality Assurance (QA) Manual (Revision 3, dated 03/31/09)
- Section 16, "Corrective Action," of Wyle QA Manual, Revision 3, effective 03/31/09
- Qualification Plan for Safety Related Squib Valve Actuators and Electrical Connection Assemblies for Westinghouse Electric Company for Use in Westinghouse, 56354QP09, dated 11/18/11, Revision D
- Quality Directive (QD) III-3, Revision G, "Software Development and Configuration Control," dated 06/27/12
- QD IV-1, Revision H, "Procurement of Safety-Related and Commercial Grade Materials, Services, and Instrumentation," effective 07/08/11
- QD V-1, "Instructions, Procedures, and Certification Reports," effective 06/08/12
- QD XII-1, Revision R, "Control of Measuring and Testing Equipment," effective 06/18/12
- QD XIV-1, Revision I, "Receiving Inspection," dated 10/14/09
- QD XV-1, Revision L, "Control of Nonconforming Materials, Items, and Services," effective 07/08/12
- QD XV-2, Revision G, "Notice of Anomaly," effective 03/31/09
- QD XVI-1, Revision F, "Corrective Action Program," effective 03/31/09
- QD XIX-1, Revision F, "Reporting of Defects and Noncompliance Per 10 CFR Part 21," effective 04/23/09

- Software V&V Report "Quality Plan 1592VV01, Verification and Validation for OPTIM Electronics TCS for Windows Version 3.4.0 and PSFUNC.DLL Version B 3.1.8.5," dated 11/16/01
- Test Report No. WTRP57428, "PWR Owners Group Jet Impingement Testing from A 2" Nozzle," dated 03/01/12
- SPX Drawing "14" ADS Squib Valve Cartridge Housing Assembly" (Revision 9, dated 06/07/11)
- SPX Drawing "8" HP Squib Valve Cartridge Housing Assembly" (Revision 10, dated 06/07/11)
- Westinghouse APP-PV70-VPH-001 (Revision 0, dated 11/11), "AP1000 Squib Valve Equipment Qualification Test Plan"
- Westinghouse Design Specification APP-PV70-Z0-001 (Revision 4, dated 06/05/12), "Squib (Pyrotechnic Actuated) Valves, ASME Boiler and Pressure Vessel Code, Section III Class 1"
- Westinghouse Data Sheet APP-PV70-Z0R-001 (Revision 7, dated 06/01/12), "PV70 Squib (Pyrotechnic Actuated) Valves, ASME Section III Class 1, Data Sheet Report"
- Westinghouse Design Specification APP-PV98-Z0-001 (Revision 1, dated 03/30/11), "Pyrotechnic Actuator for ASME Boiler and Pressure Vessel Code, Section III Class 1 Squib Valves (PV70)"
- Wyle Test Procedure WLTPL56415 (Revision 0, dated 10/26/10), "Qualification Plan for QME-1-2007 Qualification of 8" & 14" Squib Valve for Westinghouse Electric"
- Wyle Test Procedure WTP57622-02 (dated 04/12/12), "QME-1 Testing of a 14"-2500# Squib Valve"
- Wyle Test Procedure WLQP57873-1 (Revision 0, dated 06/21/11), "Qualification Plan for QME-1 Testing on a 3" Class 1500# Gate Valve for Flowserve"
- Wyle Test Procedure WLQP57873-2 (Revision A, dated 08/12/11), "Qualification Plan for QME-1 Testing on a 6" Class 150# Gate Valve for Flowserve"
- Wyle Test Procedure WLQP57873-3 (Revision A, dated 08/12/11), "Qualification Plan for QME-1 Testing on a 14" Class 1515# Gate Valve for Flowserve"
- Wyle Test Procedure WLQP57873-4 (Revision A, dated 08/12/11), "Qualification Plan for QME-1 Testing on a 3" Class 1850# Globe Valve for Flowserve"
- Wyle Test Procedure WLQP57873-6 (Revision A, dated 08/12/11), "Qualification Plan for QME-1 Testing on an 8" Class 1530# Globe Valve for Flowserve"
- Wyle Test Procedure WLTP58290 (Revision 0, dated 02/13/12), "Qualification Plan for Flow Testing on 3" & 6" Class 1500# Globe Valves for Masoneilan"
- Wyle Test Control Record T57873-2 (Revision A, dated 08/17/11), "Test Specimen: 6" 150# Gate Valve"
- Wyle Test Control Record T57873-3 (Revision A, dated 08/17/11), "Test Specimen: 14" 1515# Gate Valve"
- Wyle Test Control Record T57873-4 (Revision B, dated 12/05/11), "Test Specimen: 3" 1850# Globe Valve"
- Wyle Test Control Record T57873-5 (Revision B, dated 09/15/11), "Test Specimen: 4" 1530# Globe Valve"
- Wyle Test Report WTR56976-02 (dated 12/06/11), "Perform Pre QME-1 Flow Testing to Establish Final System Response Parameters"
- Appendix G (dated 05/18/12), "Sealing Capability," to Wyle Test Procedure WTP57622-02 for 14-inch Squib Valve Sealing Test

Purchase Orders

- Purchase Order (PO) No. HSV0059506 from Wyle to Steris Corporation for Gamma Irradiation of Electrical Connectors dated 03/29/12
- Wyle PO No. HSV0031500, "DADiSP 2002 Software," dated 04/05/04
- Wyle PO No. HSV0059311, "DADiSP 2002 Software Technical Support," dated 03/12/12
- Westinghouse Purchase Order 4500312821 (dated 07/30/09), "IEEE Qualification Program for AP1000 PV70 Safety-Related Squib Valves," and Change Notices 1 to 5 (dated up to 02/20/12).

