Clinton Power Station
8401 Power Road
Clinton, IL 61727

U-604258
December 31, 2015

10 CFR 50.73
SRRS 5A.108

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Licensee Event Report 2014-005-01

Enclosed is Licensee Event Report (LER) No. 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. This revised report is being submitted in accordance with the requirements of 10 CFR 50.73.

There are no regulatory commitments contained in this report.

Should you have any questions concerning this report, please contact Mr. Dale Shelton, Regulatory Assurance Manager, at (217) 937-2800

Respectfully,

BRADLEY T. KAPELLAS FOR TED STONER

Theodore R. Stoner
Site Vice President
Clinton Power Station

dra/cas

Enclosure: Licensee Event Report 2014-005-01

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Clinton Power Station
Office of Nuclear Facility Safety – IEMA Division of Nuclear Safety

IE22
NRR

NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

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4. TITLE

Failure of Shutdown Service Water Pump Results in Loss of Division 3 Emergency Diesel Generator and High Pressure Core Spray Safety Functions

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	16	2014	2014	- 005	- 01	12	31	2015		05000
									FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
097	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
	☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☒ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Dale Shelton, Regulatory Assurance Manager	217-937-2800

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	BI	P	B260	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On 9/16/14 during Division 3 operability testing of the Division 3 Shutdown Service Water (SX) pump, the pump was started and motor thermal overload protection tripped off the pump after 36 seconds. There was no evidence the pump had rotated. Operators immediately declared the Division 3 SX system, the Division 3 Emergency Diesel Generator, and the High Pressure Core Spray system inoperable due to the pump trip as required by Technical Specifications. The cause of the pump failure to start was a failure of the suction bell bushing assembly. Failure of the suction bell bushing assembly would have occurred during the previous successful run of 1SX01PC on 5/30/14, resulting in 109 days with the Division 3 SX pump inoperable, which is beyond the Limiting Condition for Operation (LCO) Required Action Completion Time of 14 days to restore HPCS. This resulted in a condition prohibited by Technical Specifications. The root cause is the procedures used to develop plant modification change packages contained an inadequate process to identify the need for further reviews and the level of design detail required by those reviews. A new pump has been installed and the pump was restored to operable status on 9/21/14. An eight-hour ENS notification (#50463) was made at 2220 CDT on 9/16/14. This event is reportable under 10CFR50.73(a)(2)(i)(B) and 10CFR50.73(a)(2)(v)(D).

NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

General Electric -- Boiling Water Reactor, 3473 Megawatts Thermal Rated Core Power
Energy Industry Identification System (EIIS) codes are identified in text as [XX].

EVENT IDENTIFICATION

Failure of Shutdown Service Water Pump Results in Loss of Division 3 Emergency Diesel Generator and High Pressure Core Spray Safety Functions

A. Plant Operating Conditions Before the Event

Unit: 1 Event Date: 9/16/14 Event Time: 1905 Central Time
Mode: 1 Mode Name: Power Operation Reactor Power: 97 percent

B. DESCRIPTION OF EVENT

On 9/16/14 at approximately 1905 hours, Operators were performing an operability test of the Shutdown Service Water (SX) [BI] system. The Division 3 SX pump [P] (1SX01PC) was started to support the 2-year Comprehensive Pump Test and the motor [MO] thermal overload protection tripped off the pump after approximately 36 seconds. There was no evidence the pump had rotated, and oil was coming down from the top of the motor shaft, forming a puddle on the horizontal part of the bottom of the motor.

Operators immediately declared the Division 3 SX, Division 3 Emergency Diesel Generator (EDG) [EK], Division 3 Inverter [EF], Division 3 Direct Current Distribution [EJ], Division 3 Alternating Current Distribution [ED] systems and the High Pressure Core Spray (HPCS) [BG] system inoperable due to the pump trip. Operators entered the Technical Specification Actions Requirements for Limiting Conditions for Operation (LCO) 3.7.2, Division 3 SX Subsystem; LCO 3.8.4, DC Sources - Operating; LCO 3.8.7, Inverters - Operating; and LCO 3.5.1, ECCS - Operating. Operators verified within one hour that the RCIC system was operable, and entered the action to restore HPCS to Operable status within 14 days.

Initial troubleshooting found the pump breaker [BKR] on and not tripped, and the motor thermal overloads were tripped. There was no physical damage visible at the breaker cubicle. The pump motor windings tested satisfactory and a 500 volts megger test was performed with acceptable results. Engineering determined that motor thermal overloads tripping in 36 seconds was consistent with expectations for a locked rotor condition.

At 2220 hours, Operators completed an 8-hour non-emergency notification to the NRC (Event Notification Number 50463) under 10 CFR 50.72(b)(3)(v)(D) due to the loss of a single train safety system, that is, the loss of the HPCS system function. This event is also reportable under 10 CFR 50.73(a)(2)(v)(D) due to a condition that could have prevented the fulfillment of the safety function needed to mitigate the consequences of an accident.

