

March 26, 2015

Mr. Rick Davis, Quality Manager
National Testing Services
7800 Highway 20 West
Huntsville, AL 35806

SUBJECT: NUCLEAR REGULATORY COMMISSION VENDOR INSPECTION OF
NATIONAL TESTING SERVICES REPORT NO. 99900905/2015-201 AND
NOTICE OF NONCONFORMANCE

Dear Mr. Davis:

On December 15 to 17, 2014 and February 11, 2015, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the National Testing Facilities Laboratories (NTS) facility in Huntsville, Alabama. The purpose of this limited-scope inspection was to assess NTS'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 inspection was performed as part of the NRC's program to provide enhanced oversight of the manufacturing and testing of key safety related components being supplied as part of the AP1000 reactor design. During this inspection, the NRC inspectors observed the setup and reviewed procedures associated with the submergence testing and irradiation of the explosive cartridges, a subcomponent of the 8-inch squib valves, which are used in safety related applications for the AP1000 reactor design. The submergence testing and irradiation are part of the overall equipment qualification program for these valves and are 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 2.2.03.12a.i. and 2.2.03.12a.ii of Appendix C, from the Combined License for Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3.

The enclosed report presents the results of the 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 found that the implementation of your QA program failed to meet certain NRC requirements imposed on you by your customers. Specifically, the NRC inspectors determined that NTS was not fully implementing its QA program in the area Design Control consistent with regulatory and contractual requirements and applicable procedures. The specific findings and references to the pertinent requirements are identified in the enclosures to this letter.

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 Notice of Nonconformance. We will consider extending the response time if you show good cause for us to do so.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure(s), 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 at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response, (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).

Sincerely,

/RA/

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

Docket No.: 99900905

Enclosures:

1. Notice of Nonconformance
2. Inspection Report No. 99900905/2015-201
and attachment

R. Davis

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In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure(s), 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 at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response, (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).

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/RA/

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

Docket No.: 99900905

Enclosures:

1. Notice of Nonconformance
2. Inspection Report No. 99900905/2015-201 and attachment

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NRO-002

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DATE	03/20/15	03/20/15	03/20/15	03/19/15	03/26/15

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NOTICE OF NONCONFORMANCE

National Testing Services
7800 Highway 20 West
Huntsville, AL 35806

Docket No. 99900905
Report No. 2015-201

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted of National Testing Services (NTS), at their facility in Huntsville, Alabama from December 12-14, 2014 and February 11, 2015, it appears that certain activities were not conducted in accordance with NRC requirements that were contractually imposed upon NTS by its customers or by NRC licensees.

- A. Criterion III, "Design Control," of Appendix B to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, states, in part, that "applicable regulatory requirements and the design basis are correctly translated into specifications, drawings, procedures, and instructions." It also states that "measures shall be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems, and components."

Criterion V, "Instructions, Procedures, and Drawings," of Appendix B to 10 CFR Part 50, states in part, that "Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances...."

Contrary to the above, as of December 12, 2014, NTS had not performed sufficient actions to ensure the suitability of processes that are essential to the safety-related functions of the components being tested. Specifically, NTS did not take sufficient measures to validate the accuracy of the commercial vendor's irradiation system as applied to the components sent for irradiation to a commercial facility by NTS. Also, NTS procedure NEQ 409, "The Wyle Third Party Dedication Process," did not provide sufficient guidance on the "dedication" of commercial grade services. Upon questioning by the inspection team, the previously stated accuracy of the irradiation system was found to be non-conservative as it did not include several factors that could impact the accuracy of the radiation measurements. When all factors were accounted for, the measurement uncertainty went from 7 percent to 14.56 percent. As a consequence, nuclear safety related components (squib valve actuators for the Westinghouse AP1000 reactor) currently undergoing environmental qualification at NTS did not receive the full radiation dose when subtracting out the actual uncertainty of the measurement system.

This issue has been identified as Nonconformance 99900905/2015-201-01.

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

Docket No.: 99900905

Report No.: 99900905/2015-201

Vendor: National Testing Services
7800 Highway 20 West
Huntsville, Alabama 35806

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

Nuclear Industry Activity: National Testing Services (NTS) 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. NTS also performs testing services for U.S. Nuclear Regulatory Commission (NRC) licensees and vendors that supply safety-related replacement components to U.S. nuclear power plants.

