



Nebraska Public Power District

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NLS2011103
November 14, 2011

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

Subject: Licensee Event Report No. 2011-006-00
Cooper Nuclear Station, Docket No. 50-298, DPR-46

Dear Sir or Madam:

The purpose of this correspondence is to forward Licensee Event Report 2011-006-00.

Sincerely,

Demetrius L. Willis
General Manager of Plant Operations

/bk

Attachment

cc: Regional Administrator w/attachment USNRC - Region IV	NPG Distribution w/attachment
Cooper Project Manager w/attachment USNRC - NRR Project Directorate IV-1	INPO Records Center w/attachment
Senior Resident Inspector w/attachment USNRC - CNS	SORC Chairman w/attachment
SRAB Administrator w/attachment	CNS Records w/attachment

LEZZ
NRR

LICENSEE EVENT REPORT (LER)(See reverse for required number of
digits/characters for each block)

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.

1. FACILITY NAME

Cooper Nuclear Station

2. DOCKET NUMBER

05000298

3. PAGE

1 of 5

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																																				
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10. POWER LEVEL																																														
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12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME

David W. Van Der Kamp, Licensing Manager

TELEPHONE NUMBER (include Area Code)

(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	MANUFACTURER	REPORTABLE TO EPIX
B	BI	V	R137	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 August 15, 2011, the 'A' Service Water (SW) strainer backwash outlet air-operated valve (AOV) failed to open as expected. Cooper Nuclear Station (CNS) found the AOV's internal rubber sleeve had ruptured and caused the AOV to fail. This condition impacted the ability of the strainer to perform the automatic backwash function to keep it clear of debris. CNS personnel replaced the sleeve, but it ruptured again prior to returning the subsystem to operable. CNS replaced the AOV with a temporary pipe spool piece and returned SW 'A' subsystem to operable on August 19, 2011.

CNS' evaluation identified a history of ruptures with the strainer backwash outlet AOV's internal rubber sleeve for both divisions of SW. The previous sleeve ruptures did not result in either SW subsystem being declared inoperable. CNS identified two root causes: Inadequate application of the design process to ensure vendor specifications and design functions are met; and, non-conservative decision making resulted in the failure to implement actions to resolve equipment problems.

CNS initiated compensatory measures to maintain both SW strainers operable and subsequently installed manual ball valves. To prevent recurrence, CNS will ensure that a valve that incorporates the lessons learned from the root cause evaluation is specified in the SW strainer replacement modification. This event has low risk significance.

(10-2010)

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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 on September 15, 2011, and when the actual event occurred on August 15, 2011.

BACKGROUND

The service water (SW) [EIS:BI] system is designed to provide cooling water for the removal of heat from equipment, such as the diesel generators [EIS:DG] and reactor equipment cooling (REC) system heat exchangers [EIS:HX], and to provide a supply of water for the residual heat removal (RHR) [EIS:BO] SW heat exchangers through the RHR SW booster system pumps [EIS:P]. The SW system also provides cooling to turbine building [EIS: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 [EIS: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 [EIS: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. An air-operated (AOV) outlet valve [EIS:V], one for each SW strainer, opens to provide a discharge path for the backwash flow whenever a strainer backwash signal is present. This backwash water is then returned to the Missouri River.

The AOV utilized for the strainer backwash function for both divisions of SW is a Type A, three-inch valve, manufactured by Red Valve Co.

EVENT DESCRIPTION

On August 15, 2011, at approximately 2200 hours, a CNS station operator discovered that a pilot valve that controls the instrument air to actuate the 'A' and 'C' SW strainer backwash outlet AOV (SW-AOV-857AV) was constantly venting air even though the 'A' SW strainer was not blowing down. Control room operators directed the station operator to place 'A' SW strainer in "continuous" mode to validate proper operation. The station operator reported water coming out of the solenoid valve bleed off port after the strainer was placed in continuous mode and SW-AOV-857AV failed to open as expected. This condition impacted the ability of the SW strainer to successfully perform the automatic backwash function to keep it clear of debris.

At 0038 hours on August 16, 2011, control room operators declared SW subsystem 'A', RHR containment spray subsystem 'A', and DG-1 inoperable due to failure of SW-AOV-857AV to open with the 'A' SW strainer in service. At 0207 hours on August 16, 2011, 'B' SW strainer was placed in service to verify proper operation.

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17. NARRATIVE

CNS maintenance personnel removed SW-AOV-857AV and replaced a ruptured internal rubber sleeve. This damaged sleeve caused SW-AOV-857AV to fail. Prior to returning SW subsystem 'A' to operable, the replacement AOV rubber sleeve failed again in a similar location as the initial failure. As a compensatory action, a temporary configuration change was implemented on August 19, 2011, to replace the affected AOV with a fabricated pipe spool piece. SW subsystem 'A', RHR containment spray subsystem 'A', and DG-1 returned to operable status on August 19, 2011, at 0345.

