

December 7, 2016

Ms. Lynn Skarin, Quality Assurance Manager  
Pentair Valves and Controls  
55 Cabot Boulevard  
Mansfield, MA 02048

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION REPORT OF PENTAIR VALVES & CONTROLS REPORT NO. 99901431/2016-201 AND NOTICE OF NONCONFORMANCE

Dear Ms. Skarin:

From October 31, 2016, through November 3, 2016, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the Pentair Valves and Controls (Pentair) facility in Mansfield, Massachusetts. The purpose of this limited-scope inspection was to assess Pentair's compliance with the provisions of selected portions 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, and Part 21, "Reporting of Defects and Noncompliance."

This inspection specifically evaluated Pentair's implementation of quality activities associated with the design, fabrication, assembly, and testing of the PV-16, auxiliary relief valves, for the Westinghouse Electric Corporation AP1000 reactor design. The inspection also evaluated activities related to Section III, "Rules for Construction of Nuclear Power Plant Components," of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (BPV Code) and ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." Further, the inspection assessed Pentair's corrective actions to close the previous NRC identified violation and nonconformances in NRC Inspection Report (IR) 99901431/2014-201 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14073A652) and IR 99901431/2013-201 (ADAMS Accession No. ML13212A265).

In addition, the NRC staff reviewed qualification tests associated with inspections, tests, analyses, and acceptance criteria (ITAAC) from Revision 19 to the certified AP1000 Design Control Document, Tier 1. Specifically, these activities were associated with ITAAC 2.1.02.05a.ii, ITAAC 2.1.02.08a.i, ITAAC 2.1.02.08.a.ii, and ITAAC 2.2.03.05a.ii. The NRC inspection team did not identify any adverse findings associated with the ITAAC contained in Section 4 of the Attachment of this report. This NRC inspection report does not constitute NRC endorsement of your overall quality assurance (QA) or Part 21 programs.

Based on the results of this inspection, the NRC inspection team 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 NRC inspection team determined that Pentair was not fully implementing its QA program in the area of corrective action. The NRC places significant reliance on the adequacy of a vendor's corrective action program and encourages Pentair to fully address the concerns identified in this inspection report. The specific finding and references to the pertinent requirements are identified in the enclosures to this letter. In response to the enclosed notice of nonconformance (NON), Pentair should document the results of the extent of condition review for this finding and determine if there are any adverse effects on other safety-related components.

Please provide a written explanation or statement within 30 days of this letter in accordance with the instructions specified in the enclosed NON. Based on the extent of this finding, please discuss the steps you are taking to provide assurance that the identified weaknesses in your QA program do not have an adverse impact on other customers, including the operating fleet of power reactors.

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 Agencywide Document Access and Management System (ADAMS), which is accessible from the NRC website 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 (SGI) 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, please provide a bracketed copy of your response that identifies the information that should be protected, as well as a redacted copy of your response that deletes such information.

If you request that such material be 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 SGI 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/*

John Burke, Chief  
Quality Assurance Vendor Inspection Branch-2  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Docket No.: 99901431

Enclosures:

1. Notice of Nonconformance
2. Inspection Report No. 99901431/2016-201  
and Attachment

provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

**/RA/**

John Burke, Chief  
Quality Assurance Vendor Inspection Branch-2  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Docket No.: 99901431

Enclosures:

- 1. Notice of Nonconformance
- 2. Inspection Report No. 99901431/2016-201 and Attachment

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**ADAMS Accession No.: ML16323A463** \*via e-mail NRO-002

<b>OFC</b>	NRO/DCIP/QVIB-2	NRO/DCIP/QVIB-2	NRO/DEIA/MEB
<b>NAME</b>	SObadina	RPatel	TScarborough
<b>DATE</b>	12/01/16	12/01/16	12/01/16
<b>OFC</b>	RII/DCO/IB2	NRO/DCIP/QVIB-2	NRO/DCIP/QVIB-2: BC
<b>NAME</b>	TSteadham*	ABelen	JBurke
<b>DATE</b>	12/01/16	12/06/16	12/07/16

**OFFICIAL RECORD COPY**

## NOTICE OF NONCONFORMANCE

Pentair Valves and Controls  
55 Cabot Boulevard  
Mansfield, MA 02048

Docket No. 99901431  
Report No. 2016-201

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted at the Pentair Valves and Controls (Pentair) facility in Mansfield, Massachusetts, from October 31, 2016, through November 3, 2016, certain activities were not conducted in accordance with NRC requirements that were contractually imposed on Pentair by its customers or NRC licensees.

- A. Criterion XVI, "Corrective Action," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," states in part that, "Measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected."

Section XVI, "Corrective Action," of QC-110, "Pentair Quality Assurance Manual" Revision 46, dated June 24, 2016, states in part that, "conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, defective qualified source material or items are promptly identified and reported to appropriate levels of management for determination of cause and corrective actions by both AG Crosby and/or vendors and follow up to assure that the corrective actions have been effective."

Contrary to the above, as of November 3, 2016, Pentair failed to promptly identify and correct conditions adverse to quality. Specifically, Pentair closed its corrective action reports (CARs) 665, 666, and 709 without adequately implementing the corrective actions to address the findings in the 2013 NRC Inspection Report 99901431/2013-201. This is demonstrated through the following three examples:

1. In response to Nonconformance 99901431/2013-201-06, Pentair initiated CAR No. 665, dated June 27, 2013, to address the finding related to failure to have controls in place for the weld rod oven temperature read out display and humidity indication. Pentair addressed the weld rod oven temperature read out display and closed CAR 665. However, Pentair failed to address and take corrective action related to the humidity indication of the weld rod oven as specified in Nonconformance 99901431/2013-201-06.
2. In response to Nonconformance 99901431/2013-201-04, Pentair initiated CAR No. 666, dated June 27, 2013, to address the finding related to inadequate control or documentation for the purchase, selection, and verification of the appropriate type of Neolube1 used to lubricate various valve types during and after testing activities. In CAR 666, Pentair stated that it would: (a) remove any ambiguous requirements of Neolube materials from nuclear assembly/test procedures; (b) update the 57 nuclear procedures (40 cleaning procedures and 17 assembly procedures) by removing the reference and the use of Neolube1; and, (c) train personnel to the revised procedures. However, Pentair closed CAR 666 without completing the corrective actions: (a) to address the removal of ambiguous requirements of Neolube1 from nuclear

assembly/test procedures; (b) to complete procedure updates; and (c) to complete training of personnel to the revised procedures as specified in Pentair's response to Nonconformance 99901431/2013-201-04.

3. In response to Nonconformance 99901431/2013-201-05, Pentair initiated CAR No. 709, dated September 9, 2013, to address the finding related to inadequate verification that commercial-grade items received from its suppliers conformed to the applicable specification requirements and failed to validate the required critical characteristics during commercial-grade dedication, receipt inspection and testing for three U-cup O-rings using a sampling process. Instead, Pentair relied on a commercial supplier-issued certified material test report (CMTR) as the sole method to verify critical characteristics for the entire batch of U-cup O-rings without conducting a commercial-grade survey, source verification, or other method to verify that the supplier's quality program was capable of appropriate control of the required critical characteristics. This included appropriate controls for material traceability and adequacy of CMTRs. In CAR 709 Pentair stated that they would plan and perform commercial-grade surveys or source surveillances of elastomer suppliers prior to the acceptance of their CMTRs. However, Pentair closed CAR 709 without performing the commercial-grade survey or source surveillance of elastomer suppliers prior to the acceptance of their CMTRs as specified in Pentair's response to Nonconformance 99901431/2013- 201-05.

This issue has been identified as Nonconformance 99901431/2016-201-01.

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Chief, Quality Assurance Vendor Inspection Branch-2, Division of Construction Inspection and Operational Programs, Office of New Reactors, within 30 days of the date of the letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to a Notice of Nonconformance" and should include for each noncompliance: (1) the reason for the noncompliance or, if contested, the basis for disputing the noncompliance; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid further noncompliance; and (4) the date when the 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 Agencywide Documents Access and Management System (ADAMS), which is accessible from the NRC web site at <http://www.nrc.gov/readingrm/adams.html>, to the extent possible it should not include any personal privacy, proprietary, or Safeguards Information (SGI) 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 be withheld, 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 SGI is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Requirements for the Protection of Safeguards Information."

Dated this the 7<sup>th</sup> day of December 2016.

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

Docket No.: 99901431

Report No.: 99901431/2016-201

Vendor: Pentair Valves and Controls  
55 Cabot Boulevard  
Mansfield, MA 02048

Vendor Contact: Ms. Lynn Skarin  
Quality Assurance Manager  
Telephone: (508) 594-4450  
E-mail: lynn.skarin@pentair.com

Nuclear Industry Activity: Pentair Valves and Controls (Pentair) is an American Society of Mechanical Engineers (ASME) certificate holder with a scope of supply that includes design, fabrication and testing of safety-related ASME *Boiler & Pressure Vessel Code* (BPV Code) valves; qualification testing of those valves in accordance with the ASME Standard QME-1, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants;" and providing engineering services to the nuclear power industry. Pentair has been contracted by the Westinghouse Electric Corporation (WEC) to provide safety-related valves for the AP1000 reactor design and to complete QME-1 testing for those valves.

Inspection Dates: October 31, 2016 to November 3, 2016

NRC Inspection Team:	Raju B. Patel	NRO/DCIP/QVIB-2, Team Leader
	Sara Obadina	NRO/DCIP/QVIB-2, Trainee
	Thomas Scarbrough	NRO/DEIA/MEB, Technical Specialist
	Timothy Steadham	RGN II/DCI/CIB3, Inspector

Approved by: John Burke, Chief  
Quality Assurance Vendor Inspection Branch-2  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors



## **EXECUTIVE SUMMARY**

Pentair Valves and Controls  
99901431/2016-201

The U.S. Nuclear Regulatory Commission (NRC) conducted this vendor inspection to verify that Pentair has implemented an adequate quality assurance (QA) program that complies with the requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 21, "Reporting of Defects and Noncompliance." The NRC inspection team conducted the inspection at the Pentair facility in Mansfield, Massachusetts from October 31, 2016, to November 3, 2016.

This inspection evaluated Pentair's QA activities associated with the design, fabrication, assembly, and qualification testing of the PV-16 auxiliary relief valves to the Section III, "Rules for Construction of Nuclear Power Plant Components," of the ASME BPV Code and ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants," for the WEC AP1000 reactor design. Some activities observed by the NRC inspection team are associated with or directly affect closure of inspections, tests, analyses, and acceptance criteria (ITAAC) from Revision 19 of the certified AP1000 design. These ITAAC are included in the combined licenses of Vogtle Units 3 and 4, and V.C. Summer Units 2 and 3.

