Nebraska Public Power District

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NLS2017086
September 27, 2017

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

Subject: Licensee Event Report No. 2016-001-01
Cooper Nuclear Station, Docket No. 50-298, DPR-46

Dear Sir or Madam:

The purpose of this correspondence is to forward Licensee Event Report 2016-001-01.

There are no new commitments contained in this letter.

Sincerely,

John Dent, Jr.
Vice President Nuclear-
Chief Nuclear Officer

/jo

Attachment: Licensee Event Report 2016-001-01

cc: Regional Administrator w/attachment
USNRC - Region IV

Cooper Project Manager w/attachment
USNRC - NRR Plant Licensing Branch IV

Senior Resident Inspector w/attachment
USNRC - CNS

SRAB Administrator w/attachment

NPG Distribution w/attachment

INPO Records Center w/attachment
via ICES entry

SORC Chairman w/attachment

CNS Records w/attachment

IE22
NRR

COOPER NUCLEAR STATION
P.O. Box 98 / Brownville, NE 68321-0098
Telephone: (402) 825-3811 / ***Fax:*** (402) 825-5211
www.nppd.com

NRC FORM 366 (04-2017) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2020

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 Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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)

(See NUREG-1022, R 3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

De-Energized High Pressure Coolant Injection Auxiliary Lube Oil Pump Caused by Relay Failure Results in Loss of Safety Function, a Condition Prohibited by Technical Specifications, and a 10 CFR Part 21 Report

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 05000
04	25	2016	2016	001	01	09	27	2017	FACILITY NAME	DOCKET 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)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
10. POWER LEVEL	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
100	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☒ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☒ OTHER – 10 CFR Part 21	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER (Include Area Code)
Jim Shaw, Licensing Manager	(402) 825-2788

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
B	BJ	RLY	A160	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☒ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☐ NO		12	31	2017

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

On April 25, 2016, while performing a walkdown of Control Room panels, it was noticed that the green indication light for High Pressure Coolant Injection (HPCI) auxiliary lube oil pump (ALOP) was not illuminated. A non-licensed operator was dispatched to the HPCI ALOP starter and reported that the local indication lights were not illuminated. HPCI was declared inoperable at 2117 Central Daylight Time (CDT) resulting in entry into Technical Specifications (TS) Limiting Condition of Operation 3.5.1, Condition C, HPCI System Inoperable.

Investigation determined that the coil in the electrical relay for the ALOP, which had recently been replaced during a preventive maintenance window, had failed after 133 hours of service. The cause of the failure was determined to be the prior pre-installation checks performed by NuTherm on the relay were inadequate to prevent the type of infant mortality failure that occurred in this case. HPCI was declared operable at 1314 CDT on April 26, 2016, after the coil was replaced.

This event is being reported as a loss of safety function due to HPCI being a single-train safety system, as a condition prohibited by TS and in accordance with 10 CFR Part 21.

The potential safety consequences of this event were minimal due to both the limited duration the condition existed and the redundant/diverse core cooling systems which remained operable.

NARRATIVE

PLANT STATUS

Cooper Nuclear Station (CNS) was in Mode 1, Power Operation, at 100 percent steady state power at the time the condition was identified. Service Water Pump "B" and Service Water Booster Pump "B" were inoperable when High Pressure Coolant Injection (HPCI) was inoperable. No other emergency core cooling systems were inoperable during the event.

BACKGROUND

The HPCI System (EIIS:BJ) provides protection to the core for the case of a small break in the reactor coolant pressure boundary which does not result in rapid depressurization of the reactor vessel (EIIS:RPV). The HPCI System permits the nuclear plant to be shutdown while maintaining sufficient reactor vessel water inventory until the reactor vessel is depressurized. The HPCI System continues to operate until reactor vessel pressure is below the pressure at which Low Pressure Coolant Injection (EIIS:BO) operation or Core Spray System (EIIS:BM) operation can be used to maintain core cooling.

