UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
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January 26, 2018

EA–17–203

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 INSPECTION REPORT 05000461/2017011 AND PRELIMINARY WHITE FINDING

Dear Mr. Hanson:

On December 28, 2017, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Clinton Power Station, Unit 1. The inspectors presented the results of this inspection during an exit meeting with Mr. B. Kapellas and other members of your staff. The results of this inspection are documented in the enclosed report.

The enclosed inspection report documents a self-revealing finding and an apparent violation of Title 10 *Code of Federal Regulations* (CFR) 50, Appendix B, Criterion XVI, "Corrective Action" and associated Technical Specification (TS) violations of TS 3.7.2, "Division 3 Shutdown Service Water (SX)," and TS 3.5.1, "[Emergency Core Cooling Systems] ECCS - Operating." The NRC preliminarily determined the finding to be White, with low to moderate safety significance. This finding involved the licensee's failure to correct a degraded condition identified as a result of the Division 3 SX pump failure in 2014. The Division 3 SX pump is a component subject to the requirements of 10 CFR 50, Appendix B. The failure to correct the identified degraded condition resulted in the failure of the Division 3 SX pump to start on June 15, 2017. We assessed the significance of the finding using the significance determination process (SDP) and readily available information. We are considering escalated enforcement for the apparent violation consistent with the NRC's Enforcement Policy, which can be found at https://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html.

Because we have not made a final determination, no notice of violation is being issued at this time. Please be aware that further NRC review may prompt us to modify the number and characterization of the apparent violations. This finding does not represent an immediate safety concern based upon your actions to replace the Division 3 SX pump with a pump that incorporated design changes as a result of the 2014 and 2017 failures, including the installation of self-lubricating packing and sleeves made from new material.

We intend to issue our final significance determination and enforcement decision, in writing, within 90 days from the date of this letter. The NRC's SDP is designed to encourage an open dialogue between your staff and the NRC; however, neither the dialogue nor the written information you provide should affect the timeliness of the staff's final determination.

Before the NRC makes a final decision on this matter, you may choose to communicate your position on the facts and assumptions used to arrive at the finding and assess its significance by either; (1) attending and presenting at a Regulatory Conference, or (2) submitting your position in writing. The focus of a Regulatory Conference is to discuss the significance of the finding. Written responses should reference the inspection report number and enforcement action number associated with this letter in the subject line. Your written response should be sent to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Center, Washington, DC 20555-0001, with a copy to Ms. Karla Stoedter, Chief, Branch 1, Division of Reactor Projects, U.S. Nuclear Regulatory Commission, Region III, 2443 Warrenville Road, Lisle, IL 60532.

If you request a Regulatory Conference, it should be held within 40 days of the receipt of this letter. Please provide information you would like us to consider or discuss with you at least 10 days prior to any scheduled conference. If a Regulatory Conference is held, it will be open for public observation. If you decide to submit only a written response, such submittal should be sent to the NRC within 40 days of your receipt of this letter. If you choose not to request a Regulatory Conference or to submit a written response, you will not be allowed to appeal the NRC's final significance determination.

Please contact Ms. Karla Stoedter at 630–829–9731, and in writing, within 10 days from the issue date of this letter to notify the NRC of your intentions. If we have not heard from you within 10 days, we will continue with our significance determination and enforcement decision. The final resolution of this matter will be conveyed in separate correspondence.

This letter, its enclosure, and your response (if any) will be made available for public inspections and copying at https://www.nrc.gov/reading-rm/adams.html and at the NRC Public Document room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Patrick L. Louden, Director
Division of Reactor Projects

Docket No. 50–461
License No. NPF–62

Enclosure:
Inspection Report 05000461/2017011

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Letter to Bryan C. Hanson from Patrick L. Louden dated January 26, 2018

SUBJECT: CLINTON POWER STATION—NRC INSPECTION REPORT 05000461/2017011 AND PRELIMINARY WHITE FINDING

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REGION III

Docket No:	50–461
License No:	NPF–62
Report No:	05000461/2017011
Licensee:	Exelon Generation Company, LLC
Facility:	Clinton Power Station
Location:	Clinton, IL
Dates:	June 15 through December 28, 2017
Inspectors:	W. Schaup, Senior Resident Inspector E. Sanchez, Resident Inspector J. Hanna, Senior Reactor Analyst
Approved by:	P. Louden, Director Division of Reactor Projects

Enclosure

SUMMARY

Inspection Report 05000461/2017011; 06/15/2017 – 12/28/2017; Clinton Power Station; Unit 1, Problem Identification and Resolution.

