UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
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LISLE, IL 60532-4352

March 17, 2016

EA-15-064

Mr. Bryan C. Hanson
Senior VP, Exelon Generation Company, LLC
President and CNO, Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: CLINTON POWER STATION – NRC SUPPLEMENTAL INSPECTION REPORT 05000461/2016008 AND ASSESSMENT FOLLOW-UP LETTER

Dear Mr. Hanson:

On September 16, 2014, the Division 3 Shutdown Service Water (SX) pump failed to start due to a damaged bushing. The pump was determined to have been inoperable since the last successful run of the pump on May 30, 2014. Therefore, the pump was inoperable for approximately 108 days, a period greater than the allowed limiting condition for operation outage times provided in Technical Specification (TS) 3.7.2 and TS 3.5.1. Additionally, because your staff was not aware of the pump's inoperability during the unit's operation cycle, the required actions of TS 3.7.2.A.1, TS 3.5.1.B.2 and TS 3.5.1.D.1 were not followed. The performance deficiency that led to the pump failure was determined to have occurred on or about October 3, 1995, when your staff failed to review the suitability of application of the Division 3 SX pump modifications essential to the safety-related functions of the High Pressure Core Spray system as required by Title 10, *Code of Federal Regulations* (CFR), Part 50, Appendix B, Criterion III, "Design Control."

On March 31, 2015, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Clinton Power Station (CPS). Based on the results of this inspection, documented in NRC Inspection Report 05000461/2015001 (ML15134A224) on May 13, 2015, and the final significance determination documented in NRC Inspection Report 05000461/2015009 (ML15223B382) on August 11, 2015, the NRC assigned a White finding Action Matrix input to the Mitigating Systems cornerstone in the first quarter of 2015.

In response to this Action Matrix input, the NRC informed you that a supplemental inspection under Inspection Procedure (IP) 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," would be required.

On November 6, 2015, you informed the NRC that CPS was ready for the supplemental inspection.

On February 4, 2016, the NRC completed the supplemental inspection and discussed the results of this inspection and the implementation of your corrective actions with B. T. Kapellas and other members of your staff. The inspection team documented the results of this inspection in the enclosed inspection report.

The NRC performed this supplemental inspection to determine if: (1) the root and contributing causes for the significant issues were understood; (2) the extent of condition and extent of cause for the identified issues were understood; and (3) your completed or planned corrective actions were sufficient to address and prevent repetition of the root and contributing causes.

Your staff identified the primary root cause of the issue to be less than adequate legacy procedures used to develop plant modification change packages. Specifically, the legacy procedures contained an inadequate process to identify the need for further reviews and the level of design detail required by those reviews. In addition, your staff's evaluations identified the apparent cause of the Division 3 SX pump failure to be a failure of those legacy procedures to maintain design control, resulting in application of a hardfacing material to the sleeves that lost integrity and delaminated under normal system operating conditions, causing greater sleeve to bushing friction, which increased temperatures and resulted in bushing failure. Your staff's evaluations also identified the following contributing causes for the issue: (1) the original pump 1SX01PC had incorrect design specifications; (2) station management failed to provide effective corrective actions to address known equipment deficiencies; (3) suspended silt in the process fluid (lake water) that interacted with the pump internals resulted in higher operating temperatures and was anticipated to accelerate the effects of the apparent cause identified; (4) the operational profile that CPS used on the 1SX01PC pump contributed to fatigue and eventual delamination of hardfacing due to the frequent start/stop cycles; and (5) corrosion of sleeve materials may have contributed to crack propagation and hardfacing delamination.

The extent of condition evaluations performed by your staff did not identify any other safety-related pumps susceptible to the same condition, a common bearing design with the failed pump, except for the currently installed Division 3 SX pump. The condition was entered into your Corrective Action Program for further evaluation. The extent of cause evaluation performed by your staff identified one safety-related modification susceptible to the primary root cause of the issue, and this was also entered into your Corrective Action Program for further evaluation.

To correct the issues and prevent recurrence, your staff plans to ultimately replace the Division 3 SX pump with a bushing design that has been validated to be suitable for its operational requirements and not susceptible to the failure mechanisms as identified by the apparent cause evaluation performed for the pump failure. The new bushing is planned to be designed using current configuration change control procedures, which your staff identified as containing robust barriers to preclude an inadequate bushing design from being generated. Specifically, the current configuration change control procedures were identified to contain a more robust screening and risk assessment of modifications and a formal graduated approach to modification significance. In addition, your staff identified that the current procedures and processes in place further enhance identification and mitigation of the risk of flaws in vendor designs.

The NRC has determined that completed and planned corrective actions should be sufficient to address the performance that led to the White finding. Therefore, the performance issue will not be considered as an Action Matrix input after the end of the first quarter of 2016 in which the supplemental inspection exit meeting was conducted.

After reviewing CPS's performance in addressing the White finding subject of this IP 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," the NRC concluded your actions met the objectives of IP 95001. Therefore, in accordance with the guidance in Inspection Manual Chapter 0305, "Operating Reactor Assessment Program," the NRC is closing the White finding that had been held open pending completion of the supplemental inspection. As a result, the NRC determined the performance at CPS to be in the Licensee Response Column of the Reactor Oversight Process Action Matrix as of the date of this letter. However, the finding can still be considered for agency actions in accordance with the Action Matrix until March 31, 2016.

Based on the results of this inspection, the NRC identified one issue that was evaluated under the significance determination process as having a very-low safety significance (Green). The finding was also determined to involve a violation of NRC requirements. The violation is being treated as a Non-Cited Violation (NCV), consistent with Section 2.3.2 of the Enforcement Policy. The NCV is described in the subject inspection report.

If you contest the subject or severity of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copies to the Regional Administrator, Region III; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at CPS. In addition, if you disagree with the cross-cutting aspect assigned to any finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region III, and the NRC Resident Inspector at CPS.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC's Public Document Room or from the Publicly Available Records (PARS) component of the NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Robert J. Orlikowski, Chief
Operations Branch
Division of Reactor Safety

Docket No. 50–461
License No. NPF–62

Enclosure:
Inspection Report 05000461/2016008

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No.:	50-461
License No.:	NPF-62
Report No.:	05000461/2016008
Licensee:	Exelon Generation Company, LLC
Facility:	Clinton Power Station
Location:	Clinton, IL
Dates:	January 25 – February 4, 2016
Inspectors:	L. Rodriguez, Reactor Inspector (Lead) M. Jones, Reactor Inspector V. Petrella, Reactor Inspector (NSPDP Observer)
Approved by:	R. Orlikowski, Chief, Operations Branch Division of Reactor Safety

Enclosure

SUMMARY

Inspection Report 05000461/2016008; 01/25/2016 – 02/04/2016; Clinton Power Station; Supplemental Inspection – Inspection Procedure 95001.

This report covers about a 2-week period of inspection by two reactor inspectors from Region III, Division of Reactor Safety. Based on the results of this inspection, one Green Non-Cited Violation was identified. The significance of inspection findings is indicated by their color (i.e., greater than Green, or Green, White, Yellow, Red), and determined using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process," dated April 29, 2015. Cross-cutting aspects are determined using IMC 0310, "Aspects Within the Cross-Cutting Areas," dated December 4, 2014. All violations of U.S. Nuclear Regulatory Commission (NRC) requirements are dispositioned in accordance with the NRC's Enforcement Policy, dated February 4, 2015. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG–1649, "Reactor Oversight Process," dated February 2014.

