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NLS2011098
October 12, 2011

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

Subject: Licensee Event Report No. 2011-003-01
Cooper Nuclear Station, Docket No. 50-298, DPR-46

Dear Sir or Madam:

The purpose of this correspondence is to forward Licensee Event Report 2011-003-01.

Sincerely,

Demetrius L. Willis
General Manager of Plant Operations

/bk

Attachment

cc: Regional Administrator w/attachment
USNRC - Region IV

Cooper Project Manager w/attachment
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/attachment
USNRC - CNS

SRAB Administrator w/attachment

NPG Distribution w/attachment

INPO Records Center w/attachment

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 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013

Estimated burden per response to comply with this mandatory information collection request: 80 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Service 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 reverse for required number of digits/characters for each block)

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4. TITLE
Loss of Safety Function and Past Inoperability of Service Water Strainers

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
										05000
03	27	2010	2011	- 003 -	01	10	12	2011	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE
1

10. POWER LEVEL
100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 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)
☐ 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)
☐ 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

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
David W. Van Der Kamp, Licensing Manager	(402) 825-2904

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	BI	CPLG	W287	Y					

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On March 27, 2010, the 'A' Service Water (SW) strainer failed to operate as expected. Cooper Nuclear Station (CNS) found the strainer wiper motor-to-gearbox coupling was not engaged to turn the gearbox shaft. The gear side key had become dislodged allowing the coupling half to move enough to disengage the coupling sleeve. This condition impacted the ability of the strainer to perform the automatic backwash function to keep it clear of debris. CNS did not enter the applicable Technical Specification limiting condition for operation due to acceptable differential pressure across the strainer, the ability to take actions to maintain the strainer operable, and the lack of available information indicating an inoperable condition existed.

CNS' evaluation of the failure identified a history of performance problems for both divisions of SW strainer couplings. The root causes are design and design control of the reduction gear-to-motor shaft configuration for the SW strainers, specifically including the coupling, is inadequate; and historical coupling failure evaluations failed to identify the original design fault.

As an interim measure, CNS installed new worm gear shafts and couplings with solid sleeves for both SW strainers. To prevent recurrence of the failure, CNS will implement a new SW strainer modification. The equipment failure is not risk significant.

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17. NARRATIVE

PLANT STATUS

Cooper Nuclear Station (CNS) was in Mode 1, Power Operation, at 100 percent power at the time the event was discovered, i.e., June 7, 2011, and when the actual event occurred on March 27, 2010, at 12:25 Central Daylight Time (CDT).

BACKGROUND

The service water (SW) [EIIS:BI] system is designed to provide cooling water for the removal of heat from equipment, such as the diesel generators [EIIS:DG] and reactor equipment cooling (REC) system heat exchangers [EIIS:HX], and to provide a supply of water for the residual heat removal (RHR) [EIIS:BO] SW heat exchangers through the RHR SW booster system pumps [EIIS:P]. The SW system also provides cooling to turbine building [EIIS:NM] non-essential loads and other unit components, as required, during normal operation.

The SW system consists of four pumps located in the intake structure [EIIS:ME]. These pumps are separated into two pairs. Each pair takes suction from the SW bay in the intake structure and discharges through a motorized, self-cleaning strainer [EIIS:STR] to the SW supply header. The two SW strainers remove suspended particles equal to or larger than 1/8 inch in size from the water in order to prevent or minimize fouling of the heat transfer surfaces in the downstream REC and RHR SW heat exchangers.

Debris accumulated in the SW strainers is removed through a backwash function. This creates a low pressure area in between a set of wiper blades that draws a portion of the strained water backward through the strainer, down between the wiper blades, and out the backwash outlet. This backwash water is then returned to the Missouri River.

EVENT DESCRIPTION

On March 27, 2010, at 12:25 CDT, when operators placed the 'A' SW strainer in the mode for continuous operation, the strainer did not operate as expected. Further investigation revealed that the SW strainer wiper motor-to-gearbox coupling [EIIS:CPLG] was not engaged to turn the gearbox shaft. The gear side key had become dislodged allowing the coupling half to move enough to disengage the coupling sleeve. This condition impacted the ability of the SW strainer to successfully perform the automatic backwash function to keep it clear of debris.

At the time of the failure, differential pressure across the 'A' SW strainer was steady at 0.1 to 0.2 psid and was not approaching the operational limit of 15 psid. CNS control room operators considered the SW 'A' subsystem operable based on the fact that differential pressure remained within operational limits, the ability existed to take manual actions to perform the strainer's backwash function per alarm card response procedures, and the lack of available information indicating an inoperable condition existed. As such, the applicable technical specification limiting condition for operation for SW was not entered. CNS maintenance personnel restored the coupling at approximately 17:19 CDT on March 27, 2010, and staked the gear side keyway to prevent the key from coming out.

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17. NARRATIVE

A root cause evaluation for the equipment failure was completed on May 11, 2010. The evaluation identified a history of performance problems for both divisions of SW strainer couplings. Prior Corrective Action Program (CAP) evaluations failed to recognize an original design deficiency with the reduction gear to motor shaft configuration; specifically, the length of the worm gear shaft keyway is too short for adequate engagement of the coupling on the shaft. The design inadequacies were introduced at the time of initial installation of the SW strainers in 1973. Previous actions to correct the conditions have not prevented failure.