HPCI consists of a steam turbine assembly (EIIS:TRB) driving a multi-stage booster and main pump assembly (EIIS:P) and system piping, valves, controls and instrumentation. The HPCI turbine is driven by steam from the reactor which is generated by decay and residual heat.

A control governor (EIIS:65) receives a HPCI flow signal and adjusts the turbine steam control valve (EIIS:SCV) so that HPCI design pump discharge flow rate is obtained. The flow signal used for automatic control of the HPCI turbine is derived from a differential pressure measurement across a flow element (EIIS:FE) in the HPCI pump discharge pipeline. The governor controls the pressure applied to the hydraulic operator of the turbine control valve, which, in turn, controls the steam flow to the HPCI turbine.

Upon receipt of the actuation signal, the auxiliary oil pump starts, providing hydraulic pressure for the turbine stop valve and turbine control valve hydraulic operator. The flow signal will ramp the control governor until rated flow is achieved. As hydraulic oil pressure is developed, the turbine stop valve and the turbine control valve open simultaneously and the turbine accelerates toward the speed setting of the control governor. As HPCI flow increases, the flow signal adjusts the control governor setting so that design flow is maintained.

EVENT DESCRIPTION

On April 25, 2016, while performing a walkdown of Control Room panels, a licensed operator noticed that the green indication light for the HPCI auxiliary lube oil pump (ALOP) was not illuminated. The bulb in the Control Room panel was replaced, but did not illuminate. A non-licensed station operator was subsequently sent to the HPCI ALOP starter to verify local indications and found the local indication lights were not illuminated on the starter rack, indicating that the ALOP starter had lost power. The ALOP is required to start in order to open the steam admission valves for the HPCI turbine. An attempt was made in the Control Room to start the ALOP, but it did not start.

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NARRATIVE

Operations then declared HPCI inoperable at 2117 Central Daylight Time (CDT), resulting in entry into Technical Specifications Limiting Condition of Operation 3.5.1, Condition C, HPCI System Inoperable.

Investigation revealed that the electrical relay (27) [Allen Bradley 700DC Type P relay] for the ALOP had been replaced on April 19, 2016, during the recent three-year required preventive maintenance window. After various checks were made, it was discovered that the coil within the relay had failed after 133 hours of service. The relay is expected to provide three years of reliable service between replacements. As such, it was concluded that the coil had sustained an infant mortality type failure.

The dedication process used by the vendor of the relay, NuTherm, at the time the relay was purchased by CNS, consisted of verifying the pickup and dropout voltages, and verifying contact resistances. After purchase of the relay, but prior to installation, NuTherm revised their dedication process to require additionally cycling the relay 30 times in addition to the previous voltage and resistance checks.

The relay that failed was replaced with a new relay that was purchased in September 2013 from a different lot than the failed relay purchased in March 2011. After satisfactory completion of post work testing of the ALOP, HPCI was declared operable at 1314 CDT on April 26, 2016.

BASIS FOR REPORT

The HPCI System is a single train safety system. This condition is reportable in accordance with 10 CFR 50.73(a)(2)(v) as "any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to...(D) Mitigate the consequences of an accident." The condition is also reportable in accordance with 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by TS since, due to HPCI inoperability, the verification of the Reactor Core Isolation Cooling system operability exceeded the 1 hour required completion time plus the 12 hour completion time to be in Mode 3 if this verification is not completed. The event was reported as Event Notification Number 51882.

10 CFR PART 21 REPORT

Name and address of the individual (or individuals) informing the Nuclear Regulatory Commission:
John Dent, Vice President-Nuclear and Chief Nuclear Officer
Cooper Nuclear Station
72676 648A Avenue
Brownville, NE 68321

The facility the dedication plan and basic component was supplied for which contained a defect:
Cooper Nuclear Station
72676 648A Avenue
Brownville, NE 68321

The basic component is: Allen-Bradley DC control relay, model number 700DC-P220Z2 and NuTherm Dedication Package 141-DD-01.

