

May 21, 2013

Mr. David Gobbi, Quality Assurance Manager  
Flowserve Pump Division  
2300 E. Vernon Ave.  
Vernon, CA 90058

SUBJECT: NUCLEAR REGULATION COMMISSION INSPECTION REPORT  
NO. 99901369/2013-201

Dear Mr. Gobbi:

From April 8-12, 2013, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the Flowserve Pump Division (hereafter referred to as Flowserve) facility in Vernon, CA. The purpose of this limited-scope routine inspection was to assess Flowserve's compliance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," and selected portions of Appendix B, "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

This technically-focused inspection evaluated the implementation of Flowserve's quality assurance activities associated with the design, fabrication, assembly, and testing of safety-related pumps for the domestic nuclear power plants with a focus on the pumps being provided for the Westinghouse Electric Company's AP1000 reactor design. Some of the activities observed by the NRC inspection team are associated with, or directly affect, the closure of inspections, tests, analyses, and acceptance criteria (ITAAC) from Revision 19 to the certified AP1000 design. The NRC inspection team did not identify any findings associated with the ITAAC in Section 4 of the attachment to this report. Currently, the combined licenses of Vogtle Electric Generating Plant Units 3 and 4, and Virgil C. Summer Nuclear Station Units 2 and 3, incorporate these ITAAC. The enclosed report presents the results of this inspection. This NRC inspection report does not constitute the NRC's endorsement of Flowserve's overall quality assurance or 10 CFR Part 21 programs.

Based on the inspection samples, the NRC inspection team concluded that Flowserve met all program requirements and no violations or nonconformances were identified within the scope of this inspection. Although the NRC inspection team did identify some issues during the inspection, these issues were already identified during the most recent Nuclear Procurement Issues Committee audit performed at your facility and are being currently worked on under your corrective action program. The NRC inspection team did not identify any new issues of significance during the inspection.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," the NRC will make available electronically for public inspection

D. Gobbi

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a copy of this letter, its enclosure, and your response through the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System, which is accessible at <http://www.nrc.gov/reading-rm/adams.html>.

Sincerely,

*/RA/*

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

Docket No. 99901369

Enclosures:

1. Inspection Report No. 99901369/2013-201  
and Attachment

D. Gobbi

- 2 -

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

Docket No.: 99901369

Report No.: 99901369/2013-201

Vendor: Flowserve Pump Division  
2300 E. Vernon Ave.  
Vernon, CA 90058

Vendor Contact: Mr. David Gobbi  
Quality Assurance Manager  
Telephone: 704-916-3121  
E-mail: dgobbi@flowserve.com

Nuclear Industry Activity: Flowserve Pump Division (hereafter referred to as Flowserve) is an American Society of Mechanical Engineers (ASME) and Nuclear Parts certificate holder. Flowserve's scope of supply for the domestic commercial nuclear industry includes the manufacturing, repair, and replacement of safety-related ASME Class 1, 2, & 3 and non-ASME safety-related pumps, including spare and replacement parts, components, and appurtenances; associated engineering and field services. Flowserve performs the design and manufacture of the pumps and commercial-grade dedication of the pump components.

Inspection Dates: April 8 - 12, 2013

Inspectors:	Yamir Diaz-Castillo	NRO/DCIP/CMVB	Team Leader
	Jonathan Ortega-Luciano	NRO/DCIP/CMVB	
	Marlayna Vaaler	NRO/DCIP/CMVB	
	Paul Coco	NRO/DCIP/CMVB	
	Robert Wolfgang	NRR/DE/EPNB	

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

Enclosure

## **EXECUTIVE SUMMARY**

Flowserve Pump Division  
99901369/2013-201

The U.S. Nuclear Regulatory Commission (NRC) conducted this inspection to verify that Flowserve Pump Division (hereafter referred to as Flowserve) 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." In addition, the NRC inspection verified that Flowserve implemented a program under 10 CFR Part 21, "Reporting of Defects and Noncompliance," that met the NRC's regulatory requirements. The NRC inspection team conducted the inspection at the Flowserve facility in Vernon, CA from April 8 - 12, 2013.

This technically-focused inspection evaluated the implementation of Flowserve's QA activities associated with the design, fabrication, assembly, and testing of safety-related pumps for the domestic nuclear power plants with a focus on the pumps being provided for the Westinghouse Electric Company AP1000 reactor design.

Specific activities observed by the NRC inspection team included:

- commercial-grade dedication (CGD) of a gear case oil gauge 1.250 national pipe thread (NPT) taper
- receipt inspection of a safety-related round bar to be used as a pump shaft
- welding of a vane guide in the interior of a pump cover for an internal upper pump head casing
- liquid penetrant testing of two welds on a pump rotating assembly
- normal residual heat removal centrifugal pump performance test setup
- calibration of a pressure gage
- Flowserve's process for categorizing and dispositioning nonconformances and corrective actions during the daily Material Review Board meeting
- implementation of Flowserve's information and database systems used to evaluate and track 10 CFR Part 21 notifications, nonconformance reports, and corrective action requests

In addition to observing these activities, the NRC inspection team verified that measuring and test equipment (M&TE) was properly identified, marked, calibrated and used within its calibrated range. Furthermore, the NRC inspection team walked down Flowserve's assembly floor and verified that nonconforming components were properly identified, marked, and segregated when practical, to ensure that they were not reintroduced into the manufacturing processes.

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

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

During the course of this inspection, the NRC inspection team implemented 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, and IP 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012.

This was the third documented NRC inspection of the Flowserve's facility in Vernon, CA. The last NRC inspection was conducted in September 2011. The results of this inspection were documented in Inspection Report No. 99901369/2011-202, dated October 28, 2011. The report documented one violation of NRC requirements and one nonconformance to NRC requirements that were contractually imposed upon Flowserve by its customers. This inspection report documents the NRC's followup on Flowserve's implementation of the corrective actions for these issues.

The NRC inspection team concluded that Flowserve'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 Flowserve's personnel are implementing these policies and procedures effectively. The results of this inspection are summarized below.

#### 10 CFR Part 21 Program

The NRC inspection team concluded that Flowserve is implementing its 10 CFR Part 21 program in accordance with the regulatory requirements of 10 CFR Part 21. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Flowserve is implementing its policies and procedures associated with the 10 CFR Part 21 program. No findings of significance were identified.

#### Design Control and Commercial Grade Dedication

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

#### Oversight of Contracted Activities and Internal Audits

The NRC inspection team concluded that Flowserve is implementing its oversight of contracted activities and internal audits program in accordance 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. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Flowserve is implementing its policies and procedures associated with the oversight of contracted activities. No findings of significance were identified.

### Control of Special Processes

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

### Test Control

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

### Control of Measuring and Test Equipment

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

### Nonconforming Material, Parts, or Components

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

### Corrective Action

The NRC inspection team concluded that Flowserve is implementing its corrective action program in accordance with the regulatory requirements of Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Flowserve is implementing its policies and procedures associated with the corrective action program. No findings of significance were identified.

## REPORT DETAILS

The U.S. Nuclear Regulatory Commission (NRC) inspection team observed various activities related to Flowserve's quality assurance (QA) activities associated with the design, fabrication, assembly, and testing of safety-related pumps for the domestic nuclear power plants with a focus on the pumps provided for the Westinghouse Electric Company (WEC) AP1000 reactor design.