This report covers a 6-month period of inspection by the resident inspectors. One finding was identified and considered an apparent violation of NRC regulations. 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 NRC requirements are dispositioned in accordance with the NRC’s Enforcement Policy, dated November 1, 2016. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG–1649, “Reactor Oversight Process,” dated July 2016.

NRC-Identified and Self-Revealed Findings

Cornerstone: Mitigating Systems

Preliminary White. A self-revealing finding and an apparent violation of 10 CFR 50, Appendix B, Criterion XVI, “Corrective Action,” with associated violations of Technical Specification (TS) 3.7.2 and TS 3.5.1 were identified on June 15, 2017, for the licensee’s failure to correct a degraded condition identified during the evaluation performed as a result of the Division 3 shutdown service water (SX) pump failure in 2014. Specifically, the licensee identified corrosion of the Division 3 SX pump sleeves as a contributing cause of the 2014 pump failure and failed to appropriately evaluate and correct this issue. This resulted in the Division 3 SX pump’s failure to start on June 15, 2017, and rendered the Division 3 SX pump inoperable for a time longer than its TS allowed outage time. The licensee entered this issue into the corrective action program and implemented design changes to the pump and motor assembly, including installing a new motor with higher starting torque characteristics and replacing the pump shaft sleeves and packing with parts more resistant to corrosion. The licensee has completed multiple successful runs of the new pump with no abnormalities noted.

The inspectors determined that the licensee’s failure to correct a degraded condition identified during the evaluation performed as a result of the 2014 Division 3 SX pump failure appears to be not in accordance with the requirements of 10 CFR 50, Appendix B, Criterion XVI, and was a performance deficiency. The performance deficiency was determined to be more than minor because it impacted the Mitigating Systems cornerstone attribute of equipment performance and adversely affected the cornerstone objective of ensuring the availability, capability and reliability of equipment that responds to initiating events. Specifically, the performance deficiency resulted in the failure of the Division 3 SX pump, which impacted the operability and functionality of the high pressure core spray system and the Division 3 emergency diesel generator. Using IMC 0609, Appendix A, “Significance Determination Process for Findings At-Power,” dated June 19, 2012, a Significance and Enforcement Review Panel preliminarily determined the finding to be of low to moderate safety significance. The inspectors determined that this finding affected the cross-cutting area of problem identification and resolution in the aspect of evaluation, where the organization thoroughly evaluates issues to ensure that resolutions address causes and extent of

conditions commensurate with their safety significance. Specifically, the licensee failed to properly evaluate the Division 3 SX pump sleeve corrosion rates when performing the component life evaluation, the component operability evaluation and the evaluation in response to the abnormal noises identified during periodic pump runs. [P.2] (Section 4OA2)

REPORT DETAILS

1. REACTOR SAFETY

Cornerstone: Mitigating Systems

4OA2 Identification and Resolution of Problems (71152)

.1 Annual Follow-up of Selected Issues: Failure of the Division 3 Shutdown Service Water Pump to Start

a. Inspection Scope

The inspectors selected the following condition report for an in-depth review:

- Action Request (AR) 04022176, “Division 3 [shutdown service water] SX Pump Tripped during Start Up of 9069.01”.

The inspectors selected this issue because it was very similar to a Division 3 SX pump failure that occurred in 2014. The inspectors reviewed the causal evaluation for both the 2014 failure as well as the 2017 failure to determine what similarities existed. The inspectors also reviewed the corrective actions taken in response to the 2014 pump failure to determine whether they were adequate to address the identified causes.