Cornerstone: Mitigating Systems

The NRC staff performed the supplemental inspection in accordance with Inspection Procedure 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," to assess the licensee's evaluations associated with the failure of the Division 3 Shutdown Service Water (SX) pump to perform its intended safety function. The NRC staff previously characterized this issue as having (low to moderate) safety significance [White], as documented in NRC Inspection Report 05000461/2015001 (ML15134A224) on May 13, 2015, and the final significance determination documented in NRC Inspection Report 05000461/2015009 (ML15223B382) on August 11, 2015.

During the supplemental inspection, the inspectors observed that the licensee's evaluations identified the primary root cause of the issue to be less than adequate legacy procedures used to develop plant modification change packages. In addition, the licensee's evaluations identified the apparent cause of the Division 3 SX pump failure to be a failure of those legacy procedures to maintain design control, resulting in application of a hardfacing material to the sleeves that lost integrity and delaminated under normal system operating conditions, causing greater sleeve to bushing friction which increased temperatures and resulted in bushing failure.

To correct the issues and prevent recurrence, the licensee plans to replace the Division 3 SX pump with a bushing design that will be validated to be suitable for its operational requirements and will not be susceptible to the failure mechanisms identified by the apparent cause evaluation performed for the pump failure. The new bushing is to be designed using current configuration change control procedures, which the licensee identified as containing robust barriers to preclude an inadequate bushing design from being generated. Specifically, the current configuration change control procedures were identified to contain a more robust screening and risk assessment of modifications and a formalized graduated approach to modification significance. In addition, the licensee identified that the current procedures and processes in place further enhance identification and mitigation of the risk of flaws in vendor designs.

After reviewing the licensee's performance in addressing the White finding, the NRC inspectors concluded that the licensee's actions met the objectives of Inspection Procedure 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area." Therefore, in accordance with the guidance in IMC 0305, "Operating Reactor Assessment Program," the NRC is closing the White finding that had been held open pending completion of the supplemental inspection. As a result, the NRC determined the performance at Clinton Power Station to be in the Licensee Response Column of the Reactor Oversight Process Action Matrix as of the date of the cover letter of this inspection report. The finding will be considered for agency actions in accordance with the Action Matrix until March 31, 2016. (Section 4OA4)

NRC-Identified and Self-Revealed Findings

Green: The inspectors identified a finding of very-low safety significance (Green), and an associated Non-Cited Violation of Title 10, *Code of Federal Regulations*, Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," for the licensee's failure to follow Step 4.3.4 of procedure PI-AA-125, "Corrective Action Program Procedure." Specifically, the licensee failed to perform Class "B" Equipment Apparent Cause Evaluation (EACE) 2381871, "1SX01PC Failed to Start for Testing," in accordance with PI-AA-125-1003, "Apparent Cause Evaluation Manual," because they: (1) failed to analyze each causal factor to determine contributing causes as required by Step 4.4.1.2; and (2) failed to assign an effectiveness review for the EACE as required by Step 4.4.9.1. The licensee entered this finding into their Corrective Action Program and revised their EACE to: (1) include three contributing causes; (2) upgrade a corrective action to a corrective action to prevent recurrence; and (3) assign an effectiveness review to determine the effectiveness of the corrective action to prevent recurrence.

The performance deficiency was determined to be more than minor because if left uncorrected, it would have the potential to lead to a more significant safety concern. Specifically, an effectiveness review is required to provide assurance that the Division 3 SX pump design change is successful in preventing recurrence of pump failure before another pump failure occurs, which would be a more significant safety concern. The finding impacted the Mitigating Systems Cornerstone and screened as having very-low safety significance (Green) because although the finding is a deficiency ultimately affecting the design or qualification of the Division 3 SX pump, the pump still maintains its operability. The inspectors determined this finding had an associated cross-cutting aspect in the area of Human Performance ("Conservative Bias") because although a "B" Apparent Cause Evaluation may have been allowable for investigating the failure of the Division 3 SX pump, had an "A" Root Cause Analysis been performed, a more rigorous investigation process would have been used to identify contributing causes, assign corrective actions, and identify effectiveness reviews for the failure of the Division 3 SX pump. [H.14] (Section 4OA4.02.03.f)

Licensee-Identified Violations

No violations were identified.

REPORT DETAILS

4. OTHER ACTIVITIES

4OA4 Supplemental Inspection (95001)

.01 Inspection Scope

This inspection was conducted in accordance with Inspection Procedure 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," to assess the licensee's evaluation of one White inspection finding in the Mitigating Systems Cornerstone. The inspection objectives were to:

- Provide assurance that the root causes and contributing causes of risk-significant performance issues are understood;
- Provide assurance that the extent of condition and extent of cause of risk-significant issues are identified; and
- Provide assurance that licensee corrective actions (CAs) to risk-significant performance issues are sufficient to address the root causes and contributing causes, and to prevent recurrence.

Clinton Power Station (CPS) was in the Regulatory Response column of U.S. Nuclear Regulatory Commission's (NRC's) Action Matrix in the first quarter of 2015 because of a greater-than-green Security Cornerstone input as described in letter dated October 23, 2014. Clinton has remained in the Regulatory Response column since the second quarter of 2015 as a result of one inspection finding of low to moderate (White) safety significance. The White finding was associated with a performance deficiency issued in NRC Inspection Report (IR) 05000461/2015001 (ML15134A224) on May 13, 2015, for Clinton's failure to review the suitability of application of the Division 3 Shutdown Service Water (SX) pump modifications essential to the safety-related functions of the High Pressure Core Spray system as required by Title 10, *Code of Federal Regulations* (CFR), Part 50, Appendix B, Criterion III, "Design Control," in 1995. This finding was self-revealed on September 16, 2014, during a surveillance test to ensure operability of the Division 3 SX pump, after the pump failed to start due to a damaged bushing which rendered the pump inoperable. The finding was characterized as having (White) safety significance based on the results of a Detailed Risk Evaluation performed by a region-based senior reactor analyst, as discussed in NRC IR 05000461/2015001, dated May 13, 2015, and the final significance determination documented in NRC IR 05000461/2015009 (ML15223B382), dated August 11, 2015.

Exelon Generation Company, LLC informed the NRC on November 6, 2015, that they were ready for the supplemental inspection. The licensee performed two separate investigations to address the performance issue related to the Division 3 SX pump failure. The first investigation was Equipment Apparent Cause Evaluation (EACE) 2381871, "1SX01PC Failed to Start for Testing." This investigation focused on determining the apparent and contributing causes for the equipment failure: the Division 3 SX pump failure to start. The second investigation was Root Cause Report (RCR) 2577348, "NRC White Finding on Design Control of the Division 3 Shutdown Service Water Pump." This investigation focused on determining the root and contributing causes for the design failure: the failure to verify the suitability of the design of the replacement Division 3 SX pump when it was installed in 1995.

Since the failure of the Division 3 SX pump and its inability to perform its safety function are what led to the White finding, both the EACE and the RCR were reviewed by the inspectors because both the equipment failure and the design failure played a role in the pump being unable to perform its safety function.