Specific activities observed by the NRC inspection team included:

- commercial-grade dedication of a gear case oil gauge 1.250 national pipe thread (NPT) taper
- receipt inspection of a safety-related round bar to be used as a pump shaft
- welding of a vane guide in the interior of a pump cover for an internal upper pump head casing
- liquid penetrant testing of two welds on a pump rotating assembly
- normal residual heat removal system (RNS) centrifugal pump performance test setup
- calibration of a pressure gage
- Flowserve's process for categorizing and dispositioning nonconformances and corrective actions during the daily Material Review Board (MRB) meeting
- implementation of Flowserve's information and database systems used to evaluate and track 10 CFR Part 21 notifications, nonconformance reports, and corrective action requests

In addition to observing these activities, the NRC inspection team verified that measuring and test equipment (M&TE) was properly identified, marked, calibrated and used within its calibrated range. Furthermore, the NRC inspection team walked down Flowserve's assembly floor and verified that nonconforming components were properly identified, marked, and segregated when practical, to ensure that they were not reintroduced into the manufacturing processes.

### 1. 10 CFR Part 21 Program

#### a. Inspection Scope

The NRC inspection team reviewed Flowserve's policies and implementing procedures that govern Flowserve's Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," program to verify compliance with the regulatory requirements. In addition, the NRC inspection team evaluated the 10 CFR Part 21 postings and a sample of Flowserve's purchase orders (POs) for 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 verified the content of Flowserve's 10 CFR Part 21 postings, as well as the location of each posting. The NRC inspection team verified that the information required by 10 CFR 21.6 was included on the postings distributed throughout the Vernon, CA complex. The NRC inspection team walked down each of the locations and also verified that Flowserve posted the required documents in conspicuous locations consistent with the requirements of 10 CFR 21.6(2). The NRC inspection team also verified that Flowserve's nonconformance and corrective action procedures provide a link to the 10 CFR Part 21 program. In addition, the NRC inspection team reviewed Flowserve's procurement procedures, as well as a sample of purchase orders (PO), and verified that the procurement process and each procurement document specified, when applicable, that the vendor must report defects and noncompliances in accordance with 10 CFR Part 21. Furthermore, the NRC inspection team discussed the 10 CFR Part 21 program with Flowserve's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

For a sample of six evaluations under 10 CFR Part 21, the NRC inspection team verified that Flowserve had effectively implemented the requirements for evaluating deviations and failures to comply. In addition, the NRC inspection team reviewed a sample of corrective action reports (CAR) and nonconformance reports (NCRs) to verify that Flowserve had appropriately determined that an evaluation of the reported issues was not necessary in accordance with 10 CFR Part 21.

c. Conclusion

The NRC inspection team concluded that Flowserve is implementing its 10 CFR Part 21 program in accordance with the regulatory requirements of 10 CFR Part 21. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Flowserve is implementing its policies and procedures associated with the 10 CFR Part 21 program. No findings of significance were identified.

2. Design Control

a. Inspection Scope

The NRC inspection team reviewed Flowserve's policies and implementing procedures that govern the design control program to verify compliance with the regulatory requirements in Criterion III, "Design Control," of Appendix B, "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," and the requirements in Subsection NCA, "General Requirements for Division 1 and Division 2"; Subsection NB, "Class 1 Components"; and Subsection ND, "Class 3 Components," of Section III, "Rules for Construction of Nuclear Facility Components," of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, 1998 Edition, 2000 Addenda. The NRC inspection team also reviewed a sample of assembly drawings, part drawings, bills of materials, applicant reports, design reports, engineering change order (ECO), and associated WEC POs.

The NRC inspection team also verified that Flowserve is appropriately implementing the requirements of Subsection NCA 3855.5, "Utilization of Unqualified Source Material," of Subsection NCA, "General Requirements of Division 1 and Division 2," of Section III of the ASME B&PV Code. In addition, the NRC inspection team reviewed Flowserve's program for the

dedication of commercial-grade items (CGI) for use in safety-related applications to verify compliance with the applicable regulatory requirements. The NRC inspection team reviewed several dedication packages, including dedication plans, the criteria for the selection of critical characteristics, and the selection of verification methods to verify effective implementation of Flowserve's CGI dedication process. The NRC inspection team also observed the dedication of a gear case oil gauge by one of the Flowserve quality control (QC) inspectors. Furthermore, the NRC inspection team also discussed the design control and commercial-grade dedication programs with Flowserve's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

b.1 Implementation of Flowserve's Design Control Program

Flowserve has been awarded a contract from WEC to design and fabricate RNS centrifugal pumps for the AP1000 reactor design, and it continues to provide numerous other pumps and pump components to the operating nuclear fleet. The RNS pumps are safety-related for pressure boundary purposes only. The NRC inspection team reviewed Flowserve Order Numbers RLCU00087 and RLCU00088 for the RNS pumps for Vogtle Electric Generating Plant Units 3 and 4 (hereafter referred to as Vogtle), and Virgil C. Summer Nuclear Station Units 2 and 3 (hereafter referred to as V.C. Summer), respectively, and evaluated the associated design control process.

The NRC inspection team verified that WEC AP1000 procurement specification APP-MP08-Z0-001, Revision 6 dated April 2, 2012, for the RNS pumps for Vogtle and V.C. Summer, was properly translated into Flowserve specification sheets, drawings, procedures, analyses, calculations, and instructions and that engineering data supported this information. The specifications verified included material specifications, applicable ASME Code construction requirements, qualification reports, test requirements, and test reports. The associated documentation reviewed included design reports, pump drawings, and lists of materials of construction. All documents reviewed contained the appropriate technical details and met the WEC AP1000 procurement specification. No issues of significance were identified.

In response to operating experience associated with the use of mechanical seals made with Teflon, the NRC inspection team reviewed the WEC design specification and the Flowserve documents to ensure that the use of Teflon was not allowed and is not being used by Flowserve. The tensile and elasticity properties of Teflon degrade at radiation levels above  $10^4$  rads. Because of this degradation in a radiation area, Teflon is not used in nuclear power plants. The NRC inspection team confirmed that the WEC design specification specifically prohibited the use of Teflon in the RNS pumps. A review of the Flowserve material listings did not identify any Teflon being used in the pumps.

b.2 Implementation of Flowserve's Commercial Grade Item Dedication Program

The NRC inspection team reviewed several dedication packages, including dedication plans, the criteria for the selection of critical characteristics, and the selection of verification methods to verify effective implementation of Flowserve's CGI dedication process. The NRC inspection team reviewed a sample of dedication packages associated with pumps being supplied to Exelon, First Energy, and Florida Power and Light. The NRC sample included items such as: O-rings, ball bearings, gear case oil gauges, space gear couplings, and washers. The NRC inspection team noted that Flowserve performed verification activities as part of the dedication

of these items in accordance with the engineering (EE) requirements and acceptance criteria established in the engineering evaluation documents, including recording actual values of critical dimensions on inspection reports when conducting inspection and test activities related to the dedication. No issues of significance were identified.

c. Conclusion

The NRC inspection team concluded that Flowserve is implementing its design control and commercial-grade dedication programs 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 Flowserve is implementing its policies and procedures associated with the design control and commercial-grade dedication programs. No findings of significance were identified.