As appropriate, the inspectors verified the following attributes during their review:

- complete and accurate identification of the problem in a timely manner commensurate with its safety significance and ease of discovery;
- consideration of the extent of condition, generic implications, common cause, and previous occurrences;
- evaluation and disposition of operability/functionality/reportability issues;
- classification and prioritization of the resolution of the problem commensurate with safety significance;
- identification of the root and contributing causes of the problem;
- identification of corrective actions, which were appropriately focused to correct the problem; and
- completion of corrective actions in a timely manner commensurate with the safety significance of the issue.

The inspectors discussed the corrective actions and associated evaluations with licensee personnel.

This activity constituted one in-depth problem identification and resolution inspection sample as defined in IP 71152.

b. Findings

Failure to Correct an Identified Degraded Condition on the Division 3 Shutdown Service Water Pump

Introduction: A preliminary white finding and an apparent violation (AV) of Title 10 of the Code of Federal Regulations (CFR) 50, Appendix B, Criterion XVI, “Corrective Action,”

and the associated violations of Technical Specification (TS) 3.7.2 and TS 3.5.1 were self-revealed on June 15, 2017, due to the licensee's failure to correct a degraded condition identified during the evaluation performed as a result of the 2014 Division 3 SX pump failure. Specifically, the licensee identified corrosion of the Division 3 SX pump sleeves as a contributing cause of the 2014 pump failure but failed to appropriately evaluate and correct this issue, resulting in a failure of the pump to start on June 15, 2017.

Description: The purpose of the Division 3 SX system is to provide cooling water to the Division 3 loads including the high pressure core spray (HPCS) pump room coolers, the Division 3 emergency diesel generator (EDG) and the Division 3 switchgear heat removal system. Under design basis event conditions such as a loss of offsite power (LOOP), a Division 3 SX pump start signal would be generated and the cross-tie valve from the plant service water system closes. At this point, the Division 3 SX pump would provide cooling water flow from the lake to the Division 3 SX cooling loads. The pump design was modified in 1995 to address issues associated with a previous pump failure. The modification included replacing the suction bell bearing with a self-cooling design as well as replacing the pump packing with a dry packing/dry start condition design.

In September 2014, the Division 3 SX pump also failed to start. The licensee determined that the pump's failure to start was caused by a loss of the pump shaft sleeve hard-facing integrity mainly in the area of the suction bell bearing that resulted in bearing failure. Additional degradation was noted in other areas of the pump shaft. In August 2015, as a result of the 2014 pump failure, the NRC issued a White finding and an associated design control violation (ML15223B382) for the licensee's failure to review the suitability of application of materials, parts, equipment and processes that were essential to the safety-related functions of structures, systems and components. Specifically, the licensee failed to review the suitability of application of the design for the Division 3 SX pump installed in 1995 and ensure the pump internals would not degrade under expected operating conditions.

On February 4, 2016, the NRC completed a 95001 supplemental inspection (ML16077A312) in response to the White finding. The inspectors identified a non-cited violation associated with the failure to determine the contributing causes of the 2014 Division 3 SX pump failure. As a result, the licensee identified and documented three contributing causes: (1) cyclic heat-up due to the start/stop cycles performed as part of quarterly surveillance testing; (2) the possibility of silt in the water further increasing the cyclic heat-up; and (3) the possibility of a corrosion mechanism attacking the shaft sleeve base metal after fatigue cracks of the hard-facing provided a path to the base metal.

After the September 2014 failure, the licensee replaced the Division 3 SX pump. Initially, the licensee believed the replacement pump was not a like for like replacement. During the 95001 inspection, the inspectors found that the replacement Division 3 SX pump was a like for like replacement. The licensee performed an operability determination in February 2016 to evaluate the acceptability of installing and operating a pump identical to the one that failed. This operability determination was documented in Engineering Change (EC) 404045, "Division 3 SX Pump Lower Bearing Failure." The licensee considered the pump operable but non-conforming because the licensee had not determined how long the pump would be able to operate before degrading in a manner similar to the 2014 failure mechanisms. The inspectors reviewed EC 404045 as

part of this inspection and determined that it only evaluated the suction bell bearing failure condition. It did not consider or evaluate whether any of the other design changes incorporated in the 1995 modification, such as the installation of dry packing, or other known SX system deficiencies could have any adverse impact on pump operability.