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

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

The NRC inspection team implemented Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," dated July 2013; IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated November 2013; IP 36100, "Inspection of 10 CFR Parts 21 and Programs for Reporting Defects and Noncompliance," dated February 2012; IP 65001 E, "Inspection of the ITAAC Related Qualification Program," dated August 2008; and IP 35034, "Design Certification Testing Inspection," dated January 2010, during the conduct of this inspection.

The NRC inspection team observed various activities associated with the implementation of Pentair's QA policies and procedures for the procurement, design, fabrication, assembly, testing, and commercial-grade dedication (CGD) of valves and associated parts for the current operating fleet. In addition, the NRC inspection team verified that these activities were being implemented in accordance with the applicable requirements of 10 CFR Part 21 and Appendix B to 10 CFR Part 50.

Specific activities observed by the NRC inspection team included:

- implementation of the Pentair policies and procedures for design control and design changes associated with the AP1000 PV-16 auxiliary relief valves
- commercial-grade dedication of the disc insert pin
- pre-test calibration of alloy-identification machine
- weld repair of body using Shield Metal Arc Welding process
- daily Material Review Board (MRB) meeting for disposition of nonconforming components
- ASME Standard QME-1 seismic and functional qualification testing of the AP1000 PV-16 auxiliary relief valve
- pre and post-test calibration of pressure gauges, load cell and temperature gauge
- commercial-grade dedication of incoming thread plug gauges
- magnetic particle examination of completed weld repair of valve body
- liquid penetrant examination of valve disc

In addition to observing these activities, the NRC inspection team conducted walk downs of Pentair's facility and verified that nonconforming components and measuring and test equipment (M&TE) were properly identified, marked, and segregated when practical, to ensure that they were not reintroduced into the manufacturing processes.

The NRC had previously conducted inspections at Pentair's facility in Mansfield, Massachusetts, in February 2014, and June 2013. The inspection results are documented in Inspection Report (IR) 99901431/2014-201, dated March 31, 2014 and in IR 99901431/2013-201, dated August 20, 2013, respectively. The 2014 IR documented one violation of NRC requirements and the 2013 IR documented six nonconformances of NRC requirements that were contractually imposed upon Pentair by its customers or NRC licensees. This inspection report documents the NRC's verification of Pentair's implementation of its corrective actions to resolve these issues.

With the exception of the nonconformance described below, the NRC inspection team concluded that Pentair's QA policies and procedures comply with the applicable requirements of 10 CFR Part 21 and Appendix B to 10 CFR Part 50, and that Pentair personnel are implementing these policies and procedures effectively.

The results of this inspection are summarized below.

#### Corrective Action

The NRC inspection team issued Nonconformance 99901431/2016-201-01, as a result of Pentair's failure to implement the regulatory requirements of Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50. Nonconformance 99901431/2016-201-01, cites Pentair for failing to ensure conditions adverse to quality were promptly identified and corrected. Specifically, Pentair closed its corrective action reports (CARs) 665, 666 and 709 without fully implementing the previous committed corrective actions to address the findings in the 2013 NRC inspection report 99901431/2013-201.

### Other Inspection Areas

The NRC inspection team determined that Pentair is implementing its programs for the design control, supplier oversight, control of measuring and test equipment, control of special processes, and nonconforming materials, parts, and components programs in accordance with the applicable regulatory requirements of Appendix B to 10 CFR Part 50. In addition, the NRC inspection team determined that Pentair is implementing its 10 CFR Part 21 program for evaluating deviations and reporting defects that could create a substantial safety hazard in accordance with regulatory requirements. No findings of significance were identified.

## REPORT DETAILS

### 1. Corrective Action Program

#### a. Inspection Scope

The U.S. Nuclear Regulatory Commission (NRC) inspection team reviewed the Pentair Valves & Controls (hereafter referred to as Pentair) policies and implementing procedures and records that govern the corrective action program (CAP) to verify compliance with the regulatory requirements of Criterion XVI, "Corrective Actions," of Appendix B to 10 CFR Part 50.

Specifically, the NRC inspection team reviewed the corrective actions that Pentair had taken to address the previously identified violation and nonconformances identified in NRC Inspection Report (IR) 99901431/2014-201(Agencywide Documents Access and Management System (ADAMS) Accession No. ML14073A652) and IR 99901431/2013-201 (ADAMS Accession No. ML13212A265).

In addition, the NRC inspection team sampled additional corrective actions and customer complaints to verify that conditions adverse to quality were being promptly identified and corrected and for a significant condition adverse to quality (SCAQ), that measures were taken to preclude repetition. The NRC inspection team discussed the CAP with Pentair's management and technical staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

#### b. Observations and Findings

##### b.1 Corrective Action Associated with Violation 99901431/2014-201-01

Notice of Violation 99901431/2014-201-01 was issued for Pentair's failure to evaluate deviations identified during the NRC February 2014 inspection associated with the qualification testing of the AP1000 pressurizer safety valve (PV-62) and failed to submit an interim report.

The NRC inspection team reviewed the SCAQ in Pentair's corrective action reports (CARs) 673, 674 and 675 that addressed Pentair's failure to evaluate deviations, to identify defects within 60 days of discovery and failure to submit an interim report within 60 days. The NRC inspection team reviewed Pentair's interim report to the NRC dated June 25, 2014, "Update to Interim Report- 10 CFR Part 21 Evaluation regarding potential deficiencies in Seismic Qualification for PV-62," and verified actions taken by Pentair related to the valve requalification. The NRC inspection team also reviewed Pentair's final report dated August 27, 2014, "Close-out to Interim Report - 10 CFR Part 21 Evaluation Regarding Potential Deficiencies in Seismic Qualification for PV-62." The NRC inspection team verified Pentair's extent of condition, and noted that Pentair had recalled the PV-62 valve and performed requalification using a revised test procedure. CARs 673, 674, and 675 described the corrective actions that provided objective evidence of the completion of corrective actions. Pentair closed CAR 673 on November 5, 2014, CAR 674 on February 5, 2014, and CAR 675 on April 15, 2014.

The NRC inspection team determined that Pentair's corrective actions were adequate to address the identified finding. Based on its review, the NRC inspection team closed Violation 99901431/2014-201-01.

b.2 Corrective Action Associated with Nonconformance 99901431/2013-201-01

Nonconformance 99901431/2013-201-01 was issued for Pentair's failure to adequately evaluate the results of the natural frequency testing reports prepared by National Technical Systems (Pentair's contractor) to determine the proper setup of the QME-1 seismic qualification tests for the PV-16 auxiliary relief valves and PV-62 pressurizer safety valves, respectively. In addition, Pentair failed to specify in its valve qualification test procedure for PV-62, that the static side load be applied at the design pressure set point during the QME-1 seismic qualification testing of the AP1000 PV-62 pressurizer safety valve. This resulted in the QME-1 seismic qualification test of the PV-62 failing to verify the proper lift of the safety valve under seismic conditions as required by the Westinghouse Electric Corporation (WEC) design specification.

The NRC inspection team reviewed CARs 673 and 674 that Pentair initiated to address Nonconformance 99901431/2013-201-01. The NRC inspection team reviewed the documentation that provided objective evidence for the completion of the corrective actions. Specifically, the NRC inspection team verified that Pentair's engineering procedures VQT-38173 for the PV-62 pressurizer safety valve and VQT-38188 for the PV-16 auxiliary relief valve had been revised to include provisions for the proper application of the static seismic load along the least rigid axis of the valve. The NRC inspection team also verified that Pentair's test procedure T-161093 had been revised to include the prorated spring justification for the PV-62 valve. During an NRC inspection at Pentair in 2014, the NRC inspection team had observed the repeat performance of the QME-1 qualification test for the PV-62 pressurizer safety valve, including verification of the correct application of the static seismic load and the determination of an appropriate prorated spring for use during the QME-1 qualification test. The NRC inspection team determined that Pentair's corrective actions were adequate to address the identified finding. Based on its review, the NRC inspection team closed Nonconformance 99901431/2013-201-01.

b.3 Corrective Action Associated with Nonconformance 99901431/2013-201-02

Nonconformance 99901431/2013-201-02 was issued for Pentair's failure to evaluate the validity of the QME-1 qualification test of the PV-62 pressurizer safety valve with an ambient temperature higher than the allowable test temperature. Further, Nonconformance 99901431/2013-201-02, cites that during QME-1 qualification testing of a PV-16 auxiliary relief valve, Pentair failed to install a device to ensure that the valve satisfied the leakage acceptance criteria.

The NRC inspection team reviewed CARs 675 and 707 that Pentair initiated to address Nonconformance 99901431/2013-201-02. The NRC inspection team reviewed the documentation that provided objective evidence for the completion of the corrective actions. The NRC inspection team verified that QME-1 qualification

Test Report TR-5509 addressed the ambient temperature of 145 °F during the Post Natural Frequency operational test prior to the qualification test compared to the 50 to 120 °F test criteria. During review of CAR 707, the NRC inspection team found that the training log dated September 15, 2013, listed only the Pentair engineer who briefed the testing staff on the valve leakage provisions. In response to this observation, Pentair provided specific training to its testing staff on November 3, 2016, for the valve leakage provision, and updated CAR 707. The NRC inspection team determined that Pentair's corrective actions were adequate to address the identified finding. Based on its review, the NRC inspection team closed Nonconformance 99901431/2013-201-02.

b.4. Corrective Action Associated with Nonconformance 99901431/2013-201-03

Nonconformance 99901431/2013-201-03 was issued for Pentair's failure to perform technical evaluations to justify that the critical characteristics and associated acceptance methods selected for various valve parts and components would provide reasonable assurance that the valves would perform their intended safety functions. Further, Nonconformance 99901431/2013-201-03 cited Pentair for failure to perform a technical evaluation to identify additional technical requirements to be included in the purchase order for the specific measuring and test equipment (M&TE) being calibrated.

The NRC inspection team reviewed CAR 667 and 708 that Pentair initiated to address Nonconformance 99901431/2013-201-03. The NRC inspection team reviewed the documentation that provided objective evidence for the completion of the corrective actions. The NRC inspection team verified for a sample of 13 dedicated component files, that Pentair engineering had documented the technical evaluation to identify critical characteristics and the selection of acceptance methods on Form Q.C.639, "Evaluation Criteria for Determination of Piece Part Classification as Safety-Related," and Form Q.C. 710, "Critical Characteristics Identification." The NRC inspection team determined that Pentair's corrective actions were adequate to address the identified finding. Based on its review, the NRC inspection team closed Nonconformance 99901431/2013-201-03.

b.5. Corrective Action Associated with Nonconformance 99901431/2013-201-04

Nonconformance 99901431/2013-201-04 was issued for Pentair's failure to have adequate controls or documentation in place to select and verify that the appropriate type of Neolube1 lubricant was purchased and used on various valve types during and after testing activities in accordance with the application and design specifications for the valves.

