

October 25, 2012

Mr. Jeffery McConkey, Quality Assurance Manager  
Flowserve Corporation  
Limitorque Valve Operator Manufacturer  
5114 Woodall Road  
Lynchburg, VA 24502

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION REPORT  
NO. 99900100/2012-201 NOTICE OF VIOLATION, AND NOTICE OF  
NONCONFORMANCE

Dear Mr. McConkey:

From September 10, 2012, through September 13, 2012, the U.S. Nuclear Regulatory Commission (NRC) staff conducted a limited scope inspection at the Flowserve, Limitorque facility (hereafter referred to as Flowserve), in Lynchburg, VA. The inspection assessed Flowserve's compliance with 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." The technically focused inspection specifically evaluated quality assurance activities associated with the fabrication, manufacturing, assembly, and testing activities of motor-operated valve (MOV) actuators, actuators being supplied to the AP-1000 and operating U.S. nuclear power plants, and the status of corrective actions associated with identified violations and nonconformances documented in NRC Inspection Report (IR) 99900100/2011-201. The enclosed report presents the results of this inspection. This inspection report does not constitute the NRC's endorsement of your overall quality assurance or 10 CFR Part 21 programs.

Based on the results of this inspection, the NRC has determined that one Severity Level IV violation of NRC requirements occurred. The NRC evaluated the violation in accordance with the agency's Enforcement Policy, which is available on the NRC's Web site at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>.

The enclosed Notice of Violation (notice) cites this violation, and the inspection report describes the circumstances surrounding it. Flowserve failed to: (1) adopt appropriate procedures to identify when a deviation is discovered, reviewed, evaluated, and approved by the Part 21 committee, and (2) evaluate deviations identified in Evaluation Reports 11-69 and 11-72 within 60 days of discovery in accordance with 10 CFR 21.21, "Notification of Failure to Comply or Existence of a Defect and Its Evaluation."

You are required to respond to this letter and should follow the instructions specified in the enclosed notice when preparing your response. If you have additional information that you believe the NRC should consider, you may provide it in your response. The NRC review of your response to the notice also will determine if further enforcement action is necessary to ensure compliance with regulatory requirements.

In addition, during this inspection, the NRC inspection team found that implementation of your quality assurance program did not meet certain NRC requirements imposed on Flowserve by its customers or NRC licensees. Specifically, the NRC inspection team determined that Flowserve was not fully implementing its quality assurance program in training, design control, inspections, and corrective actions consistent with regulatory and contractual requirements and applicable procedures. The specific findings and references to the pertinent requirements are identified in the enclosed notice of nonconformance (NON) to this letter, and the enclosed IR describes in detail the circumstances surrounding them.

Information on the Limitorque MOV actuators for the AP-1000 reactor design is summarized in this letter and its enclosures to avoid disclosure of proprietary material. This letter and its enclosures will be withheld for 5 days from the date of issuance to allow you to identify any information you consider proprietary. If you consider any information in this letter or its enclosures to be proprietary, you must submit a timely request to the NRC to withhold that information in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice."

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

In accordance with 10 CFR 2.390, the NRC will make a copy of this letter, its enclosure(s), and your response available electronically for public inspection in the NRC's Public Document Room or from the NRC's Agencywide Documents Access and Management System, accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or Safeguards Information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, please submit a bracketed copy of your response that identifies the information that should be protected, along with 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 would create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

/RA/

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

In addition, during this inspection, the NRC inspection team found that implementation of your quality assurance program did not meet certain NRC requirements imposed on Flowserve by its customers or NRC licensees. Specifically, the NRC inspection team determined that Flowserve was not fully implementing its quality assurance program in training, design control, inspections, and corrective actions consistent with regulatory and contractual requirements and applicable procedures. The specific findings and references to the pertinent requirements are identified in the enclosed notice of nonconformance (NON) to this letter, and the enclosed IR describes in detail the circumstances surrounding them.

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

In accordance with 10 CFR 2.390, the NRC will make a copy of this letter, its enclosure(s), and your response available electronically for public inspection in the NRC's Public Document Room or from the NRC's Agencywide Documents Access and Management System, accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or Safeguards Information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, please submit a bracketed copy of your response that identifies the information that should be protected, along with 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 would create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

/RA/

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

Docket No.: 99900100

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RidsNroDcipCMVB  
AP-1000 CONTACTS

NRC-001

OFFICE	NRO/DCIP/CEVB	NRO/DCIP/CEVB	NRO/DCIP/CMVB	NRO/DCIP/CEVB	NRO/DE/SEB1
NAME	SSmith	DBollock	PCoco	GNewman	TScarborough
DATE	10/25/2012	10/19/2012	10/22/2012	10/25/2012	10/16/2012
OFFICE	R-II/DCI/CIB1	NRO/DCIP/CAEB	NRO/DCIP/CITB	NRO/DCIP/CEVB	
NAME	GCrespo	TFrye	MKowal	RRasmussen	
DATE	10/19/2012	10/24/2012	10/23/2012	10/25/2012	

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## NOTICE OF VIOLATION

Flowserve, Limitorque  
Lynchburg, VA 24502

Docket No. 99900100  
Report No. 2012-201

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted at the Flowserve, Limitorque facility in Lynchburg, VA, from September 10, 2012, through September 13, 2012, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Title 10 of the *Code of Federal Regulations* (10 CFR) 21.21, "Notification of Failure to Comply or Existence of a Defect and Its Evaluation," requires, in part, that "each individual, corporation, partnership, dedicating entity, or other entity subject to the regulations in this part shall adopt appropriate procedures to evaluate deviations and failures to comply to identify defects and failures to comply associated with substantial safety hazards as soon as practicable...in all cases within 60 days of discovery, in order to identify a reportable defect or failure to comply that could create a substantial safety hazard, were it to remain uncorrected."

Contrary to the above, as of September 10, 2012, Flowserve failed to:

1. Adopt appropriate procedures to identify when a deviation is discovered, reviewed, evaluated, and approved by the Part 21 committee. Specifically, the use of terms "evaluation", "deviation", and "defect" in QAP 13.2, "Reporting Defects for Safety Related Equipment," were inconsistent within the procedure and inconsistent with the definitions in 10 CFR 21.3, "Definitions."
2. Evaluate deviations identified in Evaluation Reports 11-69 and 11-72 within 60 days of discovery.

These issues have been identified as Violation 99900100/2012-201-01.

This is a Severity Level IV violation (Section 6.9.d of the NRC Enforcement Policy).

Pursuant to the provisions of 10 CFR 2.201, "Notice of Violation," Flowserve is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, Attn.: Document Control Desk, Washington, DC 20555-001 with a copy to the Chief, Electrical Vendor Branch, Division of Construction Inspection and Operational Programs, Office of New Reactors, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation;" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence if the correspondence adequately addresses the required response. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you also should provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>, it should not, to the extent possible, include any personal privacy, proprietary, or Safeguards Information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Specific Requirements."

In accordance with 10 CFR 19.11, "Posting of Notice to Workers," you may be required to post this notice within 2 working days of receipt.

Dated this 25th day of October 2012.

## NOTICE OF NONCONFORMANCE

Flowserve, Limatorque  
Lynchburg, VA 24502

Docket No. 99900100  
Report No. 2012-201

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted at the Flowserve, Limatorque facility in Lynchburg, VA, from September 10, 2012, through September 13, 2012, it appears that certain activities were not conducted in accordance with NRC requirements that were contractually imposed upon Flowserve by its customers or by NRC licensees.

- A. Criterion XVI, "Corrective Action," of Appendix B, to Title 10 of the *Code of Federal Regulation* (10 CFR) Part 50 states, in part, that "[m]easures 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."

Flowserve Quality Management System Manual (QMSM), Revision 4, dated June 27, 2011, in Section 8.5.2 states that corrective action shall be appropriate to the effects of the nonconformities encountered.

Contrary to the above, as of September 10, 2012, Flowserve failed to take corrective action to resolve several inadequacies in its program for the design, production, and testing of safety-related Limatorque motor-operated valve actuators consistent with the NRC regulations and Flowserve policies and procedures. These inadequacies include the following:

- Flowserve did not complete the extent of condition review for application of the Configurator software over the previous 2 years specified in the Flowserve letter dated August 2, 2011, in response to NRC Inspection Report No. 99900100/2011-201.
- Flowserve did not complete the extent of condition review and the quarterly independent calculations of the Center of Gravity computer software consistent with the completion date of September 12, 2011, specified in the Flowserve letter dated August 2, 2011, in response to NRC Inspection Report No. 99900100/2011-201.
- Flowserve failed to generate a discrepant material report to identify a failure to meet an inspected attribute during the inspection of gear limit switches.
- Flowserve failed to promptly identify and correct six customer complaints in its corrective action program.

These issues have been identified as Nonconformance 99900100/2012-201-02.

- B. Criterion III, "Design Control," of Appendix B to 10 CFR Part 50 states, in part, "Measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems, and components."