3. Oversight of Contracted Activities and Internal Audits

a. Inspection Scope

The NRC inspection team reviewed Flowserve's policies and implementing procedures that govern the implementation of Flowserve's oversight of contracted activities and internal audits program to verify compliance with the 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. The NRC inspection team reviewed a sample of POs, external and internal audits, and receipt inspection records to evaluate compliance with Flowserve's program and technical requirements. In addition, the NRC inspection team reviewed the disposition of corrective actions to resolve deficiencies that audit findings identified for adequacy and timeliness. Furthermore, the NRC inspection team discussed the oversight of contracted activities with Flowserve's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

b.1 Procurement Document Control

The NRC inspection team reviewed a sample of POs that Flowserve issued in support of the WEC AP1000 design to determine if the requirements identified in the procedures were imposed on the applicable purchasing documents. The NRC inspection team found that the POs adequately documented the procurement requirements as established by Flowserve's governing policies and implementing procedures, which include (1) imposition of appropriate quality, technical, and regulatory requirements and (2) identification of the applicable codes and standards. In addition, the NRC inspection team confirmed that all the safety-related POs reviewed included clauses that invoke the provisions of 10 CFR Part 21 and that require the vendor or supplier to conduct safety-related work under its approved QA program. No issues of significance were identified.

b.2 Maintenance of the Approved Vendors List

Flowserve maintains two approved vendors lists (AVL). The first AVL includes suppliers authorized to provide ASME B&PV Code (QL-1) and safety-related (QL-3) products. The second AVL includes suppliers of commercial products and services (QL-5). When Flowserve procures products or services to be used in safety-related applications from suppliers identified

as QL-5, these products and services are dedicated in accordance with Flowserve's commercial-grade dedication program. The NRC inspection team reviewed both the AVLs to ensure that qualified and approved suppliers were listed; that the lists were maintained, distributed, and periodically updated by authorized personnel; and that any revisions to the lists were implemented following the applicable procedures.

### b.3 External and Internal Audits

The NRC inspection team reviewed a sample of external and internal audits to verify the implementation of Flowserve's audit program. The NRC inspection team verified that Flowserve had prepared and approved plans that identify the audit scope, focus, and applicable checklist criteria before the initiation of the audit activity. The NRC inspection team confirmed that the audit reports contained a review of the relevant QA criteria in Appendix B to 10 CFR Part 50 for the activities that individual suppliers performed and documentation of pertinent supplier guidance associated with each criterion. For audits that resulted in findings, the NRC inspection team verified that the supplier had established a plan for corrective action and that Flowserve had reviewed and approved the corrective action and verified its satisfactory completion and proper documentation. Flowserve's audit program also includes the performance of annual evaluations of suppliers to ensure that they are effectively implementing their approved QA programs. For a sample of annual evaluations, the NRC inspection team verified that these were performed in accordance with Flowserve's procedures and contained all the required information. No issues of significance were identified.

### b.4 Receipt Inspection

The NRC inspection team observed the receipt of the inspection of a safety-related round bar to be used as a pump shaft. The NRC inspection team observed the Flowserve QC inspector review documentation, confirm the PO information, conduct a review for any obvious damage, verify the quantity received, verify dimensional aspects of the bar, and compare measurements to the drawing. No issues of significance were identified.

### b.5 Qualification and Training of Auditors, Lead Auditors and Inspection Personnel

The NRC inspection team reviewed a sample of the training and qualification records of Flowserve's lead auditors, auditors and inspection personnel and confirmed that auditing and inspection personnel had completed all required training and had maintained qualification and certification in accordance with Flowserve's policies and procedures. No issues of significance were identified.

### c. Conclusion

The NRC inspection team concluded that Flowserve is implementing its oversight of contracted activities and internal audits 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 Flowserve is implementing its policies and procedures associated with the oversight of contracted activities. No findings of significance were identified.

#### 4. Control of Special Processes

##### a. Inspection Scope

The NRC inspection team reviewed Flowserve'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, Section III, Section V, "Nondestructive Examination," and Section IX, "Welding and Brazing Qualification," of the ASME Code, 1998 Edition, 2000 Addenda. The NRC inspection team also reviewed a sample of test reports and observed liquid penetrant testing of two welds on a pump rotating assembly as well as welding of a vane guide in the interior of a pump cover. In addition, the NRC inspection team discussed the control of special processes program with Flowserve's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

##### b.1 Welding Process

The NRC inspection team observed Flowserve's tack welding of a guide vane in the interior of a pump cover. The pump cover was for an internal upper pump head casing for a RCP for St. Lucie Plant. All components or parts at Flowserve are fabricated with each step of the process documented in Operation Notes (ON). ONs provide Flowserve's personnel with the appropriate procedures, processes, hold points, and quality checks required during each step of the fabrication process. The welding of the guide vane was performed using procedure WR-1503, "General Welding Requirements ASME Code Section III Class 1 Nuclear Parts," Revision F, dated January 20, 2005.

The NRC inspection team also determined that qualified welders perform welding on ASME B&PV Code materials and fabrication in accordance with approved Welding Procedure Specifications and Procedure Qualification Records. The NRC inspection team also confirmed that, for a sample of certified material test reports, the reports complied with the chemical composition and mechanical properties, as required by applicable edition and addenda of Section III of the ASME B&PV Code.

##### b.2 Control of Weld Material

The NRC inspection team observed that Flowserve clearly identified welding materials at all times, and that it retained identification of acceptable material throughout storage, handling, and use until the material was actually consumed in the welding process. The NRC inspection team also observed that covered weld electrodes and flux were stored in moisture and temperature controlled environments, and that the process for conditioning of electrodes was being implemented, as applicable, in accordance with Section IX of the ASME B&PV Code. The temperature indications for storage areas were all within calibration periodicity. No issues of significance were identified.

##### b.3 Nondestructive Examination

The NRC inspection team observed a liquid penetrant examination of two welds on a pump rotating assembly for St. Lucie Plant. The examination was performed by a Level II non-destructive examination (NDE) QC inspector using Flowserve-NPO- PT-1505, "Liquid Penetrate Examination ASME Section III Subsection NB for Class 1 Primary Coolant Components," Revision H, dated June 6, 2008. The purpose of the examination was to inspect

the finished welds at each side ring of the pump shaft and verify that the welds met the acceptance criteria in accordance with the Section III ASME B&PV Code. Upon the completion of the examination, the NRC inspection team observed the NDE QC inspector document and log all the results in accordance with the procedure. No issues of significance were identified.

#### b.4 Qualification and Training of Welding and Nondestructive Testing Personnel

The NRC inspection team reviewed a sample of training and qualification records for Flowserve's welders and welding operators. The NRC inspection team confirmed that these individuals had completed all the required training and had maintained qualification and certification in accordance with Flowserve's policies and procedures, and that the welding operators were qualified in accordance with the applicable requirements of Sections III and IX of the ASME B&PV Code. The NRC inspection team also verified that the welder performance qualification list was adequately maintained. No issues of significance were identified.

The NRC inspection team selected a sample of training and qualification records for Flowserve's NDE personnel. The NRC inspection team confirmed that Flowserve's personnel were trained and qualified in accordance with American Society for Nondestructive Testing SNT-TC-1A, "Personnel Qualification and Certification in Nondestructive Testing," 1992 Edition, and the applicable requirements of Section III of the ASME B&PV Code. No issues of significance were identified.

#### c. Conclusion

The NRC inspection team concluded that Flowserve is implementing its control of special processes program in accordance with the 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 Flowserve is implementing its policies and procedures associated with the control of special processes program. No findings of significance were identified.