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The firm supplying the dedication plan and basic component which contained a defect is:

NuTherm International, Inc.
501 South 11th Street
Mount Vernon, IL 62864

The cause of the condition is an inadequate pre-installation test plan and defect of an Allen-Bradley control relay in a NuTherm starter. The relay failure appeared to be a fault caused by a manufacturing flaw that likely occurred due to a tensioning issue at the start of the coil wire winding process. The dedication plan for the Allen-Bradley control relay was inadequate to identify the defect in the relay. The failed starter was associated with the HPCI auxiliary lube oil pump causing the HPCI system to be inoperable. The relay model is used in numerous other HPCI starters and in the reactor recirculation pump discharge valve starters. The dedication plan is specific to the Allen-Bradley DC control relay, model number 700DC-P220Z2; therefore, the population affected is the same as that of the relay installation listed below. A review of the adequacy of other NuTherm dedication plans to identify a similar condition has not been completed. The results of this review will be included in a future supplement to this LER. The loss of HPCI as a single train system is considered a substantial safety hazard, as defined by 10 CFR Part 21.

The date on which the information of a defect was obtained was August 28, 2017. A Part 21 assessment was completed on this date that determined the deviation constituted a defect in accordance with regulatory definitions. The initial 10 CFR Part 21 report was completed on August 28, 2017, in Event Notification Number 52934.

There were ten relays of that model installed in the plant, located in the following starters:

CNS-2-EE-STR-250HPCI ALOP (HPCI Auxiliary Lube Oil Pump)
CNS-2-EE-STR-250HPCI CP (HPCI Condensate Pump)
CNS-2-EE-STR-250HPCI GSE (HPCI Gland Seal Exhauster)
CNS-2-EE-STR-250HPCI MO14 (HPCI Turbine Steam Inlet Valve)
CNS-2-EE-STR-250HPCI MO19 (HPCI Injection Valve)
CNS-2-EE-STR-250HPCI MO20 (HPCI Injection Valve)
CNS-2-EE-STR-250HPCI MO21 (HPCI Test Line Valve)
CNS-2-EE-STR-250HPCI MO25 (HPCI Minimum Flow Valve)
CNS-1-EE-STR-250DIV1 MO53A (Recirculation Pump "A" Discharge Valve)
CNS-2-EE-STR-250DIV2 MO53B (Recirculation Pump "B" Discharge Valve)

The failed relay was replaced with a relay from a different batch by CNS maintenance on April 26, 2016. NuTherm revised their dedication process such that this type of failure will be detected. This action was completed on May 13, 2016. In addition, current pre-installation checks were reviewed to determine what is necessary to reasonably ensure that infant mortality failures are minimized. This action was completed by the CNS Design Engineering Department on May 25, 2016.

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NARRATIVE

There is no advice related to the *defect* or *failure to comply* about the facility, activity or *basic component* that has been, is being, or will be given, to purchasers or licensees.

This event does not involve an early site permit.

SAFETY SIGNIFICANCE

This is a Safety System Functional Failure. There were no actual safety consequences associated with this event. The potential safety consequences of this event were minimal due to the limited duration the condition existed and the redundant/diverse core cooling systems which remained operable throughout the event. The HPCI system is an emergency core cooling system designed to inject water into the reactor vessel to provide core cooling. The total duration of inoperability, including the time prior to discovery of the condition was less than the 14 day Technical Specification Completion Time. During the time period of inoperability, other core cooling systems (Automatic Depressurization System, Core Spray, and Low Pressure Coolant Injection) were operable and would have adequately responded to a design basis event. The Reactor Core Isolation Cooling system was also operable during this event.

CAUSE

The root cause of the event was determined to be that the prior pre-installation checks performed by NuTherm on the relay were inadequate to prevent the infant mortality failure that occurred in this case.

CORRECTIVE ACTIONS

NuTherm revised their dedication process such that this type of failure will be detected. In addition, there are no relays from this lot in storage at CNS; however a check of maintenance records found that some of the relays from this lot are installed in the plant. These installed relays are well beyond the infant mortality period and have performed as expected.

PREVIOUS EVENTS

There have been no events reported in the last three years related to the HPCI ALOP.