Inspection Dates: December 15-17, 2014 and February 11, 2015

NRC inspectors: Jeffrey Jacobson NRO/DCIP/MVIB Team Leader
Tim Steadham R-II/DCI/CIB3
Paul Carman R-II/DCI/CIB3

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

EXECUTIVE SUMMARY

National Testing Services
99900905/2015-201

The NRC staff conducted this limited scope vendor inspection to verify that National Testing Services (NTS), 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." The NRC inspectors reviewed NTS's implementation of the Appendix B criteria related to test control, and measuring and test equipment, as related to the irradiation and submergence testing of the explosive actuators, which are a subcomponent of the 8-inch squib valves being supplied as part of the Westinghouse Electric Corporation (WEC) AP1000 reactor design. The NRC conducted this inspection at NTS's facility in Huntsville, AL.

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

- 10 CFR 50.49, "Environmental Qualification Important to Safety for Nuclear Power Plants"
- Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"
- Part 21 of 10 CFR "Reporting of Defects and Noncompliance"

The NRC inspectors used portions of Inspection Procedures (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, as applicable to the scope of the inspection.

The results of the inspection are summarized below.

Submergence Testing – Test Control

The NRC inspectors reviewed the applicable test procedures and inspected portions of the submergence test set-up of the AP1000 8-inch squib valve actuators. The inspection team concluded that NTS had developed adequate test procedures that encompassed the design basis requirements for the actuators. No findings of significance related to NTS's test control activities were identified.

Submergence Testing – Control of Testing Equipment

The NRC inspectors concluded that NTS's control of test equipment was 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.

Irradiation of the Squib Valve Cartridges

The NRC inspectors identified that NTS did not adequately validate of the accuracy of the dosimetry system which was being used by an NTS commercial sub-vendor to measure the amount of radiation being applied to squib valve cartridges. This was identified as Nonconformance of Criterion III, "Design Control" and Criterion V, "Instructions, Procedures, and Drawings" of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Nonconformance 99900905/2015-201-01.

No findings were identified regarding the neutron radiation testing.

REPORT DETAILS

1. Submergence Testing – Test Control

a. Inspection Scope

Under contract to Westinghouse, NTS is conducting two separate but inter-related equipment qualification programs for the AP1000 squib valves: one program for the squib valve actuators (the portion of the valve that contains the explosive system); and another program for the valve itself (the mechanical portion of the squib valve assembly). As part of the actuator qualification program, 20 test specimens are being subjected to a number of specific tests including thermal aging; radiation aging; seismic testing (including vibration testing), and accident simulation. The accident testing includes subjecting test samples to two different accident profiles, one that is for a loss of coolant accident only (no submergence), and one that is for a direct vessel injection line break that includes submergence. The submergence testing applies only to the 8-inch squib valve actuators as the 14-inch valves are not required to be operated while submerged. During this inspection at NTS, the NRC inspectors focused on the radiation aging (which had been subcontracted out by NTS to White Sands) and the submergence testing portions of the overall actuator qualification program.

The team reviewed the relevant test procedures, interviewed NTS personnel, inspected the test set-up, assessed the adequacy of the test instrumentation, and toured the testing facility. The team compared the test parameters being utilized against Westinghouse provided specifications and reviewed the adequacy of the actuator testing program with respect to selective relevant industry standards such as IEEE 323-1974. This inspection was conducted over two time periods since during the first time period, the testing was halted due to issues with NTS's chemical injection system.

During the first part of the inspection, the inspectors observed the installation of the two test specimen actuators into the test chamber. As specified in the testing plan, these two 8-inch actuators had previously undergone thermal aging, radiation aging, and seismic testing prior to being inserted into the test chamber. During the second portion of the inspection, the inspectors observed that the test chamber was brought up to the pre accident conditions, followed by application of the test profile. One actuator was successfully fired approximately 30 minutes into the profile at a point judged most severe from a thermal absorption perspective. The remaining actuator was fired at the end of the 72 hour submergence test. Both actuators were fired into closed bomb fixtures and were instrumented for pressure output which was compared against the component vendor's provided acceptance criteria. The firing circuit utilized during the test accurately replicated the actual interfacing systems when installed in the power plant. No findings were identified with this phase of the testing program.

b. Findings and Observations

The team identified that the accident profile provided by Westinghouse to NTS includes a very steep ramp up to maximum temperature and pressure that could not be met by the NTS testing facility. This ramp up to maximum temperature and pressure is

calculated to occur within approximately one second after the postulated line break accident and cannot be achieved using conventional testing methods. Consequently, the tested ramp up to maximum temperature and pressure was achieved over a much longer time period (on the order of 10 seconds). The inspectors determined that this appeared conservative from the standpoint of exposing the equipment to more thermal energy, but was potentially non-conservative with respect to thermal shock and thermal expansion issues. This was a previously known issue that was discussed with both NTS and Westinghouse during the inspection. NTS stated that they will be documenting the issue on a Notice of Anomaly that will be provided to Westinghouse for evaluation.