Calibration Certificates

- Certificate No. 01321:1336491547, Honeywell Pressure Transducer, M&TE ID 01321, dated 05/08/12
- Certificate No. 01442:1331719490, Fluke Current Clamp, M&TE ID 01442, dated 03/14/12
- Certificate No. 01556:1335254341, Honeywell Pressure Transducer, M&TE ID 01556, dated 04/24/12
- Certificate No. 01572:1342690486, Honeywell Pressure Transducer, M&TE ID 01572, dated 07/19/12
- Certificate No. 01625:1341845929, Honeywell Pressure Transducer, M&TE ID 01625, dated 07/09/12
- Certificate No. 02340:1334748473, Sensotec Pressure Transducer, M&TE ID 02340, dated 04/18/12
- Certificate No. 02582:1340881700, Honeywell Pressure Transducer, M&TE ID 02582, dated 06/28/12
- Certificate No. 02593:1341825813, Sensotec Pressure Transducer, M&TE ID 02593, dated 07/09/12
- Certificate No. 113739:1317625104, Optim Module T/C, M&TE ID 113739, dated 10/03/11
- Certificate No. 113742:1317625057, Optim Jack Panel, M&TE ID 113742, dated 10/03/11
- Certificate No. 113803:1317711954, Optim Megadac, M&TE ID 113803, dated 10/04/11
- Certificate No. 117167:1317711213, Optim Input Card, M&TE ID 117167, dated 10/04/11
- Certificate No. 117171:1317711001, Optim Input Card, M&TE ID 117171, dated 10/04/11
- Certificate No. 117570:1317625469, Optim Card Analog Out, M&TE ID 117570, dated 10/03/11
- Goodrich Certificates of Compliance dated 06/12 and 07/24/12

Other

- A2LA Certificate No. 845.03, "Scope of Accreditation to ISO/IEC 17025:2005 & ANSI/NCSL Z540-1-1994, for Wyle Laboratories, Inc.," dated 04/17/12
- A2LA Certificate No. 2166.01, "Scope of Accreditation to ISO/IEC 17025:2005 & ANSI/NCSL Z540-1-1994, for Fluke Corporation.," dated 06/06/12
- ACLASS Certificate AC-1443, "Lockheed Martin Accreditation to ISO/IEC 17025:2005 & ANSI/NCSL Z540-1-1994," dated 03/08/12
- Audit SA-10-013, Supplier Evaluation of Mars Labs, dated 05/03/10
- LTR-EQ-10-5, "Equipment Qualification Testing Requirements for AP1000 Zone 1 Group 2 Abnormal Events", dated 01/22/10

- Notification of Out-of-Tolerance Condition 04-011 dated 03/24/11
- Notification of Out-of-Tolerance Condition 05-011 dated 03/24/11
- Notification of Out-of-Tolerance Condition 06-011 dated 03/24/11
- Request for Calibration Extension 01-011 dated 02/15/11
- Request for Calibration Extension 02-011 dated 02/15/11
- Request for Calibration Extension 03-011 dated 02/15/11
- Request for Calibration Extension 05-011 dated 02/15/11
- Steris-Isomedix Services, Inc., NIAC Audit No. 15020 dated 06/04/10
- Wyle Current Approved Software List dated 05/30/12
- Wyle Approved Supplier List dated 07/23/12
- Wyle Letter No. 593-P21-032010, to Westinghouse Electric Company, "Potential Part 21 on Design Basis Event (DBE) Jet Impingement Tests," dated 03/09/10
- Wyle Supplier Evaluation Worksheet for Steris-Isomedix Services dated 12/21/11
- Wyle Supplier Evaluation Worksheet for Steris-Isomedix Services dated 12/21/10
- Wyle Supplier Evaluation Worksheet for Mars Labs dated 12/15/11
- Wyle Supplier Evaluation Worksheet for Lockheed Martin dated 12/15/11
- Wyle Supplier Evaluation Worksheet for Fluke Corporation dated 12/13/11
- Wyle e-mail to SPX (dated 06/18/12) Confirming Cartridge Serial Numbers