In response letters dated December 26, 2013 and March 24, 2014, Pentair stated that it would: (a) identify and label all Neolube1 bottles as "Navy-Use-Only;" (b) remove Neolube1 from the nuclear assembly/test area; (c) conduct training of all assembly personnel on the use of Neolube1 to be restricted for Navy jobs only; (d) train the manufacturing supervisor to monitor and label all new incoming shipments of Neolube1 prior to disbursement into the shop; (e) remove any ambiguous requirements for use of Neolube1 from nuclear assembly/test procedures that consisted of 40 cleaning procedures and 17 assembly procedures;

and (f) conduct training all engineering and assembly personnel on the updated procedures. Pentair initiated CAR 666, dated June 27, 2013, to address the Nonconformance 99901431/2013-201-04.

The NRC inspection team reviewed CAR 666, interviewed personnel, reviewed documents, and performed a walk-down of the nuclear assembly and test areas. The NRC inspection team did not locate any bottles of Neolube1 in the nuclear assembly or test areas, verified with personnel that Neolube1 was not an approved lubricant for nuclear applications, and verified that Neolube1 was not included in procedure C-14234, "Cleaning Procedure," Revision 3, dated January 13, 2008.

The NRC inspection team determined that Pentair closed the CAR 666 without completing the following corrective actions: (a) to address the removal of ambiguous requirements of Neolube1 from nuclear assembly/test procedures; (b) to complete procedure updates; and (c) to complete training of personnel to the revised procedures as specified in Pentair's response to Nonconformance 99901431/2013-201-04. Based on its review, the NRC inspection team determined that Pentair did not adequately implement all the committed corrective actions identified in Nonconformance 99901431/2013-201-04. During this inspection, Pentair initiated CAR 974, dated November 2, 2016 to address this finding.

This issue is identified as the first example of Nonconformance 99901431/2016-201-01.

b.6. Corrective Action Associated with Nonconformance 99901431/2013-201-05

Nonconformance 99901431/2013-201-05, was issued for Pentair's failure to adequately verify that commercial-grade items received from its suppliers conformed to the applicable specification requirements and failed to validate the required critical characteristics during commercial-grade dedication, receipt inspection and testing for three U-cup O-rings using a sampling process. Instead, Pentair relied on a commercial supplier-issued certified material test report (CMTR) as the sole method to verify critical characteristics for the entire batch of U-cup O-rings without conducting a commercial-grade survey, source verification, or other method to verify that the supplier's quality program was capable of appropriate control of the required critical characteristics. This included appropriate controls for material traceability and adequacy of CMTRs.

In response letter dated September 20, 2013, Pentair stated that it would conduct source verification to verify the supplier's capability to control material traceability to a heat number, production lot number or batch number.

The NRC inspection team reviewed Pentair's CAR 709, dated September 9, 2013, that Pentair had initiated to address the Nonconformance 99901431/2013-201-05. The NRC inspection team reviewed the copy of the 2014 External Audit Schedule attached to the CAR 709. The 2014 External Audit Schedule listed three elastomer suppliers that were scheduled to have a commercial-grade survey before March 31, 2014. Pentair could not provide documented evidence of

commercial-grade surveys or source surveillance reports of these elastomer suppliers. Further, the NRC inspection team determined that Pentair had closed CAR 709 without performing the commercial-grade surveys or source surveillances of the elastomer suppliers prior to acceptance of their CMTRs. Based on its review, the NRC inspection team determined that Pentair did not adequately implement all the committed corrective actions identified in Nonconformance 99901431/2013-201-05. During this inspection, Pentair initiated CAR 978, dated November 3, 2016, to address this finding.

This issue is identified as the second example of Nonconformance 99901431/2016-201-01.

b.7. Corrective Action Associated with Nonconformance 99901431/2013-201-06

Nonconformance 99901431/2013-201-06 was issued for Pentair's failure to have controls in place for the temperature read out display and humidity indication on nuclear weld rod ovens to provide assurance that the weld rods were adequately maintained in accordance with the applicable sections of the ASME BPV Code.

In response letter dated March 24, 2014, Pentair stated that it would procure and install a calibrated temperature gauge on the weld rod ovens. In addition, Pentair stated that it would revise its calibration procedure CPIE-0240 to include a quarterly verification of the weld rod oven temperature between 175 and 300 °F and train its welding and calibration personnel to the revised procedure.

The NRC inspection team reviewed CAR 665, dated June 27, 2013, that Pentair initiated to address the finding in Nonconformance 99901431/2013-201-06. The NRC inspection team performed a walk-down of the welding area and noted that calibrated temperature gauges were installed on the weld ovens and that a daily temperature log was being maintained to monitor the temperature as committed in their response. Further, the NRC inspection team reviewed Pentair's revised calibration procedure CPIE-0240 to confirm it included daily verification of the weld rod oven temperature between 175 and 300 °F. However, the NRC inspection noted that Pentair had closed CAR 665, but failed to address or take corrective actions related to humidity indication of the nuclear weld rod ovens as specified in Nonconformance 99901431/2013-201-06. As a result, the NRC inspection team determined that Pentair's corrective actions did not fully address all aspects of Nonconformance 99901431/2013-201-06. During this inspection, Pentair initiated CAR 976, dated November 2, 2016, to address the omission of weld rod oven humidity indication from CAR 665.

This issue has been identified as the third example of Nonconformance 99901431/2016-201-01.

c. Conclusion

The NRC inspection team issued Nonconformance 99901431/2016-201-01 for Pentair's failure to implement the regulatory requirements of Criterion XVI of Appendix B to 10 CFR Part 50. Nonconformance 99901431/2016-201-01 cites Pentair for failing to



assure conditions adverse to quality are promptly identified and corrected. Specifically, Pentair closed CARs 665, 666, and 709, without fully implementing all corrective actions that Pentair had committed to performing in their response to address the nonconformances identified in the NRC IR 99901431/2013-201.

## 2. Control of Special Processes

### a. Inspection Scope

The NRC inspection team reviewed Pentair's policies and implementing procedures that govern the control of special processes to verify compliance with the regulatory requirements of Criterion IX, "Control of Special Processes," of Appendix B to 10 CFR Part 50; as well the requirements of Section V, "Nondestructive Examination," and Section IX, "Welding and Brazing Qualification," of the ASME BPV Code. Specifically, the NRC inspection team reviewed a sample of nondestructive examination (NDE) test reports for pressure boundary welds for the PV-16 auxiliary relief valves serial number N900133-00-0001 and N900133-00-0002, and observed liquid penetrant and magnetic particle testing of a valve disc and valve body, respectively. In addition, the NRC inspection team reviewed coating records for the PV-16 auxiliary relief valve serial number N900138-00-0002 to determine whether the valve was coated per Pentair's procedures, standards and specifications.

The NRC inspection team selected a sample of training and qualification records of quality control (QC) inspectors to assure they were adequately qualified and records were current. The NRC inspection team discussed the control of special processes program with Pentair's management and technical staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

### b. Observations and Findings

The NRC inspection team reviewed WEC purchase order (PO) No. 4500340946, as revised on February 17, 2014, and noted that it invoked WEC specification APP-PV16-Z0-001, "AP1000 Auxiliary Relief Valves," Revision 8, for the design and construction of PV-16 ASME Section III Class 2 and 3 auxiliary relief valves. WEC specification APP-PV16-Z0-001, Section 7.5.3, "Coatings," requires that, "All external, non-corrosion resistant surfaces shall be protected in accordance with APP-G1-MX-001."

WEC specification APP-G1-MX-001, "AP1000 Painting of OEM Mechanical Components," required that the application of inorganic zinc coatings to components located inside containment meet the requirements for Zone 3-I coatings. Step 5.4 of APP-G1-MX-001, required that Pentair prepare detailed stepwise procedures and process control records for Zone 3-I inorganic zinc coating work and that those procedures and process control records identify: (1) the inspection instruments to be used for the process attributes that required inspection; (2) the texture (profile) achieved and how it was measured in process control records; (3) the dry film thickness of each coat in process control records; and (4) the inspection instrumentation that was used and their calibration status in process control records.

To meet the requirements of APP-G1-MX-001, Pentair implemented PF-30113, "Painting Procedure," that was reviewed and approved by WEC. The NRC inspection team reviewed this procedure and its attached Form Q.C. 456, "Certificate of Inspection Post Coating." Further, the NRC inspection team reviewed the Certificate of Inspection Post Coating record for valve serial number N900138-00-0002, a PV-16 auxiliary relief valve that had the lever, cap top and cap coated with a WEC-approved inorganic zinc coating material and noted that Pentair Q.C inspector had inspected and stamped the inspection results met the procedure acceptance criteria as "satisfactory." However, the Certificate of Inspection Post Coating record did not identify the M&TE used and their calibration status.

The NRC inspection team questioned Pentair about the identification and calibration of M&TE used for the inspection of painting attributes. The NRC inspection team discussed these issues with Pentair management, and Pentair initiated a CAR 979, dated November 4, 2016, to address the issues related to documenting the actual inspection attributes and the identification of M&TE used and their calibration status in Certificate of Inspection Post Coating for PV-16 valves. The NRC inspection team determined that not identifying M&TE used and their calibration status is not a greater-than-minor finding.

c. Conclusion

The NRC inspection team concluded that Pentair is implementing its control of special processes program in accordance with regulatory requirements of Criterion IX of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Pentair is implementing its policies and procedures associated with the control of special processes program. No findings of significance were identified.

3. Design Control

a. Inspection Scope

The NRC inspection team reviewed Pentair's policies and implementing procedures to verify that design control activities were being implemented in accordance with the regulatory requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50, as well the requirements of Section III, "Rules for Construction of Nuclear Facility Components," of the ASME BPV Code, and ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment used in Nuclear Power Plants."

Specifically, the NRC inspection team evaluated the implementation of the Pentair's design control process associated with the review of design calculations to determine if an auxiliary relief valve complied with the requirements of Section III of the ASME Code. The NRC inspection team reviewed Engineering Calculation EC-2839, "Design Report AG-Crosby 3K4 Style JLT-JB5-E-75 Relief Valve," Revision 5 dated October 26, 2016, which was completed to support ASME III certification for an auxiliary relief valve classified as commodity code PV16 by WEC. In addition, the NRC inspection team reviewed documentation and observed activities associated with Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) 2.1.02.02.a, ITAAC 2.1.02.04.a, ITAAC 2.1.02.05.a.ii, ITAAC 2.1.02.08.a.i, ITAAC 2.1.02.08.a.ii, ITAAC 2.2.03.02.a,

ITAAC 2.2.03.04.a, and ITAAC 2.2.03.05.a.ii from the AP1000 Design Control Document (DCD), Tier 1, Revision 19.