In May 2016, the licensee completed the design life calculation for the Division 3 SX pump and documented the results in EC 402788, "1SX01PC [Division 3 SX pump] Design Life and Vendor Manual Update." Based on this evaluation, the licensee concluded the pump would operate acceptably for at least 6 years. The inspectors reviewed this document during this inspection and determined that the licensee only took into account the potential hard-facing delamination due to pump starts and stops since they believed this to be the most bounding value. They did not calculate corrosion rates associated with the identified contributing cause nor did they consider if any changes to operating conditions could impact these rates such that the delamination due to starts and stops would no longer be the most bounding condition.

In March 2016, the licensee replaced the Division 3 SX pump discharge check valve 1SX001C which was identified to have internal backleakage. Documents within the licensee's corrective action system indicated that the valve had been leaking in 2006, but the licensee suspected it had been leaking since initial installation. As a result, the Division 3 SX pump was maintained in a wet condition even though the 1995 design modification documents indicated that the pump was to be kept in a "normally dry" condition. The pump run performed following the check valve replacement indicated higher than usual starting currents. The licensee did not identify any issues associated with these indications or take any corrective actions.

In May 2016, the licensee issued EC 404045, "Division 3 SX Pump Lower Bearing Failure," Revision 2 to incorporate new information provided by the pump vendor. The licensee did not make any changes to the operability evaluation related to the change in SX system operating conditions due to the repair of the pump discharge check valve. As a result, this document did not evaluate the expected operating conditions of the SX pump.

In June 2016, the licensee operated the Division 3 SX pump and noticed abnormal noises when the pump started. The licensee documented this issue in AR 2682433 and concluded the condition was not indicative of degraded pump performance nor did it impact pump operability. During the September 2016 quarterly pump run, similar conditions to those identified during the June 2016 pump run were observed. Again, the licensee determined the pump was operable and no degraded conditions existed based upon other pump operating parameters being within the expected range. The licensee decided to repack the pump during its next system outage window scheduled for September 2017.

On June 15, 2017, the Division 3 SX pump motor breaker tripped during surveillance testing. The pump attempted to start for approximately 30 seconds before thermal overloads tripped the pump motor breaker. The licensee confirmed the pump could be rotated by hand and proceeded to run the pump a second time. During the second run, the pump rotated at 70 rotations per minute for 8 seconds before the licensee manually secured it. Based on the failed surveillance, the licensee declared the pump inoperable.

The licensee documented this issue in AR 4022176 and performed a root cause evaluation. The licensee determined the following root cause:

> "Incremental increase of internal pump resistance that could not be overcome by the developed torque of the motor starting from standby. The increased pump resistance was due to unidentified impacts during a design modification (result: dry-packing at pump start, unidentified corrosion effects on packing shaft sleeve, inadequate hard-face material)."

In order to determine the cause of the June 2017 Division 3 SX pump failure, the licensee had the packing shaft sleeve and a portion of the column sleeve examined by an independent testing facility. The sleeve metallurgical evaluations determined that the shaft packing area sleeve contained numerous large pits and evidence of corrosion. Because of the rough surface texture, the pits would have resisted shaft rotations. There would also be additional rotational resistance from any hard particles that fell out of the pitted areas and became embedded in the packing area sleeve. Based on these observations, the licensee concluded that the coarse pits on the packing sleeve area would have contributed to the 2017 pump failure. The column sleeve had several long cracks in the hard-facing overlay. In four local areas, the cracks branched and allowed for local lifting of the hard-facing materials further increasing the resistance to shaft rotation. The licensee stated that the hard-face cracking indications in the packing and column sleeves were similar to those seen in the 2014 pump failure. The licensee credited part of the root cause to friction due to sleeve cracking. Lastly, the licensee determined the corrosion was due to oxygen being trapped in crevices and attacking the sleeve base metal. The crevices were formed due to shaft sleeve hard-facing cracking caused by thermal cycling (starting/stopping) and scoring of the shaft sleeve from embedded hard particles in the pump packing. It also appeared that the corrosion rate was exacerbated by the creation of dry start/dry pump packing condition.