Flowserve QMSM, Section 7.3.3 states, in part, "Acceptance criteria conforms to the applicable regulatory industry consensus standard requirements and identifies the characteristics of the design necessary to ensure proper functioning of the product."

Flowserve Procedure QCAP 10.10, "Commercial Grade Dedication," Section 6.6.2, states, "Fasteners material characteristics will be verified by testing the hardness of the fasteners."

Contrary to the above, as of September 10, 2012, Flowserve failed to verify the adequacy of certain design features associated with Grade 5 Hex Head Cap Screws that were procured from commercial suppliers and dedicated by Flowserve for use in safety-related applications. Specifically, the material characteristics of the cap screws were tested on a limited basis from the shipment received from the distributor without establishing a basis for lot sampling. Flowserve failed to verify the source of the screws or traceability from the original manufacturer.

This issue has been identified as Nonconformance 99900100/2012-201-03.

- C. Criterion X, "Inspection," of Appendix B to 10 CFR Part 50 states, in part, "A program for inspection activities affecting quality shall be established and executed by or for the organization performing the activity to verify conformance with the documented instructions, procedures, and drawings for accomplishing the activity. Such inspection shall be performed by individuals other than those who performed the activity being inspected."

Contrary to the above, as of September 10, 2012, Flowserve failed to ensure that individuals performing quality inspections for commercial-grade dedication do not perform assembly work. Specifically, the quality control inspector performing the inspection of three four-train geared limit switches disassembled one limit switch when it did not pass one of its critical characteristic checks, performed work to correct the problem, reassembled, did not document, and retested the switch.

This issue has been identified as Nonconformance 99900100/2012-201-04.

- D. Criterion II, "Quality Assurance Program," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," states, in part, that "the program shall provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained."

Criterion XVII, "Quality Assurance Records," of Appendix B to 10 CFR Part 50 states, in part, that "sufficient records shall be maintained to furnish evidence of activities affecting quality. The records shall include at least the following: Operating logs and the results of reviews, inspections, tests, audits, monitoring of work performance, and materials analyses. The records shall also include closely-related data such as qualifications of personnel, procedures, and equipment."

"Flowserve Quality Management System Manual," Section 1.1, states, in part, "that the Lynchburg facility will also comply with [American Society for Mechanical Engineers] NQA-1-1994."

American Society of Mechanical Engineers standard NQA-1-1994, "Quality Assurance Requirements for Nuclear Facility Applications," Supplemental Requirement 2S-1, "Supplementary Requirements for the Qualification of Inspection and Test Personnel," Section 2.6 states, "The job performance of inspection and test personnel shall be reevaluated at periodic intervals not to exceed 3 years."

Contrary to the above, as of September 10, 2012, Flowserve failed to establish a program to maintain proficiency for test personnel and maintain sufficient records to demonstrate maintenance of qualification. Specifically, QAP 18.1, "Indoctrination and Training," Revision 13, dated December 11, 2009, and QAP 10.1, "Test Laboratory Procedures," Revision 12, dated November 20, 2008, failed to describe the requirements for conducting or documenting requalification testing for test personnel. Additionally, Flowserve was unable to provide evidence that two test personnel had been trained in the diagnostic testing equipment being used or that they had maintained proficiency since training conducted in 1993.

This issue has been identified as Nonconformance 99900100/2012-201-05.

Please submit 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, Mechanical Vendor Branch, 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 noncompliance, and (4) the date the corrective action will be completed. If you should require more time and can show good cause, the NRC will consider 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 (accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>), do not include—to the extent possible—any personal privacy, proprietary, or Safeguards Information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Dated at Rockville, MD, this 25th day of October 2012.



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

Docket No.: 99900100

Report No.: 99900100/2012-201

Vendor: Flowserve, Limitorque  
5114 Woodall Road  
Lynchburg, VA 24502

Vendor Contact: Mr. Jeff McConkey  
Quality Assurance Manager

Background: Flowserve Limitorque Actuation Systems manufacturing facility is located in Lynchburg, VA. The Limitorque Corporation has been providing valve operators to the U.S. and international nuclear community since construction of nuclear power plants began. Most U.S. operating nuclear power plants use Limitorque actuators. Flowserve Limitorque actuators will be used in new reactor designs, including the AP-1000 reactor design, which will be constructed in the United States in the near future, and in the Chinese AP-1000 nuclear power plants. Several years ago, Flowserve Corporation, an international pumps and valves manufacturer, purchased Limitorque. This inspection will be the second inspection of Flowserve Limitorque Actuation Systems since the purchase of the Limitorque Corporation.

Inspection Dates: September 10–13, 2012

Inspection Team:	Stacy Smith	NRO/DCIP/CEVB, Team Leader
	Doug Bollock	NRO/DCIP/CEVB
	Paul Coco	NRO/DCIP/CMVB
	Guillermo Crespo	R-II/DCI/CIB1
	Garrett Newman	NRO/DCIP/CEVB
	Thomas Scarbrough	NRO/DE/CIB

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

## **EXECUTIVE SUMMARY**

Flowserve, Limitorque  
99900100/2012-201

The U.S. Nuclear Regulatory Commission (NRC) conducted this inspection to verify that Flowserve, Limitorque (hereafter referred to as Flowserve) implemented an adequate quality assurance (QA) program for the design and manufacturing of the safety-related Limitorque motor-operated valve (MOV) actuators for the AP-1000 reactor design and operating nuclear power plants (NPPs) that complied 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 performed this inspection to verify that Flowserve implemented a program under 10 CFR Part 21, "Reporting of Defects and Noncompliance," that met the NRC's regulatory requirements. The NRC staff previously conducted an inspection of the Part 21 and QA programs at the Flowserve facility from February 28, 2011, through March 2, 2011. NRC Inspection Report No. 99900100/2011-201, dated April 22, 2011, documents the results of that inspection (ML111101696). During this inspection, the team reviewed the improvements to the QA program for safety-related Limitorque MOV actuators in response to that 2011 inspection.

The NRC conducted the inspection at the Flowserve facility, in Lynchburg, VA, on September 10 through 13, 2012.

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

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

During the conduct of this inspection, the NRC inspection team implemented Inspection Procedure (IP) 43002, "Routine Vendor Inspections," as supplemented by IP 43004, "Inspection of Commercial-Grade Dedication Programs," and IP 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance."

The NRC inspection team observed various activities associated with the design, manufacturing, and assembly of the AP-1000 and operating NPP safety-related Limitorque MOV actuators, conducted interviews with responsible Flowserve personnel, and reviewed documents to determine if Flowserve performed these activities in accordance with the applicable design, quality, and technical requirements imposed in the purchase orders (POs). Some of the activities the NRC inspection team observed include:

- receipt inspection and dedication of fasteners
- daily discrepant material report meeting
- daily work status meeting
- L949885 Actuator Production Test for PO 112732 for the AP-1000

In addition to observing these activities, the NRC inspection team walked down Flowserve's assembly floor and verified that Flowserve had properly identified nonconforming materials, and marked them and segregated them, when practical, to ensure they were not reintroduced into the production processes. This report summarizes the results of this inspection below.

## 10 CFR Part 21 Program

The NRC inspection team reviewed Flowserve policies and implementing procedures that govern 10 CFR Part 21.

Based on this review, the NRC inspection team issued Violation 99900100/2012-201-01 in association with Flowserve's failure to implement the regulatory requirements in 10 CFR 21.21, "Notification of Failure to Comply or Existence of a Defect and Its Evaluation." Specifically, Flowserve failed to: (1) adopt appropriate procedures to identify when a deviation is discovered, reviewed, evaluated, and approved by the Part 21 committee, and (2) evaluate deviations identified in Evaluation Reports 11-69 and 11-72 within 60 days of discovery.

## Nonconforming Materials, Parts, or Components and Corrective Action

The NRC inspection team concluded that Flowserve is implementing its policies and procedures that govern Nonconforming Material, Parts, or Components consistent with the regulatory requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," of Appendix B to 10 CFR Part 50.

However, the NRC inspection team issued Nonconformance 99900100/2012-201-02 in association with Flowserve's failure to implement the regulatory requirements of Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50. Specifically, Flowserve failed to take corrective actions to resolve several inadequacies in its program for the design, production, and testing of safety-related Limitorque MOV actuators.

## Design Validation and Control

The NRC inspection team reviewed Flowserve policies and implementing procedures that govern the design control activities for Limitorque MOV actuators to be used in safety-related applications in nuclear power plants to verify compliance with the requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50.

Based on this review, the NRC inspection team issued Nonconformance 99900100/2012-201-03 in association with Flowserve's failure to implement the regulatory requirements of Criterion III of Appendix B to 10 CFR Part 50. Specifically, the material characteristics of the cap screws were tested on a limited basis from the shipment received from the distributor without establishing a basis for lot sampling. Flowserve failed to verify the source of the screws or traceability from the original manufacturer.

In addition, the NRC inspection team issued Nonconformance 99900100/2012-201-04 in association with Flowserve's failure to implement the regulatory requirements of Criterion X, "Inspections," of Appendix B to 10 CFR Part 50. Specifically, a quality control inspector performing the inspection of three 4-train geared limit switches disassembled one limit switch when it did not pass one of its critical characteristic checks, performed work to correct the problem, reassembled, did not document, and retested the switch.

