July 18, 2016

Richard Kuntz, Quality Assurance Manager
SPX, Copes-Vulcan
5620 West Road
McKean, PA 16426

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION OF SPX, COPES-VULCAN, REPORT NO. 99900080/2016-202

Dear Mr. Kuntz:

On June 13 through June 16, 2016, the U.S. Nuclear Regulatory Commission (NRC) staff conducted a limited scope inspection of SPX, Copes-Vulcan. The purpose of this limited scope inspection was to assess SPX's compliance with provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," and selected portions of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

This inspection specifically verified the closure of nonconformances identified in NRC Inspection Reports 99900080/2012-201 and 9990080/2013-201; evaluated the adequacy of design changes to the squib valves that were implemented to address issues concerning water intrusion identified during qualification testing; and evaluated the adequacy of a modification to the initiators (part of the squib valve explosive system) that was implemented to address degradation in performance identified during recent data analysis. The enclosed report presents the results of the inspection. This NRC inspection report does not constitute NRC endorsement of your overall quality assurance (QA) program.

The activities inspected were also associated with inspections, tests, analyses, and acceptance criteria (ITAAC) from Appendix C from the Combined License for Vogtle Units 3 and 4 and V.C. Summer Units 2 and 3. Specifically, these activities were associated with 2.2.03.02a, 2.2.03.05a.ii, 2.2.03.07a.i, and 2.2.03.12a.i. Within the scope of this inspection, no violations or nonconformances were identified.

In accordance with 10 CFR 2.390, "Agency Rules of Practice and Procedure," a copy of this letter, its enclosure(s), and your response (if applicable) will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible at http://www.nrc.gov/reading-rm/adams.html. To the extent possible, your response (if provided) 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 provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material be withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of

information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

/RA/

Terry W. Jackson, Chief
Quality Assurance Vendor Inspection Branch-1
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Docket No.: 99900080

Enclosure:
Inspection Report No. 99900080/2016-202
and Attachment

information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

/RA/

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and Attachment

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Rick.Kuntz@spx.com

ADAMS Accession No.: ML16193A630 *via e-mail NRO-002

OFC	NRO/DCIP/QVIB-1	NRO/DCIP/QVIB-2	NRO/DCIP/QVIB-3
NAME	JJacobson	ETorres	AFerguson
DATE	07/12/16	07/18/16	07/12/16
OFC	RII/DCI/CIB3	NRO/DCIP/QVIB-1	
NAME	TSteadham*	TJackson	
DATE	07/11/16	07/18/16	

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

Docket No.:	99900080		
Report No.:	99900080/2016-202		
Vendor:	SPX, Copes-Vulcan 5620 West Road McKean, PA 16426		
Vendor Contact:	Mr. Richard Kuntz, Quality Assurance Manager Rick.Kuntz@spx.com (814) 476-5840		
Nuclear Industry Activity:	SPX, Copes Vulcan is currently manufacturing squib valves that are being supplied for use in safety-related systems as part of the Westinghouse AP1000 reactor design at the Vogtle and V.C. Summer nuclear plants.		
Inspection Dates:	June 13-16, 2016		
Inspection Team:	Jeffrey Jacobson Ashley Ferguson in Training Tim Steadham Edgardo Torres	NRO/DCIP/QVIB-1 NRO/DCIP/QVIB-3 Region II/DCI/CIB3 NRO/DCIP/QVIB-2	Team Leader Team Leader
Approved by:	Terry W. Jackson, Branch Chief Quality Assurance Vendor Branch-1 Division of Construction Inspection and Operational Programs Office of New Reactors		

Enclosure

EXECUTIVE SUMMARY

SPX, Copes-Vulcan
99900080/2016-202

The U.S. Nuclear Regulatory Commission (NRC) conducted a limited scope inspection at the SPX Copes-Vulcan (hereafter referred to as SPX) facility to verify that SPX has implemented an adequate quality assurance (QA) program in compliance with the applicable requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 21, "Reporting of Defects and Noncompliance."

This technically focused inspection evaluated SPX's design of the safety-related squib valves for the Westinghouse AP1000 design. This inspection specifically evaluated the adequacy of designs changes to the squib valves that were implemented to address issues concerning water intrusion and evaluate the adequacy of the modification to the squib valve initiators that was made to address degradation in performance. Additionally this inspection assessed SPX's corrective actions to close previous NRC identified non-conformances identified in Inspection Reports 99900080/2012-201 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12158A154) and 99900080/2013-201 (ADAMS Accession No. ML13302B397). The NRC conducted this inspection at the SPX facility in McKean, PA.

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

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

During the course of this inspection, the NRC inspection team implemented Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," 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 information below summarizes the results of this inspection.

Design Control of Initiator Modifications

The inspectors concluded that SPX had appropriately accounted for the reduced output observed during the separate effects testing of the initiators by increasing the explosive charge that would be loaded into each initiator. The inspectors also concluded that the resulting modification did not impact the results of the previous qualification testing that had been performed on the explosive cartridge and/or valve bodies. Based on the sample evaluated, the inspectors concluded that SPX had adequately implemented the design changes to the initiator in accordance with Criterion III, "Design Control," of Appendix B to 10 CFR Part 50. No findings of significance were identified.

Design Control of 8" Squib Valve Modifications

The inspectors concluded that SPX has conducted an appropriate design change to ensure the valve remained leak tight while submerged and that no other testing or analysis was affected by the design change. Based on the sample evaluated, the inspectors concluded that SPX had adequately implemented the design changes in accordance with Criterion III, "Design Control,"

of Appendix B, to 10 CFR Part 50. Although these inspection activities are related to AP1000 ITAAC, these activities are a portion of the overall inspection of the referenced ITAAC. Thus, these inspection activities do not constitute final inspection of the referenced ITAAC. No findings of significance were identified.