Based upon the data available, the inspectors determined that the Division 3 SX pump was not exposed to a dry start/dry packing condition until March 2016 when the long-standing leakage on the pump's discharge check valve was repaired. Prior to the check valve repair, the excessive valve leakage caused the pump to be maintained in a wet condition up to the stuffing box during normal and standby conditions. The licensee determined that this allowed for a reduction in the amount of friction introduced by the packing. Once the check valve was repaired, the pump was no longer wet up to the stuffing box which resulted in a change to the thermal cycling conditions referenced in the licensee's pump design life evaluation. This increased the friction provided by the packing and exposed the degraded shaft sleeve hard-facing material to an environment that supported corrosion.

The inspectors determined that the identified corrosion in 2017 was similar to the corrosion identified as a contributing cause of the 2014 pump failure. Therefore, the inspectors identified a performance deficiency for the failure to correct a degraded condition identified during the evaluation performed as a result of the Division 3 shutdown service water (SX) pump failure in 2014. Specifically, the licensee identified corrosion affecting the Division 3 SX pump sleeves contributed to the pump failure in 2014 and failed to appropriately evaluate and correct this issue. This resulted in the failure of the pump to start on June 15, 2017. The inspectors concluded this failure was within the licensee's ability to foresee and correct because the licensee was aware of the pump susceptibility to corrosion, the timing of the operability and component life

evaluations in relation to the check valve replacement, and the abnormal indications noted during the quarterly pump runs subsequent to the check valve replacement.

Based on the degradation mechanism, the inspectors also concluded that the pump became inoperable during the last quarterly surveillance run on March 15, 2017. The degradation mechanism would not continue to progress after the pump packing shaft was dry. The packing shaft was designed to be dry, and made of non-absorbent material, therefore, the inspectors determined it would take a short period of time for it to be in a dry condition.

Analysis: Title 10 of the CFR, Part 50, Appendix B, Criterion XVI, "Corrective Action," required, in part, that measures be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective materials and equipment, and non-conformances are promptly identified and corrected. The inspectors determined that the licensee's failure to correct a degraded condition identified during the evaluation performed as a result of the Division 3 SX pump failure in 2014 appears not to be in accordance with the requirements of 10 CFR 50, Appendix B, Criterion XVI, and was a performance deficiency. Specifically, the licensee identified corrosion of the Division 3 SX pump sleeves as a contributing cause of the 2014 pump failure and failed to evaluate and correct the issue. This resulted in the failure of the pump to start on June 15, 2017. The performance deficiency was determined to be more than minor in accordance with IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Screening," dated September 7, 2012, because it impacted the Mitigating Systems cornerstone attribute of equipment performance and adversely affected the cornerstone objective of ensuring the availability, capability and reliability of equipment that respond to initiating events. Specifically, the performance deficiency resulted in the failure of the Division 3 SX pump which impacted the operability and functionality of HPCS and the Division 3 emergency diesel generator.

The inspectors determined the finding could be evaluated using the SDP in accordance with IMC 0609, "Significance Determination Process," Attachment 4, "Initial Characterization of Findings," dated October 7, 2016 and Appendix A, "The Significance Determination Process for Findings at Power," Exhibit 2, "Mitigating Systems Screening Questions," dated June 19, 2012. The finding represented an actual loss of system safety function of the high pressure core spray system for greater than its Technical Specification 3.5.1, Condition B.2, allowed outage time of 14 days. Therefore, a detailed risk evaluation was performed in accordance with IMC 0609, Appendix A.