### 5. Test Control

#### a. Inspection Scope

The NRC inspection team reviewed Flowserve's policies and implementing procedures that govern the test control program to verify compliance with the requirements of Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50. The NRC inspection team also reviewed a sample of test plans and test procedures and observed an RNS centrifugal pump performance test setup. In addition, the NRC inspection team discussed the test control program with Flowserve's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

#### b. Observations and Findings

##### b.1 Test Plan and Procedure

The NRC inspection team verified that Flowserve's test procedures adequately included the technical, quality, and regulatory requirements identified in the associated customer POs and technical specifications. The NRC inspection team also verified that Flowserve's test procedure provided an adequate description of the test responsibilities, objectives, sequences, instructions, parameters, M&TE usage, acceptance criteria, and posttest activities and that they

also met the applicable requirements of Section III of the ASME B&PV Code, 1998 Edition, 2000 Addenda. No issues of significance were identified.

#### b.2 Test Program Implementation

At the time of the inspection, Flowserve did not perform any testing activities. Although the NRC inspection team did not observe any testing being performed, the NRC inspection team noted that two AP1000 RNS centrifugal pumps remained on the test stand from a previous test. The test setup for the RNS centrifugal pumps included a performance, NPSH, vibration, and full train tests in accordance with test procedure 156RLCU00087.

The NRC inspection team also verified that Flowserve had established and implemented a training and qualification program for the training and qualification of testing personnel. The NRC inspection team reviewed the qualification records for Level I, Level II, and Level III test engineers and confirmed that they had met all the required training and had maintained qualification and certification in accordance with Flowserve's NPO-FLTP-A-0005, "Test Engineer and Operator Qualifications and Certification," Revision D dated August 1, 2005 and ANSI N45.2.6 "Qualification of Inspection, Examination and Testing Personnel for Nuclear Power Plants."

#### b.3 Test Results and Data Evaluation

The NRC inspection team verified the test data results for the completed AP1000 RNS centrifugal pumps documented in Test Report No. 156RLCU00087. The NRC inspection team confirmed that the format and content of the test documentation was representative of the tests performed and that a qualified test technician appropriately recorded and evaluated required test data in accordance with the PO and the test procedure requirements.

The NRC inspection team also reviewed the Final Quality Assurance Records Data Packages for two centrifugal residual heat removal pumps shipped to Vogtle Unit 4 in April 2013. The data packages included records such as certificates of compliance, certified material test reports, heat treatments, tests, inspections, and signed code data reports for pump serial numbers 10RLCU0008703001 and 10RLCU0008703002. The NRC inspection team verified that all suppliers were on the Flowserve approved supplier list at the time of the item being supplied. No issues of significance were identified.

#### c. Conclusion

The NRC inspection team concluded that Flowserve is implementing its test control 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 Flowserve is implementing its policies and procedures associated with the test control program. No findings of significance were identified.

### 6. Control of Measuring and Test Equipment

#### a. Inspection Scope

The NRC inspection team reviewed Flowserve'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. The NRC inspection

team also reviewed a sample of calibration records and observed the calibration of a pressure gage. The NRC inspection team also verified that when M&TE equipment is received from the calibration service supplier and the calibration certificate states that it was found to be out of calibration, Flowserve generates an NCR to identify items that have been accepted using this equipment since the last valid calibration date and to perform an extent of condition. No issues of significance were identified. In addition, the NRC inspection team discussed the M&TE program with Flowserve's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

The NRC inspection team reviewed Flowserve's database used for tracking calibration completion and due dates for each of the approximately 2,000 M&TE devices. The NRC inspection team performed a visual sample inspection of several M&TE devices at the Flowserve calibration laboratory and in various test work stations. The NRC inspection team found that the sampled M&TE had the appropriate calibration stickers and current calibration dates, including the calibration due date. In addition, 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. The NRC inspection team also verified that the selected M&TE was calibrated using procedures traceable to known industry standards. No issues of significance were identified.

c. Conclusion

The NRC inspection team concluded that Flowserve 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 Flowserve is implementing its policies and procedures associated with the M&TE program. No findings of significance were identified.

7. Nonconforming Materials, Parts, or Components

a. Inspection Scope

The NRC inspection team reviewed Flowserve's policies and implementing procedures that govern the control of nonconformances to verify compliance with the requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed a sample of NCRs and verified that the disposition and control of nonconformances was in accordance with Flowserve's procedural guidelines. The NRC inspection team also verified that the nonconformance process provides an effective interface to Flowserve's 10 CFR Part 21 program and procedure, and that a management system has been established for the oversight of NCRs. In addition, the NRC inspection team discussed the nonconformance program with Flowserve's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

For the sample of NCRs reviewed, the NRC inspection team verified that Flowserve implemented an adequate program to assess and control nonconforming items, including appropriate identification, documentation, segregation, evaluation, and disposition of these items. Each NCR receives a review during the daily MRB meeting, which consists of QA,

engineering, purchasing, and inspection personnel evaluating all NCRs created since the last MRB or any NCRs with a changed status, dispositioning the NCRs in accordance with the Flowserve process, and documenting the bases for these decisions, as needed. For any NCRs requiring a more in-depth review, the MRB assigns engineering or inspection personnel, as necessary, to evaluate and disposition the nonconformance and provide adequate documentation of the evaluation. The NRC inspection team attended an MRB meeting to verify implementation of the nonconformance process. No issues of significance were identified.

The NRC inspection team also toured the shop floor to verify that there are designated areas to segregate and control the various classes of nonconforming materials. This process properly applies the principles of acceptable, repair, rework, hold, scrap, or use-as-is, and it provides for the necessary technical justifications to be adequately supported and properly documented by the associated engineering, quality, and purchasing organizations, including the need for additional design control measures as necessary, commensurate with those applied to the original design. No issues of significance were identified.

c. Conclusion

The NRC inspection team concluded that Flowserve is implementing its nonconforming materials, parts, or components program 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 Flowserve is implementing its policies and procedures associated with the control of nonconforming materials, parts, or components. No findings of significance were identified.

8. Corrective Action

a. Inspection Scope

The NRC inspection team reviewed the current status of the corrective actions implemented in response to the findings from the September 2011 NRC inspection at Flowserve. The NRC inspection team also reviewed Flowserve's policies and implementing procedures that govern the corrective action program to verify compliance with the requirements of Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed a sample of CARs and verified that the CARs' disposition and control provide adequate documentation and description of conditions adverse to quality, and specify the cause of these conditions and the corrective actions taken to prevent recurrence. The NRC inspection team also verified that the corrective action process provides an effective interface to Flowserve's 10 CFR Part 21 program and procedure, and that a management system has been established for the oversight of CARs and identification of trends for conditions adverse to quality. In addition, the NRC inspection team discussed the corrective action program with Flowserve's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

b.1 Corrective Action Associated with Violation 99901369/2011-202-01

The NRC issued Violation 99901369/2008-201-01 for Flowserve's failure to complete an evaluation of a deviation or failure to comply within 60 days of discovery and failure to submit an interim report in writing to the NRC when the evaluation of an identified deviation or failure to

comply could not be completed within 60 days, as required by 10 CFR 21.21, "Notification of Failure to Comply or Existence of a Defect and Its Evaluation."