Corrective Action

The inspectors concluded that SPX has established a corrective action program in accordance with the regulatory requirements of Criterion XVI, “Corrective Action” of Appendix B to 10 CFR Part 50. Based on the limited sample evaluated, the inspectors determined that SPX is effectively implementing its policies and procedures associated with the corrective action program. No findings of significance were identified.

REPORT DETAILS

1. Design Control of Initiator Modifications

   a. Scope

   The squib valves contain an explosive cartridge which is use to provide the motive force to operate the valve. The explosive cartridge is comprised of two parts: (1) a small initiator, which is an explosive device that is designed to detonate upon receipt of an electrical signal from the plant's Protection and Safety Monitoring and/or Diverse Actuation Systems, and (2) a larger cartridge that interfaces with the initiator and contains the actual explosive propellant that is used to operate the valve. In response to a previous nonconformance identified by the NRC, Nonconformance 99900080/2012-201-01, SPX performed a series of separate effects tests to quantify performance of the initiators under design basis accident conditions. The separate effects testing included thermal aging, neutron and gamma irradiation and is described in detail in NRC Inspection Report 99900080/2015-201 (ADAMS Accession No. ML15152A080). While the primary purpose of that testing was to demonstrate that the initiators would detonate at the proper input current levels, supplemental data was also taken by SPX during the testing on initiator output energy.

   As described in Inspection Report 99900080/2015-201, the separate effects testing results indicated no issues regarding detonation of the initiators in any of the aged or irradiated samples. However, further analysis of the separate effects testing data by SPX indicated that the output of the initiators was reduced on those test samples that had been exposed to a combination of thermal aging, neutron, and gamma irradiation. To address this reduction in observed energy output, SPX modified the design of the initiators to increase the explosive load in an amount that is in proportion to the reduction in output observed during the separate effects testing.

   During this inspection, the inspectors reviewed the basis for the modification made by SPX to the squib valve initiators to account for the reduction in energy output. The inspectors reviewed documents associated with this modification and interviewed key SPX personnel as necessary to assess whether: 1) the proposed modification was sufficient to address the observed reduction in energy output, and 2) whether the modification being made to the initiators would potentially invalidate any of the previous testing that was performed to qualify the explosive system and/or valves.

   The inspectors reviewed SPX Report No. 10.4.526 which contained an impact analysis for the proposed increase in initiator loading. The inspectors also reviewed Manufacturing Procedure (MP) 17399(01) which contained the instructions for loading the explosives into the initiator. These inspection activities are related to ITAAC 2.2.03.07a.i.

   The documents reviewed by the NRC inspection team are included in the attachment to this inspection report.

b. Finding and Observations

The inspector reviewed SPX Report No. 11.1.325, “Summary of Squib Valve Initiator Design Verification Testing,” which contained the data from the separate effects testing of the initiators. During this testing the initiators were fired into a closed bomb and pressure measurements were taken that were then utilized to assess energy output. The data was presented in a series of time vs pressure curves both for individual initiators and for families of initiators tested. The curves showed the reduction in energy output for the family of initiators that were exposed to the combination of thermal aging, gamma, and neutron irradiation. Since the actual number of initiators tested and exposed to all three aging mechanisms was limited, the inspectors verified that SPX had appropriately accounted for the statistical variation in the samples when deriving the explosive loads for the modified initiators.

The inspectors determined that SPX Report No. 10.4.526, “Impact Analysis for Initiator Mass Increase,” provided an extensive analysis of the potential impacts of the modification. The report examined 27 different potential effects, including effects associated with qualification, manufacturing, performance, and testing. For each potential effect, SPX provided a documented basis for why the stated potential effect was not of concern, or alternatively described what planned actions were being implemented to mitigate the potential issue.

The inspectors raised a concern associated with the modification’s potential impact on the cartridge performance, specifically with respect to the timing between ignition of the powder and granules contained within the cartridge, and ultimately on the potential changes that could occur in the cartridge output. While SPX is required by the Westinghouse design specification to perform lot acceptance testing of both the initiators and the initiator/cartridge, the inspectors identified that there could be possible changes to the cartridge performance that would not be picked up by just the standard lot acceptance testing which consists of destructively firing the cartridge and/or initiators into an instrumented closed bomb and measuring peak pressure and time to peak pressure. The lot acceptance testing is required to be performed on no less than 8, or 10 percent of each manufactured lot of initiators and initiator/cartridge. While these parameters provide a good indication of the relative performance of one lot of cartridges as compared to a previous similar lot, they are not conclusive with respect to the total energy or rate of energy being supplied by the cartridge, and thus might not be conclusive when evaluating the performance of dissimilar cartridges.

To address the inspectors concerns, SPX issued Corrective Action Report (CAR) 1212 on June 16, 2016. The CAR disposition stated that SPX would perform a qualitative comparison of the pressure output of cartridges prior to and after changes to the initiator’s explosive load and document the results of their comparison in a design calculation. The inspectors determined the CAR was responsive to the questions raised and no further concerns were noted.

No findings of significance were identified.

c. Conclusion

The inspectors concluded that SPX appropriately accounted for the reduced output observed during the separate effects testing of the initiators by increasing the explosive charge that would be loaded into each initiator. The inspectors also concluded the resulting modification did not impact the results of the previous qualification testing that had been performed on the explosive cartridge and/or valve bodies. Based on the sample evaluated, the inspectors concluded that SPX adequately implemented the design changes to the initiator in accordance with Criterion III, "Design Control," of Appendix B to 10 CFR Part 50. No findings of significance were identified.