The inspectors reviewed the licensee's EACE and RCR to: (1) determine if the root causes and contributing causes of the performance issue were understood; (2) determine if the extent of condition and extent of cause of the performance issue had been identified; and (3) determine if the licensee's CAs for the performance issue were sufficient to address the root and contributing causes and prevent recurrence. The inspectors also reviewed additional supporting documents, held discussions with licensee personnel, and performed a walk down of the currently installed Division 3 SX pump to meet the inspection objectives of Inspection Procedure 95001.

.02 Evaluation of Inspection Requirements

02.01 Problem Identification

a. Inspection Procedure 95001 requires the inspectors to determine whether the licensee's evaluation documented who identified the issue (i.e., licensee-identified, self-revealing, or NRC-identified) and under what conditions the issue was identified.

The investigations (EACE and the RCR) reviewed by the inspectors documented that the Division 3 SX pump (1SX01PC) failed to start on September 16, 2014, when attempting to perform the 2-year In-Service Testing (IST) comprehensive test under CPS 9069.01, "Shutdown SX Operability Test." Therefore, the issue was self-revealed. The issue was originally captured in Action Request (AR) 02381871, "Failure of the Outer/Upper Motor Bearing for 1SX01PC." The inspectors verified that the discovery information in the investigations matched the information in the CA document.

The inspectors determined that the investigations performed by the licensee adequately identified who and under what conditions the issue was identified.

b. Inspection Procedure 95001 requires the inspectors to determine whether the licensee's evaluation documented how long the issue existed, and whether there were any prior opportunities for identification.

The investigations reviewed by the inspectors discussed the issue, the pump being unable to start, as existing since the last successful run of the pump during its May 30, 2014, IST surveillance. At that time, the pump met all IST surveillance requirements. From that time until the pump failure occurred on September 16, 2014, there were no other opportunities documented in the investigations that would have allowed identification of the issue. The pump was inoperable for approximately 108 days. The inspectors reviewed IST test trend data for the pump to confirm that no other pump starts had been attempted in that timeframe.

Since the pump failure was caused by an inadequate design, the investigations also documented opportunities to identify the design deficiency. One documented opportunity was when the currently installed replacement pump was procured in the 2012 timeframe. A design review could have been performed, but since it was only

subjected to the procurement process, no review was performed. The inspectors reviewed Purchase Order 462656, "SR Procurement Spec: Pump Assembly, Centrifugal, Type: 2 Stage, Vertical, Model 8 x 14A VCM," which procured the replacement pump to confirm that a design review had not been performed.

In addition, the investigations documented that the inadequate pump design was generated in 1992 under Plant Modification Change Package SXF022. At that time, there were multiple reviews performed for the design change that had the opportunity to identify the design inadequacies. The inspectors reviewed SXF022 to confirm that the reviews had not captured the design deficiency.

The inspectors determined that the investigations adequately identified how long the issue existed and whether there were any prior opportunities for identification.

c. Inspection Procedure 95001 requires the inspectors to determine whether the licensee's evaluation documented the plant-specific risk consequences and compliance concerns associated with the issue.

The licensee's investigations documented the plant-specific risk consequences and concluded that the Nuclear Safety risk was Medium with a low to moderate safety significance. The Online Plant Risk became Yellow when the 1SX01PC pump became unavailable. The inspectors were able to verify that the Nuclear Safety risk documented was equivalent to the NRC identified low to moderate safety significance (White) assigned to the issue.

The licensee's investigations also documented the compliance concerns that resulted from the issue. The RCR documents the White finding and the associated 10 CFR Part 50, Appendix B, Criterion III, "Design Control," violation that resulted from the issue. In addition, the RCR documents the licensee's status in the NRC Action Matrix, in the Regulatory Response column, as a result of the issue. The inspectors reviewed the NRC inspection reports associated with this issue to ensure that the compliance concerns had been adequately captured in the licensee's RCR.

In addition, the licensee's RCR documented the reportability impact of the issue. A Licensee Event Report (LER) 2014-005-00 was submitted to the NRC as a result of the pump failure. A revised report, LER 2014-005-01, was later submitted to the NRC to address the impact on the Technical Specifications due to the timeframe the pump had been inoperable. The inspectors reviewed the LERs, and compared them to the information in the RCR, to verify that the compliance concerns were correctly captured in the RCR.

The inspectors determined that the investigations adequately identified the plant-specific risk consequences and the compliance concerns associated with the issue.

02.02 Root Cause, Extent of Condition, and Extent of Cause Evaluation

d. Inspection Procedure 95001 requires the inspectors to determine whether the problem was evaluated using a systematic methodology to identify the root and contributing causes.

The licensee used investigation techniques outlined in their procedures to complete the investigations. For the EACE, they used Attachment 14, "Evaluation Guide for Equipment Issues," of their PI-AA-125-1006, "Investigation Techniques Manual," to perform the investigation.

For the RCR, the following systematic methods were used to perform the investigation:

- Cause and Effect Analysis (Why Staircase); and
- Events and Causal Factors Chart Analysis/TapRoot®.

The inspectors reviewed the licensee's guidance in PI-AA-125-1006 to assess their use of the investigation methods for the EACE and RCR.

The inspectors determined the licensee evaluated the issue using systematic methodologies to identify root and contributing causes.

e. Inspection Procedure 95001 requires the inspectors to determine whether the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.

As discussed above, both the EACE and the RCR were reviewed by the inspectors as part of the inspection because both the equipment failure and the design failure played a role in the pump being unable to perform its safety function.

The EACE, which evaluated the equipment failure, determined the apparent cause of the Division 3 SX pump failure to be a failure of the legacy procedures to maintain design control, resulting in application of a hardfacing material to the sleeves that lost integrity and delaminated under normal system operating conditions, causing greater sleeve to bushing friction which increased temperatures and resulted in bushing failure. The EACE did not identify any contributing causes. The inspectors questioned the adequacy of the EACE because there were evaluations attached to the document that identified potential causes for the pump failure. Upon further review, the licensee revised the EACE and identified the following as contributing causes: (1) suspended silt in the process fluid (lake water) that interacted with the pump internals resulted in higher operating temperatures and was anticipated to accelerate the effects of the apparent cause identified; (2) the operational profile that CPS used on the 1SX01PC pump contributed to fatigue and eventual delamination of hardfacing due to the frequent start/stop cycles; and (3) corrosion of sleeve materials may have contributed to crack propagation and hardfacing delamination.

The level of detail of the EACE was not initially commensurate with the safety significance of the pump failure. This is evident by the failure of the EACE to originally identify three contributing causes that influenced the outcome of the pump failure. The failure to identify the contributing causes, along with the failure to assign an effectiveness review for the EACE, was determined to be a finding and is discussed below in Section 02.03.f of this report. However, because the licensee took CAs and addressed the weaknesses identified in the EACE during the inspection, the inspectors determined the revised EACE was conducted to level of detail commensurate with the safety significance of the pump failure.

The RCR, which evaluated the design failure, determined the root cause to be less than adequate legacy procedures used to develop plant modification change packages. Specifically, the legacy procedures contained an inadequate process to identify the need for further reviews and the level of design detail required by those reviews. In addition, the RCR identified the following contributing causes for the design failure: (1) the original pump 1SX01PC had incorrect design specifications; and (2) station management failed to provide effective CAs to address known equipment deficiencies. The root cause and contributing causes were determined by using the systematic investigation methods described above. The methods adequately drove the depth of the investigation to a level commensurate with the significance of the design failure.