The NRC inspection team also reviewed the ASME Data Report Form NV-1 prepared by Pentair, including the WEC Certificate of Conformance (CoC) that accept the ASME Design Reports. The NRC inspection team reviewed the resolution of the Nonconformance 99901431/2013-201-01 related to seismic qualification testing of PV-16 and PV-62 valves. Furthermore, the NRC inspection team discussed the design control program with Pentair's management and technical staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that Pentair is implementing its oversight of contracted activities in accordance with the regulatory requirements of Criterion III of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Pentair is implementing its policies and procedures associated with the design activities. No findings of significance were identified.

4. Test Control

a. Inspection Scope

The NRC inspection team reviewed Pentair's policies and implementing procedures that govern test control activities to verify compliance with the regulatory requirements of Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50, as well as the requirements of Section III of the ASME BPV Code and ASME Standard QME-1-2007.

The NRC inspection team evaluated Pentair's test controls associated with the AP1000 PV-16 auxiliary relief valves to satisfy the WEC design specifications for the qualification of these valves in accordance with ASME Standard QME-1-2007, as endorsed in NRC Regulatory Guide 1.100 (Revision 3), "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants."

The NRC inspection team observed the QME-1 qualification test activities for AP1000 auxiliary relief valve PV16-Z0D-105 that will function as the Normal Residual Heat Removal Hot Leg Suction Relief Valve RNS-PL-V021 at Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3. The NRC inspection team observed the pre-test set-up activities for the PV-16 valve D-105, including verification of the calibration status of the test equipment. The NRC inspection team observed the QME-1 qualification test of the PV-16 valve D-105, including pressure relief performance, valve disc lift, and seat leakage. The NRC inspection team evaluated the disassembled PV-16 valve D-105 for wear following the QME-1 qualification testing.

The NRC inspection team reviewed the QME-1 test reports being prepared for other PV-16 auxiliary relief valves to be used at Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3. Further, the NRC inspection team reviewed the Pentair qualification and test procedures and QME-1 test reports for the AP1000 PV-62 pressurizer safety valves and PV-18 vacuum breakers. The NRC inspection team discussed the test control program with Pentair's management and technical staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

b. Observations and Findings

During this inspection, the NRC inspection team reviewed Pentair Engineering Procedure - Valve Qualification Test Procedure VQT-38188, "ASME QME-1 Functional Qualification Test Program for Active Valve Assemblies – PV16 Auxiliary Relief Valves," and Pentair Engineering Procedure - Production Test Procedure T-161162, "Test Procedure – PV16-Z0-001." The NRC inspection team verified the calibration of the test equipment for the QME-1 qualification test for the PV-16 valve D-105, including pressure gauges, thermometer, caliper, and pneumatic cylinder. The NRC inspection team did not identify any issues of concern with the Pentair qualification and test procedures, or the calibration of the test equipment for the QME-1 qualification test of the AP1000 PV-16 auxiliary relief valve D-105.

The NRC inspection team observed the Pentair QME-1 qualification test of the PV-16 valve D-105, and found that the QME-1 qualification test was conducted according to Pentair Procedure VQT-38188 with appropriate test controls by Pentair personnel and oversight by a Pentair quality control inspector. The NRC inspection team verified that Pentair applied the seismic static load along the least rigid axis of the PV-16 valve D-105 as identified through testing by a subsupplier. The NRC inspection team discussed the confirmation of the front-to-back orientation of the least rigid axis for the PV-16 valve D-105 with Pentair personnel in light of the different least rigid axis for the other PV-16 valves. In that Pentair's test facility could not achieve the functional performance parameters of pressure and flow for the PV-16 valve D-105, the NRC inspection team reviewed Pentair's use of a prorated spring for the QME-1 qualification test of the PV-16 valve D-105 based on the Pentair spring selection table and discussions with Pentair personnel. The NRC inspection team verified that a leak collection device was used during the QME-1 qualification test of the PV-16 valve D-105. The NRC inspection team found that the PV-16 valve D-105 successfully met the QME-1 qualification test acceptance criteria for pressure relief, valve disc lift, and seat leakage. The final production test with the full size spring and test pressure of the PV-16 valve D-105 to verify the set pressure was scheduled to be conducted following completion of this NRC inspection.

The NRC inspection team evaluated the disassembled parts of the PV-16 valve D-105 for wear following the observed QME-1 qualification test. The NRC inspection team identified only slight abrasions on the internal parts of the PV-16 valve D-105. Pentair personnel indicated that minor lapping would be performed on the internal parts of the PV-16 valve D-105 prior to re-assembly in preparation for the final production test. The NRC inspection team did not identify any issues of concern with the evaluation of the internal parts of the PV-16 valve D-105.

The NRC inspection team reviewed the information to be used by Pentair in preparing the QME-1 test report for the PV-16 valve D-105. For example, the NRC inspection

team reviewed Pentair Test Report (TR)-5557 for the functional qualification of Topworx Position Indication Switch for the PV-16 valve D-105. The NRC inspection team reviewed the certification from the National Board of Boiler and Pressure Vessel Inspectors, dated February 2, 2011, for the flow capacity of the Pentair JLT valve design (including the PV-16 valve D-105). The NRC inspection team reviewed a sample of QME-1 test reports for other PV-16 valves, including verification that the static seismic load was applied along the least rigid axis using photographs of the setups in the test reports. In reviewing QME-1 TR-5618 for the PV-16 valve D-114, the NRC inspection team observed that the QME-1 qualification of the PV-16 valve D-114 was determined by extrapolation based on test data from the PV-16 valve D-112 with limited test data from the PV-16 valve D-114. In response to this observation, Pentair indicated that QME-1 TR-5618 for the PV-16 valve D-114 will be finalized with a justification for the QME-1 qualification by extrapolation for the PV-16 valve D-114 based on the similarity of the D-112 and D-114 valve designs consistent with the provisions in ASME Standard QME-1-2007.

The NRC inspection team reviewed Pentair QME-1 TR-5609 for the AP1000 PV-62 pressurizer safety valves for Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3 that had been addressed during the NRC inspections in 2013 and 2014. The NRC inspection team observed that QME-1 TR-5609 for the PV-62 pressurizer safety valves had been finalized consistent with the previous corrective actions for the inspection findings, including seismic load application, prorated spring selection, and ambient temperature conditions. The NRC inspection team did not identify any issues of concern with the completed QME-1 qualification testing of the PV-62 pressurizer safety valves.

The NRC inspection team reviewed Pentair QME-1 TR-5622 and TR-5623 for the AP1000 PV-18 vacuum breakers to be supplied to nuclear power plants in China, which will be used to support the QME-1 qualification of those valve designs for Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3. In QME-1 TR-5622, the NRC inspection team found that a photograph of the test set-up revealed that the orientation of the application of the static seismic load during the QME-1 qualification test of the Class 150 vacuum breaker did not fully align with the least rigid axis of the valve assembly. Based on this observation, Pentair stated they will justify the orientation of the static seismic load application in the final PV-18 QME-1 test reports for the vacuum breakers to be supplied to Vogtle and V.C. Summer. The NRC inspection team found this approach to be acceptable in light of the symmetrical nature of the vacuum breaker design. No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that Pentair is implementing its test program in accordance with the regulatory requirements of Criterion XI of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Pentair is implementing its policies and procedures associated with the testing activities. No findings of significance were identified.

## 5. 10 CFR Part 21 Program

### a. Inspection Scope

The NRC inspection team reviewed Pentair's policies and implementing procedures that govern the programs and activities used to establish and verify compliance with the regulatory requirements of 10 CFR Part 21. In addition, the NRC inspection team evaluated the 10 CFR Part 21 postings as well as a sample of Pentair POs, internal audit results, and training documents in order to evaluate Pentair's compliance with the requirements of 10 CFR 21.6, "Posting Requirements," 10 CFR 21.21, "Notification of Failure to Comply or Existence of a Defect and its Evaluation," and 10 CFR 21.31, "Procurement Documents." The NRC inspection team reviewed resolution of the Notice of Violation 99901431/2014-201-01. The review of the corrective actions for the 2014 NRC inspection violation is described in Section 1 of the report. Furthermore, the NRC inspection team discussed the 10 CFR Part 21 program with Pentair's management and technical staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

### b. Observations and Findings

No findings of significance were identified.

### c. Conclusion

The NRC inspection team concluded that Pentair is implementing its 10 CFR Part 21 program in accordance with the regulatory requirements of 10 CFR Part 21. The NRC inspection team concluded that the Pentair activities in response to Notice of Violation 99901431/2014-201-01 are adequate to resolve this violation. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Pentair is appropriately implementing its policies and procedures associated with the 10 CFR Part 21 program. No findings of significance were identified.

## 6. Supplier Oversight

### a. Inspection Scope

The NRC inspection team reviewed Pentair's policies and implementing procedures that govern the implementation of supplier oversight program to verify compliance with the regulatory requirements of Criterion IV, "Procurement Document Control," Criterion VII, "Control of Purchased Material, Equipment, and Services," and Criterion XVIII, "Audits," of Appendix B to 10 CFR Part 50.

Specifically, the NRC inspection team reviewed a sample of purchase orders, receipt inspection records, and external audit reports (including those conducted by third parties) to evaluate compliance with the Pentair technical and supplier oversight program requirements and adequate implementation of those requirements. The NRC inspection team also reviewed a sample of the training and qualification records for Pentair's lead auditors, auditors, and inspection personnel. In addition, the NRC inspection team reviewed the disposition of corrective actions to resolve deficiencies identified by audit findings for adequacy and timeliness. Furthermore, the NRC inspection team discussed supplier oversight with Pentair's management and technical

staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that Pentair is implementing its supplier oversight program in accordance with the regulatory requirements of Criterion IV, Criterion VII, and Criterion XVIII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Pentair is implementing its policies and procedures associated with the supplier oversight program. No findings of significance were identified.

7. Commercial-Grade Dedication

a. Inspection Scope

The NRC inspection team reviewed Pentair's policies and implementing procedures that govern the dedication of commercial-grade items (CGIs) for use in safety-related applications to verify compliance with the applicable regulatory requirements of 10 CFR Part 21 and Criterion III, "Design Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50. Specifically, the NRC inspection team reviewed several dedication packages, including dedication plans, the technical evaluation for the identification of critical characteristics, the basis for sampling plan selection, and the selection of acceptance methods to verify effective implementation of the Pentair commercial-grade dedication (CGD) process.