## Training and Qualification of Personnel

The NRC inspection team reviewed Flowserve policies and implementing procedures that govern the training and qualification of Flowserve personnel to verify compliance with the

requirements of Criterion II, "Quality Assurance Program," and Criterion XVII, "Quality Assurance Records," of Appendix B to 10 CFR Part 50.

Based on this review, the NRC inspection team issued Nonconformance 99900100/2012-201-05 in association with Flowserve's failure to implement the regulatory requirements of Criterion II and Criterion XVII of Appendix B to 10 CFR Part 50. Specifically, Flowserve was unable to provide evidence that two test personnel had been trained in the diagnostic testing equipment being used or that they had maintained proficiency since training conducted in 1993.

#### Oversight of Contracted Activities and Audits

The NRC inspection team concluded that Flowserve is implementing its policies and implementing procedures that govern the oversight of contracted activities consistent 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.

#### Control of Manufacturing Process

The NRC inspection team concluded that Flowserve is implementing its policies and procedures that govern test control and measuring and test equipment programs consistent with the regulatory requirements of Criterion XI, "Test Control," and Criterion XII, "Control of Measuring and Test Equipment," of Appendix B to 10 CFR Part 50, respectively.

## **REPORT DETAILS**

The Nuclear Regulatory Commission (NRC) inspection team observed various activities associated with the design, manufacturing, and assembly of the Limitorque motor-operated valve (MOV) actuators, conducted interviews with responsible Flowserve personnel, and reviewed fabrication documents to determine if Flowserve performed these activities in accordance with the applicable design, quality, and technical requirements. In addition, the NRC inspection team reviewed the improvements to the quality assurance (QA) program for safety-related Limitorque MOV actuators in response to the violations and nonconformances documented in Inspection Report (IR) 99900100/2011-201, dated April 22, 2011. Some of the activities observed by the NRC inspection team include:

- receipt inspection and dedication of fasteners
- daily discrepant material report (DMR) meeting
- daily work status meeting
- L949885 Actuator Production Test for purchase order (PO) 112732 for the AP-1000

In addition to observing these activities, the NRC inspection team walked down Flowserve's assembly floor and verified that Flowserve had properly identified nonconforming materials, and marked and segregated them, when practical, to ensure they were not reintroduced into the production processes. The attachment to this inspection report lists the documents the NRC inspection team reviewed.

### **1. 10 CFR Part 21 Program**

#### **a. Inspection Scope**

The NRC inspection team reviewed Flowserve's policies and implementing procedures that govern its program under Title 10 of the *Code of Federal Regulation* (10 CFR) Part 21 to verify compliance. In addition, the NRC inspection team reviewed a sample of 10 CFR Part 21 evaluations completed since the previous NRC inspection and Flowserve's implementation of 10 CFR 21.21, "Notification of Failure to Comply or Existence of a Defect and Its Evaluation." To verify an adequate link to the 10 CFR Part 21 process, the NRC inspection team also reviewed Flowserve's procedures that govern corrective action and nonconforming conditions to verify adequate implementation of the regulatory requirements identifying items that cause conditions adverse to quality.

#### **b. Observations and Findings**

##### **b.1 10 CFR Part 21 Procedures and Implementation**

Flowserve Quality Assurance Procedure (QAP) 13.2, "Reporting Defects for Safety Related Equipment," Revision 16, dated August 9, 2012, establishes formal guidelines by which deviations that could potentially affect the operability of any Limitorque actuator in a safety-related application are identified, evaluated, and, if necessary, reported.

The inspectors verified that Flowserve's nonconforming items and corrective action programs, as described in QAP 13.3, "Discrepant Material Report Procedure,"

Revision 16, dated July 23, 2012, and QAP 14.1, "Corrective and Preventive Action Procedure," Revision 14, dated January 31, 2011, provide a connection to the 10 CFR Part 21 program.

The NRC inspection team noted that QAP 13.2 used terms such as "evaluation", "deviation" and "defect" inconsistently within the procedure and inconsistent with the definitions in 10 CFR 21.3, "Definitions." For example, Section 5.0 of QAP 13.2 is titled "Evaluating Reported Defects." Per 10 CFR 21.3, *evaluations* are the process used to determine if a *deviation* could create a substantial safety hazard.

QAP 13.2, Section 5.1 states that evaluation of reported conditions shall be accomplished by the Part 21 committee. Section 5.3 states, in part, that "[t]he Part 21 Committee meetings shall be convened on a regular basis provided that potentially reportable conditions are under evaluation." The NRC inspection team was informed by Flowserve, that Step 5.3 referred to the technical evaluation, not the Part 21 evaluation. Flowserve acknowledged that it was during the technical evaluation that a discovery date would be assigned. Flowserve considered the technical evaluation to be the process where engineering determined if a potential defect existed and would provide the technical evaluation/rationale to the Part 21 committee for evaluation; however, the NRC inspection team considers this part of the evaluation process, and 60 day evaluation timeline, required by Part 21 to determine if a particular deviation would create a substantial safety hazard (defect).

10 CFR 21.21 states, in part, that "each individual, corporation, partnership, dedicating entity, or other entity subject to the regulations in this part shall adopt appropriate procedures to evaluate deviations and failures to comply to identify defects and failures to comply associated with substantial safety hazards as soon as practicable...in all cases within 60 days of discovery, in order to identify a reportable defect or failure to comply that could create a substantial safety hazard, were it to remain uncorrected."

The NRC inspection team identified the failure of QAP 13.2 to appropriately identify when a deviation is discovered, reviewed, evaluated, and approved by the Part 21 committee. Specifically, the use of the terms "evaluation", "deviation", and "defect" in QAP 13.2 were inconsistent within the procedure and inconsistent with the definitions in 10 CFR 21.3, "Definitions." The NRC inspection team identified this as an example of Violation 99900100/2012-201-01.

In addition, the NRC inspection team identified the following examples of Flowserve's failure to evaluate deviations within 60 days of discovery as required by Part 21:

- Evaluation Report 11-72: Flowserve received documentation of a deviation in a customer notification on August 2, 2011; however Flowserve did not document the date of discovery until October 5, 2011. In this example, the evaluation process determined this to be a reportable defect that was not reported to the NRC until November 21, 2011.
- Evaluation Report 11-69: Flowserve documented date of discovery on August 26, 2011 and completed the technical rationale on October 14,

2011; however, the evaluation was not completed by the Part 21 committee until November 3, 2011.

b.2 Purchase Orders (POs)

The NRC inspection team reviewed a sample of POs to verify that Flowserve had implemented a program consistent with the requirements described in 10 CFR 21.31, "Procurement Documents," which specify the applicability of 10 CFR Part 21 in POs for safety-related services. The NRC inspection team verified that Flowserve imposed the requirements of 10 CFR Part 21 on qualified suppliers with programs that met the requirements of Appendix B to 10 CFR Part 50.

b.3 Closure of Violation 99900100/2011-201-01

The NRC issued Violation 99900100/2011-201-01 in the 2011 NRC inspection and identified that Limitorque had not completed an evaluation, nor prepared and submitted an Interim Report to the Commission for an ongoing Part 21 evaluation initially identified on September 28, 2010.

During the current inspection, the NRC inspection team verified the response Flowserve provided to the NRC, dated August, 12, 2011 (Agencywide Document Accession & Management System (ADAMS) accession number ML11229A768), and that the NRC accepted, September 29, 2011 (ADAMS accession number ML112650760), to ensure all actions were completed associated with this violation. Although the NRC inspection identified an additional violation regarding the time to evaluate a deviation and report a defect, 99900100/2012-201-01, the NRC inspection team determined that Flowserve adequately addressed the specific violation previously identified and has closed Violation 99900100/2011-201-01.

b.4 Closure of Violation 99900100/2011-201-02

The NRC issued Violation 99900100/2011-201-02 in the 2011 NRC inspection and identified that Limitorque failed to document the basis for determining a nonconforming condition associated with safety-related corrective action to be "Not Reportable" or "Not Applicable."

During the current inspection, the NRC inspection team verified the response Flowserve provided to the NRC, dated August, 12, 2011, and that the NRC accepted, September 29, 2011, to ensure all actions were completed associated with this violation. The NRC inspection team did not identify any issues and has closed Violation 99900100/2011-201-02.

b.5. Closure of Violation 99900100/2011-201-03

The NRC issued Violation 99900100/2011-201-03 in the 2011 NRC inspection and identified that Limitorque issued procurement documents for basic components that did not impose the provisions of 10 CFR Part 21.