In its response to the NRC, Flowserve stated that the corrective measures implemented in response to this violation include: (1) Flowserve [NPO] QA-1717, "Quality Department Control of Nonconforming Items," was revised on November 22, 2011, to include a definition for the "point of discovery;" (2) Flowserve [NPO]-NNP-02, "Reporting of Defects Which May Result in Substantial Safety Hazards (10 CFR 21)," was revised to become NPO-NNP-03 on November 21, 2011, to include a definition for the "point of discovery;" (3) Flowserve [NPO]-CNP-02, "Implementation of the Nuclear Products Operations Corrective Action Program," was revised to become NPO-CNP-03 on November 21, 2011, to include a definition for the "point of discovery" and the steps of the CAR process that involve the evaluation of deviations; (4) Flowserve [NPO]-NNF-07, "Formal Evaluation of Deviation for Impact to Safety," was created to provide consistency in the reporting method for formal 10 CFR Part 21 evaluations and to provide objective evidence of the formal evaluations; and (5) Flowserve personnel received training regarding the revisions to the above documents.

The NRC inspection team reviewed CAR 104172, which Flowserve initiated to provide a root cause analysis and implement corrective measures for Violation 99901369/2011-202-01. CAR 104172 described the corrective actions detailed above, provided objective evidence of the completion of corrective actions, and was closed on December 20, 2011.

The NRC inspection team reviewed the documentation that provided objective evidence for the completion of the corrective actions. The NRC inspection team confirmed that Flowserve revised the procedures listed above and provided the associated training to address Violation 99901369/2011-202-01, and that no further deviations from the 10 CFR Part 21 notification and timeliness requirements had occurred. The NRC inspection team determined that Flowserve's corrective actions were adequate to address the identified finding. Based on its review, the NRC inspection team closed Violation 99901369/2011-202-01.

#### b.2 Corrective Action Associated with Nonconformance 99901369/2011-202-02

The NRC issued Nonconformance 99901369/2008-201-02 for Flowserve's failure to disposition nonconforming material in accordance with Flowserve NPO QA-1717, "Quality Department Control of Nonconforming Items," which provides for disposition categories of use-as-is, rework, repair, or scrap, but provides no provisions for cancellation of NCRs. This failure resulted in the cancellation of several NCRs without a disposition allowed by QA-1717.

In its response to the NRC, Flowserve stated that QA-1717 was revised to include "cancel" as a type of disposition that may be used on nonconformance documents and to identify the responsible authorities and controls for determining and approving an NCR disposition of "cancel." In addition, Flowserve personnel received training regarding the revisions to the above document and appropriate use of the "cancel" disposition for NCRs.

The NRC inspection team reviewed CAR 104173, which Flowserve initiated to provide a basis and implement corrective measures for Nonconformance 99901369/2011-202-02. CAR 104173 described the corrective actions detailed above, provided objective evidence of the completion of corrective actions, and was closed on December 20, 2011.

The NRC inspection team reviewed the documentation that provided objective evidence for the completion of the corrective actions. The NRC inspection team confirmed that Flowserve

revised QA-1717 and provided the associated training to address Nonconformance 99901369/20011-202-02. The NRC inspection team determined that Flowserve's corrective actions were adequate to address the identified finding. Based on its review, the NRC inspection team closed Nonconformance 99901369/2011-201-02.

### b.3 Implementation of Flowserve's Corrective Action Program

The NRC inspection team verified that Flowserve's implementing procedures provide assurance that conditions adverse to quality are promptly identified, documented and corrected or otherwise handled in accordance with the established requirements. The procedures also ensure that the causes of the conditions adverse to quality are identified and that corrective or preventive action is taken to preclude recurrence. The NRC inspection team reviewed a sample of Flowserve's corrective actions including both internal CARs and CARs related to corrective actions imposed upon or implemented by Flowserve's suppliers. The NRC inspection team verified that the CARs provide (1) adequate documentation and description of conditions adverse to quality; (2) an appropriate analysis of the cause of these conditions and the corrective actions taken to prevent recurrence; (3) direction for review and approval by the responsible authority; (4) a description of the current status of the corrective actions; and (5) the follow-up actions taken to verify timely and effective implementation of the corrective actions. No issues of significance were identified.

### c. Conclusion

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

## 9. Entrance and Exit Meetings

On April 8, 2013, the NRC inspection team discussed the scope of the inspection with Ms. Jama Meyer, Flowserve's General Manager, and other members of Flowserve's management and technical staff. On April 12, 2013, the NRC inspection team presented the inspection results and observations during an exit meeting with Mr. Hassan Farah, Flowserve's Corporation Quality Manager, and other members of Flowserve's management and technical staff. The attachment to this report lists the entrance and exit meeting attendees, as well as those individuals whom the NRC inspection team interviewed.

## ATTACHMENT

### 1. ENTRANCE/EXIT MEETING ATTENDEES

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Jama Meyer	General Manager	Flowserve Pumps Division (Flowserve)	X		
Hassan Farah	Quality Manager	Flowserve Corporation Quality Manager	X	X	
Erik Meisner	Director Nuclear Products Operation (NPO)	Flowserve	X	X	X
David P. Gobbi	Quality Assurance (QA) Manager NPO	Flowserve	X	X	X
Dan M. Baehner	QA Manager NPO Vernon	Flowserve	X	X	X
Michael Eftychiou	Nuclear Engineering Manager NPO	Flowserve	X	X	X
John DeNova	Manufacturing Manager	Flowserve	X	X	
Gabriel Casas	Procurement Manager	Flowserve			X
Juan Estenoz	Quality Control (QC) Supervisor NPO	Flowserve	X	X	X
Edward Villalva	Senior Quality Engineer	Flowserve			X
Mark Maurer	Quality Engineer NPO	Flowserve	X	X	X
Gerardo Galvan	Quality Engineer NPO	Flowserve			X
Denise Sychingiok	QA Engineer	Flowserve			X
Nancy Macias	QA Engineer	Flowserve			X
Camilo Galzeto	QC Inspector	Flowserve			X
Binh Pham	Test Engineer	Flowserve			X
Octavio Torres	Nondestructive Examination Inspector Level 2	Flowserve			X
Jeff Bartholomew	Engineering Representative	Flowserve			X

Name	Title	Affiliation	Entrance	Exit	Interviewed
John Ao	Calibration Technician	Flowserve			X
Jesus Zambrano	Welder	Flowserve			X
Mohamed Abdelaziz	Authorized Nuclear Inspector	Hartford Steam Boiler Inspection and Insurance Company		X	X
Yamir Diaz-Castillo	Inspection Team Leader	NRC	X	X	
Jonathan Ortega-Luciano	Inspector	NRC	X	X	
Marlayna Vaaler	Inspector	NRC	X	X	
Paul Coco	Inspector	NRC	X	X	
Robert Wolfgang	Inspector	NRC	X	X	
Kerri Kavanagh	Branch Chief	NRC		X	

## 2. INSPECTION PROCEDURES USED

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

IP 43002, "Routine Inspections of Nuclear Vendors," dated April 25, 2011.

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

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

Item Number	Status	Type	Description	Applicable Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) from the AP1000 Design Control Document, Tier 1, Revision 19
99901369/2011-202-01	Closed	NOV	10 CFR Part 21	N/A
99901369/2011-202-02	Closed	NON	Criterion XV	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 manufactured by Flowserve Pump Division. At the time of the inspection, Flowserve was involved in manufacturing ASME Code Section III pumps for the AP1000 reactor design. For the ITAAC listed below, the NRC inspection team reviewed Flowserve's quality assurance controls in the areas of design control, procurement, training, control of special processes, inspection, testing, and measuring and test equipment. The ITAAC's design commitment referenced below are for future use by the NRC staff during the ITAAC closure process; the listing of these ITAAC design commitments does not constitute that they have been met and closed. The NRC inspection team did not identify any findings associated with the ITAAC identified below.