Therefore, the inspectors determined that the evaluations (revised EACE and RCR) were conducted to a level of detail commensurate with the significance of the problem.

f. Inspection Procedure 95001 requires the inspectors to determine whether the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience.

The licensee's investigations documented prior occurrences and knowledge of prior operating experience with the Division 3 SX pump. The original Division 3 SX pump failed to start on May 24, 1990, due to tight packing which led to the mechanical binding of the pump. It again failed to start on August 17, 1990, due to binding as a result of silt intrusion. As a CA, the licensee developed modification SXF022 to address the silt intrusion failure mechanism. The design developed in 1992, and installed in 1995, was the design that led to the pump failure in 2014. The evaluation of these prior occurrences led to the identification of the two contributing causes identified in the RCR for the Division 3 SX pump failure.

The investigations also considered the pump operating experience as part of the evaluations. From 2010 through 2012, IST test data demonstrated a degrading trend in pump performance. The investigations attributed the degraded pump performance to mud/silt build-up in the pump columns. Licensee investigations noted that back leakage of raw water from the plant service water system past the pump's discharge check valve was believed to have led to the build-up of the mud and silt. Although the check valve leakage was considered in the investigations, it was determined to not be a contributing cause to the pump failure in 2014.

The licensee's investigations also considered previous events at other sites. Operating experience from four different sites was reviewed to determine its applicability to the issue at CPS.

The inspectors reviewed SXF022, IST trend data, and past CA documents, and also interviewed licensee personnel, to evaluate whether the licensee had adequately considered prior occurrences and operating experience as part of the investigations.

The inspectors determined that the investigations adequately included a consideration of prior occurrences of the problem and knowledge of prior operating experience.

g. Inspection Procedure 95001 requires the inspectors to determine whether the root cause evaluation addressed the extent of condition and the extent of cause of the problem.

The licensee's investigations addressed the extent of condition of the problem. A review was performed to determine whether any other safety-related pumps at the site shared a common bearing design with the failed pump, making them susceptible to failure in the same manner as the failed pump. The only susceptible pump identified during the extent of condition review was the replacement Division 3 SX pump, which is currently installed. It contains shaft sleeves with similar welded overlay hardfacing. No other pumps were identified in the extent of condition as being susceptible to the same failure mechanism as the failed Division 3 SX pump.

The RCR addressed the extent of cause of the design problem. Specifically, all safety-related plant modifications developed with assistance of a vendor under the legacy design change procedures were determined to be susceptible. The RCR identified 32 engineering changes which included significant vendor involvement in the design justification. Of the 32 engineering changes, one was determined to require additional evaluation to determine if the modification introduced new unevaluated failure modes. The licensee generated a CA (AR 2583455) to perform additional engineering reviews to verify the adequacy of the engineering change.

To evaluate the extent of condition, the inspectors reviewed documentation provided by a vendor of safety-related pumps at the site to confirm the licensee's conclusions that other safety-related pumps at CPS were not susceptible to the failure mechanism that led to the failure of the Division 3 SX pump. In addition, the inspectors reviewed the operability evaluation (EC 404045) of the currently installed Division 3 SX pump that was determined to be susceptible to the failure mechanism of the failed pump. To evaluate the extent of cause, the inspectors reviewed one of the 32 engineering changes determined to be susceptible to the extent of cause and for which no additional evaluation was required (FECN 27287). The inspectors also reviewed the engineering change (FECN 24896) that was determined to require additional evaluation.

The inspectors determined that the investigations adequately addressed the extent of condition and the extent of cause of the problem.

h. Inspection Procedure 95001 requires the inspectors to determine whether the root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture components as described in Inspection Manual Chapter (IMC) 0310.

The licensee's RCR documented their safety culture assessment for the performance issue. The licensee identified the following cross-cutting aspects in the area of Human Performance:

- H.1. Resources - Less than adequate legacy procedures for performing design changes;
- H.5. Work Management - Failure to appropriately identify and manage the risk associated with the design change made in 1992;
- H.6. Design Margins - Failure to carefully guard the design margins of the pump when it's design was changed;
- H.9. Training – A potential training gap existed when the change was performed related to individuals recognizing and challenging the utilization of new materials in safety-related systems;

- H.12. Avoid Complacency - Individuals did not consider potential undesired consequences of the design change performed; and
- H.14. Conservative Bias – Individuals assumed that vendor expertise was satisfactory when developing the design change.

The licensee also identified the following cross-cutting aspect in the area of Problem Identification and Resolution:

- P.3. Resolution - The CA taken to address silting issues in 1992, a design change for the pump, created a new latent issue.

The licensee determined that the new design change process, including procedures and training, was sufficient to address the cross-cutting aspects identified in the safety culture assessment.

The inspectors reviewed the current design change procedures and interviewed licensee personnel to assess how the new design change process would address the cross-cutting aspects identified.

The inspectors determined that the root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture aspects as described in IMC 0310.

02.03 Corrective Actions

a. Inspection Procedure 95001 requires the inspectors to determine whether appropriate CAs are specified for each root and contributing cause or that the licensee has an adequate evaluation for why no CAs are necessary.

The EACE determined the apparent cause of the Division 3 SX pump failure to be a failure of the legacy procedures to maintain design control, resulting in application of a hardfacing material to the sleeves that lost integrity and delaminated under normal system operating conditions, causing greater sleeve to bushing friction which increased temperatures and resulted in bushing failure. The licensee originally developed a CA to replace the Division 3 SX pump with a pump that contained a bushing design validated to be suitable to ensure operational requirements would be met. The inspectors questioned the adequacy of the CA categorization because the licensee was crediting the action to prevent recurrence of the Division 3 SX pump failure. The licensee subsequently revised the EACE and upgraded the categorization of the action to a CA to prevent recurrence (CAPR). The revised CAPR for the apparent cause is to ultimately replace the Division 3 SX pump with a bushing design that has been validated to be suitable for its operational requirements and not susceptible to the failure mechanisms as identified by the apparent and contributing causes in the EACE.

The EACE did not originally identify any contributing causes. Due to questions from the inspectors, the EACE was revised to include the following contributing causes: (1) suspended silt in the process fluid (lake water) that interacted with the pump internals resulted in higher operating temperatures and was anticipated to accelerate the effects of the apparent cause identified; (2) the operational profile that CPS used on the 1SX01PC pump contributed to fatigue and eventual delamination of hardfacing due

to the frequent start/stop cycles; and (3) corrosion of sleeve materials may have contributed to crack propagation and hardfacing delamination. The revised CAPR for the apparent cause, as discussed above, is also credited to address the contributing causes identified.

The RCR determined the root cause to be less than adequate legacy procedures used to develop plant modification change packages. Specifically, the legacy procedures contained an inadequate process to identify the need for further reviews and the level of design detail required by those reviews. The CAPR for the root cause was determined to have already been completed when the licensee transitioned to the use of corporate procedures for developing plant modification change packages in 2001. The licensee identified procedure CC-AA-103, "Configuration Change Control for Permanent Physical Plant Changes," as having barriers that address the root cause because it employs a more robust screening and risk assessment of modifications as well as containing a formalized graduated approach to modification significance. In addition, the following procedures were also credited as part of the CA to prevent recurrence because they were determined to enhance identification and mitigation of the risk of flaws in vendor designs:

- CC-AA-103-1003, "Owners Acceptance Review of External Engineering Technical Products";
- HU-AA-1212, "Technical Task Risk/Rigor Assessment, Pre-Job Brief, Independent Third Party Review, and Post-Job Review"; and
- HU-AA-1081, "Fundamentals Tool Kit," with Forms B, C, and D.