During the current inspection, the NRC inspection team verified the response Flowserve provided to the NRC, dated August, 12, 2011, and that the NRC

accepted, September 29, 2011, to ensure all actions were completed associated with this violation. The NRC inspection team did not identify any issues and has closed Violation 99900100/2011-201-03.

c. Conclusion

The NRC inspection team issued Violation 99900100/2012-201-01 in association with Flowserve's failure to implement the regulatory requirements in 10 CFR 21.21, "Notification of Failure to Comply or Existence of a Defect and Its Evaluation." Specifically, Flowserve failed to: (1) adopt appropriate procedures to identify when a deviation is discovered, reviewed, evaluated, and approved by the Part 21 committee, and (2) evaluate deviations identified in Evaluation Reports 11-69 and 11-72 within 60 days of discovery.

**2. Nonconforming Materials, Parts, or Components and Corrective Action**

a. Inspection Scope

The NRC inspection team reviewed Flowserve policies and implementing procedures that govern the implementation of Flowserve's nonconforming material, parts, or components and corrective actions consistent with the regulatory requirements of Criterion XV and Criterion XVI of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed a sample of corrective action documents associated with 10 CFR Part 21 evaluations and customer complaint notifications. In addition, the NRC inspection team reviewed a sample of safety-related discrepant material reports (DMRs) to verify that nonconforming items were reviewed and dispositioned in accordance with Flowserve's implementing procedures.

b. Observations and Findings

b.1 Procedures

QAP 13.3, "Discrepant Material Report Procedure," Revision 16, dated July 23, 2012, defines those conditions that are documented by the issuance of a DMR, the manner in which the report is completed, the process for the resolution of a DMR, and the manner by which these DMRs are evaluated and provide a connection to the 10 CFR Part 21 program.

QAP 14.1, "Corrective and Preventive Action Procedure," Revision 14, dated January 31, 2011, defines the various measures to identify cause, determine, and implement corrective and preventive action, as a result of either hardware or programmatic deficiency and provides a connection to the 10 CFR Part 21 program.

b.2 Implementation of the Nonconforming Materials, Parts, or Components Program

The NRC inspection team verified that the disposition documentation for repaired or use-as-is items contained adequate justifications and that repaired or use-as-is items were subject to design control measures commensurate with those applied to the original design specification. The NRC inspection team also attended a



DMR meeting in which various organizations attended to claim reasonability for DMR items for further adjudication.

The NRC inspection team verified that Flowserve's process for controlling nonconforming materials provides guidance to evaluate nonconformances for 10 CFR Part 21 reporting. However, Section 3.b.2, "Dedication and Accepting Testing of Subcomponents," documents an example of inadequate corrective actions cited in Nonconformance 99900100/2012-201-02 for Flowserve's failure to generate a DMR to identify a failure to meet an inspected attribute during the inspection of gear limit switches.

### **b.3 Implementation of the Corrective Action Program**

QAP 14.1 defines multiple methods to document conditions or trends adverse to quality, including the following: DMR, Audit Deficiency Notice (ADN), Customer Complaint (CC), Quality Alert, Customer Specific Forms (i.e. SDR, QDR, etc.), (LCAR), and Supplier Corrective Action Request (SCAR).

Through interviews with the Flowserve QA personnel, the NRC inspection team determined that a CC is initiated when a customer requests a corrective action and when any complaint from a customer addresses safety-related components. However, the NRC inspection team identified six examples of safety-related conditions adverse to quality, CCs 11-43, 11-72, 11-88, 11-96, 12-127, and 12-128, that were not promptly identified and corrected in Flowserve's CAP in accordance with QAP 14.1.

Criterion XVI of Appendix B to 10 CFR Part 50 states, in part, that "[m]easures 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."

Contrary to the above, Flowserve failed to identify and track corrective actions associated with customer complaints in accordance with QAP 14.1 and Criterion XVI. This has been identified as an example of Nonconformance 99900100/2012-201-02.

### **c. Conclusion**

The NRC inspection team issued Nonconformance 99900100/2012-201-02 in association with Flowserve's failure to implement the regulatory requirements of Criterion XVI of Appendix B to 10 CFR Part 50. Specifically, Flowserve failed to identify and track corrective actions associated with customer complaints and failed to promptly enter corrective actions from 10 CFR Part 21, "Reporting of Defects and Noncompliance," evaluations into their corrective action process.

Furthermore, the NRC inspection team identified additional examples of inadequate corrective action that are documented in Section 3, "Design Control."

## **3. Design Control**

### **a. Inspection Scope**

The NRC inspection team reviewed Flowserve policies and implementing procedures that govern the design control activities for the Limitorque MOV actuators to be used in safety-related applications in NPPs to verify compliance with the requirements of Criterion III of Appendix B to 10 CFR Part 50. The team performed its review through discussions with Flowserve personnel, review of Flowserve policies and procedures related to design control, evaluation of a sample of purchase orders and their processing, observation of dedication activities for a sample of actuator parts, and observation of manufacturing and testing activities, to the extent possible, during the inspection.

b. Observations and Findings

b.1 Design Control

In the April 2011 NRC IR, the NRC inspection team documented Flowserve's failure to perform independent reviews of changes to the Center of Gravity software as an example of Nonconformance 99900100/2011-201-04. During this inspection, the NRC inspection team discussed with Flowserve personnel the activities to verify and validate the use of this software in the design process for safety-related Limitorque MOV actuators. The NRC inspection team verified that Flowserve performed some of the actions necessary to verify and validate the Center of Gravity software; however, Flowserve did not adequately dedicate the software. Specifically, Flowserve did not institute adequate measures to identify appropriate acceptance methods and critical characteristics to verify suitability of the software. Flowserve generated LCAR 12-04, dated September 13, 2012, to address this concern. Due to actions previously taken by Flowserve to utilize this software for safety-related design application and the identification of additional corrective actions that will be taken to dedicate the software, addressed in LCAR 12-04, the NRC inspection team has documented this issue as a minor nonconformance. However, the NRC inspection team also identified that Flowserve did not complete the extent of condition review and the quarterly independent calculations of the Center of Gravity computer software consistent with the completion date of September 12, 2011, specified in the Flowserve letter dated August 2, 2011, in response to NRC Inspection Report No. 99900100/2011-201. This is documented in Section 3.b.3, "Status of Nonconformance 99900100/2011-201-04."

The NRC inspection team observed Flowserve testing of the torque output and torque switch settings of a safety-related Limitorque SB-00 actuator with Serial No. L949885 to be supplied to Flowserve Raleigh under P.O. No. 112732. The NRC inspection team found that Flowserve was conducting the torque testing of this actuator in an acceptable manner using QAP 10.1, "Test Laboratory Procedures," and other associated test procedures.

b.2 Dedication and Acceptance Testing of Subcomponents

The NRC inspection team reviewed QCP-10.10, "Commercial Grade Dedication," Revision 9, dated September 29, 2011, and noted that it identifies the method for performing commercial-grade dedication. The document discusses the technical and quality requirements for performing a dedication and process to develop a

specific inspection plan for each component. The inspection plans are developed with engineering to determine critical characteristics to be verified during inspection. Flowserve also uses Quality Control Instruction (QCI)-10.7, "Sample Inspection Plan," to help determine sampling plans for certain commercial material parts that are part of the assembly of the safety-related components. Section 6.0 of QCP-10.10 states that items meant for commercial use that will be dedicated for safety-related use will use a commercial-grade survey in conjunction with Electric Power Research Institute (EPRI) Method 1 testing for dedication.

Industrial Products Company (IPC) provided Grade 5 hex head cap screws that Flowserve was dedicating for AREVA under PO 1012058146. The NRC inspection team discovered that Flowserve does not perform commercial-grade surveys of IPC. The NRC inspection team also identified that during the dedication process of these screws, employees only performed a hardness test to check the material characteristics of the screws on three of the 500 screws bought commercially from IPC. IPC is a distributor of these parts, not the manufacturer. The NRC inspection team discovered that Flowserve treated the 500 screws as a lot, sampling only three as representation of the group they procured, following QCI-10.7, "Sample Inspection Plan," Revision 3, dated May 14, 2010. Without verifying traceability of the commercially procured items through the distributor to the manufacturer, there is no assurance that the group of screws purchased is of the proper material content by testing such a small amount. The failure to properly dedicate Grade 5 hex head cap screws is identified as Nonconformance 99900100/2012-201-03. Flowserve issued LCAR 12-08, dated September 17, 2012, to address this issue.

The NRC inspection team witnessed the dedication of three 4-train geared limit switches that were to be sent to AREVA under PO 1012053802. The NRC inspection team noted the dedication was being performed following IP-10.38, "2-Train and 4-Train Geared Limit Switch Assemblies," Revision 6, dated September 3, 2012.

During the dedication process, one of the limit switch's contacts failed a conductivity check. The conductivity check was identified in the inspection plan as a critical characteristic of the limit switch. The quality control inspector disassembled the limit switch and performed work to clear a Fibrite plastic burr on one of the rotor assemblies. The inspector then reassembled the limit switch and performed the inspection again, without assembly instructions or guidance documents. The NRC inspection team concluded that this activity potentially affected attributes of the actuator that formed the basis for the overall dedication of the limit switch.

In addition, the Flowserve QA manual fails to clearly identify that for safety-related components, inspections of the quality of the component cannot be conducted by those performing work on the components, as required by 10 CFR Part 50, Appendix B, Criterion X, "Inspections."