During the inspection, Westinghouse provided the team a copy of a procedure that they had previously issued to address such issues as they arise in the qualification program; however, the adequacy of this procedure could not be evaluated during this inspection since it had not been implemented yet for the issue raised above.

No other issues were identified associated with the submergence testing.

c. Conclusions

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

2. Submergence Testing – Control of Testing Equipment

a. Inspection Scope

The NRC inspection team reviewed calibration records for selected measurement and test equipment that NTS intended to utilize to perform the submergence testing of the 8-inch squib valve actuators to verify the compliance with Criterion XII, "Control of Measuring and Test Equipment," of Appendix B, to 10 CFR Part 50. The inspectors performed this review to ensure that the instruments were properly calibrated, accurate, and reliable. The NRC inspection team reviewed a sample of inspection and testing instruments to verify that the equipment was being properly calibrated and controlled. The specific instruments sampled were associated with the submergence testing of the 8-inch squib valve actuators. The NRC inspectors confirmed the instruments were calibrated and appropriate for the range of operation of the test. The NRC inspectors confirmed that all test instrumentation was appropriate for use and was capable of conducting measurements to the precision required in the test plan.

b. Findings and Observations

No findings of significance were identified.

c. Conclusions

The NRC inspectors determined that NTS was implementing its measurement and test equipment program in accordance with the regulatory requirements of Criterion XII of Appendix B to 10 CFR Part 50. No findings of significance were identified.

3. Irradiation of the Squib Valve Cartridges

a. Inspection Scope

The team reviewed Source Surveillance Report SA-11-023, dated November 21, 2012, which was performed by NTS on the White Sands Missile Range near Los Cruces, NM. White Sands was contracted by NTS to perform both gamma and neutron irradiation of the squib valve actuator specimens (eight 14-inch cartridges and ten 8-inch cartridges) being utilized as part of the overall equipment qualification program. While neutron radiation is not typically applied as part of a nuclear environmental qualification program, the application of neutron irradiation to the test cartridges was specified as a conservative measure due to the lack of industry knowledge on the effects of neutron irradiation on explosive device performance. White Sands does not have an approved nuclear quality assurance program and as such is considered a commercial grade service provider.

b. Findings and Observations

Since White Sands was a commercial service provider that was performing services critical to the qualification of the squib valves, their services should have been "dedicated" by NTS. This would have included performing a technical evaluation of the service and identifying critical characteristics of the service for verification. The inspectors determined that NTS had not dedicated this service. While NTS had in existence a procedure for performing commercial grade dedications, the procedure did not cover commercial grade services. NTS did, however, perform a surveillance of White Sands and documented the surveillance results in a very detailed accounting of the processes used by White Sands to apply both gamma and neutron radiation to test specimens. NTS provided the required radiation levels to White Sands based upon information provided by Westinghouse and contained in the Westinghouse approved NTS Qualification plan.

With respect to gamma radiation, the samples were exposed to 125 MRads of gamma radiation which includes a total estimated operating plus accident dose of 109 MRads, plus a margin of 10 percent as required by IEEE 323-1974, plus an additional 7 percent margin to cover dosimetry errors. The samples were irradiated using a Cobalt 60 source array. The test samples were rotated several times during the process to ensure uniform exposure.

The team identified that there was not a documented basis for NTS's acceptance of the White Sands stated accuracy of their dosimetry system. White Sands had stated that the accuracy of their system was 7 percent, and NTS took that into consideration when specifying radiation values, however, the basis for the 7 percent had not been validated by NTS at the time of the inspection. This was identified by the NRC inspectors as a potential issue during the first phase of this inspection. Upon further review by NTS, after receiving questions from the NRC team on this subject, NTS identified that the 7 percent number previously cited did not account for all the uncertainties in the process. As a result of the team's questions, NTS provided a new uncertainty analysis dated February 10, 2015, which concluded that the actual uncertainty could be as much as 11 percent for the 14-inch ADS valves and 14.56 percent for the 8-inch valves. Factors such as source decay, specimen placement uncertainty, and exposure duration uncertainty were not factored into the original 7 percent uncertainty number. NTS issued a Notice of Anomaly #21, dated February 10, 2015, to report this issue to their customer Westinghouse. While the overall uncertainty analysis performed by NTS appeared to be reasonable, the team identified that the uncertainty analysis still did not contain a validation for the original 7 percent dosimetry uncertainty which is one factor used on the overall uncertainty analysis. The team identified the lack of validation of the accuracy of the dosimetry system as a Nonconformance of Criterion III, "Design Control" and Criterion V, "Instructions, Procedures, and Drawings" of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." This issue has been identified as Nonconformance 99900905/2015-201-01.