The type of coupling utilized in the strainer motor-to-gear box application for both divisions of SW is a TB Wood's Inc. product type 4J. Prior to 2003, the SW strainer couplings were classified as "non-essential," so failures were addressed as corrective maintenance work items. Following reclassification of the SW strainer components to "essential" in 2003 to 2006, there were three coupling failures. Two of the failures were assigned as "validate and fix the identified condition" in the CAP. An apparent cause evaluation was performed for the third condition, which did not detect the design problem. In July 2007, the CAP implemented new condition classification criteria, specifically designed to escalate corrective action efforts associated with repetitive equipment failures and programmatic breakdowns.

The following table provides a summary of SW strainer coupling failures that have occurred at CNS in the last three years and the associated cause and corrective actions:

Date	Condition Description	Cause	Actions Taken
3/27/10	'A' SW strainer gear side key dislodged inside of coupling sleeve.	Inadequate coupling design.	Installed new worm gear shafts and couplings with solid sleeves (both strainers). New strainer modification is planned.
4/29/09 5/01/09	'A' SW strainer gear side coupling found loose. 'A' SW strainer motor side coupling moved during installation.	Key setscrew was positioned on the radius portions of the key and keyway.	Coupling replaced and dimpled the gear box and motor shafts for the shaft setscrew (both strainers). Procedure guidance also revised.
9/02/08	'B' SW strainer gear side key found dislodged from worm gear and coupling hub keyway.	Accessibility is not optimal to prevent coupling failures (lack of visual access to ensure correct assembly).	Worm gear and coupling replaced. Procedure revised to add instruction for coupling inspections when disassembled.
6/26/08	'A' SW strainer moving erratically; rubber coupling found on shaft behind coupling half.	Improper coupling installation.	Coupling replaced and enhanced procedure guidance for coupling installation.

17. NARRATIVE

Application of the CAP criteria, implemented in July 2007 for repetitive equipment failures, resulted in escalation of three out of four of the SW strainer coupling failures (the April and May 2009 failures were evaluated together). The most recent escalation, to perform a root cause evaluation for the March 2010 failure, enabled identification of the SW strainer coupling design deficiency.

BASIS FOR REPORT

CNS discovered that the March 2010 SW strainer coupling failure was reportable on June 7, 2011, during a backend review of the resulting 2010 root cause evaluation. At the time of the March 2010 failure, there was a lack of knowledge regarding the SW strainer coupling design deficiency. As such, past operability of the SW subsystem was not considered. The root cause evaluation performed for the March 2010 failure documents firm evidence that a design deficiency has existed since 1973; therefore, CNS is reporting the March 2010 and past failures in accordance with the following 10 CFR 50.73 criteria:

- 50.73(a)(2)(i)(B) – An operation or condition prohibited by Technical Specifications.
- 50.73(a)(2)(v) – An event or condition that could have prevented fulfillment of the safety function of structures or systems that are needed to: (B) remove residual heat.
- 50.73(a)(2)(vii) – An event where a single cause or condition caused at least one independent train or channel to become inoperable in multiple systems or two independent trains or channels to become inoperable in a single system designed to: (B) remove residual heat.

SAFETY SIGNIFICANCE

The safety significance of the 'A' SW strainer wiper motor-to-gearbox coupling failure on March 27, 2010, is low. The impact of this condition was limited to the strainer automatic backwash function and strainer differential pressures remained steady at 0.1 to 0.2 psi, which is significantly lower than the operational limit. Therefore, the likelihood of the strainer not being able to provide sufficient SW flow was low. Additionally, the 'B' SW strainer was available and capable of providing required cooling water for all conditions.

The March 2010 failure and other past occurrences discussed in the Event Description section are considered a safety system functional failure.

CAUSE

CNS identified two root causes for the March 2010 SW strainer motor-to-gearbox coupling failure:

- Design and design control of the reduction gear-to-motor shaft configuration for the SW strainers, specifically including the coupling, is inadequate. The design inadequacies were introduced at the time of initial installation of the SW strainers in 1973.

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17. NARRATIVE

- Historical SW strainer coupling failure evaluations failed to identify the original design fault.

CORRECTIVE ACTIONS

In July 2007, the CAP implemented new condition classification criteria, specifically designed to escalate corrective action efforts associated with repetitive equipment failures and programmatic breakdowns. No additional actions are needed to address the cause related to historical processes for equipment failure evaluations.

As an interim measure, CNS installed new worm gear shafts and couplings with solid sleeves for both SW strainers. This interim action was completed on July 19, 2010, for the 'B' SW strainer and October 25, 2010, for the 'A' SW strainer. To further prevent recurrence of this equipment mechanistic failure, CNS will implement a new SW strainer modification.

PREVIOUS EVENTS

CNS has experienced historical performance problems with the SW strainer couplings as discussed in the Event Description section. There have been no other events reported in the last three years.

ATTACHMENT 3 LIST OF REGULATORY COMMITMENTS©[4]

Correspondence Number: NLS2011098

The following table identifies those actions committed to by Nebraska Public Power District (NPPD) in this document. Any other actions discussed in the submittal represent intended or planned actions by NPPD. They are described for information only and are not regulatory commitments. Please notify the Licensing Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITMENT NUMBER	COMMITTED DATE OR OUTAGE
None		