The RCR also identified the following as contributing causes: (1) the original pump 1SX01PC had incorrect design specifications; and (2) station management failed to provide effective CAs to address known equipment deficiencies. To address the first contributing cause, a CA was generated to revise specification K-2828B, "Shutdown Service Water Pump Clinton Power Station – Unit 1," to document the correct source of bearing lubrication for pump 1SX01PC. To address the second contributing cause in the RCR, the licensee is crediting the revised CAPR in the EACE, as described above.

To evaluate the adequacy of the CAs, the inspectors reviewed the new design change procedures and interviewed licensee personnel to understand the difference between the legacy design change procedures and the new design change procedures. The inspectors also reviewed the licensee's progress for the development of a new design for the Division 3 SX pump by interviewing licensee personnel and reviewing Engineering Change Request 418529, "Requirements for Suction Bell Bearing Design for 1SX01PC," which contains relevant information for the new bearing design. Although the licensee had started the design change process for the new design, the development of the design was still in its infancy at the conclusion of the inspection. The licensee is tracking the design change as Engineering Change (EC) 404025, "Div. 3 SX Pump Bearing and Suction Bell Design Change."

The inspectors determined that, based partly on the revisions made to the EACE during the inspection, appropriate CAs were specified for each root and contributing cause.

b. Inspection Procedure 95001 requires the inspectors to determine whether the CAs have been prioritized with consideration of risk significance and regulatory compliance.

Procedure PI-AA-125, "Corrective Action Program (CAP) Procedure," defines different action types the licensee can use to prioritize actions taken to address identified issues. The following are three of the action types, and their definitions, used to address the causes identified in the RCR and EACE investigations. They are listed in order of decreased priority:

- CAPR: Action taken to prevent recurrence of the root cause(s) of the event.
- CA: An action taken or planned that restores a Condition Adverse to Quality to an acceptable condition or capability.
- Action Tracking Item (ACIT): Action items that are completed to improve performance, or correct minor problems that do not represent Condition Adverse to Qualities.

To address the apparent cause identified in the EACE, the licensee originally generated three ACITs and one CA. The inspectors questioned the adequacy of the CA designation because the licensee was ultimately crediting this action to prevent recurrence of the Division 3 SX pump from failing in the same manner in the future. The licensee subsequently revised the EACE and upgraded the categorization of the CA to a CAPR. The finding documented in Section 02.03.f below provides more details on the revision of the EACE. The revised EACE also identified three contributing causes. The CAPR generated in the revised EACE is also credited to address the new contributing causes identified.

The inspectors interviewed licensee staff and reviewed CAP procedures to determine the adequacy of the action types assigned to the issues identified in the investigations.

The inspectors determined, with the revisions made during the inspection, that the licensee adequately prioritized the CAs with consideration of the risk significance and regulatory compliance.

c. Inspection Procedure 95001 requires the inspectors to determine whether a schedule has been established for implementing and completing the CAs.

The ACITs and CAPR generated to address the apparent cause identified in the EACE have a final due date of September 5, 2017.

The CAPR generated to address the root cause identified in the RCR was determined to have already been completed since 2001. Specifically, the corporate procedures being credited to address the root cause have been in effect at CPS since 2001. The CA that was generated to address the first contributing cause identified in the RCR has a due date of October 28, 2016.

The inspectors reviewed the licensee's progress for the development of the new design for the Division 3 SX pump by interviewing licensee personnel. Although the licensee had started the design change process, the development of the design was still in its infancy at the conclusion of the inspection. The licensee is tracking the design change under EC 404025.

The inspectors determined that the licensee adequately established a schedule for implementing and completing the CAs.

d. Inspection Procedure 95001 requires the inspectors to determine whether quantitative or qualitative measures of success have been developed for determining the effectiveness of the CAs to prevent recurrence.

The RCR documented the Effectiveness Review (EFR) to be performed for the CAPR that addresses the root cause. Since the CAPR was determined to have been completed since 2001, an EFR could be performed. The EFR was to perform a review of safety-related modifications completed after CPS implemented administrative controls to ensure design modifications received an adequate level of review. The review was done for modifications from 2002 until approximately August of 2015. The EFR reviewed the modifications for the following:

- A review for safety-related physical plant modifications with significant vendor involvement;
- A review for evidence of overreliance on vendors in the justification;
- Screen on whether it was reasonable that CPS had sufficient expertise on site to adequately challenge the modification;
- If expertise was not available on site, did CPS seek out an independent third party review?;
- Was level of review adequate for the modification?; and
- Did the modification add new failure modes? Were these failure modes adequately described and dispositioned?

The criteria defined for determining the effectiveness of the CAPR was the following: No (zero) safety-related modifications with inadequate level of review that add new failure modes without adequate disposition, because of a lack of procedures (Standards, Policies, or Administrative Controls) or because these procedures needed improvement.

Since the EFR, which had an assigned due date of December 4, 2015, had been completed prior to the inspection, the inspectors reviewed the results. A total of 405 safety-related modifications were originally within the scope. After performing a screening, the population of modifications for review was reduced to 58. More screenings then led to a total of three modifications that needed detailed reviews. Based on the screenings and reviews, the licensee determined that the CAPR had been effective. To evaluate the results of the EFR, the inspectors reviewed two of the three modifications (EC 339008 and EC 366623) that had detailed reviews performed as part of the EFR.

The licensee originally did not identify any EFR for the actions in the EACE. Due to questions from the inspectors, the licensee revised the EACE and developed a CAPR with an EFR for the apparent cause. The failure to assign an EFR for the actions in the EACE, along with the failure to identify contributing causes in the EACE, was determined to be a finding and is discussed below in Section 02.03.f of this report.

The EFR in the revised EACE was to verify that the pump installed as part of the CAPR met the following:

- Design validation specifically addresses failure mechanisms identified by apparent and contributing causes;
- Post Modification Testing for the modification was performed per design requirements and results were acceptable; and

- Preventative Maintenance to clean and inspect pump on 10 year frequency specified by ACIT 2381871-59 had been performed to clean and inspect pump with results indicating pump bearings were resistant to failure mechanisms identified by the Apparent and Contributing Causes in the EACE.

The criteria defined for determining the effectiveness of the CAPR was: 0 failures attributable to failure mechanisms identified by apparent and contributing causes. The EFR has a due date of September 19, 2027. The licensee provided justification to the inspectors for the due date, and the 10 year preventative maintenance inspection frequency, by stating that it was long enough to provide a method for validating the effectiveness of the new design, but short enough to catch any degradation before failure of the pump. The licensee also stated the frequency was supported by industry experience with process lubricated bearings in vertical pumps.

The inspectors determined that, based on the revisions made to the EACE during the inspection, the licensee adequately developed quantitative or qualitative measures of success for determining effectiveness of the CAs to prevent recurrence.

e. Inspection Procedure 95001 requires the inspectors to determine whether the CAs planned or taken adequately address a Notice of Violation (NOV) that was the basis for the supplemental inspection.