CNS completed a root cause evaluation for the SW-AOV-857AV failure on September 28, 2011. The evaluation identified a history of ruptures with the internal rubber sleeves for both divisions of SW strainer backwash outlet AOVs (SW-AOV-857AV and SW-AOV-858AV). There have been several occurrences of sleeve ruptures for both SW-AOV-857AV and SW-AOV-858AV, some of which have occurred in the last three years. CNS has had improved performance with the strainer backwash outlet AOVs since instituting preventive maintenance for replacement of the rubber sleeves every 24 months, yet there still have been ruptures since 1994 when the preventive maintenance plans were initiated.

As part of the root cause investigation, CNS sent three ruptured sleeves to an independent laboratory for failure analysis. The analysis identified that the rupture initiated along the outside diameter on the pure gum rubber layer and grew inward until breaching the inside diameter surface. Once the pure gum rubber layer was breached, the system fluid pressure blew out the neoprene and reinforcing layers. The cause of the initiation was due to local hardening and embrittlement of the reinforcing layer, most likely formed during the fabrication of the AOVs. This failure mechanism was common to all three sleeves.

CNS' review of the Red Valve vendor manual and discussions with the manufacturer identified the AOV was not utilized in accordance with recommendations since initial installation. The closing pressure for the backwash outlet AOVs in the SW strainer application was almost twice the manufacturer recommended closing differential pressure. The manufacturer also recommends that the pipeline flanges be flat. Contrary to this recommendation, CNS utilized raised flange connections. Additionally, SW system design requirements had changed beyond what was originally considered. The AOV in the SW strainer backwash application was at one time considered "non-essential" and sleeve ruptures did not affect a safety function. The classification was subsequently changed to "essential" for pressure boundary only, in which only the sleeve flanges performed a safety function. The AOVs currently have an active safety function to open. Other items CNS didn't consider during previous design reviews include the potential to introduce instrument air into the SW system and the potential for the AOV to fail such that it remains in the closed position.

CNS' review of the performance history concluded that there were multiple opportunities to implement modifications that would have prevented failure of SW-AOV-857AV, yet in each case, the modifications were cancelled and lower cost alternatives implemented that did not fix the issue.

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17. NARRATIVE**BASIS FOR REPORT**

CNS discovered that the August 15, 2011, SW-AOV-857AV rubber sleeve failure was reportable on September 15, 2011, during a backend review of the root cause evaluation. At the time of the actual event, it had not yet been identified that the SW strainer backwash outlet AOVs were being used outside of vendor specifications. The root cause evaluation documents that a potential past inoperable condition for both SW-AOV-857AV and SW-AOV-858AV existed for a period longer than permitted by Technical Specifications; therefore, CNS is reporting the August 15, 2011, event and past sleeve ruptures for SW-AOV-857AV and SW-AOV-858AV 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 SW-AOV-857AV failure on August 15, 2011, is low. The impact of this condition was limited to the strainer backwash function and strainer differential pressures remained within operational limits. The SW system is normally operating and differential pressure across the SW strainers is monitored two times per day and alarmed in the control room. The condition did not result in elevated strainer differential pressure or alarms. The low safety significance associated with the failure of a strainer to perform a backwash is based on the relatively slow debris build-up on the strainers and the monitoring/alarms prompting operator action to maintain SW flow.

The August 15, 2011, failure and past occurrences of sleeve ruptures discussed in the Event Description section are considered a safety system functional failure.

CAUSE

CNS identified two root causes: Inadequate application of the design process to ensure vendor specifications and design functions are met; and, non-conservative decision making resulted in the failure to implement actions to resolve equipment problems.

CORRECTIVE ACTIONS

CNS took compensatory measures to replace SW-AOV-857AV with a fabricated pipe spool piece on August 19, 2011, and to deactivate SW-AOV-858AV in its full open configuration by isolating its air supply on September 16, 2011. These compensatory measures maintained both SW

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17. NARRATIVE

strainers operable. On November 3 and 4, 2011, temporary configuration changes were implemented to install manual ball valves on the backwash lines for both SW strainers.

To prevent recurrence of this equipment failure, CNS will ensure that a valve that incorporates the lessons learned from the root cause evaluation is specified in the SW strainer replacement modification. The modification will be implemented during the next refueling outage at CNS currently scheduled for October 2012.

The non-conservative decisions for failing to replace the SW strainer backwash outlet AOVs are considered legacy issues. The current CNS processes for identification and resolution of adverse conditions have improved significantly since the occurrence of the missed opportunities.

PREVIOUS EVENTS

LER 2011-003-01 - On March 27, 2010, the 'A' SW strainer failed to operate as expected. CNS personnel 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. CNS' evaluation of the failure identified a history of performance problems for both divisions of SW strainer couplings. The root causes were 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.

Correspondence Number: NLS2011103

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		