Appendix C from the Combined License for Vogtle Units 3 and 4 and VC Summer Units 2 and 3	No. 355	ITAAC 2.3.06.02a
Appendix C from the Combined License for Vogtle Units 3 and 4 and VC Summer Units 2 and 3	No. 357	ITAAC 2.3.06.03a

#### 5. DOCUMENTS REVIEWED

- Flowserve Nuclear Products Operations (NPO), "Nuclear Quality Assurance Manual," Revision 3, dated October 15, 2011
- Flowserve NPO "ASME Code Nuclear Quality Assurance Manual," Edition 4, Revision 4, dated April 20, 2011
- Flowserve NPO-ACP-08, "Requirements for Qualifying Suppliers for the Placement of Purchase Orders through Method 2, Commercial Grade Survey," Revision 00, dated December 16, 2008
- Flowserve NPO-ACP-09, "Requirements for Qualifying Suppliers Quality Programs, Accepting Supplier Products and Services and for the Maintenance of the NPO Approved Vendors List," Revision 00, dated December 21, 2012
- Flowserve NPO-ANP-02, "Internal Audit Quality Program," Revision 00, dated December 10, 2012
- Flowserve NPO-CNP-03, "Implementation of the Nuclear Products Operations Corrective Action Program," Revision 0, dated November 21, 2011
- Flowserve NPO CP-1578, "Preservation, Packaging and Marking of Elastomeric Seals for Controlled Shelf-Life Service," Revision F, dated October 13 2004
- Flowserve NPO-C-Q-33, "Quality Department Calibration Procedure," Revision G, dated January 5, 2003

- Flowserve NPO-E-105, "Engineering Utilizing Commercial Items as Safety Related Components," Revision B, dated May 18, 2010
- Flowserve NPO-E-102, "Engineering Quality Level Classification," Revision A, dated August 30, 2005
- Flowserve NPO-E-104, "Engineering Nuclear Item Master, BOM's and ECO's," Revision C, dated June 22, 2010
- Flowserve NPO-E-106, "Engineering Design Control," Revision C, dated April 20, 2011
- Flowserve NPO-E-116, "Engineering Nuclear Drawing Control," Revision 0, dated January 14, 2010
- Flowserve NPO-E-119, "Engineering Bill of Material," Revision 0, dated June 22, 2010
- Flowserve NPO-E-120, "Engineering Change Order (ECO) Processing, Revision 0, dated July 8, 2010
- Flowserve NPO-ECP-03, "Auditor Training and Qualification Requirements," Revision 00, dated December 11, 2012
- Flowserve NPO-EE-1009, "Engineering Evaluation of Direct Reading Oil Level Gauges," Revision 0, dated March 23, 1994
- Flowserve NPO-EE-1010, "Engineering Evaluation of Ball Bearings," Revision H, dated April 4, 2012
- Flowserve NPO-EE-1053, "Engineering Evaluation for the Dedication of Miscellaneous Small Machined Parts for Safety Related Services," Revision 0, dated October 16, 1997
- Flowserve NPO-EE-1073, "Engineering Evaluation for the Dedication of Type 420 Direct Laser Deposition (DLD) Hardsurfacing for Safety Related Services," Revision A, dated October 8, 2012
- Flowserve NPO-EE-1098, "Engineering Evaluation of QL-3 O-Rings," Revision A, dated November 17, 2010
- Flowserve NPO-EE-1122, "Engineering Evaluation for the Dedication of Calibration Services," Revision 0, dated December 31, 2012
- Flowserve NPO-GS-1640, "Alloy Verification Procedure using the Niton XLp 818 Alloy Analyzer from the Thermo Electron Corporation," Revision B, dated September 13, 2006
- Flowserve NPO-INP-04, "Procurement Process - Interface with Source Inspection Roles and Responsibilities," Revision 00, dated December 8, 2004
- Flowserve NPO-ID-1000, "Part Identification Methods, Locations, and Content Nuclear Power Products," Revision C, dated October 20, 2011

- Flowserve NPO-IP-1777, "Inspection Requirements for Elastomeric Seals for Nuclear Services," Revision C, dated April 19, 2012
- Flowserve NPO-ITP-U00087, "Inspection and Test Plan," Revision D
- Flowserve NPO-MC-1741 Revision L, "Materials of Construction 6 X 19 WD RNS Pumps (Orders RLCU00087/88)," dated October 31, 2012
- Flowserve NPO-MR-1533, "Requirements for Stock Conversion of Casting from QL-3 Vendors for ASME Section III Pumps and Parts," Revision 0, dated April 3, 2008
- Flowserve NPO-NNF-07, "Formal Evaluation of Deviation for Impact to Safety" [Corrective Action Request (CAR) -105252], dated September 14, 2011
- Flowserve NPO-NNF-07, "Formal Evaluation of Deviation for Impact to Safety" (CAR-107052), dated November 17, 2011
- Flowserve NPO-NNF-07, "Formal Evaluation of Deviation for Impact to Safety" (CAR-143313), dated September 19, 2012
- Flowserve NPO-NNF-07, "Formal Evaluation of Deviation for Impact to Safety" (CAR-150012), dated November 26, 2012
- Flowserve NPO-NNF-07, "Formal Evaluation of Deviation for Impact to Safety" (CAR-159552), dated February 20, 2013
- Flowserve NPO-NNF-07, "Formal Evaluation of Deviation for Impact to Safety" (CAR-159652 and CAR-159653), dated February 21, 2013
- Flowserve NPO-NNP-03, "Reporting of Defects Which May Result in Substantial Safety Hazards (10 CFR 21)," Revision 0, dated November 21, 2011
- Flowserve NPO-P-109, "Trailer Text for Purchase Orders," Revision B, dated December 13, 2005
- Flowserve NPO-P-110, "Blanket Purchase Order," Revision 0, dated July 18, 2005
- Flowserve NPO-P-116, "Purchase Order Content Control," Revision 0, dated July 18, 2005
- Flowserve NPO-PT-1505, "Liquid Penetrate Examination ASME Section III Subsection NB for Class 1 Primary Coolant Components," Revision H, dated June 6, 2008
- Flowserve NPO-SN-19, "Non-Conformance Control," Revision 1, dated October 15, 2011
- Flowserve NPO-SN-20, "Corrective Action," Revision 1, dated October 15, 2011
- Flowserve NPO-SR-1422 Revision G, "Pump – Design Qualification Report of the Residual Heat Removal Pump Structural Integrity," dated October 25, 2012