The NRC inspection team also observed the dedication during receipt inspection of go/no-go thread gauge received from an approved calibration service supplier and dedication of disc insert pin by a Pentair QC inspector. The NRC inspection team discussed the CGD program with Pentair's management and technical staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

b. Observations and Findings

No finding of significance were identified.

c. Conclusion

The NRC inspection team concluded that Pentair is implementing its dedication program in accordance with the regulatory requirements of Criterion III and VII of Appendix B to 10 CFR Part 50 and 10 CFR Part 21. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Pentair is implementing its policies and procedures associated with the CGD process. No finding of significance were identified.

8. Control of Measuring and Test Equipment (M&TE)

a. Inspection Scope

The NRC inspection team reviewed Pentair's policies and implementing procedures that govern the M&TE program to verify compliance with the requirements of Criterion XII, "Control of Measuring and Test Equipment," of Appendix B to 10 CFR Part 50. Specifically, the NRC inspection team reviewed a sample of Pentair's M&TE activities related to the AP1000 PV-16 auxiliary relief valves and verified the calibration status of the related equipment. The NRC inspection team reviewed the Pentair database used for tracking calibration status, completion, and due dates of all their M&TE devices. The NRC inspection team observed pre and post-test calibration of several M&TE devices used in activities related to the QME-1 testing of the PV-16 valves.

Further, the calibration records reviewed by the NRC inspection team indicated the as-found or as-left conditions, accuracy required, calibration results, calibration dates, and the due date for recalibration. In addition, the NRC inspection team reviewed Pentair's control and disposition of defective M&TE to verify Pentair adequately controlled defective M&TE through identification and segregation in a locked cabinet in M&TE area and to assure that it was identified and an evaluation was documented with technical justification prior to disposition as scrap or repair. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

b. Observations and Findings

No finding of significance were identified.

c. Conclusion

The NRC inspection team concluded that Pentair is implementing its M&TE program in accordance with the regulatory requirements of Criterion XII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Pentair is appropriately implementing its policies and procedures associated with the M&TE program. No findings of significance were identified.

9. Control of Nonconforming Materials, Parts, or Components

a. Inspection Scope

The NRC inspection team reviewed Pentair's policies and implementing procedures that govern the control of nonconformances to verify compliance with the regulatory requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," of Appendix B to 10 CFR Part 50.

The NRC inspection team reviewed Pentair's Material Rejection Notices (MRNs) log and reviewed a sample of MRNs to ensure that Pentair implemented an adequate program to assess and control of nonconforming items, including appropriate identification, documentation, segregation, evaluation and disposition. Additionally, the NRC inspection team interviewed Pentair personnel and verified that there were designated areas to segregate and control nonconforming materials. The NRC inspection team



observed a Material Review Board (MRB) meeting in which Quality Engineering, Manufacturing and Engineering staff reviewed and dispositioned nonconforming items. Finally, the NRC inspection team verified that the Pentair nonconformance process provided a link to the 10 CFR Part 21 program.

The NRC inspection team discussed the nonconformance program with Pentair's management and technical staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that Pentair has established a program for the control of nonconforming materials, parts, or components in accordance with the regulatory requirements of Criterion XV of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Pentair is implementing its policies and procedures associated with the control of nonconforming materials, parts, or components. No findings of significance were identified.

10. Training and Qualification of Personnel

a. Inspection Scope

The NRC inspection team reviewed policies, implementing procedures, and records that govern Pentair's training and qualification to verify compliance with Criterion II, "Quality Assurance Program," of Appendix B to 10 CFR Part 50. The NRC inspectors reviewed Pentair's programs to address the training and qualification of personnel performing activities that affect quality. The training programs include procedures that incorporate appropriate training and qualification practices. The NRC inspection team reviewed a sample of qualification records of Pentair employees that participated in the qualification testing of the PV-16 auxiliary relief valve as well as calibration of M&TE. The NRC inspection team confirmed the qualification records included the necessary education, on-the-job training, examinations and annual vision examination for the specific method and level for which the individual was qualified, and that the records were current. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusions

The NRC inspection team concluded that Pentair is implementing its training and qualification program in accordance with Criterion II of Appendix B to 10 CFR Part 50. Based on the documents reviewed, the NRC inspection team also determined that Pentair is implementing its policies and procedures associated with its training and

qualification programs. No findings of significance were identified.

#### 11. Entrance and Exit Meetings

On October 31, 2016, the NRC inspection team discussed the scope of the inspection with Ms. Lynn Skarin, Pentair Quality Assurance Manager, and other members of the Pentair management and staff. On November 3, 2016, the NRC inspection team presented the inspection results and observations during an exit meeting with Ms. Skarin and other Pentair management and staff. The attachment to this report lists the entrance and exit meeting attendees, as well as those individuals interviewed by the NRC inspection team.

## ATTACHMENT

### 1. ENTRANCE / EXIT MEETING ATTENDEES AND PERSONS CONTACTED

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Lynn Skarin	Quality Assurance Manager	Pentair	X	X	X
Michael DePronnio	Quality Assurance Engineer	Pentair	X		X
Chris Morin	Quality Assurance Engineer	Pentair	X		X
June DelGrosso	Nuclear Project Manager	Pentair	X		X
Kevin Frieswick	Plant Manager	Pentair	X	X	
Jin Yu	Engineering Manager	Pentair	X	X	X
David Thibault	Engineering	Pentair	X	X	
Thomas Beagen	Project Engineer	Pentair	X	X	
Dan Robinson	Inside Sales Manager	Pentair	X	X	
Jim Stone	Materials Manager	Pentair	X		
John Brennan	Human Resources Manager	Pentair	X		
Norman Coggeshall	Manufacturing Engineer	Pentair	X	X	X
Mike Myette	Test Engineer	Pentair		X	X
Steven Jarrett	Test Technician	Pentair			X
Sean Raymond	Test Technician	Pentair			X
John Mackey	Quality Control Inspector/Calibration Technician	Pentair			X
Rita Westberg	Quality Assurance	Pentair			X

### 2. INSPECTION PROCEDURES USED

Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," dated April 25, 2011.

IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated April 25, 2011.

IP 36100, "Inspection of 10 CFR Parts 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012.

IP 65001 E, "Inspection of the ITAAC Related Qualification Program," dated August 19, 2008.

IP 35034, "Design Certification Testing Inspection," dated January 27, 2010.

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

<b>Item Number</b>	<b>Status</b>	<b>Type</b>	<b>Description</b>	<b>Applicable ITAAC</b>
99901431/2014-201-01	Closed	NOV	10 CFR Part 21	N/A
99901431/2013/201-01	Closed	NON	Criterion III	2.1.2.02.a, 2.1.2.05.a.ii 2.1.2.08.a.ii 2.2.3.02.a 2.2.3.05.a.ii
99901431/2013-201-02	Closed	NON	Criterion XI	N/A
99901431/2013-201-03	Closed	NON	Criterion III	N/A
99901431/2013-201-04	Closed	NON	Criterion IV & VII	N/A
99900293/2013-201-05	Closed	NON	Criterion VI	N/A
99901431/2013-201-06	Closed	NON	Criterion IX	N/A
99901431/2016-201-01	Open	NON	Criterion XVI	N/A

4. INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA

The U.S. Nuclear Regulatory Commission (NRC) inspection team identified the following inspections, tests, analyses, and acceptance criteria (ITAAC) related to components being designed, manufactured, and tested at Pentair. At the time of the inspection, Pentair was testing PV-16 auxiliary relief valves and had completed work on the PV-62 pressurizer safety valves for the AP1000 reactor design. For the ITAAC listed below, the NRC inspection team reviewed Pentair's quality assurance controls in the areas of design control, commercial-grade dedication, special processes, test control, supplier oversight, control of measuring and test equipment, nonconforming materials parts and components, and corrective actions. The ITAAC design commitments referenced below are for future use by the NRC staff during the ITAAC closure process; the listing of these ITAAC design commitments does not constitute that they have been met and/or closed.

ITAAC	Design Commitment	Component
2.1.02.02.a	2.a) The components identified in Table 2.1.2-1 as ASME Code Section III are designed and constructed in accordance with ASME Code Section III requirements.	PV-62 valves RCS-PL-V005A & B (Pressurizer Safety Valves)
2.1.02.04.a	4.a) The components identified in Table 2.1.2-1 as ASME Code Section III retain their pressure boundary integrity at their design pressure.	PV-62 valves RCS-PL-V005A & B (Pressurizer Safety Valves)
2.1.02.05.a.ii	5.a) The seismic Category I equipment identified in Table 2.1.2-1 can withstand seismic design basis loads without loss of safety function.	PV-62 valves RCS-PL-V005A & B (Pressurizer Safety Valves)
2.1.02.08.a.i	8.a) The pressurizer safety valves provide overpressure protection in accordance with Section III of the ASME Boiler and Pressure Vessel Code.	PV-62 valves RCS-PL-V005A & B (Pressurizer Safety Valves)
2.1.02.08.a.ii	8.a) The pressurizer safety valves provide overpressure protection in accordance with Section III of the ASME Boiler and Pressure Vessel Code.	PV-62 valves RCS-PL-V005A & B (Pressurizer Safety Valves)
2.2.03.02.a	2.a) The components identified in Table 2.2.3-1 as ASME Code Section III are designed and constructed in accordance with ASME Code Section III requirements.	PV-16 valves PXS-PL-V022A & B (Accumulator Relief Valves)
2.2.03.04.a	4.a) The components identified in Table 2.2.3-1 as ASME Code Section III retain their pressure boundary integrity at their design pressure.	PV-16 valves PXS-PL-V022A & B (Accumulator Relief Valves)
2.2.03.05.a.ii	5.a) The seismic Category I equipment identified in Table 2.2.3-1 can withstand seismic design basis loads without loss of safety function.	PV-16 valves PXS-PL-V022A & B (Accumulator Relief Valves)