To address the NOV that was the basis for the supplemental inspection, the licensee plans to ultimately replace the Division 3 SX pump with a bushing design that will be validated to be suitable for its operational requirements and not susceptible to the failure mechanisms identified by the EACE performed for the pump failure. The new bushing is planned to be designed using current configuration change control procedures, which the licensee identified as containing robust barriers to preclude an inadequate bushing design from being generated.

The inspectors determined that the corrective actions planned would adequately address the NOV that was the basis for the supplemental inspection.

f. Findings

Failure to Perform an Adequate EACE

Introduction: The inspectors identified a finding of very-low safety significance (Green), and an associated Non-Cited Violation (NCV) of 10 CFR Part 50, Appendix B, Criterion V, “Instructions, Procedures, and Drawings,” for the licensee’s failure to follow Step 4.3.4 of Procedure PI-AA-125, “CAP Procedure.” Specifically, the licensee failed to perform Class “B” EACE 2381871, “1SX01PC Failed to Start for Testing,” in accordance with PI-AA-125-1003, “Apparent Cause Evaluation Manual,” because they: (1) failed to analyze each causal factor to determine contributing causes as required by Step 4.4.1.2; and (2) failed to assign an EFR for the EACE as required by Step 4.4.9.1.

Description: The licensee’s Quality Assurance Topical Report (QATR) NO-AA-10 is the highest tiered document that describes the Quality Assurance Program. It is intended to comply with the requirements of 10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.” Procedure PI-AA-125, “CAP Procedure,” is a lower tiered document which implements the requirements of the QATR. The procedure describes the licensee’s CAP. One of the purposes of the CAP

is to ensure that, at the direction of site management, Significant Conditions Adverse to Quality and Conditions Adverse to Quality are resolved through direct action, the implementation of CAPRs, and CAs. Another purpose of the CAP is to provide direction on the resolution and documentation of undesirable conditions. CAP procedures include provisions for investigation, CA determination, investigation report review and approval, action tracking, and issue analysis.

When an undesirable condition is identified at CPS, procedure PI-AA-120, "Issue Identification and Screening Process," is entered and the condition is screened. Once the condition has been screened, it is evaluated and reviewed in accordance with Procedure PI-AA-125.

On September 16, 2014, the Division 3 SX pump failed to start. The licensee entered the issue, the subject of this inspection report, into their CAP as AR 2381871, "Failure of the Outer/Upper Motor Bearing for 1SX01PC." The issue was screened using Procedure PI-AA-120, and it was determined to have a Significance Level of 2 and a Medium Likelihood. Per Procedure PI-AA-120, this meant that either an "A" Root Cause Analysis or a "B" Apparent Cause Evaluation could be assigned to investigate the issue. As documented in AR 2381871 the licensee decided to assign a "B" investigation, which is less rigorous than an "A" investigation, to the issue. Consequently, Step 4.3.4 of Procedure PI-AA-125 required the class "B" Apparent Cause Evaluation to be performed in accordance with PI-AA-125-1003, "Apparent Cause Evaluation Manual."

The EACE 2381871, "1SX01PC Failed to Start for Testing," dated December 21, 2015, was the "B" class investigation performed for the issue. It focused on determining the apparent and contributing causes for the Division 3 SX pump failure to start. The EACE determined the apparent cause to be a failure of a legacy CPS procedure to maintain design control, resulting in application of a hardfacing material to the sleeves that lost integrity and delaminated under normal system operating conditions, causing greater sleeve to bushing friction which increased temperatures and resulted in bushing failure. The EACE did not identify any contributing causes. Through a review of the EACE, the inspectors noted that technical information attached to the document suggested there were potential causes for the pump bearing failure that should have been evaluated. However, the EACE did not provide a discussion on the evaluation of those potential causes to justify their dismissal as apparent or contributing causes.

The inspectors reviewed PI-AA-125-1003, and noted that Step 4.4.1.2 requires the licensee to analyze each Causal Factor to determine the apparent causes and contributing causes. The inspectors determined the licensee's failure to evaluate the potential causes identified was a failure to analyze each causal factor to determine the apparent and contributing causes and was contrary to the requirements of Step 4.4.1.2 of PI-AA-125-1003.

While reviewing the EACE, the inspectors also noted that although only a CA had been generated as part of the EACE, it was being credited to prevent recurrence of the Division 3 SX pump failure. The CA was to ultimately replace the Division 3 SX pump with a bushing design that was to be validated to be suitable for operational requirements. One of the requirements for the new design was that it not be susceptible to the failure mechanisms identified in the EACE. In order to understand the failure

mechanisms of the Division 3 SX pump, it was necessary to understand the contributing causes that lead to the pump failure. Therefore, it was necessary to adequately determine the contributing causes in the EACE in order to generate an adequate design change that prevented recurrence of the equipment failure.

Through additional review of the EACE, the inspectors also noted that no effectiveness review (EFR) assignments had been generated as part of the EACE to assess the effectiveness of the CA once implemented. Therefore, there was no mechanism in place to assess the adequacy of the Division 3 SX pump design change to ensure that it would be successful in preventing a future recurrence of pump failure.

The inspectors reviewed PI-AA-125-1003, and noted that Step 4.4.9.1 requires the licensee to perform effectiveness reviews in accordance with PI-AA-125-1004, "Effectiveness Review Manual." It also requires the licensee to: (1) perform an effectiveness review for all Significance Level 1 and 2 Apparent Cause Evaluations; (2) determine the actions to be evaluated in the EFR and the success criteria that will be used to evaluate the EFR; (3) identify the parameters that will be measured and establish quantitative and/or qualitative acceptance criteria; and (4) determine a due date that allows sufficient time for implementation and evaluation of the effectiveness of the action. The inspectors determined the licensee's failure to assign an EFR for the EACE was contrary to the requirements in Step 4.4.9.1 of PI-AA-125-1003.

Therefore, the licensee failed to perform EACE 2381871 in accordance with PI-AA-125-1003, as required by Step 4.3.4 of procedure PI-AA-125.

The licensee captured the inspectors' concerns in the CAP as AR 2621533, "NRC 95001: EACE 2381871-05 Contributing Causes Documentation," and AR 2618997, "EFR Assignment not Generated for EACE 2381871-05." The licensee's immediate CAs included revising the EACE to: (1) include three contributing causes; (2) upgrade a CA to a CAPR; and (3) assign an EFR to determine the effectiveness of the CAPR. The licensee determined that the operability of the currently installed Division 3 SX pump was not affected by the deficiencies identified.

Analysis: The inspectors determined the licensee's failure to perform EACE 2381871 in accordance with PI-AA-125-1003, was contrary to procedure Step 4.3.4 of PI-AA-125, and was a performance deficiency. Specifically, the licensee: (1) failed to analyze each causal factor to determine contributing causes, as required by Step 4.4.1.2 of PI-AA-125-1003; and (2) failed to assign an EFR for the EACE as required by Step 4.4.9.1 of PI-AA-125-1003. The performance deficiency was determined to be more than minor because if left uncorrected, it would have the potential to lead to a more significant safety concern. Specifically, an effectiveness review is required to provide assurance that the Division 3 SX pump design change is successful in preventing a future recurrence of pump failure, which would be a more significant safety concern. In addition, a failure to identify contributing causes could lead to an incomplete understanding of potential failure mechanisms that need to be considered when implementing a design change to prevent recurrence of an equipment failure.