The NRC identified Flowserve's failure to ensure that quality control inspectors performing inspections are not performing repair work and then inspecting their own work as Nonconformance 99900100/2012-201-04. Flowserve issued LCAR 12-01, dated September 13, 2012, to address this issue.

Furthermore, Flowserve failed to initially enter the failed conductivity test into its corrective action process until questioned by the NRC inspection team. QAP 13.3, "Discrepant Material Report Procedure," Revision 16, dated July 23, 2012, states, in part, that, "A discrepancy is defined as a failure to meet any inspected attribute. Discrepancies may be related to drawing attributes, variances from specifications, or deviations from standard accepted practice." A separate DMR was written against a mechanical attribute out of the acceptable criteria of IP-10.38. However, Flowserve failed generate a corrective action related to the conductivity check failing the acceptance criteria for 3 days, and it was only written after NRC questioning. This is identified as an example of inadequate corrective actions that is noted in Nonconformance 99900100/2012-201-02. Flowserve generated LCAR 12-01, dated September 13, 2012, to address this concern.

**b.3 Status of Nonconformance 99900100/2011-201-04**

The NRC issued Nonconformance 99900100/2011-201-04 in the April 2011 NRC IR and identified that Limitorque failed to establish measures to assure that applicable regulatory requirements and design basis are correctly translated into specifications, drawings, procedures, and instructions; and failed to perform independent reviews of changes to software used in the manufacturing of safety-related actuators.

In Flowserve's response to the nonconformance, dated August 12, 2011, Flowserve indicated that its process had been clarified to ensure that an independent review of the Bill of Material is performed to verify that the purchase order information is properly specified. Flowserve Sales Administration Procedure (SAP) 3.4, "Configurator," instructs Flowserve personnel in the steps to process a purchase order for actuators and parts. The Flowserve contract administrator enters the purchase order information into the Limitorque business system ("Configurator") software that performs the safety-related function of preparing the bill of material for the manufacturing and testing of the equipment. The NRC inspection team determined that the independent engineering review specified in the Flowserve procedures is sufficient to verify each use of the Configurator software for design and production of safety-related Limitorque MOV actuators.

However, in the August 12, 2011, letter, Flowserve also stated that an extent of condition evaluation had been performed by Flowserve Engineering to review the last 2 years of Configurator changes. During this inspection, the NRC inspection team could not locate documentation of the extent of condition review for application of the Configurator software over the previous 2 years, as specified in the August 2, 2011, response. In addition, Flowserve stated that its Engineering Department would perform an extent of condition evaluation to review the last 2 years of Center of Gravity computer calculations, and that random hand calculations of the Center of Gravity of safety-related Limitorque MOV actuators would be performed on a quarterly basis. The NRC inspection team found that the extent of condition review and the quarterly independent calculations had not been performed consistent with the completion date of September 12, 2011, specified in the August 2, 2011, letter from Flowserve. The NRC inspection team considers these examples of inadequate corrective action, as noted in Nonconformance 99900100/2012-201-02.

Due to the issues identified above, the NRC inspection team will leave Nonconformance 99900100/2011-201-04 in the open status.

c. Conclusion

The NRC inspection team issued Nonconformance 99900100/2012-201-03 in association with Flowserve's failure to implement the regulatory requirements of Criterion III of Appendix B to 10 CFR Part 50. Specifically, Flowserve tested the material characteristics of cap screws on a limited basis from the shipment received from the distributor without verifying the source of the screws or maintaining traceability from the original manufacturer.

In addition, the NRC inspection team issued Nonconformance 99900100/2012-201-04 in association with Flowserve's failure to implement the regulatory requirements of Criterion X of Appendix B to 10 CFR Part 50. Specifically, a quality control inspector who performed the last step in the dedication process and quality control inspection of three 4-train geared limit switches disassembled one limit switch when it did not pass one of its critical characteristic checks, performed work to correct the problem, reassembled, did not document, and retested the switch.

Furthermore, the NRC inspection team identified examples of inadequate corrective action that are noted in Nonconformance 99900100/2012-201-02.

**4. Training and Qualification of Personnel**

a. Inspection Scope

The NRC inspection team reviewed the Flowserve policies and implementing procedures that govern the implementation of the Flowserve training and qualification process to verify compliance with the regulatory requirements of Criterion II of Appendix B to 10 CFR Part 50, as it relates to training and qualification of personnel. The NRC inspection team reviewed a sample of personnel training and qualification records and discussed personnel training and qualification activities with Limitorque management and technical staff to verify that Flowserve ensured that its staff performing safety-related work achieved and maintained suitable proficiency. The NRC inspection team sample included personnel who were performing assembly, inspection, testing, and auditing activities associated with ongoing safety-related work at the time of the inspection, as well as past work associated with Watts Bar and AP-1000 purchase orders.

b. Observations and Findings

The NRC inspection team noted that QAP 18.1, "Indoctrination and Training," Revision 13, dated December 11, 2009, and QAP 10.1, "Test Laboratory Procedures," Revision 12, dated November 20, 2008, failed to describe the requirements for conducting or documenting requalification testing for test personnel. The NRC inspection team determined that this deficiency was contrary to Criterion II, "Quality Assurance Program," of Appendix B to 10 CFR 50, which states, in part, that "the program shall provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained," and American Society of Mechanical Engineers (ASME) NQA-1-1994,

Supplemental Requirement 2S-1, "Supplementary Requirements for the Qualification of Inspection and Test Personnel," Section 2.6, which states, "The job performance of inspection and test personnel shall be reevaluated at periodic intervals not to exceed 3 years." The Flowserve Quality Management System Manual, Revision 4, dated June 27, 2011, states that the Lynchburg facility will comply with ASME NQA-1-1994.

As part of the NRC inspection team's observation of the testing of an SB-00 actuator under order number 120311.001, the team attempted to verify that the test personnel were qualified. The NRC inspection team requested the training records for the test personnel involved with the witnessed actuator test. Flowserve provided training records from 1993 but was unable to furnish evidence of training or qualification that was more recent or relevant to the equipment being used for testing. Specifically, the NRC inspection team noted the test personnel used digital signal converters feeding into computer software and screen displays for data acquisition; however, the training records document the last training completed by the test personnel was in 1993 on strip recorders. Flowserve indicated that the test personnel had been trained since 1993 on the test equipment, but failed to provide documented evidence.

The NRC inspection team determined that the training and qualification program for test personnel failed to meet Criteria II and XVII of Appendix B to 10 CFR 50. The NRC inspection team did not identify any deficiencies in the performance of the test as a result of the training issue; however, the NRC inspection team determined that failure to establish a program to maintain proficiency for test personnel and maintain sufficient records to demonstrate maintenance of qualification, if left uncorrected, could result in significant safety consequences. This issue has been identified as Nonconformance 99900100/2012-201-05. Flowserve issued Limiting Corrective Action Request (LCAR) 12-05, dated September 17, 2012, to address this issue.

c. Conclusions

The NRC inspection team issued Nonconformance 99900100/2012-201-05 in association with Flowserve's failure to implement the regulatory requirements of Criterion II and Criterion XVII of Appendix B to 10 CFR Part 50. Specifically, Flowserve failed to establish a program to maintain proficiency for test personnel. Additionally, Flowserve was unable to provide evidence that two test personnel had been trained in the test equipment being used or that they had maintained proficiency since training conducted in 1993.

**5. Oversight of Contracted Activities and Audits**

a. Inspection Scope

The NRC inspection team reviewed the Flowserve policies and implementing procedures that govern the implementation of Flowserve's oversight of contracted activities to verify compliance with the regulatory requirements of Criterion IV, Criterion VII, and Criterion XVIII of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed a sample of purchase documents associated with Limiting MOV actuators for operating and new reactors to evaluate compliance with the Flowserve program requirements. The NRC inspection team reviewed a sample of external audits Flowserve performed on suppliers that provided material and calibration services associated with Limiting MOV actuator manufacturing.

b. Observations and Findings

b.1 Procurement Document Control

The NRC inspection team reviewed a sample of the POs Flowserve issued in support of Limitorque MOV actuator manufacturing to determine if the requirements identified in QAP 6.1, "Purchasing Procedure," Revision 20, dated June 27, 2011, were translated into applicable purchasing documents. The NRC inspection team found that the POs adequately documented the quality, technical, and regulatory requirements. The NRC inspection team also determined that the POs adequately defined appropriate procurement requirements, such as deliverables, disposition of nonconformances, and access rights to suppliers.

b.2 Control of Purchased Material Equipment and Services

The NRC inspection team reviewed Flowserve's Approved Suppliers Listing (ASL) to verify that only qualified and approved suppliers were listed. The NRC inspection team verified that a sample of suppliers on the list had been appropriately qualified by audits. The NRC inspection team also noted that Flowserve maintains approved commercial suppliers on its ASL. Flowserve appropriately annotated the ASL to distinguish which suppliers had been qualified by audit to supply basics components (i.e., safety-related). The NRC inspection team reviewed a sample of commercial-grade surveys to verify that commercial vendors had appropriate quality controls and procedures in place to control certain critical characteristics to support commercial-grade dedication.