## 5. DOCUMENTS REVIEWED

### Policies and Procedures

- Pentair Quality Assurance Manual QC-110, Revision 46, dated June 24, 2016
- QC-110, "XV. Nonconformance Source Material or Items," Revision 46, dated June 24, 2016
- QC-110, "XVI Corrective Action," Revision 46, dated June 24, 2016
- Pentair QC-110, Supplement 6, "Quality Assurance Manual QC-110 for the Dedication of Commercial Grade Parts to Comply with 10CFR50 APP. B & 10CFR21 for Safety-Related Nuclear Power Plant Applications," Revision 6, dated November 12, 2014
- Crosby Valve & Gage Company Manual DS-6103, "Design Specification for Series 900 Omni Trim Pressure Relief Valves," Revision 4, dated June 5, 1996
- Crosby Engineering Procedure SS-5726, "Spring Selection Procedure," Revision 1, dated December 2, 1998
- Crosby Engineering Procedure SS-5751, "Spring Selection Procedure," Revision A, September 29, 2006
- Pentair Calibration Procedures for Inspection Equipment (CPIE)-001, "CPIE Index," Revision 72, dated April 16, 2014
- CPIE-0240, "Calibration and Verification Procedure for Weld Rod Ovens," Revision 5, dated March 21, 2014
- Pentair Engineering Procedure C-14234, "Cleaning Procedure," Revision 3, dated January 13, 2008
- Pentair Dedication Procedure (DP) -6001, "Dedication Procedure for Metallic Parts," Revision 3, dated April 15, 2015
- DP-6005, "Dedication Procedure for O-Rings (Elastomeric)," Revision 6, dated April 25, 2011
- DP-6044, "Dedication Procedure," Revision 11, dated June 27, 2013
- DP-60138, for the dedication procedure of Timken/Fafnir bearings, dated June 12, 2013
- DP-60159, "Dedication Procedure for 12-inch butterfly valves- Vanessa with Morin Pneumatic Actuator & Accessories," for Ontario Power Generation Darlington plant, Revision 0, dated July 14, 2014
- Pentair Departmental Operating Instruction (DOI) General Engineering (GE)-40-3002, "Document Status Record," Revision 19, dated June 13, 2016
- DOI-GE-40-3006, "Design Control Procedure," Revision 9, dated July 22, 2016
- DOI-QA-48-3016, "Reporting of Defects and Noncompliance- Section III/Nuclear," Revision 11, dated January 6, 2014
- DOI-QA-48-3039, "Control of Nonconforming Product," Revision 6, dated June 14, 2016
- DOI QA-48-3055, "Corrective Action Board," Revision 0, dated June 3, 2011
- DOI-Power Group PG-67-3004, "Quotations and Order Processing for ASME Section III New Application Pressure Relief Valves," Revision 6, dated June 29, 2004
- Pentair Engineering Procedure I-11554, "Instruction Manual – PV16-Z0-001," Revision 0, dated March 20, 2013
- Pentair Engineering Calculation EC-2839, "Design Report AG-Crosby 3K4 Style JLT-JB5-E-75 Relief Valves," Revision 5, dated October 26, 2016
- Pentair Inspection Instruction No. Q-549, "Positive Material Identification by Optical Spectrometer," Revision 1, dated February 14, 1995
- Inspection Instruction No. Q-507, "Sampling Instruction," Revision 14, dated November 8, 2002

- Inspection Instruction No. Q-506, “Final Parts Inspection,” Revision 8, dated March 21, 1992
- Inspection Instruction No. Q-531, “Specific Alloy Identity Testing,” Revision 15, dated March 8, 2005
- Inspection Instruction No. Q-532, “Visual Inspection,” Revision 3, dated July 25, 2001
- Pentair Liquid Penetrant Procedure LP-1020, “Liquid Penetrant Procedure,” Revision 20, dated August 3, 2005
- Pentair Magnetic Particle Procedure MP-2415, “Magnetic Particle Inspection Procedure Dry Particles – Continuous Method,” Revision 22, dated February 7, 2005
- Pentair Painting Procedure PF-30113, “Painting Procedure,” Revision 9, dated September 23, 2013
- Pentair Quality Plan (QP) “Quality Plan for 12-inch Butterfly Valves-Vanessa 30000 series,” Revision 0, dated July 14, 2014
- Quality Assurance Instruction QAI-32829, “Quality Assurance Instruction ASME Boiler & Pressure Vessel Code Section III – Miscellaneous Relief Valves,” Revision 14, dated April 7, 2014
- QP-55242, “Quality Plan for Butterfly Valves-Keystone for Ontario Power Generation Darlington station, AG Crosby Factory Order No. G663250000,” Revision 1, dated March 24, 2015
- Pentair Engineering Procedure – Production Test Procedure T-161093, “Test Procedure – 6” P8” HB-BP-86 Pressurizer Safety Valves,” Revision 7, dated February 4, 2014
- Pentair Engineering Procedure – Production Test Procedure T-161162, “Test Procedure – PV16-Z0-001,” Revision 5, dated May 19, 2014
- Pentair Engineering Procedure – Production Test Procedure T-161206, “Test Procedure – PV18-Z0-001,” Revision 0, dated December 12, 2011
- Pentair Training Procedure (TP)-5900, “Qualification and Certification Program for Inspection Personnel,” Revision 5, dated August 27, 2013
- TP-5901, “Qualification and Certification Program for Nuclear Test Personnel,” Revision 6, dated March 3, 2014
- TP-5905, “Qualification and Certification Program for Engineering Personnel,” Revision 1, dated October 23, 1991
- TP-5908, “Qualification and Certification Program for NDE Personnel,” Revision 20, dated August 22, 2016
- Pentair Ultrasonic Testing Procedure UT-1928, “Ultrasonic Procedure,” Revision 12, dated August 3, 2005
- Pentair Engineering Procedure – Valve Qualification Test Procedure (VQT)-38173, “ASME QME-1 Functional Qualification Test Program for Active Valve Assemblies – 6” P 8” HB-BP-86 Pressurizer Safety Valves APP-PV62-Z0-001,” Revision 7, dated February 6, 2014
- VQT-38188, “ASME QME-1 Functional Qualification Test Program for Active Valve Assemblies – PV16 Auxiliary Relief Valves APP-PV16-Z0-001,” Revision 6, dated May 19, 2014
- VQT-38197, “ASME QME-1 Functional Qualification Test Program for Active Valve Assemblies –1 x 1 Vacuum Relief Valve PV18-Z0-001,” Revision 2, dated October 3, 2013

## Drawings

- Pentair Drawing DS-B900137, "Pressure Relief Valve – APP-PV16-Z0D-105," Revision G, dated October 19, 2016
- Drawing DS-B94946, "12 inch 150 CL. QTL Vanessa 30,000 Series Butterfly Valve w/Morin Actuator," Revision B, dated January 30, 2014
- Drawing DS-C95760-35, "Pressure Relief Valve – 0.750 x 1-inch Omni Series Model 861301MA," Revision 0, dated October 24, 2003
- Drawing DS-B95760-66, "12-inch Style Figure 360 Wafer, K-LOK ANSI Class 150 Water Style Butterfly Valve with Blow-out Proof Stem," Revision A, dated January 6, 2015

## Commercial-Grade Dedication Documents

- Dedication package for Pentair Sales Order No. G64750000 for D02129-0001 and D02129-0002 12-inch QTL 30,000 series butterfly valves dedicated in accordance with dedication procedure DP-60159, for Ontario Power Generation Inc., PO No. 00231070 Item 002 on, reviewed and approved by Pentair QA on March 23, 2015
- Dedication package for Pentair Sales Order No. G69110000 for one D01207-0011 Omni series pressure relief valve 0.750 x 1-inch 861301MA, for Exelon Generation PO No. 00576796, dedicated in accordance with DP-6044, certificate of conformance reviewed and accepted by QA on October 21, 2016
- Dedication package for Pentair Sales Order No. G663250000 for three D02164-0001 through D02164-0003, 12 x 12-inch Figure 360 K-LOK Butterfly valves, for Ontario Power Generation PO No. 00237335.002, dedicated in accordance with DP-60164, certificate of conformance reviewed and accepted by QA on September 22, 2015
- Dedication Package for O-Rings P/N D00548-0003, Viton, on Work Order No. 00922 underwent dedication using Dedication Procedure DP6005, traceable to Batch No. 220625 Cure Date 1Q16, on PO No. A56431, for Georgia Power Company PO No. SNG10140589, Work Order No. G695070000, with Certificate of Conformance approved by QA on October 7, 2016
- Pentair Forms quality control (Q.C.)-639, Revision B, "Evaluation Criteria for Determination of Piece Part Classification as Safety-Related," with Form Q.C.-710, "Critical Characteristics Identification," for Hammel Dahl Seal Ring, part number (P/N) D01377 to dedication procedure DP-6087, prepared by Engineering on May 23, 2016, reviewed and approved by Engineering, and QA on May 27, 2016
- Forms Q.C.-639 and Q.C.-710 for Piston Rod reviewed and approved on July 8, 2016
- Forms Q.C.-639 and Q.C.-710 for Seal P/N D00903, dedication procedure DP-6051, reviewed and approved by Engineering and QA on July 8, 2016
- Forms Q.C.-639 and Q.C.-710 for disc holder and bushing assembly to DP-60184, reviewed and approved by Engineering and QA on March 30, 2016
- Forms Q.C.-639 and Q.C.-710 for gasket to DP-6001, reviewed and approved by Engineering and QA on March 18, 2016
- Forms Q.C.-639 and Q.C.-710 for Nozzle Ring P/N D00015, to DP-6001, reviewed and approved by Engineering & QA on March 16, 2014
- Forms Q.C.-639 and Q.C.-710 for Butterfly Valve P/N D02129 to DP 60158 reviewed and approved by Engineering and QA on September 5, 2014
- Forms Q.C.-639 and Q.C.-710 for U-Cup P/N D00923 to DP 6052 reviewed and approved by Engineering and QA on February 27, 2015
- Forms Q.C.-639 and Q.C.-710 for Seat P/N D02189 to DP-60168, reviewed and approved by Engineering and QA on February 23, 2015



- Forms Q.C.-639 and Q.C.-710 for H-D Piston Ring P/N D02132 to DP-60160, reviewed and approved by Engineering and QA on June 18, 2014
- Forms Q.C.-639 and Q.C.-710 for Upper Diaphragm P/N D02138 to DP-60161 reviewed and approved by Engineering and QA on September 5, 2014
- Forms Q.C.-639 and Q.C.-710 for spring P/N D02176 to DP-60171 reviewed and accepted by Engineering and QA on June 15, 2015
- Forms Q.C.-639 and Q.C.-710 for Cylinder P/N D00908 to DP-6053 reviewed and approved by Engineering and QA on January 30, 2015

