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NLS2005103
November 17, 2005

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

Subject: Licensee Event Report No. 2005-004-00
Cooper Nuclear Station, Docket 50-298, DPR-46

The purpose of this correspondence is to forward a Licensee Event Report.

Sincerely,

Stewart B. Minahan
General Manager of Plant Operations

/cb

Enclosure

cc: Regional Administrator w/enclosure
USNRC - Region IV

Senior Project Manager w/enclosure
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/enclosure
USNRC - CNS

NPG Distribution w/enclosure

INPO Records Center w/enclosure

CNS SORC Administrator w/enclosure

CNS SRAB Administrator w/enclosure

CNS Records w/enclosure

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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		

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2007

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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 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)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE
Loss of Condenser Vacuum Due to Failed Drain Line Results in Manual Scram

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	23	2005	2005	- 004 -	00	11	17	2005		05000
									FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE
1

10. POWER LEVEL
076

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

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER
  Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Paul V. Fleming, Licensing Manager	(402) 825-2774

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	TA	DRN	W120	Y					

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

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

On September 23, 2005, at 0022, Operations noted condenser vacuum degrading and Steam Jet Air Ejector air flow rising. The decline occurred after starting a backwash of Condenser B-2 Waterbox. Operations performed actions per Abnormal Procedures, and reduced power. Condenser vacuum continued to decline. By 0040, condenser vacuum had dropped to 23.1 inches of Mercury. The minimum acceptable value for vacuum is 23 inches of Mercury. Operators manually scrammed the reactor due to degrading condenser vacuum which was caused by significant air inleakage. The air leak was through a turbine bearing slop (waste oil and water) drain line that failed due to high-cycle fatigue. Inadequate support of slop drain lines in the Main Condenser led to piping vibration induced by Low Pressure (LP) Turbine exhaust steam flow.

An evaluation of plant response determined that all control rods were fully inserted, and systems controlling reactor pressure and level responded as designed. Condenser vacuum was maintained to support Bypass Valve operation during the event. The interim corrective action to address the Root Cause was to remove the slop drain lines from the condenser and to plug the condenser penetration holes. This was completed prior to unit restart.

LICENSEE EVENT REPORT (LER)

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17. NARRATIVE *(If more space is required, use additional copies of Form 366A)*

PLANT STATUS

Cooper Nuclear Station (CNS) was in Mode 1 (Run) at 76% power at the time of the manual reactor scram. Reactor power had been lowered from 100% due to degrading condenser (COND) vacuum (EIIS:SH).

BACKGROUND

Condenser vacuum degraded due to a failed slop drain line in the exhaust steam flow path of the generator end of Low Pressure (LP) Turbine 2 (TUR). The slop drain lines provide a means of draining oil leakage from LP Turbine bearings and water leakage from LP Turbine gland seals to a collection barrel in the Heater Bay. Due to turbine and foundation design, this piping is routed through the LP turbine cylinder base and main condenser. The cylinder base bears the weight of the LP turbine rotors, provides a pressure boundary between condenser vacuum and atmospheric pressure, and provides a drain cavity to collect liquid leaking from bearings and glands. Oil or water drains into the low point of this support structure cavity. A one and one-quarter inch pipe penetrates the cylinder base near the cavity low point to conduct the waste by gravity through the condenser for about twenty-five feet until the pipe penetrates the east wall of the condenser. Outside the condenser, the slop drains for the north and south bearings are combined into a single line that runs to the collection barrel. The slop drain is open to ambient conditions at both ends, and pipe failure would allow air to leak into the condenser through both cavity drains and from the barrel end.