Maintenance personnel were able to rotate the pump and motor assembly by hand with the assistance of a 2-foot pipe wrench, but the assembly was very hard to turn. The shaft had a steady drag that was consistent the entire rotation and did not loosen with additional revolutions. With the pump packing removed, the shaft was rotated with the same results. With the pump uncoupled from the motor, the motor turned freely. The motor was run uncoupled from the pump with acceptable results. Motor inspections and a successful uncoupled run eliminated concerns about the oil discovered at the bottom of the motor. The decision was made to replace the pump assembly with a new assembly from stores.

Issue Report 2381871 was initiated to document this event and an equipment apparent cause evaluation was performed. Issue Report 2577348 was initiated to perform a root cause investigation report.

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In 1992 the station approved plant modification change packages for the Division 3 SX pump to remove the enclosure tube and cooling/flushing lines and to change the rubber cutlass bushings to self-lubricated bronze bushings. The plant modification change was installed in 1995.

C. CAUSE OF EVENT

The pump was removed and sent to the supplier for failure analysis. The suction bell bushing had extreme damage. The direct cause for this event is degradation of the pump suction bell bushing assembly.

The apparent cause of the pump 1SX01PC failure in September 2014 is: a failure by a CPS legacy 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.

The root cause of this event is the procedures used to develop plant modification change packages, at the time of this modification, contained an inadequate process to identify the need for further reviews and the level of design detail required by those reviews.

D. SAFETY CONSEQUENCES

The purpose for the Division 3 SX system is to provide cooling water to Division 3 cooling loads including the HPCS pump room coolers [CLR], the Division 3 EDG and the Division 3 Switchgear Heat Removal System (VX). The Division 3 SX header is normally supplied by cooling water from the non-safety related Plant Service Water System (WS) [KG]. Under design basis event conditions such as Loss of Offsite Power (LOOP) or Loss of Coolant Accidents (LOCAs), a Division 3 SX pump start signal is generated and the cross-tie valve [V] (1SX014C) from the plant service water system closes. At this point the Division 3 SX pump would be providing cooling water flow from the lake to the Division 3 SX cooling loads.

Divisions 1 and 2 safety-related equipment are fully capable of mitigating the consequences of an accident and were available during the period of this event.

The failure of the Division 3 Shutdown Service Water Pump results in loss of Division 3 Emergency Diesel Generator safety function and a loss of the High Pressure Core Spray System safety function.

Failure of the pump suction bell bushing assembly was determined to have occurred during the previous successful run of 1SX01PC on 5/30/14, resulting in 109 days with the Division 3 SX pump inoperable, which is beyond the Limiting Condition for Operation (LCO) Required Action Completion Time of 14 days to restore HPCS to an operable status. This resulted in a condition prohibited by Technical Specifications, which is reportable under 10 CFR 50.73(a)(2)(i)(B).

E. CORRECTIVE ACTIONS

A new pump was installed and post maintenance testing was completed with acceptable results on 9/21/14. The Division 3 SX system, including the Division 3 EDG and HPCS system were declared operable at 1742 hours on 9/21/14.

The corrective action to prevent recurrence has already been completed. CPS transitioned to Exelon procedures containing robust barriers to prevent this issue. Specifically, the corporate procedure for permanent plant changes has governed all design configuration control since 2001. This procedure contains a more robust screening and risk assessment of modifications as well as a formalized graduated approach to modification significance.

F. PREVIOUS SIMILAR OCCURRENCES

In 1990, during an attempt to start 1SX01PC for a quarterly pump operability surveillance test, the pump motor energized but the pump did not turn and subsequently tripped. The pump was disassembled, cleaned and reassembled. The bushing enclosure tube and bushing flush water piping were found to be filled with silt which

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was determined to be the failure cause. Corrective actions included running the pump more frequently and monitoring coast down time. Also, a modification was developed to remove the pump's internal cooling/flushing lines.

In 1995, due to a decrease in the pump coast down time, the pump was disassembled and excessive amounts of silt were found in the bushing enclosure tube and bushing flush water piping. No damage was observed at that time. The pump was cleaned and reassembled as a redesigned pump using a modification kit provided by the pump supplier. The kit contained all the parts necessary to eliminate the bushing enclosure tube, change the bushings to a bronze design and eliminate the bushing flush water piping. The pump was re-assembled under the supervision of a vendor representative. A protective Belzona coating was applied to the pump and some repairs were performed using Belzona 'R' metal. This is the pump design that was in place at the time of the 9/16/14 pump failure.

G. COMPONENT FAILURE DATA

The Division 3 SX pump is a Sulzer model 8X14A VCM pump with a Siemens-Allis type RGV motor. The pump is a vertical two-stage deep well pump that consists of a discharge head, six columns and a bowl assembly to extend 30 feet below the floor elevation. The pump is driven by a 75 horsepower, 1800 RPM, 480 volt motor.