### Test Reports

- Pentair Test Report (TR)-5509, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – 6" P 8" HB-BP-86 Pressurizer Safety Valves," Revision 5, dated March 20, 2014
- TR-5557, "Functional Qualification Test Report Summary for Topworx Model C7 Position Indication Switches," Revision 2, dated June 6, 2012
- TR-5607, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies –Auxiliary Relief Valve PV16-Z0-001D-102," Revision 3, dated October 19, 2016
- TR-5609, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – 6" P 8" HB-BP-86 Pressurizer Safety Valves," Revision 6, dated February 19, 2016
- TR-5611, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – D-101," Revision 2, dated October 18, 2016
- TR-5615, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – D-108," Revision 2, dated October 25, 2016
- TR-5618, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – D-114," Revision 3, dated October 25, 2016
- TR-5620, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – D-104," Revision 2, dated October 19, 2016
- TR-5622, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – 1" x 1" Class 150 Model VR PV18-Z0-001 Vacuum Breaker," Revision 1, dated February 19, 2016
- TR-5623, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – 1" x 1" Class 600 Model VR PV18-Z0-100 Vacuum Breaker," Revision 1, dated February 19, 2016
- TR-5626, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – D-106," Revision 3, dated October 25, 2016
- TR-5630, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – D-111," Revision 2, dated October 25, 2016
- TR-5632, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – D-109," Revision 2, dated October 25, 2016
- TR-5634, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – D-112," Revision 2, dated October 25, 2016
- TR-5636, "ASME QME-1 Functional Qualification Test Report for Active Valve Assemblies – D-107," Revision 2, dated February 25, 2016
- TR-5696, "ASME QME-1 Application Report PV-16," Revision 1, dated February 16, 2016

### Purchase Order (PO)

- Pentair PO No. V662321609, dated September 21, 2016, issued to Massachusetts Materials Research (MMR), for special testing of sample of 3 O-Rings P/N D00548-0003, to verify material verification meets Viton specification and hardness meets 90 durometer in accordance with DP-6005, Revision 6 and supplier quality requirements (SQR)-1 Revision 12, invoked
- PO No. M51521, dated April 18, 2015, issued to Hexagon Metrology Inc., for calibration services of Romer Arm CMD 7525-1034-UC Model NCA7-3-52604, invoking ISO/IEC 17025, as-found as-left condition, procedure and revision used, standards used traceable to NIST, and other technical and quality requirements
- PO No. A55954, dated October 27, 2015, issued to TW Metals, PA for procurement of round bar stock 4.5 inch diameter ASME SA479 Gr. 316/316L
- PO No. A56907, dated May 24, 2016 issued to TW Metals for procurement of 946041000 bar 1inch round x 216-inch-long, ASME SA193-Grade B6, reviewed and approved by Pentair QA and purchasing
- PO No. A56956, dated June 2, 2016, issued to Stainless Steel Foundry for procurement of 5 bonnet castings 2J3 JB-TD-WR P/N 100551500 to ASME SA216 Grade WCB, for Section III to QAI-3254
- PO No. M54996, dated June 14, 2016, issued to ESSCO Calibration Laboratory, for procurement of calibration services of Precision Calibrator serial number 7415 Model 625
- PO No. A57343, dated August 10, 2016, issued to Energy & Process Corp. for procurement of forged bar size 5-inch diameter x 24-inch length, P/N 929045000 to ASME SA105, invoking Supplier Quality Requirements (SQR)-1 Revision 12
- Vogtle 1 and 2 Electric Generating Plant PO No. SNG10140589 to Pentair Valves and Controls for procurement of O-Rings, dated August 15, 2016
- Energy Northwest PO No. 00347664, Purchase Order to Pentair Valves and Controls for procurement of dedicated bearings, dated August 23, 2016
- Wolf Creek Nuclear Operating Corporation PO No. 778435/0, Purchase Order to Pentair Valves and Controls for the procurement of dedicated Metallic Parts, dated August 9, 2016

### External Audits

- Pentair review of nuclear industry assessment committee (NIAC) audit report (1745) of Massachusetts Material Research performed by Underwater Construction Corp. on April 28-29, 2014, reviewed and evaluated by Pentair on May 23, 2014, approved for testing services and NDE services
- Pentair Supplier Performance Assessment Annual Evaluation QC-56-1, of MMR, performed on September 23, 2016
- Pentair review of NIAC audit report No. 19019, of National Testing Systems, MA, dated September 15, 2014, approved for testing services
- Pentair audit report of Ringmill SpA dated March 29, 2013, approved as supplier of forgings, unqualified source materials under its QSC.
- Pentair audit report of Vermes Machine Company, Inc., performed on March 26, 2015, approved for machining services for Section III and sub-safe level 1 requirements
- Pentair supplier annual assessment evaluation of Vermes Machine Company Inc., performed on October 6, 2016

- Pentair review of NIAC Audit report No. 21076, dated February 3, 2016, reviewed and approved on February 9, 2016, approving for supplier of proximity switches, position indicators, and position sensors to ASME Section III and Appendix B requirements
- Pentair review of Laboratory Testing Inc., American Association for Laboratory Accreditation (A2LA) scope of accreditation to ISO 17025:2005 valid to March 31, 2017, reviewed and approved on August 25, 2015
- Pentair review of NIAC audit report No. 18079, dated December 18, 2013, of LTI documented on QC-56, on September 12, 2013, approved for supplier of mechanical and metallurgical testing, NDE, calibration, dimensional and machining services
- Pentair review of International Light Technologies, Inc., ISO/IEC 17025:2005, approved on April 15, 2016
- Pentair review of INNOCAL-Vernon, IL, A2LA certificate of accreditation to ISO/IEC 17025:2005, approved on October 9, 2015
- Pentair review and approval of Meegan Tool Sales Laboratory ISO/IEC 17025:2005, A2LA accreditation, performed on May 4, 2015
- Pentair audit report of Mistras Group, Inc., dated June 9, 2016 approved for Nondestructive Examination services
- Pentair audit report of Technical Hardfacing & Machining Inc. dated January 12, 2016, approved for machining Services
- Pentair audit report of Colonial Machine and Tool Inc. dated August 12, 2015, approved for machining services
- Pentair audit report of Heat Treating Engineers, Inc. dated February 4, 2015, approved for heat treating services for ferrous & non-ferrous materials
- Pentair audit report of US Drop Forge, dated November 12, 2014, approved for forgings

#### Nonconformance Reports

- Pentair Material Rejection Notice (MRN) Nos. 44474, 44486, 45019, 45607, 45672, 45678, 45691, 45705, 45759, 46082, 46087, 46099, 46111, 46118, 46128, 46140, 46156, 46161, 46180, 46184, 46186, 46205, 46210, 4621446220, and 46230
- Pentair Measuring and Test Equipment Rejection Notice Form Q.C.-88, for set rods tool No. INSP-113B, dispositioned as scrap on July 23, 2014 with review of prior inspection evaluated
- Measuring and Test Equipment (M&TE) Rejection Notice Form Q.C.-88, for standard rod, tool No. INSP-11325, rejected by Precision Metrology, dispositioned as scrap on August 13, 2015, with review of prior inspection evaluated
- M&TE Rejection Notice Form Q.C.-88, for standard rod, tool No. INSP-11327, rejected by Precision Metrology, dispositioned as scrap on August 13, 2015, with review of prior inspection evaluated
- M&TE Rejection Notice Form Q.C.-88, for test gage, tool No. R00397, dispositioned as rework/repair on September 25, 2014, with review of prior inspection evaluated, pending hold for repair
- M&TE Rejection Notice Form Q.C.-88, for bi-metal thermometer, tool No. INSP-160C, rejected for missing I.D. sticker, dispositioned as rework/repair on February 3, 2016, with review of prior inspection evaluated
- M&TE Rejection Notice Form Q.C.-88, for gage blocks, tool No. INSP-110E, size 6, 8 and 10-inch blocks, rejected by Precision Metrology for Section III use, dispositioned as scrap on January 20, 2016, with review of prior inspection evaluated
- M&TE Rejection Notice Form Q.C.-88, for go-thread plug gage, tool No. T39796-A, rejected for lead thread broken, dispositioned as scrap on October 18, 2016, with review of prior inspection evaluated

- M&TE Rejection Notice Form Q.C.-88, for internal micrometer, tool No. T58835, rejected for left in machine when operator started it, dispositioned as scrap on June 16, 2016, with review of prior inspection evaluated

#### Corrective Action Reports (CARs)

- CARs 447, 506, 663, 664, 665, 666, 667, 668, 669, 671, 673, 707, 708, 709, 747, 754, 761, 808, 842, 891, 894, 974, 975, 976, 977, 978, and 979

#### Personnel Certification and Qualification Records:

- T. Beagen, Mechanical Engineer, dated October 7, 2015
- D. Thibault, Registered Professional Engineer, dated June 9, 2016
- J. Mackey, NDE Level II Technician, dated January 10, 2015
- J. Feole, NDE Level III Technician, dated September 30, 2016
- J. Daniel, Coating Applicator, dated February 8, 2016
- R. Bennardo, Coating Inspector, dated February 18, 2016
- R. Bennardo, NDE-VT and MT Level III, dated May 1, 2014
- R. Bennardo, NDE-PT Level III, dated April 29, 2014
- S. Jolin, Visual and Mechanical Level II, dated April 30, 2016
- J. Lusignan, Visual and Mechanical Level II, dated January 20, 2016
- J. Mackey, Visual and Mechanical Level II, dated October 4, 2016
- D. Renault, Visual and Mechanical Level II, dated April 22, 2016
- E. Requald, Visual and Mechanical Level II, dated June 10, 2016
- R. Lapierre, Visual and Mechanical Level II, dated June 15, 2016
- E. Rheume, Welder Performance Maintenance Record, dated 10, 25, 2016

#### Westinghouse Electric Corporation (WEC) Documents

- WEC PO No. 4500340931 to Anderson Greenwood Crosby for Virgil. C. (V.C.) Summer Units 2 and 3 PV-16 Auxiliary Relief Valves, dated March 31, 2010, and subsequent revisions
- WEC PO No. 4500340946 to Anderson Greenwood Crosby for Vogtle Units 3 and 4 PV-16 Auxiliary Relief Valves, dated March 31, 2010, and subsequent revisions
- WEC Document No. SV0-PV16-GNR-004, "Deviation Notice for PV16 Coating," Revision 0
- WEC Design Specification APP-PV16-Z0-001, "Auxiliary Relief Valves, ASME Boiler and Pressure Vessel Code, Section III, Class 1, 2, and 3," Revision 8, dated January 30, 2014
- WEC Design Specification APP-PV16-Z0-001, "Auxiliary Relief Valves, ASME Boiler and Pressure Vessel Code, Section III, Class 1, 2, and 3," Revision 7, November 17, 2011
- WEC Data Sheet APP-PV16-Z0R-001, "Auxiliary Relief Valves, ASME Boiler and Pressure Vessel Code, Section III, Class 1, 2, and 3 Valve Data Sheet Report," Revision 8, dated June 24, 2013
- WEC APP-G1-MX-001, "AP1000 Painting of OEM Mechanical Components," Revision 6, dated July 16, 2012
- WEC APP-GW-M3C-009, "AP1000 Valve Datasheet Coating Requirements," Revision 1, dated October 29, 2012
- WEC Datasheet APP-PV16-Z0R-001, "Auxiliary Relief Valves, ASME Boiler and Pressure Vessel Code, Section III, Class 1, 2, and 3 Valve Data Sheet Report," Revision 8, dated June 24, 2013