- Flowserve NPO QA-1102, "Quality Department Written Practice for Quality Assurance Audit Personnel and Certification," Revision D, dated July 20, 2005
- Flowserve NPO QA-1104, "Quality Department Written Practice for Inspector and Test Personnel Qualification and Certification," Revision D, dated July 30, 2008
- Flowserve NPO QA-1717, "Quality Department Control of Nonconforming Items," Revision C, dated November 22, 2011
- Flowserve NPO QA-1739, "Quality Department External Audits," Revision 0, dated December 20, 2005
- Flowserve NPO QA-1783, "Quality Department Receiving Inspection Procedure," Revision B, dated October 9, 2007
- Flowserve NPO QA-1785, "Quality Department Corrective Action Request Procedure," Revision A, dated October 9, 2007
- Flowserve NPO-WC-1000, "Welding Filler Material Storage and Control," Revision N, dated January 11, 2010
- Flowserve NPO-WR-1503, "General Welding Requirements ASME Code Section III, Class 1 Nuclear Parts," Revision F, dated January 20, 2005
- Flowserve NPO, "Vernon's Quality Assurance Annual Effectiveness Report – 2012 Calendar Year," dated March 22, 2013
- Flowserve NPO, "Information / Results of Internal Corrective Action - #60312," dated March 13, 2011
- Flowserve NPO, "Non Conforming Calibration Report – NCCR #20130326-01" dated April 8, 2013
- Flowserve NPO, "Non Conforming Calibration Report – NCCR #20130325-01" dated April 8, 2013
- Flowserve NPO Approved Vendors List for Code (QL-1) and Safety-Related (QL-3) Suppliers
- Flowserve NPO Approved Vendors List for Non-Safety Related (QL-5) & Service Suppliers
- Westinghouse Electric Company (WEC) Design Specification APP-MP08-Z0-001, Revision 7, dated April 2, 2012
- WEC Pump Data Sheet APP-MP08-Z0-001, "Design Specification for RNS Centrifugal RHR Pumps," Revision 6, dated May 2, 2011
- WEC Design Specification APP-MP08-Z0R-001, "RNS Centrifugal Normal Residual Heat Removal Pumps, ASME B&PV Section III, Class 3 Datasheet Report," Revision 4, August 20, 2010

- Drawing Verification Record for Part No. 10517650, Purchase Order (PO) No. 11U03338, Lot No.11-007784
- Drawing No. DWGA64264, "Pacific Pumps Division of Dresser industries View Port Gauges," Revision 2, dated March 1, 1989
- Drawing No. 62639315, "Ingersoll Dresser Pump Company, Bearing," Revision A
- RLSA20491, "Operation Notes for Item 10517649, O-Ring"
- RLSA23188, "Operations Notes for Port View 1.250 National Pipe Thread, Item No. 10574459
- RLSA21148, "Operation Note," for Item No. 10137852, Pilot Ring, KOP-Flex, Production Order"
- RLSA21148, "Operation Note for a Size 2 Type W, Waldron Space Gear Coupling"
- RLSA22895, "Operation Note for Item No. 0636590, Bearing, Ball, Radial"
- RLSA20304, "Operation Note for Housing, BRG Item No. 10505112"
- RLSA20310, "Operation Note for Adapter, BRG, HSG Item No. 10505108"
- RLSA17837, "Operation Note for Casting Item No. 10502531"
- Final Tagging Inspection Report / Checklist: Pumps Inspection, dated March 29, 2013
- Form NPV-1, "Certificate Holder's Data Report for Nuclear Pumps or Valves," for pump 10RLCU0008801001, dated March 21, 2013,
- Form NPV-1, "Certificate Holder's Data Report for Nuclear Pumps or Valves," dated March 21, 2013, for pump 10RLCU0008801002
- Form NPV-1, "Certificate Holder's Data Report for Nuclear Pumps or Valves," for pump 10RLCU0008701001, dated March 21, 2013,
- Form NPV-1, "Certificate Holder's Data Report for Nuclear Pumps or Valves," for pump 10RLCU0008801002, dated March 21, 2013,
- Form NPV-1, "Certificate Holder's Data Report for Nuclear Pumps or Valves," for pump 10RLCU0008703001, dated March 21, 2013,
- Form NPV-1, "Certificate Holder's Data Report for Nuclear Pumps or Valves," for pump 10RLCU0008803002, dated March 21, 2013,
- PAR No. 4500328256-027-H dated July 26, 2012, for Flowserve General Arrangement Drawing 6X19WD86X3 and 6X19WD86X4, Revision H, dated July 20, 2012

- PAR No. 4500328256-028-M dated March 21, 2013 for Flowserve Pump Assembly Drawing 6X19WD500X1, Revision K, dated March 13, 2013
- PAR No. 4500328256-041-C dated April 23, 2012 for Flowserve Pump Data Sheet Report APP-MP-08-Z0-001, Revision 6, dated May 2, 2011
- Design Control Review Summary for Flowserve Job No. RLCU00087/88, dated April 1, 2013
- Contract Review Summary, dated April 2, 2013, for Order Number RLCU00088
- "RNS Centrifugal Normal Residual Heat Removal Pumps, ASME B&PV Section III, Class 3 Datasheet Report," APP-MP08-Z0R-004, Revision 4
- Engineering Change Order (ECO) No. 101364 - Revised DOC17574 (IOM) Per customer Comments, dated January 28, 2013
- ECO No. 101090 - Adding DOC17958 to the top level of U87/88, dated November 2, 2012
- ECO No. 10182 - Release of DOC17958, dated November 1, 2012
- ECO No. 100981 - Update packing procedure to reflect method 2 for MP08 (vacuum bag) , dated November 5, 2012
- ECO No. 100936 - Release of updated sectional, MC-1741, and IOM, dated October 25, 2012
- ECO No. 100930 - Release of phosphate coating levels for carbon steel washers to coincide with phosphate coated studs/bolts, dated October 24, 2012
- ECO No. 100864 - Add paint procedure to sight flow guard BOM and remove paint procedure callout from item text, dated October 22, 2012
- ECO No. 100815 - Revised seal cooler aux level by adding item number 10514906 and changing item number 10514906 to a quantity of 8. Seal cooler aux BOM was modified to undo changes that were done in Rev. J. Updated documents, drawings, and Bill of Materials, dated October 18, 2012
- ECO No. 100749 - Updated seal cooler outline per customer request, dated October 16, 2012
- ECO No. 100295 - Replaces steel washers with SST washers on Aux. Seal Piping, dated September 27, 2012
- PO 4500328256 to Flowserve from WEC for AP1000 Project Vogtle Units 3 & 4 for four Centrifugal Norm Residual Heat Removal (RHR) Pumps, dated December 23, 2009
- PO 4500328257 to Flowserve from WEC for AP1000 Project V.C. Summer Units 2 & 3 for four Centrifugal Norm RHR Pumps, dated December 23, 2009
- PO No. 1017 to Precision Instrument Correction, dated October 9, 2012

- PO No. 1078 to Precision Instrument Correction, dated April 4, 2013
- PO No. 970 to Precision Instrument Correction, dated May 8, 2012
- PO No. 1069 to Hytorc Wind of Los Angeles, dated March 1, 2013
- PO No. 1049 to Mountz, Inc., dated January 9, 2013
- PO No. 980 to Mountz, Inc., dated June 10, 2012
- PO No. 863 to Dick Munns Company, dated July 27, 2011
- PO No. 1005 to Dick Munns Company, dated August 30, 2012
- PO No. 1006 to Hytorc, dated August 30, 2012
- PO No. RLLU05691 to SKF Bearings Industries Co.
- PO No. RLLU06528 to Fenner, dated March 15, 2013
- PO No. RLLU06343 to Paramount Forge, dated February 22, 2013
- PO No. RLLU05824 to Askew Hardware and Supply Co., dated November 19, 2012
- PO No. RLLU02338 to Askew Hardware and Supply Co., dated May 26, 2011
- PO No. RLLU02491 to Flowserve Kalamazoo, dated June 22, 2011
- PO No. RLLU01111 to Bradken Atlas Limited Partnership, dated October 12, 2010
- PO No. RLLU02964 to Penn Iron Works Inc., dated August 8, 2011
- PO No. RLLU02661 to Canada Alloy Castings, Ltd., dated July 14, 2011
- PO No. RLLU04661 to Askew Hardware and Supply Co., dated May 8, 2012
- PO No. RLLU03070 to Bradken Atlas Limited Partnership, dated September 12, 2011
- PO No. RLLA23463 to Oscar's Machine Shop & Repair, dated December 22, 2009
- PO No. RLLA25889 to Precision Babbit Co., dated February 15, 2012
- 2013 External Audit Schedule
- Vendor Status Memo (VSM) for Tangent Labs, dated December 5, 2012
- VSM for Transcat - Anaheim, dated December 10, 2012
- VSM for Transcat - Houston, dated December 10, 2012