In addition, the NRC inspection team observed receipt inspection and commercial-grade dedication activities to verify that the procured items conformed to the purchase documents. The NRC inspection team determined that qualified personnel appropriately conducted these activities using approved inspection procedures and plans.

b.3 Internal Audits

The NRC inspection team reviewed a sample of internal audits to verify the implementation of the Flowserve internal audit program. The NRC inspection team verified that Flowserve had prepared and approved plans identifying the audit scope, focus, and applicable checklist criteria before the initiation of the audit activity. The NRC inspection team verified that the audit team was appropriately qualified.

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, as well as the applicable Flowserve procedures and policies associated with each area. The NRC inspection team verified that appropriate corrective actions were taken for the identified audit findings.

b.4 External Audits

The NRC inspection team reviewed a sample of external supplier audits to verify the implementation of Flowserve's program to qualify and maintain suppliers on the

ASL. Supplier audits are conducted in accordance with QAP 17.1, "Audit Procedure," Revision 18, dated February 28, 2011. The NRC inspection team also reviewed a sample of commercial-grade survey reports, which are conducted in accordance with the same procedure. The NRC inspection team verified that appropriately qualified auditors conducted the audit and survey teams.

**b.5 Closure of Nonconformance 99900100/2011-201-05**

The NRC issued Violation 99900100/2011-201-05 in the 2011 NRC inspection and identified that Limitorque failed to impose the requirements of Appendix B to 10 CFR Part 50 in documents for the procurement of safety-related equipment and services.

During the current inspection, the NRC inspection team verified the response Flowserve provided to the NRC, dated August, 12, 2011, and that the NRC accepted, September 29, 2011, to ensure all actions were completed associated with this nonconformance. The NRC inspection team did not identify any issues and has closed Nonconformance 99900100/2011-201-05.

**b.6 Closure of Nonconformance 99900100/2011-201-06**

The NRC issued Violation 99900100/2011-201-06 in the 2011 NRC inspection and identified that Limitorque used uncontrolled information (Additional QC Checks for SMB-000 Torque Switches) not documented in a quality related procedure to identify quality checks that need to be evaluated for SMB-000 torque switches used in safety-related actuators.

During the current inspection, the NRC inspection team verified the response Flowserve provided to the NRC, dated August, 12, 2011, and that the NRC accepted, September 29, 2011, to ensure all actions were completed associated with this nonconformance. The NRC inspection team did not identify any issues and has closed Nonconformance 99900100/2011-201-06.

**b.7 Closure of Nonconformance 99900100/2011-201-07**

The NRC issued Violation 99900100/2011-201-07 in the 2011 NRC inspection and identified that Limitorque accepted material test reports for components and materials used in safety-related actuators provided by a non Appendix B subcontractor. In addition, Limitorque failed to identify or reference acceptance criteria for receipt inspection to verify that purchased equipment conformed to procurement documents.

During the current inspection, the NRC inspection team verified the response Flowserve provided to the NRC, dated August, 12, 2011, and that the NRC accepted, September 29, 2011, to ensure all actions were completed associated with this nonconformance. The NRC inspection team did not identify any issues and has closed Nonconformance 99900100/2011-201-07.



b.8 Closure of Nonconformance 99900100/2011-201-08

The NRC issued Violation 99900100/2011-201-08 in the 2011 NRC inspection and identified that Limitorque performed an external audit of an approved supplier on the Approved Vendors List for safety-related components and services that did not evaluate the supplier's compliance with the requirements of Appendix B to 10 CFR Part 50.

During the current inspection, the NRC inspection team verified the response Flowserve provided to the NRC, dated August, 12, 2011, and that the NRC accepted, September 29, 2011, to ensure all actions were completed associated with this nonconformance. The NRC inspection team did not identify any issues and has closed Nonconformance 99900100/2011-201-08.

c. Conclusion

The NRC inspection team concluded that Flowserve is implementing its policies and implementing procedures that govern the oversight of contracted activities consistent 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.

**6. Control of Manufacturing Process**

a. Inspection Scope

The NRC inspection team reviewed the Flowserve policies and implementing procedures that govern the implementation of Flowserve's manufacturing process to verify compliance with the regulatory requirements of Criterion IX, Criterion XI, and Criterion XII of Appendix B to 10 CFR Part 50. The NRC inspection team observed various activities associated with the testing of safety-related Limitorque MOV actuators and measurements of actuator components; conducted interviews with responsible Flowserve personnel; and reviewed inspection reports and audits performed by Flowserve on subcontractors performing special process operations and calibration activities. The NRC inspection team also reviewed fabrication documents to determine if Flowserve performed assembly activities in accordance with the applicable design, quality, and technical requirements imposed by licensee clients.

b. Observations and Findings

b.1 Control of Special Processes

The NRC inspection team verified that Flowserve had established and implemented procedures for the control of special processes that included nondestructive examinations, heat treatment, and shot blasting as part of painting. The NRC inspection team reviewed audits performed on subcontractors involved with special processes to assess compliance with applicable standards. The NRC inspection team verified that procedures included personnel and equipment qualification requirements and specified the conditions necessary for accomplishing the process. In addition, the NRC inspection team verified that painting procedures require painters to be qualified to ASTM D4228-05 standards

or qualified under a recognized paint manufacturer representative referenced in Flowserve's Index of Paint Specifications.

The NRC inspection team reviewed QAP 9.1, "Paint Procedure," Revision 18, dated December 1, 2011, to address Corrective Action Number (CAR) 11-67, dated January 18, 2012. CAR 11-67 documented foreign materials identified in and the around compensator assembly of two (2) SBD-00 S/N L874532, L874779 and one (1) SB-2 S/N L874789 actuators. The condition was determined to be caused by openings in components left exposed to shot blasting material intrusion from improper preparation procedures. The corrective actions taken were determined to be adequate in addressing the foreign material intrusion issues.

The NRC inspection team reviewed Flowserve's metal heat treating subcontractor East Carolina Metal Treating, Inc., for heat treating operations under Certification 3429-1 and Certification 3632-1 and also reviewed inspection records that verified material hardness provided by the subcontractor. The NRC inspection team reviewed audit number 2012-01-E for this supplier and its ISO 9001:2008 certification. The NRC inspection team reviewed Welder Performance Qualifications using welding procedure specification LC-100 for a single V groove weld joint to verify welding qualifications for the personnel.

#### b.2 Test Control

The NRC inspection team witnessed a basic operational test of an SB-00 actuator. The test procedures included acceptance criteria requirements. The test instrumentation recorded torque values, applied voltage, load current, and power kilowatts. The NRC inspection team also determined that the performance of the operational test was consistent with the reference values. Reference values provided with the procedure tests included no-load open, no-load close, stall torque open, stall torque close, maximum torque open, maximum torque close, minimum (set) torque open, and minimum (set) torque close.

The NRC inspection team observed that Flowserve was recording the required data collection on Limitorque test data sheets and in computer generated Flowserve test report forms, along with screen snap shots of actual test result displays for the voltage, torque, current, and power charts. The snap shots covered no load open, no load close, stall torque open, stall torque close, max torque open, max torque close, minimum torque open, and minimum torque close. The inspection team noted that the test personnel used an initial test setting of 2.5 and then decreased the torque switch setting to 1.75 in compliance with the requirements of QAP 10.1, "Test Laboratory Procedures," Revision 12, dated November 20, 2008. The NRC inspection team verified that the procedure and the supporting documentation provided the necessary guidance for performing inspection and test control activities consistent with the requirements of Criterion X of Appendix B to 10 CFR Part 50.

The NRC inspection team observed testing of an SB-00 actuator covered under order number 120311.001. The test personnel were aware and sensitive to the repeated number of operations imposed on the actuator motor, evident by the test personnel allowing the motor to cool down for about an hour before resuming with the test. All results from the test appeared to be adequate. However, in response

to an inspector request for test personnel training records, Flowserve provided training records dated February 5, 1993, for the Flowserve test personnel performing the observed Limitorque actuator testing. The NRC inspection team found that the specified training that occurred in 1993 did not reflect the diagnostic equipment used for the observed actuator testing during this inspection. Flowserve stated that its test personnel are trained for new equipment and procedures, but it was unable to provide documented records of its recent training. During performance of the actuator testing, the team observed that the Flowserve personnel were fully capable of performing the torque testing of the safety-related Limitorque actuator using the test apparatus and procedures. This issue has been documented in Section 4, "Training and Qualification of Personnel" as Nonconformance 99900100/2012-201-05.

### **b.3 Control of Measuring and Test Equipment**

The NRC inspection team verified that the measuring and test equipment (M&TE) used during the testing of an SB-00 actuator assembly had calibration stickers and current calibration dates; including calibration due dates, and that the associated calibration records were current and available for review. The NRC inspection team reviewed a sample of calibration records and verified that they included information on as-found or as-left conditions, calibration results, reference standards used, calibration date, and the due date for recalibration. The NRC inspection team also verified that the selected M&TE were calibrated using procedures traceable to known industry standards and certified equipment that has known valid relationships to nationally recognized standards.