2. Design Control of 8" Squib Valve Modifications

a. Scope

The inspectors reviewed the design changes that SPX made to the 8" squib valves (PXS-PL-V118A/B, V120A/B, V123A/B, and V125A/B) to address leakage identified during submergence testing. SPX completed a root cause analysis to identify the technical cause of the leakage and implemented several design changes to ensure that the valves remained leak-tight during design basis submergence conditions.

Through testing and analysis, SPX determined that the cause of the submergence test failure in April 2012 was loss of bolt preload and distortion of flanges causing a loss of sealing capability of the existing seals when the valve was partially submerged as described in root cause analysis 10.4.544, Revision 0, "Root Cause Analysis - 8" Squib Valve Submergence Test Failure."

To correct the leakage, SPX redesigned several of the valve seals, modified the shear cap bolting, and added thermal shields to minimize differential thermal expansion of certain key components. A subsequent QME-1 submergence test in March 2015 confirmed the submergence capability of the valves with the new design. As described in NRC Inspection Report 99900905/2015-202, the valves were disassembled after the test and no leakage was identified.

The inspectors reviewed the qualification testing program for the 8" squib valves as described in Westinghouse Equipment Qualification Summary Report, APP-PV70-VBR-002, to determine if the design changes adversely affected the results of any qualification testing for the valves. These inspection activities are related to ITAAC 2.2.03.05a.ii, 2.2.03.07a.i, and 2.2.03.12a.i. Specifically, the inspectors reviewed the following tests to make this determination:

- Electromagnetic interference test;
- Fundamental frequency test;
- Valve actuator & initiator aging tests;
- Actuator submergence test;
- Shear cap sealing capability test;
- End loading test;
- Valve seismic analysis;
- Tension bolt seismic test; and
- Functional qualification.

The inspectors reviewed the following American Society of Mechanical Engineers (ASME) design reports to determine if SPX adequately incorporated the submergence design changes into the reports:

- Design Report 10.2.190, "8-inch Class 2500 LP Squib Valve for Westinghouse Electric Company," Revision 3, dated July 28, 2015; and

- Design Report 10.2.189, "8-inch Class 2500 HP Squib Valve for Westinghouse Electric Company," Revision 4, dated July 20, 2015.

The inspectors reviewed stress calculations for pressure retaining bolting, flanges, and covers to ensure that adequate margins of safety remained after the design changes. These inspection activities are related to ITAAC 2.2.03.02a.

The inspectors reviewed controlled drawings to ensure that the design changes were translated into QA documents appropriate to the circumstances. The inspectors determined that the newly designed parts consisted of a combination of items procured both safety-related and non-safety-related. For those items procured as safety-related, the inspectors reviewed the most recent supplier audit to ensure that the suppliers were appropriately placed on the approved vendor list. For those items procured commercial grade and dedicated by SPX, the inspectors reviewed the commercial grade dedication plan instructions to determine if SPX adequately identified the critical characteristics of the items on the checklists.

The documents reviewed by the NRC inspection team are included in the attachment to this inspection report.

b. Finding and Observations

The inspectors determined that no qualification tests or analyses were adversely affected by the design changes. The inspectors determined that the modifications were either incorporated into each prototype that was tested or analyzed and/or the design change was irrelevant to the test.

The inspectors determined that the ASME design report adequately incorporated the modifications into the applicable stress calculations and that adequate safety margin remained in all pressure retaining parts after the modification. Additionally, the inspectors determined that SPX adequately incorporated the design changes into controlled QA drawings and procedures, including commercial grade dedication plan instructions. For the new and redesigned parts, SPX either purchased the parts from vendors who were adequately audited or from commercial grade vendors with parts dedicated by SPX using appropriate commercial grade dedication plans.

No findings of significance were identified.

c. Conclusion

The inspectors concluded that SPX conducted an appropriate design change to ensure the valve remained leak tight while submerged and that no other testing or analysis was affected by the design change. Based on the sample evaluated, the inspectors concluded that SPX adequately implemented the design changes in accordance with

Criterion III, Design Control," of Appendix B, to 10 CFR Part 50. Although these inspection activities are related to AP1000 ITAAC, these activities are a portion of the overall inspection of the referenced ITAAC. Thus, these inspection activities do not constitute final inspection of the referenced ITAAC. No findings of significance were identified.

3. Corrective Action

a. Scope

The inspectors reviewed SPX's policies and implementing procedures that govern the corrective action program to verify compliance with the requirements of Criterion XVI, "Corrective Action" of Appendix B to 10 CFR Part 50.

The inspectors reviewed the implementation of the corrective actions associated with nonconformances identified in NRC Inspection Reports 99900080/2012-201 and 99900080/2013-201. The inspectors also discussed the corrective action program with SPX's management and technical staff. The documents reviewed by the inspectors are included in the attachment to this inspection report.

b. Finding and Observations

1. Corrective Action Associated with Nonconformance 99900080/2012-201-02

The NRC issued Notice of Nonconformance (NON) 99900080/2012-201-02 for failure to adequately justify the design and installation of energy absorbing material inside the squib valve. Specifically, SPX did not perform an analysis of the failure modes of the energy absorbing material, its installation, and their potentially adverse effects on the operation of the squib valves.