Corrective Action Requests

- Corrective Action Request (CAR) No. 09-009 issued 06/09/09 and closed 08/20/09 – Failure to Implement Test Procedures to Control Measuring and Test Equipment as Required (Nonconformance 99900905/2009-201-01)
- CAR No. 10-001 issued 02/24/10 and closed 03/09/10 – Potential Part 21 on DBE Jet Impingement Tests
- CAR No. 11-002 issued 07/15/11 and closed 07/20/11 – Lad notebooks were not properly annotated so that it would not be possible to identify the personnel responsible for the performance of the testing.
- CAR No. 11-003 issued 08/24/11 and closed 09/19/11 – While a customer specimen was being subjected to "specified" water pressure, the flow monitoring equipment, Flow Meter Differential Sensor, was disabled from gathering flow readings because sensing lines had not been opened as expected.
- CAR No. 11-004 opened 08/24/11 and closed 09/19/11 – After jet pump impingement tests had been completed, several pre-test humidity readings, as shown on the weighing sheets were discovered to be inaccurate, exceeding 1% relative humidity.
- CAR No. 11-005 opened 09/22/11 and closed 10/11/11 – Contrary to a customer purchase order, supplier QA was not notified prior to performing maintenance activities.
- CAR No. 11-012 opened 12/30/11 and closed 01/18/12 – Antennas that were used during normalized site attenuation (NSA) measurements were not calibrated.
- CAR No. 11-013 opened 12/30/11 and closed 05/19/12 – The purchase orders for items affecting quality of laboratory output did not contain detailed data describing the required services.
- CAR No. 11-015 opened 12/30/11 and closed 05/29/12 – The calibration certificate did not contain complete impedance information (no phase information) or isolation data.
- CAR No. 11-017 opened 12/30/11 and closed 05/29/12 – There was no record noted to show the tracking of the software used in the lab. The software includes but is not limited to Spectral Dynamics vibration controller software.

- CAR No. 12-001 opened 02/15/12 and closed 04/05/12 – Calibration certificates indicated that flow meters were calibrated for 6-inch lines, but it was discovered that the flow meters were calibrated by a subcontractor for use in 4-inch lines.
- CAR No. 12-002 opened 05/25/12 and closed 07/03/12 – Contrary to established programmatic requirements, eight Out-Of-Tolerance Reports were not addressed within the specified suspense date and remain outstanding for a response to Wyle QA.
- CAR No. 12-003 opened 05/25/12 and closed 06/26/12 – Contrary to established programmatic requirements, five Out-Of-Tolerance Reports were not addressed within the specified suspense date and remain outstanding for a response to Wyle QA.
- CAR No. 12-004 opened 06/14/12 and closed 07/02/12 – Neither the Wyle QA Program Manual nor supporting QDs address the scoping of documented instructions, procedures, and drawings based upon any criteria per NQA-1-2004 Requirement 5.
- CAR No. 12-005 opened 07/10/12 and closed 07/19/12 – QA audit of Wyle procurement activities found that three purchase orders were not processed in a timely manner by QA personnel, and items received had not been properly identified with a HOLD Tag although the initial inspection indicated possible nonconforming conditions. Further, no nonconforming material reports (NMR), were issued which would allow applicable personnel the opportunity to disposition these items.
- Westinghouse Corrective Action Issue Report No. 12-208-M012 (07/26/12), "14-Inch Squib Valve ASME QME-1 Qualification Sealing Capability Test Duration"

Notices of Anomaly

- Notice of Anomaly (NOA) No. 1 for Wyle Job No. T56977, "Safety-Related Squib Valve Actuators and Electrical Connection Assemblies for Westinghouse Electrical Company for Use in Westinghouse AP1000 Nuclear Power Plants" – 14-Inch ADS Actuator – Baseline Functional Test
- NOA No. 2 for Wyle Job No. T56977 dated 03/23/12 dated 03/22/12 – 8-Inch LP Actuator – Baseline Functional Test
- NOA No. 3 for Wyle Job No. T56977 dated 05/10/12 – 8-Inch LP and 14-Inch ADS Actuators and Viton Sleeves – Gamma Radiation Exposure Test
- NOA No. 4 for Wyle Job No. T56977 dated 05/18/12 – 14-Inch ADS Actuators – Second Half Thermal Cycling
- NOA No. 5 for Wyle Job No. T56977 dated 05/29/12 – 8-Inch LP – First and Second Half Thermal Cycle Conditioning and Thermal Aging
- NOA No. 6 for Wyle Job No. T56977 dated 05/30/12 – 14-Inch ADS Electrical Connector – Vibration Aging
- NOA No. 7 for Wyle Job No. T56977 dated 05/30/12 – 14-Inch ADS Electrical Connector Assembly – Vibration Aging of 14-Inch ADS Actuator/electrical Connector Assembly
- NOA No. 8 for Wyle Job No. T56977 dated 07/20/12 – 8-Inch LP Electrical Connector Assemblies and 8-Inch ADS Electrical Connector Assemblies – Vibration Aging of 8-Inch LP Actuator/electrical Connector Assemblies
- NOA No. 3 dated 07/25/12 – 14" ADS Valve