The NRC inspection team verified Flowserve's audit of Master Gage & Tool Co., number 2012-02-E, accredited by the American Association for Laboratory Accreditation to meet the requirements of 10 CFR Part 21, MIL-STD-45662A, ANSI/NCSL Z540-1-1994, and ISO/IEC 17025:2005 scheduled to remain active until June 30, 2014. In addition, the NRC inspection team observed tools that were tagged as "Out of Calibration – Do Not Use."

The NRC inspection team observed the performance of acceptance measurements for clutch compression springs per Flowserve's drawing 60-601-0023-1-Revision C. The NRC inspection team reviewed calibration records and the software application of BMQR – Records Program, identified as the "Calibration Manager," with information on all instruments and tools used by Flowserve to track current calibration status and upcoming calibration activities by individual item.

The NRC inspection team checked the following calibrated devices used to verify the settings:

- GQC 669 – Torque sensor – Lebow 1228-5K S/N 1288, calibration date April 14, 2011 (placed in service November 8, 2011), calibration due date November 8, 2012. The NRC Inspection team verified that calibration dates can be extended until such date as the device is placed in service following the actual calibration. Calibration by ICTS.

- QC 4164 – Digital watt meter – Yokogawa Model WT230/760503, calibration date June 21, 2012, calibration due date June 21, 2013. Calibration by ICTS.
- QC 3193 – Clamp-on current transformer – calibration date December 2, 2011, calibration due date December 2, 2012. Calibration by ICTS.
- QC 2323 – Frequency meter – calibration date March 17, 2012, calibration due date March 17, 2013. Calibration by ICTS.
- QC 2338 – Analog to digital torque module – calibration date December 15, 2011. Calibration due date December 15, 2012.
- SG-55 – Analog to digital voltage module – calibration date June 21, 2011, calibration due date June 21, 2013.
- QC 3471 – Analog to digital current module – calibration date October 1, 2011. Calibration due date October 1, 2012.
- QC 1841 – Height gage – calibration date January 28, 2012, calibration due date January 28, 2013.
- QC 3359 – 10/32 plug thread gage – calibration date November 29, 2011, calibration due date November 29, 2012.
- QC 3357 – ¼-20 plug thread gage – calibration date January 4, 2012, calibration due date January 4, 2013.

#### b.4 Closure of Nonconformance 99900100/2011-201-09

The NRC issued Nonconformance 99900100/2011-201-09 in the 2011 NRC inspection and identified that Limitorque failed to perform test activities consistent with the instructions in EIP 373 that was established to assure that actuator torque switches will perform satisfactory in service. Specifically, Limitorque technicians used an initial test setting of 2.75, and subsequently decreased the torque switch setting by half increments until reaching a torque switch setting of 1.0 during a full performance test of a safety related SB-00 actuator.

During the current inspection, the NRC inspection team verified the response Flowserve provided to the NRC, dated May, 20, 2011, and that the NRC accepted, September 29, 2011, to ensure all actions were completed associated with this nonconformance. The NRC inspection team did not identify any issues and has closed Nonconformance 99900100/2011-201-08.

#### c. Conclusion

The NRC inspection team concluded that Flowserve is implementing its policies and procedures that govern test control and measuring and test equipment programs consistent with the regulatory requirements of Criterion IX, "Control of Special

Processes,” Criterion XI, “Test Control,” and Criterion XII, “Control of Measuring and Test Equipment,” of Appendix B to 10 CFR Part 50.

However, the NRC inspection team identified an example of inadequate records to demonstrate maintenance of qualification of testing lab staff in equipment and instrumentation used to conduct a Limitorque MOV actuator performance test noted in Nonconformance 99900100/2012-201-05.

## **7. Entrance and Exit Meetings**

On September 10, 2012, the NRC inspection team discussed the inspection scope during an entrance meeting with Mr. Jeff McConkey, the quality assurance manager, and other Flowserve personnel. On September 13, 2012, the NRC inspection team presented the inspection results during an exit meeting,

## ATTACHMENT

### 1. PERSONS CONTACTED

Name	Title	Affiliation	Entrance	Exit	Interviewed
Greg Pence	Engineering Manager	Flowserve	X	X	X
Kyle Ramsey	Chief Engineer	Flowserve	X	X	X
Chris Shaffer	QA Engineer	Flowserve	X	X	X
Ronald Mooneyhan	Quality Engineer	Flowserve	X		X
Sam Westby	QRC Manager	Flowserve	X		
Bob Eventson	Facilities Manager	Flowserve	X		
Brian Lowrey	Assembler Manager	Flowserve	X	X	
Ray Hawkins	Contracts Manager	Flowserve	X	X	
Earnie Carey	Marketing Manager	Flowserve	X		
Jeff McConkey	QA Manager	Flowserve	X	X	X
Lynn White	General Manager	Flowserve	X	X	
Jim Erdly	Operations Manger	Flowserve		X	
Hugh Jackson	Quality Control Technician	Flowserve			X
Jessie Puryear	Procurement Inspector	Flowserve			X
Donnie Pillow		Flowserve			X
Michael McGlothlin		Flowserve			X
Ronnie Adams		Flowserve			X
Melvin Tucker		Flowserve			X
Stacy Smith	Operations Engineer	NRC	X	X	
Thomas Scarbrough	Senior Mechanical Engineer	NRC	X	X	
Garrett Newman	Operations Engineer	NRC	X	X	
Doug Bollock	Operations Engineer	NRC	X	X	
Paul Coco	Operations Engineer	NRC		X	
Guillermo Crespo	Senior Construction Inspector	NRC	X	X	

## 2. **INSPECTION PROCEDURES USED**

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

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

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

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

<u>Item Number</u>	<u>Status</u>	<u>Type</u>	<u>Description</u>
99900100/2011-201-01	Closed	NOV	Part 21
99900100/2011-201-02	Closed	NOV	Part 21
99900100/2011-201-03	Closed	NOV	Part 21
99900100/2011-201-04	Open	NON	Criterion III
99900100/2011-201-05	Closed	NON	Criterion IV
99900100/2011-201-06	Closed	NON	Criterion V
99900100/2011-201-07	Closed	NON	Criterion VII
99900100/2011-201-08	Closed	NON	Criterion VII
99900100/2011-201-09	Closed	NON	Criterion XI
99900100/2012-201-01	Open	NOV	Part 21
99900100/2012-201-02	Open	NON	Criterion XVI
99900100/2012-201-03	Open	NON	Criterion III
99900100/2012-201-04	Open	NON	Criterion X
99900100/2012-201-05	Open	NON	Criterion II & Criterion XVII

## 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 the Limitorque motor-operated valve (MOV) actuators for the AP-1000. These ITAAC are referenced in this section for future use by the NRC staff during the ITAAC closure process and by no means constitute that the ITAAC have been met and closed. Furthermore, since the Limitorque MOV actuators for the AP-1000 are currently in research and development until they are qualified by Westinghouse, the NRC inspection team was unable to review any of the ITAACs.

2.1.02.07a.i	1E equipment qualified for harsh environment, reactor coolant system
2.2.01.06a.i	1E equipment qualified for harsh environment, containment
2.2.03.07a.i	1E equipment qualified for harsh environment, passive core cooling system

2.2.04.07a.i	1E equipment qualified for harsh environment, steam generator system
2.3.02.06a.i	1E equipment qualified for harsh environment, chemical and volume control system
2.3.06.07a.i	1E equipment qualified for harsh environment, normal residual heat removal system

## 5. **DOCUMENTS REVIEWED**

### Audit Report

- Audit Report 2010-04/05-I, Internal Audit of Flowserve Limatorque, November 18, 2010
- Audit Report 2010-06-E, Rockbestos Suprenant Cable Corporation, February 20, 2011
- Audit Report 2010-07-E, Carboline Company, Green Bay, WI, July 29, 2010
- Audit Report 2011-01-E, Baldor Electric Company, Flowery Branch, GA, June 6, 2011
- Audit Report 2011-02/03-I, Internal Audit of Flowserve Limatorque, July 14, 2011
- Audit Report 2011-08-E, Instrument Calibration and Technical Services, Inc., Salem, VA, June 12, 2012
- Audit Number 2012-01-E, Audit of East Carolina Metal Treating, Inc., for Dis Spring Spacer

### Certificate of Compliance (CoCs)

- CoC for PO 97422, March 26, 2012
- CoC for PO 97422, March 26, 2012
- CoC for PO 189968, July 27, 2012
- CoC for PO 190644, May 17, 2012
- CoC for PO 190949, June 4, 2012

### Customer Complaints (CCs)

- CC 11-41, July 1, 2011
- CC 11-66, November 10, 2011
- CC 11-67, November 10, 2011
- CC 12-164, August 9, 2012
- CC 12-167, August 10, 2012

### Discrepant Material Reports (DMRs)

- DMR 25040, May 7, 2012
- DMR 25111, May 11, 2012
- DMR 25973, August 27, 2012



- DMR 25979, August 28, 2012
- DMR 25940, August 27, 2012
- DMR 25897, August 27, 2012
- DMR 25999, August 31, 2012
- DMR 25997, September 7, 2012
- DMR 26111, September 12, 2012