In response to the nonconformance, SPX corrective actions included performing a formal design calculation evaluating the strength of the squib valve crush tube assemblies. In addition, the failure modes effects and analysis (FMEA) report was revised to include failure modes for the energy absorbing material for the seismic, shock and vibration causes, and their potential adverse effects on the operation of the squib valve.

The inspectors reviewed Design Calculation DCR-120604, "Evaluation of Squib Valve Crush Tube Assemblies for Strength," which evaluated the structural integrity of the squib valve crush tube assemblies for the occurrence of seismic loads that occur prior to valve actuation. Additionally, the inspectors reviewed the FMEA tables for the 8" and 14" squib valves completed by SPX. The FMEA tables included the analysis of failure modes caused by material defect, improper assembly, seismic or shock load, and vibration. Based on the review of the aforementioned documentation, the inspectors determined the corrective actions were adequate to address the identified nonconformance; NON 99900080/2012-201-02 is closed.

2. Corrective Action Associated with Nonconformance 99900080/2012-201-03

The NRC issued NON 99900080/2012-201-03 for failure to establish appropriate measures to verify the suitability of the commercial software used to perform finite element analysis on aspects of the squib valve.

In response to the nonconformance, SPX corrective actions included revisions to the procedures and work instructions governing commercial grade dedication of design and analysis software (Procedure 50-5.27.79, "Commercial Grade Dedication for Parts Within and Attached to the Valve Assembly," Commercial Grade Dedication Instruction (CDI) Software, "Procured Software," and Engineering Procedure No. GT-14, "Verification and Validation of Commercially Procured Software for Design Analysis for Safety-related and Section III Jobs"). In addition, SPX developed a procedure for review and documentation of the evaluation of ANSYS Class 3 Error reports (Procedure 17.1.113, "Instructions for Review of ANSYS Class 3 Error Reports").

The inspectors reviewed the software CDI and confirmed that it identified the critical characteristics of the finite element analysis (FEA) and solid modeling software used by SPX; identified the safety-related functions in which the FEA and solid modeling software can be used; and required the documentation of evaluations performed of ANSYS Class 3 Error Reports. In addition, the inspectors reviewed the software verification process, described in Procedure No. GT-14. The inspectors reviewed a sample of software verifications performed for the use of ANSYS and SolidWorks calculations. Based on the inspectors review, the inspectors determined the corrective actions were adequate to address the identified nonconformance; NON 99900080/2012-201-03 is closed.

3. Corrective Action Associated with Nonconformance 99900080/2012-201-04

The NRC issued NON 99900080/2012-201-04 for failure to establish adequate procedures for the assembly of the 8-inch and 14-inch squib valves. Specifically, Assembly Procedures 1.2.453, "8" LP Squib Valve," Revision 5, and 1.2.446, "14-inch ADS Squib Valve," Revision 3, were inadequate in that measuring and test equipment (M&TE) data was not recorded and the procedures did not direct the use of outside diameter micrometers against SPX's standard. In addition, Procedure 1.2.453 directed the performance of a test that could have introduced stresses to internal components.

In response to the nonconformance, SPX performed an extent of condition, reviewed and identified three procedures that required revision (Assembly Procedures 1.2.445, "8" HP-L and HP-R Squib Valve," 1.2.446, and 1.2.453). SPX revised Assembly Procedures 1.2.445, 1.2446, and 1.453 to include M&TE recording blocks. Assembly Procedure 1.2.446 was revised to include outside diameter micrometer data to verify inside diameter micrometer readings. Assembly Procedure 1.2.453 was revised to correct the sequence of testing operations.

The inspectors reviewed CARs 643, 644, and 645; and Assembly Procedures 1.2.445, 1.2.446, and 1.2.453. Based on the review of the aforementioned documentation, the inspectors determined the corrective actions were adequate to address the identified nonconformance; NON 99900080/2012-201-04 is closed.

4. Corrective Action Associated with Nonconformance 99900080/2012-201-05

The NRC issued NON 99900080/2012-201-05 for failure to ensure an SPX inspector was qualified and trained to perform non-destructive examination (NDE) inspections. Specifically, an SPX NDE inspector was not qualified to perform inspections on the initiator and cartridge assembly welds.

In response to the nonconformance, SPX trained the inspector in accordance with Inspection Procedure 50-5.9.20, "Visual Inspection of Welds per ASME Section III and Section V," and in the specific acceptance criteria for the initiator and cartridge assembly welds.

The inspectors reviewed CAR 711, the inspector qualification records and Procedure 50-5.9.20. Based on the review of the aforementioned documentation, the inspectors determined the corrective actions were adequate to address the identified nonconformance; NON 99900080/2012-201-05 is closed.

5. Corrective Action Associated with Nonconformance 99900080/2012-201-06

The NRC issued NON 99900080/2012-201-06 for failure to provide sufficient guidance to identify conditions adverse to quality related to deficiencies, deviations and non-conformances. Specifically, SPX personnel failed to identify a condition adverse to quality during assembly of a safety-related squib.

In response to the nonconformance, SPX revised Assembly Procedures 1.2.446, 1.2.445, and 1.2453 to allow any step in the procedure to be interrupted and reversed at engineering's discretion. In addition, SPX conducted training on how and when to create CARs.

The inspectors reviewed CAR 635 and 636, the revisions to Assembly Procedures 1.2.446, 1.2.445, and 1.2.453, and the corrective action program training material provided to SPX staff. The inspectors interviewed personnel trained and qualified in the disposition of nonconformance and corrective action reports. Based on the review of the aforementioned documentation, the inspectors determined the corrective actions were adequate to address the identified nonconformance; NON 99900080/2012-201-06 is closed.

6. Corrective Action Associated with Nonconformance 99900080/2013-201-03

The NRC issued NON 99900080/2013-201-03 for failure to promptly correct conditions adverse to quality. Specifically, in two instances, SPX closed CARs upon receipt of proposed corrective actions from the vendor without verifying that the corrective actions had been accomplished.

In response to the NRC, SPX corrective actions included conducting training for personnel responsible for processing corrective actions, performing follow-up actions to obtain objective evidence to support the close out of the two CARS, and performing a review of other CARs for extent of condition.

The inspectors reviewed the objective evidence for the completion of the follow-up actions associated with CARs No. 850 and 881. The inspectors also discussed the results of the evaluation performed for other corrective actions being closed without having objective evidence of their completion. The evaluation performed by SPX determined that the two CARs in question (CAR Nos. 850 and 881) were an isolated case. The inspectors reviewed a sample of CARs issued within the last year that required follow-up actions. For the sample reviewed, the inspectors verified that there was objective evidence of the verification of follow-up actions for the CARs that had been closed. Additionally, the inspectors reviewed the training log for the training conducted on the corrective action process. The inspectors verified that personnel responsible for processing CARs received the training regarding the process for performing a follow-up to a CAR as identified in Procedure No. 50-5.24.10, "Processing Corrective Action Reports." Based on the inspectors review, the inspectors determined the corrective actions were adequate to address the identified nonconformance; NON 99900080/2013-201-03 is closed.

No findings of significance were identified.

c. Conclusion

The inspectors concluded that SPX has established a corrective action program in accordance with the regulatory requirements of Criterion XVI, "Corrective Action" of Appendix B to 10 CFR Part 50. Based on the limited sample evaluated, the inspectors determined that SPX is effectively implementing its policies and procedures associated with the corrective action program. No findings of significance were identified.

4. Entrance and Exit Meetings

On June 13, 2016, the NRC inspection team discussed the scope of the inspection during an entrance meeting with Mr. Rick Kuntz, Quality Assurance Manager of SPX, and other members of SPX management and staff. On June 16, 2016, the NRC inspection team presented the inspection results and observations during an exit meeting with Mr. Jerry Skolnik, Site Director, and other SPX staff. The attachment to this report lists the entrance and exit meeting attendees, as well as those individuals the NRC inspection team interviewed.

ATTACHMENT

1. ENTRANCE/EXIT MEETING ATTENDEES

Name	Title	Affiliation	Entrance	Exit	Interviewed
Adam Bosworth	Design Engineer	SPX Flow			X
Dwayne Blore	Purchasing Manager	SPX Flow	X	X	
Julia Burton	Sales Manager	SPX Flow	X	X	X
Randolph Copeland	Engineering Oversight	SCANA	X	X	
Mark Crays	Design Engineer	SPX Flow			X
Corey Erven	Nuclear Program Manager	SPX Flow	X	X	X
Nowelle Francis	Quality Assurance Manager	SPX Flow		X	X
Linda Hites	Quality Engineer	SPX Flow	X	X	X
Richard Kuntz	Quality Assurance Manager	SPX Copes-Vulcan	X		X
Dale Mays	UP Global Ind. Valves	SPX Flow	X	X	
Linda Mays	Materials Manager	SPX Flow		X	
Dan Mitchell	Engineer	Westinghouse	X	X	
Gerald Regel	Engineer	Westinghouse	X	X	
David Ristau	Engineering Manager	SPX Copes-Vulcan	X	X	X
Jerry Skolnik	Site Director	SPX Flow		X	
Cindy Stolz	Contracts Supervisor	SPX Flow	X	X	
Mark Tatara	Manufacturing Manager	SPX Flow	X	X	X
Michael Valore	Program Manager	Westinghouse	X		
Ronald Wessel	WEC Licensing	Westinghouse	X	X	
Ashley Ferguson	Team Leader (In Training)	NRC	X	X	
Terry Jackson	Branch Chief	NRC		X	
Jeffrey Jacobson	Team Leader	NRC	X	X	
Tim Steadham	Inspector	NRC	X	X	
Edgardo Torres	Inspector	NRC	X	X	

2. INSPECTION PROCEDURES USED

IP 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012 (ADAMS Accession No. ML113190538)

IP 43002, "Routine Inspections of Nuclear Vendors," dated July 15, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No.ML13148A361)

IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated November 29, 2013 (ADAMS Accession No. ML13280A478)

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Item Number	Status	Type	ITAAC	Description
99900080/2012-201-02	CLOSED	NON	N/A	Criterion III
99900080/2012-201-03	CLOSED	NON	N/A	Criterion III
99900080/2012-201-04	CLOSED	NON	N/A	Criterion V
99900080/2012-201-05	CLOSED	NON	N/A	Criterion IX
99900080/2012-201-06	CLOSED	NON	N/A	Criterion XVI
99900080/2013-201-03	CLOSED	NON	N/A	Criterion XVI

4. INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA

The NRC inspectors identified the following inspections, tests, analyses, and acceptance criteria (ITAAC) related to components being designed and tested by SPX. At the time of the inspection, SPX completed the redesign of several of the valve seals, modification of the shear cap bolting, and an addition to the thermal shields to minimize differential thermal expansion of certain key components. In addition, SPX performed modifications to the amount of explosive powder being loaded into the squib valve initiators. These modifications potentially impacted previous qualification testing performed for the squib valve explosive system. The ITAAC's design commitment referenced below are for future use by the NRC staff during the ITAAC closure process. The listing of these ITAAC design commitments does not constitute that they have been met and/or closed. The NRC inspectors did not identify any findings associated with the ITAAC identified below.