The inspectors determined the finding could be evaluated using the Significance Determination Process in accordance with IMC 0609, "Significance Determination Process," issue date April 29, 2015, Attachment 0609.4, "Initial Characterization of Findings," issue date June 19, 2012. Since the finding impacted the Mitigating Systems Cornerstone, the inspectors screened the finding through IMC 0609 Appendix A, "The

Significance Determination Process for Findings At-Power," issue date June 19, 2012, using Exhibit 2, "Mitigating Systems Screening Questions." The finding screened as having very-low safety significance (Green) because although the finding is a deficiency ultimately affecting the design or qualification of the Division 3 SX pump, the pump still maintains its operability. Specifically, a new design for the Division 3 SX pump has not yet been generated, and the currently installed Division 3 SX pump with a design similar to that of the failed pump is still considered operable.

The inspectors determined this finding had an associated cross-cutting aspect in the area of Human Performance (H.14, "Conservative Bias") because although a "B" Apparent Cause Evaluation may have been allowable for investigating the failure of the Division 3 SX pump, had an "A" Root Cause Analysis been performed, a more rigorous investigation process would have been used to identify contributing causes, assign corrective actions, and identify effectiveness reviews for the failure of the Division 3 SX pump.

Enforcement: Title 10 CFR, Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," requires, in part, that activities affecting quality be prescribed by documented procedures of a type appropriate to the circumstances and be accomplished in accordance with these procedures. The licensee established procedure PI-AA-125, "CAP Procedure," Revision 2, as an implementing procedure for the requirements of the QATR. Specifically, at the direction of site management, Significant Conditions Adverse to Quality and Conditions Adverse to Quality are resolved through direct action, the implementation of CAPRs, and CAs, activities affecting quality.

Procedure PI-AA-125, Step 4.3.4, states, "PERFORM Class "B" Apparent Cause Evaluations (ACE/EACE) in accordance with PI-AA-125-1003, "Apparent Cause Evaluation Manual" and as follows…"

Procedure PI-AA-125-1003, "Apparent Cause Evaluation Manual," Revision 2, Step 4.4.1.2, states, "ANALYZE each Causal Factor to DETERMINE the apparent causes and contributing causes."

Procedure PI-AA-125-1003, Step 4.4.9.1, also states, "PERFORM Effectiveness Reviews in accordance with PI-AA-125-1004 and the following requirements:

- PERFORM an effectiveness review for all Significance Level 1 and 2 Apparent Cause Evaluations. Consideration should be given for use Significance Level 3 investigations where complex or multi-discipline situations exist.
- DETERMINE the actions to be evaluated in the EFR and the success criteria that will be used to evaluate the EFR.
- IDENTIFY the parameters that will be measured and establish quantitative and/or qualitative acceptance criteria.
- DETERMINE a due date that allows sufficient time for implementation and evaluation of the effectiveness of the action."

Contrary to the above, on December 21, 2015, the licensee failed to follow Step 4.3.4 of Procedure PI-AA-125. Specifically, the licensee failed to perform Class "B" EACE 2381871, "1SX01PC Failed to Start for Testing," in accordance with

PI-AA-125-1003 because they: (1) failed to analyze each causal factor to determine contributing causes as required by Step 4.4.1.2; and (2) failed to assign an EFR for the EACE as required by Step 4.4.9.1.

The licensee's immediate CAs included revising the EACE to: (1) include three contributing causes; (2) upgrade a CA to a CAPR; and (3) assign an EFR to determine the effectiveness of the CAPR.

Since this violation was of very-low safety significance and was entered into the licensee's CAP as AR 2621533, "NRC 95001: EACE 2381871-05 Contributing Causes Documentation," and AR 2618997, "EFR Assignment not Generated for EACE 2381871-05," this violation is being treated as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy. (NCV 05000461/2016008-01; Failure to Perform an Adequate Equipment Apparent Cause Evaluation)

4OA6 Exit Meeting Summary

On February 4, 2016, the inspectors presented the inspection results to Mr. B. T. Kapellas, and other members of the licensee staff. The licensee representatives acknowledged the observations and violation presented. The inspectors confirmed that none of the potential report input discussed was considered proprietary.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACTS

Licensee

T. Stoner, Site Vice President
B. Kapellas, Plant Manger
D. Shelton, Regulatory Assurance Manager
M. Heger, Sr. Manager Design Engineering
D. Tapperson, Clinton Engineering
E. Rodriguez, Clinton Engineering
D. Cummings, Clinton Engineering
F. Sarantakos, Clinton Engineering
D. Avery, Regulatory Assurance

U.S. Nuclear Regulatory Commission

R. Orlikowski, Chief, Operations Branch
K. Stoedter, Chief, Branch 1
W. Schaup, Clinton Senior Resident Inspector
E. Sanchez-Santiago, Clinton Resident Inspector
L. Rodriguez, Reactor Inspector
M. Jones, Reactor Inspector
V. Petrella, Reactor Inspector (NSPDP Observer)

LIST OF OPENED, CLOSED, AND DISCUSSED

Opened

05000461/2016008-01	NCV	Failure to Perform and Adequate Equipment Apparent Cause Evaluation (Section 4OA4)

Closed

05000461/2015001-03	VIO	Failure of the Division 3 Shutdown Service Water Pump Due to an Inadequate Bushing Design (Section 4OA4)
05000461/2016008-01	NCV	Failure to Perform and Adequate Equipment Apparent Cause Evaluation (Section 4OA4)

Discussed

None

LIST OF DOCUMENTS REVIEWED

The following is a partial list of documents reviewed during the inspection. Inclusion on this list does not imply that the NRC inspectors reviewed the documents in their entirety, but rather that selected sections or portions of the documents were evaluated as part of the overall inspection effort. Inclusion of a document on this list does not imply NRC acceptance of the document or any part of it, unless this is stated in the body of the inspection report.