- VSM for Webber Gage Division, dated December 7, 2012
- VSM for CLI Metrology, dated February 11, 2013
- VSM for Hytorc Wind of Los Angeles, dated February 27, 2013
- VSM for The LS Starrett Company, dated April 2, 2013
- VSM for Alden Research Laboratory, dated October 16, 2012
- VSM for Dytran Instruments, dated October 16, 2012
- VSM for Fluke Corporation, dated October 19, 2012
- VSM for S. Himmelstein and Company, dated December 4, 2012
- VSM for Trust Manufacturing, dated September 18, 2012
- VSM for Sandvik Material Technology, dated September 18, 2012
- External audit of CLI Metrology, dated March 2, 2012
- External audit of Precision Babbit Company, dated May 21, 2010
- External audit of Askew Industrial Corp, dated January 15, 2013
- External audit of Iron Mountain, dated June 9, 2012
- External audit of Penn Iron Works, dated April 18, 2012
- External audit of FLS Kalamazoo, dated January 24, 2013
- External audit of CLI Metrology, dated February 4, 2010
- External audit of Oscar Machine Shop & Repair, dated October 3, 2012
- External audit of Precision Babbit Company, dated June 15, 2012
- External audit of Durkee Testing Laboratories, dated January 8, 2013
- External audit of Paramount Forge, dated May 24, 2012
- External audit of Barber Welding & Manufacturing, dated September 11, 2012
- External audit of Exova, dated March 3, 2012
- External audit of Braken-Atlas, dated June 15, 2012
- External audit of Cook Induction Heating Company, dated May 18, 2012

- External audit of Cambridge Materials Testing Limited, dated October 4, 2012
- Commercial Grade Survey of Certified Testing Systems, dated October 2, 2012
- Commercial Grade Survey of Specialty Seal, dated June 10, 2011
- Commercial Grade Survey of Swanson Industries – Laser Processing, dated August 21, 2012
- Commercial Grade Survey of Fenner Advance Sealing Technology (EGC Critical Component), dated October 31, 2012
- Commercial Grade Survey for Parco Inc., dated September 25, 2012
- Commercial Grade Survey of Team Industrial Kitchener, dated December 12, 2012
- 2013 Annual Internal Audit Schedule, Revision 2, dated March 19, 2013
- Internal Audit INT-12-005, “Nonconformance Control,” dated August 5, 2012
- Internal Audit INT-12-006, “Measuring and Testing Equipment,” dated September 28, 2012
- Internal Audit INT-12-008, “Procurement Document Control,” dated July 25, 2012
- Internal Audit INT-12-009, “Test Control,” dated August 25, 2012
- Internal Audit INT-12-012, “Purchased Items and Services,” dated July 25, 2012
- Internal Audit INT-12-013, “Design Control,” dated September 3, 2012
- Internal Audit INT-12-018, “Corrective Action,” dated December 10, 2012
- Internal Audit INT-12-020, “Audits,” dated December 22, 2012
- Annual Supplier Performance Review Schedule
- Annual evaluation of TW Metals - Nuclear Materials, dated September 25, 2012
- Annual evaluation of Weldstar Company, dated September 25, 2012
- Annual evaluation of Trust Manufacturing, dated September 25, 2012
- Annual evaluation of Sandvic Material Technology, dated September 25, 2012
- Annual evaluation of Steel Industries, dated September 25, 2012
- Annual evaluation of Patriot Forge, dated September 25, 2012
- Annual evaluation of Proto Space Engineering, dated September 25, 2012

- Annual evaluation of Paramount Forge, dated September 25, 2012
- Annual evaluation of John Crane Inc., dated September 25, 2012
- Annual evaluation of Johnson Brass & Machine, dated September 25, 2012
- Training and qualification records for the following auditors and lead auditors: Bruce Wheeler, Brad Boothe, Mark Mauer, Royeterell Stewart and Kent A. Huber
- Training and qualification records for the following Quality Control Inspectors: Camilo Galzote, John Ao, and Gerald Muenz
- Training and qualification records for 3 test engineers, 4 nondestructive examination inspectors, and 2 welders
- Test Procedure 156RLCU00087, “6x19 WD single stage AP1000 RNS [Normal Residual heat Removal] Centrifugal Pump”
- Test Report No. 156RLCU00087, “6x19 WD Single Stage AP1000 RNS Centrifugal Pump”
- Test Report No. 10RLCU0009201001, “2K2X1-10ARV Mark III 1 Stage Pump”
- FLTP-T-0001, “Performance testing of Horizontal Motor Driven Pumps,” Revision C, dated January 5, 2003
- Certified Material Test Report and Certificate of Compliance No. 473889 for a safety-related round bar, ASTM A-276, 3.5-in Outside Diameter, 49-in Long from Paramount Forge, dated April 9, 2013
- Certificate of Conformance No. 2869 for material BRZ C9380, ASTM B271, dated April 9, 2012
- Certificate of Conformance No. 64321 for material ASME SA-479, Type XM19, dated January 4, 2012
- Certificate of Conformance No. 652384 for material ASTM SA213, Type 304, dated June 25, 2012
- Certificate of Conformance No. 135429 for material ASTM A-193, Grade B8R Class 1C, dated March 20, 2013
- Certificate of Compliance No. 7003396 for material ASTM A240, Type 304, dated June 27, 2012
- Inspection Report for Order No. RLLU02638, dated October 25, 2011
- Receipt Inspection Report (RIR) No. 35682 for a stuffing box bearing, dated March 30, 2012
- RIR No. 7012529 for a hexagonal screw and cap, dated January 29, 2012

- RIR No. 7003396 for a cover PBD, dated July 9, 2012
- RIR No. 7001683 for a piece of tubing, dated August 1, 2012
- RIR No. 7010120 for a hexagonal screw and cap, dated March 21, 2012
- From the Flowserve's Open Nonconformance Report (NCR) Management Review Board Report, dated April 9, 2013:
  - NCR Nos. 14759, 15163, 15166, 15398, 15404, 16266, 16320, 16338, 16354, 16355, 16361, 16368, 16370, 16371, 16376, 16381, 16383, 16386, 16390, 16393, 16395, 16396, 16402, 16403, 16406, 16407, 16408, 16409, 16410, 16411 and 16419
  - CAR Nos. 39893, 60312, 104172, 104173, 144172, 144175, 144272, 155772, 155352, 155353, 156712, 156713, 156732, 156752, 156772, 156792, 156812, 159652, 159653, 161832, 161872, 161912, 161983, 161932, 163572, 164272, 164292, 164312, 164332, 164372, 164392, 164412, 164432, 164452, 164492, 164512, 166272, 166392 and 167172