Source Document	ITAAC Index No.	ITAAC	Acceptance Criteria
Appendix C from the Combined License for Vogtle Units 3 and 4 and V.C. Summer Units	No. 159	2.2.03.02a	The ASME Code Section III design reports exist for the as-built components identified in Table 2.2.3-1 as ASME Code Section III.
Appendix C from the Combined License for Vogtle Units 3 and 4 and V.C. Summer Units	No. 166	2.2.03.05a.ii	A report exists and concludes that the seismic Category I equipment can withstand seismic design basis dynamic loads without loss of safety function.
Appendix C from the Combined License for Vogtle Units 3 and 4 and V.C. Summer Units	No. 170	2.2.03.07a.i	A report exists and concludes that the Class 1E equipment identified in Table 2.2.3-1 as being qualified for a harsh environment can withstand the environmental conditions that would exist before, during, and following a design basis accident without loss of safety function for the time required to perform the safety function.
Appendix C from the Combined License for Vogtle Units 3 and 4 and V.C. Summer Units	No. 214	2.2.03.12a.i	A test report exists and concludes that each squib valve changes position as indicated in Table 2.2.3-1 under design conditions.

5. LIST OF ACRONYMS USED

ADAMS	Agencywide Documents Access and Management System
ASME	American Society of Mechanical Engineers
CAR	Corrective Action Report
CDI	Commercial Grade Dedication Instruction
FEA	Finite Element Analysis
FMEA	Failure Modes Effects and Analysis
ITAAC	Inspections, Test, Analyses, and Acceptance Criteria
M&TE	Measurement and Test Equipment
MP	Manufacturing Procedure
NDE	Nondestructive Examination
NON	Notice of Nonconformance
NRC	Nuclear Regulatory Commission
QA	Quality Assurance

6. DOCUMENTS REVIEWED

Procedures

Assembly Procedure 1.2.445, “8” HP-L and HP-R Squib Valve,” Revisions 5 and 6, dated February 9, 2012 and February 17, 2012

Assembly Procedure 1.2.446, “14-inch ADS Squib Valve,” Revisions 3 and 4, dated February 3, 2012 and February 16, 2012

Assembly Procedure 1.2.453, “8” LP Squib Valve,” Revisions 5 and 6, dated February 9, 2012 and February 15, 2012

Procedure 17.1.113, “Instructions for Review of ANYSYS Class 3 Error Reports,” Revision 0, dated June 2, 2016

Procedure 17399(01) MP, “Manufacturing Procedure for the Initiator Assembly,” Revision E, dated March 28, 2016

Procedure 17399(02) MP, “Manufacturing Procedure for the Cartridge Assembly, 8-inch Low Pressure Squib Valve,” Revision E, dated March 28, 2016

Procedure 17399(03) MP, “Manufacturing Procedure for the Cartridge Assembly, 8-inch High Pressure Squib Valve,” Revision E, dated March 29, 2016

Procedure 17399(04) MP, “Manufacturing Procedure for the Cartridge Housing Assembly,” Revision E, dated March 29, 2016

Procedure 50-5.07.01, “Control and Inspection of Micrometers and Gages,” Revision 41, dated October 19, 2015

Procedure 50-5.9.20, “Visual Inspection of Welds per ASME Section III and Section V,” Revision 1, dated February 4, 2010

Procedure 50-5.27.29, “Commercial Grade Dedication for Parts Within and Attached to the Valve Assembly and For Services,” Revision 10, dated January 17, 2014.

Commercial Grade Dedication Instruction, “Procured Software,” Revision 1, dated June 4, 2012

Engineering Procedure No GT-14, “Verification and Validation of Commercially Procured Software for Design and Analysis for Safety-Related and Section, III Jobs,” Revision 6, dated July 21, 2015

Drawings

C-401587, “Input Closure Disc Squib Valve,” Revision 5, dated October 26, 2009

C-403122, “Latch Pin Cap,” Revision 3, dated September 28, 2011

C-403122, “Latch Pin Cap,” Revision 5, dated December 10, 2014

C-403259, “Crush Tube Assembly 8” HP Squib Valve,” Revision 6, dated November 24, 2010

C-403720, “Inspection Port Cover,” Revision 2, dated September 28, 2011

C-403720, “Inspection Port Cover,” Revision 4, dated December 10, 2014

C-404052, “Crush Tube Assembly 8” LP Squib Valve,” Revision 6, dated November 22, 2010

C-416709, “Bonnet Shield Nut,” Revision 0, dated October 1, 2014

C-416710, “Bonnet Top Shield Seal,” Revision 2, dated November 7, 2014

C-416711, “Bonnet Shield Bottom Seal,” Revision 2, dated November 7, 2014

C-416713, “Flange Shield Nut,” Revision 1, dated November 6, 2014

C-416714, “Flange Shield Seal,” Revision 2, dated November 7, 2014

C-416922, “External U-Seal,” Revision 0, dated November 4, 2014

C-416923, “HP Seal Assembly,” Revision 0, dated November 4, 2014

C-416924, “LP Seal Assembly,” Revision 0, dated November 4, 2014

D-399895, “Cartridge Housing 8” Low Pressure Squib Valve,” Revision 7, dated October 26, 2009

D-399896, “Cartridge Housing Assembly 8” LP Squib Valve, Revision 14, dated October 26, 2009

D-399918, “Cartridge Housing 8” High Pressure Squib Valve,” Revision 5, dated October 26, 2009