- AR 2381871; Failure of the Outer/Upper Motor Bearing for 1SX01PC; September 16, 2014
- AR 2413550; 1SX001C Discharge Check Valve Seat Leakage; November 18, 2014
- AR 2423722; Evaluate Div 3 SX Pump Failure Under 10 CFR, Part 21; December 11, 2014
- AR 2522790; Organizational Lesson Learned from Div 3 SX Pump Failure; July 1, 2015
- AR 2561450; Readiness Assessment – Supplemental Inspection for NRC White Finding and Notice of Violation, EA -15-064; November 6, 2015
- AR 2577348; Root Cause NRC White Finding Design Control of Div 3 SX Pump; October 27, 2015
- AR 2583455; Legacy RR Bearing Design Change Lacks Technical Rigor; November 6, 2015
- AR 2592557; Revised Sulzer Div 3 SX Pump Failure Analysis; November 25, 2015
- AR 2593694; NRC ID: NRC Question Regarding Operability; November 30, 2015
- AR 2617862; Div 3 SX Watertight Door Difficult to Open; January 26, 2016
- AR 2618004; Inconsistencies Between Passport CA and EACE Action; January 27, 2016
- AR 2618985; NRC 95001 – ACE Process Enhancement; January 28, 2016
- AR 2618997; EFR Assignment Not Generated for EACE 2381871-05; January 29, 2016
- AR 2619157; NRC 95-001: Revised EACE 2381871 Impacts Op Eval EC 404045; January 29, 2016
- AR 2620934; NRC ID: CC-AA-103 Contains Incorrect Reference Step for CCT; February 2, 2016
- AR 2621533; NRC 95001: EACE 2381871-05 Contributing Causes Documentation; February 3, 2016
- CC-AA-102; Design Input and Configuration Change Impact Screening; Revision 28
- CC-AA-103; Configuration Change Control for Permanent Physical Plant Changes; Revision 27
- CC-MW-101; Engineering Change Requests; Revision 1
- Drawing B-1A278-01; Shutdown Service Water Pump Bingham Type VCM; Revision B
  Drawing M05-1052 Sheet Number 3; Shutdown Service Water (SX); Revision AK
- Drawing PCS463565-01; 8x14A VCM Sectional Drawing; Revision A
- EACE 2381871; 1SX01PC Failed to Start for Testing; December 21, 2015
- EACE 2381871; 1SX01PC Failed to Start for Testing; January 28, 2016
- EC 366623; Change Disc and Guides for 1E12F014A and 1E12F068A to Stainless/Stellite Faced Materials to Minimize Wear CDBI FASA Identified; Revision 1
- EC 339008; Check Valve Repair for 1E12F050B; Revision 2
- EC 403936; Evaluation of RR Motor Upper Guide Bearing Legacy Design Change; Revision 0
- EC 404045; Div III SX Pump Lower Bearing Failure – New Information from Pump Vendor; Revision 1
- ECN 29292; 1SX01PC Pump; August 17, 1995
- ECR 418529; Requirements for Suction Bell Bearing Design for 1SX01PC; April 7, 2015
- FECN 27287; Identify Replacement Heat Exchangers EIN: 1DG11AA/AB, 1DG12AA/AB; 1992
- FECN 24896; Alternate Upper Guide Bearing for 1B33C001A & B; 1998
- HU-AA-1081; Fundamentals Tool Kit; Revision 4
- HU-AA-1081-F-17B; Functional Area and Cross-Functional Fundamentals Nuclear Safety Culture Fundamentals – Managers; Revision 0

- HU-AA-1081-F-17C; Functional Area and Cross-Functional Fundamentals Nuclear Safety Culture Fundamentals – Supervisors; Revision 0
- HU-AA-1081-F-17D; Functional Area and Cross-Functional Fundamentals Nuclear Safety Culture Fundamentals for Individual Contributors; Revision 0
- HU-AA-1212; Technical Task Risk/Rigor Assessment, Pre-job Brief, Independent Third Party Review, and Post-job Review; Revision 6
- K-2828B; Shutdown Service Water Pump Clinton Power Station – Unit 1; Revision 3
- LER 2014-005-00; Failure of Shutdown Service Water Pump Results in Loss of Division 3 Emergency Diesel Generator and High Pressure Core Spray Safety Functions; Revision 0
- LER 2014-005-01; Failure of Shutdown Service Water Pump Results in Loss of Division 3 Emergency Diesel Generator and High Pressure Core Spray Safety Functions; Revision 1
- NSED-P-D.55; Modification and Configuration Change Control; Revision 4
- PI-AA-120; Issue Identification and Screening Process; Revision 3
- PI-AA-125; Corrective Action Program (CAP) Procedure; Revision 2
- PI-AA-125-1001; Root Cause Analysis Manual; Revision 2
- PI-AA-125-1003; Apparent Cause Evaluation Manual; Revision 2
- PI-AA-125-1004; Effectiveness Review Manual; Revision 1
- PI-AA-125-1006; Investigation Techniques Manual; Revision 2
- PO 00462656; SR Procurement Spec: Pump Assembly, Centrifugal, Type: 2 Stage, Vertical, Model 8 x 14A VCM; Revision 6
- PO 00531541; SR Procurement Spec: Pump Assembly, Centrifugal, Type: 2 Stage, Vertical, Model 8x14A VCM; Revision 10
- Policy Statement 001; Corrective Action Program Expectations and Standards; Revision 7
- RCR 2577348; NRC White Finding on Design Control of the Division 3 Shutdown Service Water Pump; November 6, 2015
- Sulzer Letter; SX Pump Sulzer Failure Analysis Review Sulzer 8x14A VCM 2 Stage Vertical Pump Serial Number 1A278, Sulzer Sales Order: 1001170784, Exelon PO 00531541; November 25, 2015
- Sulzer Letter; Division 3 Shutdown Service Water Pump – Shaft Sleeve Design Change Sulzer Model 8x14A VCM 2-Stage Vertical Pump S/N: 1A874 and 436565; January 28, 2016
- Sulzer Quotation Number 08003102; SX Pump Repair Sulzer 8x14A VCM 2 State Vertical Pump Serial Number: 1A278, Sulzer Sales Order: 100170784, Exelon PO 00531541; March 31, 2015
- SXF022; Self Lubricating Bushings for Div III SX Pump; 1992

LIST OF ACRONYMS USED

ADAMS	Agencywide Document Access and Management System
CFR	*Code of Federal Regulations*
ACIT	Action Tracking Item
AR	Action Request
CA	Corrective Action
CAP	Corrective Action Program
CAPR	Corrective Action to Prevent Recurrence
CPS	Clinton Power Station
EACE	Equipment Apparent Cause Evaluation
EC	Engineering Change
ECR	Engineering Change Request
EFR	Effectiveness Review
IMC	Inspection Manual Chapter
IP	Inspection Procedure
IR	Inspection Report
IST	In-Service Testing
LER	Licensee Event Report
NCV	Non-Cited Violation
NRC	U.S. Nuclear Regulatory Commission
NOV	Notice of Violation
PARS	Publicly Available Records
QATR	Quality Assurance Topical Report
RCR	Root Cause Report
SX	Shutdown Service Water
TS	Technical Specification

After reviewing CPS's performance in addressing the White finding subject of this IP 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," the NRC concluded your actions met the objectives of IP 95001. Therefore, in accordance with the guidance in Inspection Manual Chapter 0305, "Operating Reactor Assessment Program," the NRC is closing the White finding that had been held open pending completion of the supplemental inspection. As a result, the NRC determined the performance at CPS to be in the Licensee Response Column of the Reactor Oversight Process Action Matrix as of the date of this letter. However, the finding can still be considered for agency actions in accordance with the Action Matrix until March 31, 2016.

Based on the results of this inspection, the NRC identified one issue that was evaluated under the significance determination process as having a very-low safety significance (Green). The finding was also determined to involve a violation of NRC requirements. The violation is being treated as a Non-Cited Violation (NCV), consistent with Section 2.3.2 of the Enforcement Policy. The NCV is described in the subject inspection report.

If you contest the subject or severity of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copies to the Regional Administrator, Region III; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at CPS. In addition, if you disagree with the cross-cutting aspect assigned to any finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region III, and the NRC Resident Inspector at CPS.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC's Public Document Room or from the Publicly Available Records (PARS) component of the NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,
/RA/

Robert J. Orlikowski, Responsible Chief
Engineering Branch 2
Division of Reactor Safety

Docket No. 50–461
License No. NPF–62

Enclosure:
Inspection Report 05000461/2016008

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