With respect to neutron radiation, the team reviewed the methods used at White Sands to apply the correct energy level spectrum. No findings were identified regarding the neutron radiation testing.

c. Conclusions

The team identified the lack of validation of the accuracy of the dosimetry system as a Nonconformance of Criterion III, "Design Control" and Criterion V, "Instructions, Procedures, and Drawings" of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." This issue has been identified as Nonconformance 99900905/2015-201-01.

No findings were identified regarding the neutron radiation testing.

4. Exit Meeting

On February 11, 2015, the NRC inspectors presented their inspection scope and findings during an exit meeting with Mr. Tom Brewington, Senior Director Nuclear Engineering and Test, other NTS management and staff, and selected Westinghouse personnel.

ATTACHMENT

1. EXIT MEETING ATTENDEES AND INDIVIDUALS INTERVIEWED

Name	Title	Affiliation	Exit	Interviewed
Tom Brewington	Sr. Director, Nuclear	NTS	X	
E. Reilly Schum	Engineering Manager, EQ and TPQ	NTS	X	
Cameron Muelling	Staff Engineer	NTS	X	X
Steve Feder	Senior Engineer	WEC	X	X
Ronald P. Wessel	Principal Engineer, AP 1000 Licensing	WEC	X	X
Jeffrey Jacobson	Inspection Team Leader	NRC	X	
Tim Steadham	Inspector	NRC		
Paul Carman	Inspector	NRC	X	

2. INSPECTION PROCEDURES USED

- Inspection Manual Chapter 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

The NRC inspectors identified the following inspections, tests, analyses, and acceptance criteria (ITAAC) related to components being tested by NTS. At the time of the inspection, NTS was involved in the submergence testing of the 8-inch squib valve actuators, used as injection and recirculation valves in the passive core cooling system for the AP1000 reactor design. This testing is part of the overall equipment qualification program for the squib valves and will be used to demonstrate that the below ITAAC acceptance criteria have been met. 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.

Source Document	ITAAC Reference No.	ITAAC	Acceptance Criteria
Appendix C from the Combined License for Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3	No. 214	2.2.03.12a.i	A test report exists and concludes that each squib valve changes position as indicated in Table 2.2.3-1 under design conditions.
Appendix C from the Combined License for Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3	No. 215	2.2.03.12a.ii	A report exists and concludes that the as-built squib valves are bounded by the tests or type tests.

4. DOCUMENTS REVIEWED

NEQ 409, Revision I, 2/9/11, The Wyle Third Party Dedication Process

Wyle Qualification Plan 56354QPO9, "Qualification Plan for Safety-Related Squib Valve Actuators, Electrical Connector Assemblies, and Bracket Assemblies for Westinghouse Electric Company For Use in Westinghouse AP1000 Nuclear Power Plants," Revision E, dated 11/11/13 (with pen and ink changes dated 12/12/14)

Certificate of Calibration for Instrument No. 112742, Power Supply, dated 8/11/2014
Certificate of Calibration for Instrument No. 01229, Thermocouple, dated 3/3/2014
Certificate of Calibration for Instrument No. 03679, Thermocouple Meter, dated 6/5/2014
Certificate of Calibration for Instrument No. 01749, Pressure Transducer, dated 11/12/2014
Certificate of Calibration for Instrument No. 04523, Flow Meter, dated 3/27/2014
Certificate of Calibration for Instrument No. 03894, Thermocouple Probe, dated 11/3/2014
Certificate of Calibration for Instrument No. 01235, Thermocouple, dated 3/3/2014
Certificate of Calibration for Instrument No. 01230, Thermocouple, dated 3/3/2014

Westinghouse:

APP-GW-VPR-002, "Methodologies for Evaluating Revised DBA Transients," Revision 0, dated August 2, 2013

Certificate of Calibration for Instrument No. 00668954, Data Acquisition Unit, dated 9/3/2014
Certificate of Calibration for Instrument No. 1096, Squib Firing System, dated 9/2/2014
Certificate of Calibration for Instrument No. 2079806, Pressure Transducer, dated 9/16/2014
Certificate of Calibration for Instrument No. 2079807, Pressure Transducer, dated 9/16/2014
Certificate of Calibration for Instrument No. 2074936, Dual Mode Amplifier, dated 9/16/2014
Certificate of Calibration for Instrument No. 2074938, Dual Mode Amplifier, dated 9/16/2014