D-399919, “Cartridge Housing 14” ADS Squib Valve,” Revision 6, dated October 26, 2009

D-400966, “Cartridge Housing Assembly 8” HP Squib Valve,” Revision 14, dated October 26, 2009

D-400967, “Cartridge Housing Assembly 14” ADS Squib Valve,” Revision 14, dated October 26, 2009

D-401758, “8” HP/LP Cartridge Cover,” Revision 4, dated September 27, 2011

D-401758, “8” HP/LP Cartridge Cover,” Revision 6, dated December 10, 2014

D-403059, “Body Finish Machining ASME Code Class 1,” Revision 9, dated April 25, 2012

D-403059, “Body Finish Machining ASME Code Class 1,” Revision 13, dated December 10, 2014

D-403060, “8” HP Bonnet Final Machining,” Revision 7, dated September 28, 2011

D-403060, “8” HP Bonnet Final Machining,” Revision 11, dated March 10, 2015

D-403064, “Shear Cap Side A Finish Machining,” Revision 4, dated October 15, 2011

D-403064, “Shear Cap Side A Finish Machining,” Revision 11, dated May 5, 2014

D-403065, “Shear Cap Side B Finish Machining,” Revision 4, dated October 15, 2011

D-403065, “Shear Cap Side B Finish Machining,” Revision 11, dated May 5, 2014

D-403119, “Latch Pin Assembly 8” Squib Valve,” Revision 2, dated October 26, 2009

D-403125, “8-inch [200] HP-L Squib Valve Assembly,” Revision 15, dated February 16, 2016

D-403125, “8-inch [200] HP-L Squib Valve Assembly,” Revision 0, dated October 22, 2010

D-403465, “8” LP Bonnet Final Machining,” Revision 7, dated September 28, 2011

D-403465, “8” LP Bonnet Final machining,” Revision 11, dated January 10, 2015

D-403676, “8-inch [200] LP Squib Valve Assembly,” Revision 13, dated February 16, 2016

D-403676, “8-inch [200] LP Squib Valve Assembly,” Revision 0, dated October 22, 2010

D-404053, “Crush Tube Assembly 14” ADS Squib Valve,” Revision 6, dated November 22, 2010

D-414230, “Flange Shield Assembly,” Revision 4, dated November 7, 2014

D-416208, “Squib Bonnet Shield Assembly,” Revision 0, dated October 2, 2014

QC86-3244520CGD, “Commercial Grade Safety-Related Checklist for Part No. 324452, ¼” NPT Pipe Plug,” Revision 1, dated May 19, 2015

QC86-414230CGD, “Commercial Grade Safety-Related Checklist for Part No. 414230CGD,” Revision 0, dated November 17, 2014

QC86-416208CGD, “Commercial Grade Safety-Related Checklist for Part No. 416208CGD, Squib Bonnet Shield Assembly,” Revision 3, dated July 27, 2015

QC86-416718CGD, “Commercial Grade Safety-Related Checklist for Part No. 416718, Feedthrough Gasket,” Revision 3, dated February 3, 2015

QC86-416710CGD, “Commercial Grade Safety-Related Checklist for Part No. 416710, Bonnet Top Shield Seal,” Revision 2, dated November 14, 2014

QC86-416711CGD, “Commercial Grade Safety-Related Checklist for Part No. 416711, Bonnet Shield Bottom Seal,” Revision 2, dated November 14, 2014

QC86-416714CGD, “Commercial Grade Safety-Related Checklist for Part No. 416714, Flange Shield Seal,” Revision 2, dated November 14, 2014

Specifications, Calculations, Engineering Documents

Design Calculation AAA-141215, “Analysis of Maximum Gap Opening and Fastener Load During a Submergence Event,” Revision 3, dated August 7, 2015

Design Calculation No. ARB14056B, “Verification and Validation of ANSYS FEA models for Precompressive and Thermal Expansion Related Loads,” Revision 0, dated May 16, 2014.

Design Calculation No. ARB140516, “Effects of LOCA Event on Cartridge Cover Seal,” Revision 2, dated July 14, 2015

Design Calculation No. DCR-120604, “Evaluation of Squib Valve Crush Tube Assemblies for Strength,” Revision 1, dated August 7, 2014

Design Calculation DCR-120615, Evaluate Ability of 8” HP and LP Valves to Operate at Their Worst-Case Condition, Revision 1, dated August 13, 2015

Design Calculation DCR-150316, “Lot Acceptance Criteria for 8” Squib Valve Seals,” Revision 2, dated July 31, 2015

Design Calculation No. DCR-160525, “Verification of Finite Element Results for Deflection of a due to Applied Load,” Revision 0, dated May 25, 2016

Westinghouse Design Specification APP-PV98-Z0-001, “Pyrotechnic Actuator for ASME Boiler and Pressure Vessel Code, Section iii Class 1 Squib Valves (PV70),” Revision 3, dated May 20, 2016

Design Calculation RJW111114, “Verification and Validation for Weight and Center of Gravity Calculations in Inventor,” Revision 1, dated December 14, 2015

Design Report 10.2.189, “8-inch Class 2500 HP Squib Valve for Westinghouse Electric Company,” Revision 4, dated July 20, 2015

Design Report 10.2.190, “8-inch Class 2500 LP Squib Valve for Westinghouse Electric Company,” Revision 3, dated July 28, 2015

Corrective Action Reports (CARs)

CAR 635, “Implementation of Squib Assembly Procedure,” dated February 14, 2012

CAR 636, “Implementation of Squib Assembly Procedure,” dated February 14, 2012

CAR 643, “14” ADS valve,” dated February 16, 2012

CAR 644, “14’ ADS Squib valve,” dated February 16, 2012

CAR 645, “8” LP Squib valve,” dated February 16, 2012

CAR 646, “8” and 14” Squib valve crush tubes,” issued February 16, 2012

CAR 647, “Software Commercial Grade Dedication,” issued February16, 2012

CAR 711, “Qualification of Dimensional Inspectors for Weld Inspection,” dated May 11, 2012

CAR 850, “Cartridge Powder Missing issue at UTAS, “issued March 7, 2013

CAR 881, “QME 2 Delivery Delay SCAR 13-158-M007,” issued June 5, 2013.

CAR 944, “CAR 850 and 881 closed before objective evidence received,” issued September 27, 2013

CAR 1085, “NOVA Socket Head Cap Screws Shipped with Non-Conformities,” issued June 6, 2015

CAR 1126, “Parts Did Not Have a 90% Shelf Life When Required,” issued July 8, 2015

CAR 1129, “NOVA Socket Head CAP Screws Failed Inspection,” issued August 21, 2015

CAR 1152, “Wrong Trim Set structured,” issued December 11, 2015.

CAR 1163, “Finding 1 Audit of Hyosung Corp.” issued January 8, 2016

CAR 1168, “SQUIB Valve Critical Dimensional Errors DNs Very Late in Process,” issued January 19, 2016

CAR 1186, “Hyosung Revision Control on Drawings and Procedures,” issued March 10, 2016

CAR 1190, “Section III Internal Audit,” issued March 18, 2016

CAR 1206, “Software Verification Calculation-Design Report 10.2.189 Could Not Be Located,” issued May 25, 2016

CAR 1210, “No Designation/Delegation Letter Issued,” issued May 26, 2016

Preventative & Corrective Action Request (PCAR) 5480, “Carbon Potassium Nitrate Powder Composition,” issued March 8, 2013.

CARs Generated During NRC Inspection

CAR 1212, “Check for Effects of Initiator Mass Increase on Cartridge Output Characteristics,” issued June 15, 2016

CAR 1213, “GT-14 Software Verification,” issued June 16, 2016

CAR 1214, “UTAS Weld IPG300 Laser Weld Log Sheet,” dated June 16, 2016

CAR 1215, “CAR 1152 Response Late/ No Extension Requested,” issued in June 16, 2016

Miscellaneous

5059 Process Specification for Bridgewire Welding with the Hughes Welder, Revision D, September 7, 2010

APP-PV70-GRA-001, “AP1000 Squib Valve Failure Modes and Effect Analysis (FMEA),” Revision 2, dated May 18, 2015

External Audit Report 14-E-04 (NIAC No. 19012), External Audit of Technetics Group–Columbia as a supplier of Metallic Seals and O-Rings and Gaskets, dated May 5, 2014

External Audit Report of Trust Manufacturing as a supplier of Fasteners and Material Supply, dated March 16, 2012

ILT Laser welder with an IPG YLR 300/3000 QWC log sheet for 8” LP and HP, 14” ADS cartridge assembly input closure disc, internal closure disc and output closure disc welds

ILT Laser welder with an IPG YLR 300/3000 QWC log sheet for initiator assembly weld

Letter Number SPX_C6QD_1801, from Christian Sundberg, SPX to Rachel Bottorff, Westinghouse Electric Company, “FMEA content added and attachments,” dated June 7, 2012

Root Cause Report 10.4.544, “Root Cause Analysis - 8" Squib Valve Submergence Test Failure, “Revision 0, dated June 9, 2016

RRCA Number R5523, “Powder Processing, “dated June 17, 2013

SPX Corrective Action Program training, “How & When do we create Corrective Action Reports (CARs) at SPX?” performed on June 12, 2012, June 13, 2012 and June 20, 2012

SPX Report No. 10.4.526, “Impact Analysis for Initiator Mass Increase,” Revision 0, dated February 22, 2016

SPX Report No. 11.1.325, “Summary of Squib Valve Initiator Design Verification Testing,” Revision 1, dated February 22, 2016

Standard 3.3.8-3, “Laser Beam Welding with an ND: YAG Welder, Revision A, December 29, 1993

Technetics Procedure PS-1874, SPX Lot Acceptance Test Plan for 8" Squib Valve Seals, Revision 2, dated August 18, 2015

Technetics Report No. 15-004, Lot Acceptance Test Results, dated July 28, 2015

Training Record, "Training on Corrective Action process Section 1-6.17 of Quality Assurance Manual and work instruction 50-5.24.10 Reference Car 944," dated October 24, 2013

Qualification and Certification Records

Visual Inspection of Welds record for Dana Mays, dated March 26, 2012

Inspection of Bridgewire welds, Initiator closure welds and cartridge assemblies' closure disc welds acceptance criteria training, dated June 6, 2012

Personnel Certification Record for Dana Mays, dated September 17, 2010

ASME Section I, III, NQA-1, 10CFR21, 10CFR50 App. B training record performed on October 1, 2015

Visual Inspection per 50-5.9.20, 50-5.29, 50-5.9.33, 50-5.9.34, 50-5.9.35 for Curt Lipinski performed on July 7, 2012

Personnel Certification Record for Curt Lipinski, dated on December 6, 2010

Visual Inspection per 50-5.9.20, 50-5.29, 50-5.9.33, 50-5.9.34, 50-5.9.35 for Ken Bernosky, performed on August 14-15, 2012

Personnel Certification Record for Ken Bernosky, dated March 14, 2011