- WEC Datasheet APP-PV16-Z0D-105, "PV16 Datasheet 105," Revision 4, dated October 24, 2011
- Westinghouse Document APP-PV16-Z0D-102, "PV16 Datasheet 102," Revision 4, dated October 3, 2011

Miscellaneous:

- Pentair Form Q.C.-45A-1D, "2013-2016 Section III M.R.N. Log"
- Anderson Greenwood Crosby (AG Crosby) Q.C.-59, "ASME BP&V Section III, 10 CFR Part 50 App. B, and Sub-safe Level I Approved Supplier List," approved by Lynn Skarin on October 20, 2016
- Pentair Form Q.C.-58, "Receiving Inspection Checklist," for P/N 911044500 4-1/2-inch round bar, heat No. 265128-1, ASME SA479 type 316/316L, received from TW Metals on PO No. A55954 accepted on November 4, 2015
- Form Q.C.-58 for P/N 946041000 1-inch diameter x 144-inch long bar ASME SA193 Grade B6 materials specification traceable heat No. 262328-11, received from TW Metals on PO No. A56907 accepted on July 19, 2016
- Form Q.C.-58 for P/N 946041000 1inch diameter x 72-inch long bar ASME SA193 Grade B6 materials specification traceable heat# VBSU-5763-3, received from TW Metals on PO No. A56907 accepted on July 19, 2016
- Form Q.C.-58, for P/N D00548-0003, O-Rings, verification of material specification review received from MMR on PO No. V662321609, MMR Analytical Report accepted on September 29, 2016
- Form Q.C.-58 for one bonnet P/N 100551500, ASME SA216 Grade WCB traceable to heat No. F60375-1 from Stainless Steel Foundry on PO A56956, with CMTR accepted on September 23, 2016
- Form Q.C.-58 for forged bar P/N 929045000 5-inch diameter x 24-inch long, ASME SA105 traceable heat No. BH923 serial No. Y8741-1 from Energy & Process on PO No. A57343, CMTR reviewed and approved by QA on October 4, 2016 and receipt inspected on October 5, 2016
- MMR Analytical Report, dated September 29, 2016, for PO No. V66231609, on sample of three O-Rings P/N D00548-0003, were chemical analyzed using Fourier Transform Infrared Spectroscopy (FTIR), verifying the material is Viton, Analytical Report was reviewed and accepted by Pentair QA on September 29, 2016
- TW Metals Certificate of Compliance and CMTR for 4-1/2-inch diameter x 66-inch long bar, ASME SA479 Type 316/316L, Heat No. 255128-1, reviewed by Pentair QA on November 4, 2015
- TW Metals Certificate of Compliance and CMTR for 946041000, 1inch diameter x 72-inch long bar, ASME SA193 Grade B6, Heat No. 262328-11, reviewed by Pentair QA on July 18, 2016
- TW Metals Certificate of Compliance and CMTR for 946041000, 1inch diameter x 72-inch long bar, ASME SA193 Grade B6, Heat No. VBSU5763-3, reviewed by Pentair QA on July 18, 2016
- AG Crosby Certificate of Compliance (CoC) for O-Rings dedicated Part No. D00548-0003, dated October 7, 2016, for Georgia Power Company, PO No. SNG10140589, Pentair Sales Order No. G69507000
- AG Crosby CoC for bearings dedicated Part No. D01966-0002, dated October 23, 2016, for Energy Northwest, PO No. 00347664, Pentair Sales Order No. G695350000

- AG Crosby CoC for metallic parts dedicated Part No. D02112-0004, dated October 27, 2016, for Wolf Creek Nuclear Operating Corporation, PO No. 778435/0, Sales Order No. G694990000
- AG Crosby CoC for springs, dedicated Part No. D00433-0029, dated March 18, 2016 for NextEra Energy Seabrook, LLC, PO No. 02345687, Sales Order No. G684790000
- AG Crosby CoC for disc ring Dedicated P/N D00212-0047, for Tennessee Valley Authority, PO No. 1623648, Sales Order# G685580000
- Colonial Machine and Tool Company Inc. CoC dated January 13, 2016, for spindle assemblies Part No. K900573-45-0093 thru 0096, for machining services to Pentair Valves and Controls, PO No. V654931511
- ESSCO Certificate of Calibration Certificate No. 1283532, for calibration of Gage Block Set 82, I.D. No. E1468 to Pentair PO No. M54962, reviewed and accepted on February 12, 2016
- ESSCO Certificate of Calibration Certificate No. 1342688, for calibration of Master Gage Block Set, I.D. No. E540, to Pentair, PO No. M54991, as found condition is in tolerance and as left condition is in tolerance, reviewed and accepted on June 6, 2016
- ESSCO Certificate of Calibration Certificate No. 1373933, for calibration of Heat Probe Calibrator, I.D. No. E3369, to Pentair PO No. M55500, as found condition was in tolerance and the as left condition was in tolerance, reviewed and accepted on August 16, 2016
- Calibration Record for welding machine, S/N No. INSP-121H, calibrated on September 28, 2016
- ESSCO Certificate of Calibration No.1281999, for Starrett Gage block,” dated February 5, 2016
- ESSCO Certificate of Calibration No.196960, for Envirosafe Thermometer J31182, dated June 25, 2009
- INSTRON Certificate of Calibration No. 11122015SSA for Load Cell S/N 013,” dated November 12, 2015
- Process Instruments, Certificate of Calibration No. CAL152010, for Ametek Mass Set,” dated July 6, 2015
- Pentair Calibration Record for Pneumatic Cylinder CYL-0004, dated June 21, 2013
- Pentair Section III Gage Calibration Test Form for pressure gage S/N R00125, dated October 31, 2016
- Pentair Section III Gage Calibration Test Forms for pressure gage S/N A-11186, dated October 14 and 28, and November 3, 2016
- Pentair Thermocouple/Recorder Loop Calibration for thermometer S/N J31182, dated October 31, 2016
- National Board of Boiler and Pressure Vessel Inspectors, “Capacity Certification, Valve Type: JLT (Liquid), NB Capacity Certification No. CVM-M15095,” dated February 2, 2011
- Tyco Product Advisory, “Spring Selection Information,” dated October 27, 2006
- Pentair Form Q.C. 712, “Evaluation of a Deviation or Failure to Comply,” for CAR 761,evaluated on May 23, 2014
- Form Q.C. 712, for CAR 754, evaluated on May 8, 2014
- Form Q.C. 712, for CAR 506, evaluated on May 7, 2012
- Form Q.C. 712, for CAR 894, evaluated on April 4, 2016
- Form Q.C. 712, for CAR 891, evaluated on June 15, 2016
- Form Q.C. 712, for CAR 747, evaluated on April 12, 2014
- Form Q.C. 712, for CAR 808, evaluated on December 10, 2014
- Form Q.C. 712, for CAR 707,evaluated on March 24, 2014
- Form Q.C. 712, for CAR 842,evaluated on April 10, 2015

Documents for ASME Class 2 Vogtle-3 Valve S/N N900138-00-0002

- ASME Form NV-1, dated November 22, 2013
- Nondestructive Examination (NDE) Magnetic Particle (MP) Test Report No. 14302, "Cylinder Assembly Pressure Boundary Weld – Fit-up," dated May 24, 2012
- NDE-Penetrant Test (PT) Report No. 37802, "Cylinder Assembly Pressure Boundary Weld – Root Pass," dated April 16, 2013
- NDE-PT Report No. 38457, "Cylinder Assembly Pressure Boundary Weld – Final Weld," dated November 15, 2013
- NDE-PT Report No. 37772, "Base Assembly Pressure Boundary Weld – Fit-up," dated April 5, 2013
- NDE-PT Report No. 37815, "Base Assembly Pressure Boundary Weld – Root Pass," dated April 22, 2013
- NDE-PT Report No. 37827, "Base Assembly Pressure Boundary Weld – Final Weld," dated April 25, 2013
- NDE-PT Report No. 36616, "Cylinder and Base Assembly Pressure Boundary Weld – After Hydrostatic Test," dated January 6, 2014
- Weld Record for cylinder S/N 11025, dated November 15, 2013
- Weld Record for base assembly S/N 11356, dated November 15, 2013
- WELDSTAR CoC and CMTR for weld electrodes Arcos ER316/316L, Heat No. 738772, Lot AT9119, dated March 2, 2010
- Weldstar Certificate of Conformance Test No. 2-37744-00-0-A, for Heat No. 22581, Lot 2F320-CO2, dated April 26, 2004
- Lab Report No. 12-0421, CMTR of Base Heat No. 251733, dated March 7, 2012
- Certificate of Inspection – Post Coating, dated March 10, 2014
- Abrasive Blasting Record, dated March 7, 2014
- Coating Record, dated March 10, 2014
- Certificate of Conformance from Carboline for Pentair P.O. M47881 NUC – Carboline Shipment Release No. 1106045-1, dated December 9, 2013

Documents for ASME Class 2, V. C. Summer-2, Valve S/N N900133-00-0001

- Form NV-1, dated May 15, 2013
- Valve Test Report, dated April 29, 2013
- Consolidated Power Supply CoC for Base, dated December 2, 2011
- Consolidated Power Supply CMTR for Base, Heat No. 251052, dated February 9, 2011
- Consolidated Power Supply CMTR for Cylinder, Heat No. E5600, dated November 2, 2011
- Consolidated Power Supply CMTR for Lap Joint Stub End, dated January 21, 2011
- NDE-PT Report No. 38274, "Base Assembly Pressure Boundary Weld–Fit-up," dated March 3, 2012
- NDE-PT Report No. 38392, "Base Assembly Seating Surface," dated April 6, 2012
- NDE-PT Report No. 37236, "Cylinder Assembly Socket End Weld Prep," dated November 10, 2012
- Weld Record for base assembly S/N 10923, dated March 6, 2012
- Weld record for cylinder assembly S/N 11189, dated November 19, 2012

- Weldstar CoC for weld electrodes Heat No. 11-1645, Lot 11016196 ERCoCr-A Polymet, dated October 31, 2011
- NDE-PT Report No. 37264, "Cylinder Assembly Pressure Boundary Weld – Root Pass," dated November 19, 2012
- NDE-PT Report No. 37335, "Cylinder Assembly Pressure Boundary Weld – Final Weld," dated December 10, 2012
- NDE-PT Report No. 37857, "Cylinder Assembly Pressure Boundary Weld – After Hydrostatic Test," dated May 8, 2013