The Senior Reactor Analyst (SRA) evaluated the finding using the Clinton Standardized Plant Analysis Risk (SPAR) Model, Version 8.17, and Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE), Version 8.50. The basic event representing Division 3 SX pump failing to run was set to 1.0. The risk due to this performance deficiency was dominated by LOOP initiating events which render the non-safety related service water pumps unavailable.

In terms of exposure time, the pump failed its surveillance test on June 15, 2017, while performing a routine quarterly pump run. The pump was repaired and returned to service on June 23, 2017. The last successful run prior to failure was on March 15, 2017, for surveillance testing. The time of the actual failure of the pump was determined by the inspectors to be when the pump was secured on March 15, 2017 or shortly thereafter when the pump packing was completely dried out; therefore using

a “T/2” exposure period modeling assumption did not apply. In other words, another pump failure-to-start would have occurred any time after the last successful run of Division 3 SX pump. The exposure time (92 days) was adjusted for the outage time where Division 3 was not credited (-15 days) and for repair time (+7 days) for a total of 84 days.

Common cause failure was not assumed (and would not be relevant to this analysis) because the Division 1 and Division 2 SX pumps do not share a common cause component group with the Division 3 SX pump because of design differences. The SRA assumed that the Division 3 SX pump failure could not be recovered because the pump failed on the first and second start attempts.

The dominant sequence for internal events was LOOP 40–24 (a Loss of Offsite Power which progresses to a Station Blackout) and which contributed 39.4 percent of the total risk. The specific failures comprising the dominant core damage sequence following the station blackout initiating event were as follows:

- Failure of HPCS (due to the performance deficiency);
- Failure of operator actions to extend reactor core isolation cooling operation after initial success;
- Failure of manual reactor depressurization; and
- Failure to recover AC power from either on-site or off-site sources at 4-hours.

The total internal events change in core damage frequency (ΔCDF) for the exposure period was 4E–6/year.

External Events Risk Contribution:

The Clinton SPAR Model does not include external events. The SRA estimated the risk due to external events using information from the licensee’s external events model. Seismic and flooding risk contributions were negligible and the external event risk contribution was dominated by fire scenarios. The SRA evaluated fire cutsets specifically where the SX pump C contributed to the likelihood of core damage to ensure the values used were reasonable. The ΔCDF from the individual fire areas were summed to obtain a total fire risk. The total ΔCDF for fires and for the exposure period was determined to be approximately 4E–06/yr.

Large Early Release Frequency:

The potential risk contribution due to large early release frequency (LERF) was considered using IMC 0609 Appendix H, “Containment Integrity Significance Determination Process.” The Clinton plant is a General Electric BWR–6 [Boiling Water Reactor] with a Mark III containment. Generally, only a subset of those sequences contributing to CDF significance of a finding has the potential to impact LERF. For BWR Mark III plants, findings related to inter-system loss of coolant accidents, transients, small break loss of coolant accidents, and station blackout (SBO) events are the subsets of interest.

Per the State-of-the-Art Reactor Consequence Analyses, Table 4 of NUREG–1935, the time from the start of core damage to the time of lower head failure (and release to the

environment) for the representative BWR without high pressure coolant injection or reactor core isolation cooling was approximately 7 hours. For this performance deficiency, the dominant accident sequences involved 4-hour core damage SBO events. The SRA reviewed licensee document, “Evacuation Time Estimates for Clinton Power Station Plume Exposure Pathway Emergency Planning Zone,” dated December 2012. The time estimates summary showed that evacuation times are in the 3–5 hour timeframe, depending on the time of year and weather conditions. Based on the 3–5 hour evacuation time being shorter than the 7-hour time from core damage to lower head failure and release, the SRA believed that in most cases emergency planning zone evacuation would be completed before early release to the environment. Thus the SRA did not perform any further refinement to characterize LERF significance. The SRA determined that the change in risk due to LERF would be no greater than the change in risk due to core damage. The SRA concluded that the total estimated change in risk is best characterized by the ΔCDF result.

Licensee’s Risk Evaluation:

The licensee provided internal events and external events cutsets (both base and non-conforming results). The licensee’s internal events risk was a ΔCDF of 1.3E–06/yr for the exposure time. The external events risk information was a ΔCDF for fires of 4.3E–06/yr for the exposure time for a total ΔCDF contribution of 5.6E-6/yr. The SRA did not agree with some of the licensee’s values used in their results (e.g., initiating event frequencies for losses of offsite power or non-recovery probabilities for electric power). The analyst did a sensitivity analysis and applied an adjustment factor to those cutsets/sequences which had these basic events present in order to ensure the risk result did not exceed ΔCDF of 1E–5/year. The results remained below the Yellow/White threshold.

Total Estimated Change in Risk:

The total ΔCDF was the sum of the internal and external events ΔCDF risk, or about 8.0E–6/yr, using the NRC’s SPAR model values. This was a low to moderate safety significance (White) finding. A SERP, held on December 21, 2017, using IMC 0609, Appendix A, “Significance Determination Process For Findings At-Power,” dated June 19, 2012, made a preliminary determination that the finding was of low to moderate safety significance (White) based on the quantitative analysis performed during the detailed risk evaluation.

The inspectors determined that this finding affected the cross-cutting area of problem identification and resolution in the aspect of evaluation, where the organization thoroughly evaluates issues to ensure that resolutions address causes and extent of conditions commensurate with their safety significance. Specifically, the licensee did not properly evaluate the corrosion rates impacting the Division 3 SX pump sleeve when performing the component life evaluation, the component operability evaluation and the evaluation in response to the abnormal noises identified during the pump runs subsequent to the check valve repair. (P.2)

<u>Enforcement</u>: Title 10 of the CFR, Part 50, Appendix B, Criterion XVI, “Corrective Action,” requires in part, that measures be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective materials and equipment, and non-conformances are promptly identified and corrected.

Technical Specification limiting condition for operation (LCO) 3.7.2, requires the Division 3 SX system be operable in modes 1, 2 and 3. Limiting condition for operation 3.7.2, Condition A, states with Division 3 SX inoperable, declare high pressure core spray inoperable immediately.

Technical Specification LCO 3.5.1, requires each emergency core cooling system injection/spray subsystem be operable in Mode 1, 2 and 3. Limiting condition for operation 3.5.1, Condition B.2 states if the HPCS system is inoperable, restore the HPCS system to operable in 14 days. Limiting condition for operation 3.5.1, Condition D states, if the required action and associated completion time of Condition A, B or C is not met, be in mode 3 in 12 hours.

From May 6, 2016 through June 15, 2017, the licensee appeared to fail to correct a condition adverse to quality. Specifically, the licensee apparently failed to correct a degraded condition identified during the evaluation performed as a result of the Division 3 SX pump failure in 2014. In January 2016, the licensee identified corrosion as an issue affecting the Division 3 SX pump sleeves that contributed to the failure in 2014. As documented in EC 402785, dated May 6, 2016, the licensee did not consider this aspect when determining when the repair/replacement activities would occur, resulting in the failure of the Division 3 SX pump to run on June 15, 2017, due to pump shaft corrosion impacts on the required starting torque.

The failure to correct the identified deficiency on the Division 3 SX pump resulted in the pump being inoperable from the date of the last surveillance, March 15, 2017, to June 15, 2017, a period greater than allowed by the LCO allowed outage time provided in TS 3.5.1.

The licensee documented this issue in the corrective action program as AR 04022176 and implemented design changes to the pump and motor assembly, including installing a new motor with higher starting torque characteristics and replacing the pump shaft sleeves and packing with parts composed of material selected due to its corrosion resistant characteristics as corrective actions. The licensee has since completed multiple successful runs of the new pump with no abnormalities noted.
(AV 05000461/2017011–01: Failure to Correct an Identified Degraded Condition on the Division 3 Shutdown Service Water Pump)

4OA6 Management Meeting

.1 Exit Meeting Summary

On December 28, 2017, the inspectors presented the inspection results to Mr. B. Kapellas and other members of the licensee staff. The licensee acknowledged the issues presented. The inspectors confirmed that none of the potential report input discussed was considered proprietary.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

T. Stoner, Site Vice President
B. Kapellas, Plant Manager
R. Bair, Work Management Director
J. Cunningham, Maintenance Director
T. Dean, Training Director
C. Dunn, Operations Director
K. Engelhardt, Outage Manager
M. Friedmann, Emergency Preparedness Manager
M. Heger, Senior Manager Plant Engineering
T. Krawyck, Engineering Director
W. Marsh, Organizational Effectiveness Manager
F. Paslaski, Radiation Protection Manager
K. Pointer, Regulatory Assurance
D. Shelton, Regulatory Assurance Manager
R. Champley, Shift Operations Superintendent
D. Koons, Chemistry Manager
J. Wilson, Senior Manager Plant Engineering

U.S. Nuclear Regulatory Commission

L. Kozak, Acting Chief, Reactor Projects Branch 1
K. Stoedter, Chief, Reactor Projects Branch 1
W. Schaup, Clinton Senior Resident Inspector

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

05000461/2017011–01	AV	Failure to Correct an Identified Degraded Condition on the Division 3 Shutdown Service Water Pump (Section 4OA2)

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 inspector 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.

4OA2 Identification and Resolution of Problems

- OP-AA-108-115, "Operability Determinations," Revision 20
- EC 404045, "Div III SX Pump Lower Bearing Failure – New Information From Pump Vendor," Revision 2
- EC 402785, "1SX01PC Design Life and Vendor Manual Update"
- EC 404025, " Div 3 SX Pump Shaft Sleeve and Suction Bell Design Change," Revision 0
- CPS-40753, "Evaluations of Shaft Sleeves from the 1SX01PC Pump at Clinton Station"
- CPS 43937, "Evaluation of Packing from the Clinton 1SX01PC Pump Packing, Bulk, Square, JC 1625G, ½ In, Pump Shaft"
- Sulzer As Found Report and Repair Plan, October 27, 2017
- AR 04022176, "Div 3 SX Pump Tripped During Startup of 9069.01"
- AR 02381871, "1SX01PC Failed to Start for Testing"
- AR 02682433, "1SX01PC Unusual Sound Upon Start"
- AR 02577348, "NRC White Finding on Design Control of the Division 3 Shutdown Service Water Pump"
- AR 02697306, "Direction Needed for Resolution of Div 3 SX Pump Design"
- AR 04051306, " Eng Inspection of Removed 1SX01PC"
- AR 04051284, "Condition of the Div 3 SX Stuffing Box"
- AR 04054961, "Removed 1SX01PC Pump Visual Inspection Results"
- AR 04022481, "Second Unsuccessful Run of 1SX01PC"
- AR 04024704, "Vendor Performance for Div 3 SX Pump Sleeve"
- AR 04031102, "Cracking Found on 1SX01PC Shaft Sleeves"
- AR 04022827, "Need Work Order to Test Div 3 SX Electrical Components"
- WO 4584204, "OP 9069.01 SX Pump C Operability Test"
- DWG B-IA28-01, "Shutdown Service Water Pump," Revision B

LIST OF ACRONYMS USED

ADAMS	Agencywide Document Access Management System
AR	Action Request
AV	Apparent Violation
CDF	Core Damage Frequency
CFR	*Code of Federal Regulations*
EA	Enforcement Action
EC	Engineering Change
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
HPCS	High Pressure Core Spray
IMC	Inspection Manual Chapter
LCO	Limiting Condition for Operation
LERF	Large Early Release Frequency
LOOP	Loss of Offsite Power
NRC	U.S. Nuclear Regulatory Commission
PRA	Probabilistic Risk Assessment
SAPHIRE	Systems Analysis Programs for Hands-on Integrated Reliability Evaluations
SBO	Station Blackout
SDP	Significance Determination Process
SPAR	Standardized Plant Analysis Risk
SRA	Senior Reactor Analyst
SX	Shutdown Service Water
TS	Technical Specification
WO	Work Order