All four slop drain lines were replaced in February 2005 after thirty years of service because erosion of the outer surfaces of the piping caused a vacuum leak. The repair was a like-for-like replacement of all slop drain lines using Schedule 80 carbon steel pipe, and the lines were routed per as-built drawings, i.e., same pipe route. The piping was replaced to repair through-wall leakage attributable to erosion. Because the lines had been in service for thirty years before requiring replacement, it was reasonable to assume there were no other problems such as inadequate pipe support. However, during the most recent refueling outage the LP turbine rotors were replaced. The new rotors are more efficient and have longer blades in the last stage. The higher efficiency of the new turbines implies more steam energy is converted to work and, therefore, the exhaust steam has a higher moisture content. The higher moisture content would influence the forces imparted on the pipe. The longer blading should have an influence on flow patterns, which could also affect the slop drain piping. The failed pipe was shipped to an independent laboratory for analysis. The analysis concluded that the pipe failed due to fatigue and that there was no evidence that the microstructure or weldment had a role in the failure. The laboratory identified the root cause of the failure as vibrations in the pipe.

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17. NARRATIVE *(If more space is required, use additional copies of Form 366A)*

EVENT DESCRIPTION

On September 23, 2005, at 0022, Operations noted condenser vacuum degrading and Steam Jet Air Ejector air flow rising. The decline occurred after starting a backwash of Condenser B-2 Waterbox. Operations performed actions per Abnormal Procedures and reduced power. Condenser vacuum continued to decline. By 0040, condenser vacuum had dropped to 23.1 inches of Mercury, and Operations manually scrammed the reactor. Per the Abnormal Procedure, the minimum acceptable value for vacuum is 23 inches of Mercury.

Subsequent to the scram, reactor vessel water level dropped to approximately 19 inches below instrument zero during an expected level transient, resulting in Primary Containment Isolation System (PCIS) Group 2 (EIIS:JM) isolation. An evaluation of plant response determined that all control rods were fully inserted, and systems controlling reactor pressure and level responded as designed. Condenser vacuum was maintained to support Bypass Valve (EIIS:SO) operation during the event. The plant was maintained in Mode 3 (Hot Standby) to support troubleshooting and preplanned forced outage activities prior to proceeding to Mode 4 (Cold Shutdown) for repairs.

BASIS FOR REPORT

This event is reportable under 10 CFR 50.73(a)(2)(iv)(A) as an event that resulted in actuation of systems listed in paragraph (a)(2)(iv)(B). Specifically, these were (a)(2)(iv)(B)(1) for Reactor Protection System actuation resulting in a reactor scram and (a)(2)(iv)(B)(2) for PCIS Group 2 Isolation.

SAFETY SIGNIFICANCE

The lowering of Main Condenser Vacuum, due to air inleakage from a failed slop drain line, and resulting reactor scram had negligible effect on the CNS risk as described by the probabilistic risk assessment. The event did not challenge a fuel, reactor coolant pressure, primary containment, or secondary containment boundary. The event did not impact the plant's ability to safely shutdown or maintain the reactor in a safe shutdown condition. Following the scram, all mitigating equipment functioned as expected. In addition, the Main Turbine Bypass Valves and Main Condenser remained functional to remove decay heat. As a result, the event is bounded by the baseline Probabilistic Safety Analysis (PSA) model and has negligible risk significance.

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17. NARRATIVE *(If more space is required, use additional copies of Form 366A)*

CAUSE

The air leak was through a slop drain line that failed due to high-cycle fatigue. Inadequate support of slop drain lines in the Main Condenser led to piping vibration induced by LP Turbine exhaust steam flow.

CORRECTIVE ACTION

These corrective actions are documented in the CNS corrective action program.

1. The extent of cause applies to all four slop drain lines internal to the Main Condenser. These lines were removed at the recommendation of the Significant Event Review Team. CNS inspected the LP turbine exhaust area to determine the extent of condition looking specifically for field-run, small-bore (2 inch diameter or smaller) piping that was also installed by the main turbine vender. This piping may not have been originally installed to minimum support requirements specified by a code such as ANSI B31.1, 1967. No deficiencies requiring repair during the forced outage were found.

2. The interim corrective action to address Root Cause was to remove the slop drain lines from the condenser and to plug the condenser penetration holes. This was completed prior to unit restart.

3. A long term corrective action is to design and install appropriate pipe supports for slop drain piping internal to the Main Condenser.

PREVIOUS EVENTS

A review of LERs since 2000 was conducted. There have been no recent reportable events related to loss of condenser vacuum at CNS.