#### Limitorque Corrective Action Request (LCARs) generated from NRC inspection

- LCAR 12-1, September 13, 2012
- LCAR 12-2, September 13, 2012
- LCAR 12-3, September 13, 2012
- LCAR 12-4, September 13, 2012
- LCAR 12-5, September 17, 2012
- LCAR 12-6, September 17, 2012
- LCAR 12-7, September 17, 2012
- LCAR 12-8, September 17, 2012

#### Procedures

- Flowserve Quality Management System Manual, Revision 4, June 27, 2011
- Limitorque Engineering Instruction Procedure EIP-373, Revision 1, May 2011, "Production Test Procedure for SMB/SB Series Units Built for Westinghouse Project AP-1000 Per Specification APP-PV95-Z0-001"
- SAP-3.4, Revision 2, August 20, 2012, "Configurator"
- QAI 17.2, "Process Procedure Surveillance," Revision 0, January 10, 2012
- QCI-10.7, "Sample Inspection Plan," Revision 3, May 14, 2010
- QCP-10.5, "Inspection of Safety Related Nuclear Service Units and Parts Orders," Revision 12, December 8, 2011
- QCP 10.1, "Receipt Inspection Procedure," Revision 31, July 18, 2012
- QCP-10.10, "Commercial Grade Dedication," Revision 9, September 29, 2011
- QAP 3.1, "Order Entry and Processing Procedure," Revision 22, March 3, 2011
- QAP 4.1, "Design and Development Procedure," Revision 11, March 1, 2011
- QAP 5.1, "Procedure for and Issuance of Internal Engineering Documents Processing Engineering Change Orders," Revision 7, February 18, 2011
- QAP 6.1, "Purchasing Procedure," Revision 20, June 27, 2011
- QAP 6.2, "Qualification of Vendors and Suppliers," Revision 15, February 22, 2011
- QAP 9.1, "Paint Procedure," Revision 18, December 1, 2011
- QAP 10.1, "Test Laboratory Procedures," Revision 12, November 20, 2008
- QAP 10.2, "Safety-Related Nuclear Service Procedure," Revision 8, June 11, 2012
- QAP 10.3, "Assembly inspection Procedure," Revision 10, January 10, 2012
- QAP 10.3, "Assembly Inspection Procedure," Revision 11, February 14, 2012
- QAP 10.4, "Procedure for Certificates of Compliance," Revision 5, July 12, 2011
- QAP 13.2, "Reporting Defects for Safety Related Equipment," Revision 16, August 9, 2012
- QAP 13.3, "Discrepant Material Report Procedure," Revision 16, July 23, 2012

- QAP 14.1, "Corrective and Preventive Action Procedure," Revision 14, January 31, 2011
- QAP 17.1, "Audit Procedure," Revision 18, February 28, 2011
- QAP 18.1, "Indoctrination and Training," Revision 13, December 11, 2009
- SCP 8.3, "Sample Plan for In-Process Inspection by Machine Operators," Revision 9, January 10, 2012
- SCP 8.6, "Deburr Work Instructions," Revision 4, dated January 10, 2012
- Inspection Procedure 10.111, "Peerless-Winsmith Critical Component Testing," Revision 12, August 29, 2011
- Inspection Plan IP-10.38, "2-Train and 4-Train Geared Limit Switch Assemblies," Revision 6, September 3, 2012
- Inspection Plan IP-10.134, "Inspection Plan for Grade 5 Hex Head Cap Screws," Revision 0, August 5, 2004
- Inspection Plan IP-10.111, "Peerless-Winsmith Critical Component Material Testing," Revision 12, August 29, 2011
- ECC- 0001, "Safety Related Actuator Critical Components Evaluation and Listing," Revision 6, April 11, 2012

#### Purchase Orders

- PO 188734 to Peerless-Winsmith, January 13, 2012
- PO 189968 to Baldor, March 29, 2012
- PO 190644 to Carboline, May 9, 2012
- PO 190949 to Rockbestos, May 25, 2012
- PO 87484-9 from Flowserve Raleigh, September 21, 2009
- PO 97422 from Flowserve Raleigh, October 13, 2009
- PO 1012058146, Hex cap parts order for Areva, August 27, 2012
- PO 1012053802, 4-Train geared limit switch assemblies for Areva
- PO 25157 from the Flowserve to Supply Safety-Related Limitorque Actuators for the Watts Bar Unit 2 Nuclear Power Plant, September 30, 2009
- PO 88233 from the Flowserve Raleigh Division to Supply Safety-Related Limitorque Actuators for the Vogtle Nuclear Power Plant, October 13, 2009
- PO 88234 from the Flowserve Raleigh Division to Supply Safety-Related Limitorque Actuators for the Vogtle Nuclear Power Plant, October 13, 2009
- PO 88235 from the Flowserve Raleigh Division to Supply Safety-Related Limitorque Actuators for Vogtle Nuclear Power Plant, October 13, 2009
- PO 184329, Gear Frame, January 11, 2012
- PO 187423, Interior Pinion, September 6, 2012
- PO 191537, Finger base, August 27, 2012
- PO 191323, Rotor, August 24, 2012
- PO 1012058146, Hex Head Cap Screw

#### Test Reports

- Flowserve Test Report SB-00 Order No. 120311.001, September 12, 2012
- Limitorque Test Open Data, Form L1090A, Revision 0, August 2006
- Limitorque Test Close Data, Form L1090B, Revision 0, August 2006

- Limitorque Torque Test Data Sheet, Tag No. UNID 2- MVOP-63-0048B, PO No. 25157, May 28, 2010
- Limitorque Torque Test Data Sheet, Tag No. UNID 2- MVOP-63-0136B, PO No. 25157, May 28, 2010

#### Training Records

- Flowserve Training Session Record for QAP 10.3, January 10, 2012
- Flowserve Training Session Record for QAP 9.1, December 2, 2011
- Flowserve Training Session Record for SCP 8.3, January 11, 2012
- Flowserve Training Session Record for SCP 8.6, January 11, 2012

#### Additional Documents

- Form L-761, Assembly Qualification Record
- Nuclear Order Review/Check List, Form L3345QA, Revision 4
- Limitorque Drawing 60-700-004-1, Revision U, March 18, 2011, "Drive Pinion, GLS 4-GEAR. SMB-ALL"
- Inspection Plan 10.38, Revision 6, September 3, 2012, "2-Train and 4-Train Geared Limit Switch Assemblies"
- QAI 10.1, Revision 6, January 31, 2011, "Acceptance Criteria for Electric Actuator Production Tests"
- Lynchburg Facility Approved Vendor Listing, August 28, 2012
- Peerless-Winsmith Work Instruction 110-15-1, Revision C, September 6, 2011
- RMA 509962, July 10, 2012
- SCAR 2010-03-E-01, September 16, 2010
- Training files for Fred Cox, Ronald Solt, Jeffrey McConkey, Hugh Jackson, Jessie Puryear, Donnie Pillow, Ronald Mooneyham, Melvin Tucker, Ronnie Adams
- East Carolina Metal Treating, Inc. Certification: 3632-1, August 1, 2012 for Purchase Order: 192058, Part Number 61-409-0150-2 for Harden and Temper to 40-45 RC
- East Carolina Metal Treating, Inc. Certification: 3429-1, July 27, 2012 for Purchase Order: 191935, Part Number 61-409-0150-2 for Harden and Temper to 40-45 RC
- Flowserve Center of Gravity Calculation Sheets, September 12, 2012.
- Westinghouse MOV 3" Gate Valve Datasheet APP-PV01-Z0D-100 (Revision 3, February 2, 2012), "PV01 Datasheet 100"
- Westinghouse MOV 6" Gate Valve Datasheet APP-PV01-Z0D-110 (Revision 3, January 5, 2012), "PV01 Datasheet 110"
- Westinghouse MOV 4" Globe Valve Datasheet APP-PV01-Z0D-131 (Revision 4, March 5, 2012), "PV01 Datasheet 131"
- TR-266, Thread count calibrator, calibrated January 10, 2012
- QC-2280, Caliper, calibrated August 8, 2012
- QC-4063, Multi-meter, calibrated March 27, 2012

- QC-1621, Caliper, calibrated July 19, 2012
- QC-1041, Caliper, calibrated October 17, 2011
- QC-1990, Dial indicator, January 28, 2012
- SCAR 267, "To: Penn compression Subj: Excess Fibrite material identified on sides and top of silver contact on rotors," September 13, 2012
- 4-Train Geared Limit Switch component drawings:
- 01-472-0154-3, Revision F, July 21, 1975
- 60-700-0140-2, March 8, 1972
- 60-425-0038-1, July 2, 1965
- 60-702-0019-3, Revision G, January 18, 1978
- 60-701-0067-1, Revision R
- L 630 Flowserve Receipt Inspection Records:
- L3343 Flowserve Receipt Inspection Records for Material/Components: