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September 6, 2002

United States Nuclear Regulatory Commission
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Docket Nos. 50-316

Document Control Manager:

In accordance with the criteria established by 10 CFR 50 73 entitled Licensee Event Report System, the following report is being submitted

LER 316/2002-006-00: "Unit 2 Reactor Trip Due to Low Condenser Vacuum"

No new commitments are identified in this submittal.

Should you have any questions regarding this correspondence, please contact Mr. Brian A McIntyre, Manager, Regulatory Affairs, at (269) 697-5806.

Sincerely,

Joseph E. Pollock
Site Vice President

INJ/pae

Attachment

c: A C Bakken
L. Brandon
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NRC Resident Inspector
Records Center, INPO

IE22

NRC Form 366 (7-2001) U S NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

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Donald C. Cook Nuclear Plant Unit 2	05000-316	1 of 4

4. TITLE

Unit 2 Reactor Trip Due to Low Condenser Vacuum

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
07	22	2002	2002	--	006	-- 00	09	06	2002	FACILITY NAME	DOCKET NUMBER

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)(ii)		50 73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
	20 2201(d)		20 2203(a)(4)		50 73(a)(2)(iii)		50 73(a)(2)(x)
	20 2203(a)(1)		50 36(c)(1)(i)(A)	X	50 73(a)(2)(iv)(A)		73 71(a)(4)
	20 2203(a)(2)(i)		50 36(c)(1)(ii)(A)		50 73(a)(2)(v)(A)		73.71(a)(5)
	20 2203(a)(2)(ii)		50 36(c)(2)		50 73(a)(2)(v)(B)		OTHER Specify in Abstract below or in NRC Form 366A
	20 2203(a)(2)(iii)		50 46(a)(3)(ii)		50.73(a)(2)(v)(C)		
	20 2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)		
	20 2203(a)(2)(v)		50 73(a)(2)(i)(B)		50.73(a)(2)(vii)		
	20 2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
	20 2203(a)(3)(i)		50 73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
I. N. Jackiw, Compliance Engineer	(269) 465-5901, x 1602

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

14. SUPPLEMENTAL REPORT EXPECTED				15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
	YES (If Yes, complete EXPECTED SUBMISSION DATE).	X	NO				

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

At 0045 hours on July 22, 2002, Unit 2 tripped due to low condenser vacuum. At the time of the trip, operators were performing a flush of the main condensers in preparation for the upcoming biocide treatment of the circulating water system. In accordance with 10 CFR 50.72 (b)(2)(iv)(B), a four-hour ENS notification (Event # 39081) was made to the NRC on July 22, 2002, at 0233 hours for an event or condition that resulted in an actuation of the reactor protection system (RPS) when the reactor is critical. As such, this LER is being submitted in accordance with the requirements of 10 CFR 50.73 (a)(2)(iv)(A) for a condition or event that resulted in an automatic actuation of the RPS system.

The apparent cause of the event is a previously unrecognized steam side heat transfer anomaly in "C" main condenser that has resulted in "C" North water box removing significantly more heat than in "C" South water box. Corrective actions to prevent recurrence of this event will be determined by an equipment root cause investigation to be performed after the steam side of the "C" main condenser has been inspected during the next Unit 2 outage of sufficient duration. Additional corrective actions, including preventive actions, may be developed based on the results of the investigation. If significant changes are identified as a result of completion of the root cause investigation, an update to this LER will be submitted. As a compensatory action, the main condenser water box flushing and isolation procedure has been revised to provide improved guidance for performing these activities to minimize the possibility of a unit trip

The safety significance of this event was minimal. Plant systems responded per design with no significant anomalies noted. Plant procedures and operator training provided sufficient direction for control room personnel to shutdown the plant and maintain it in a safe shutdown condition. There was no impact on the health and safety of the public as a result of this event

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

Conditions Prior to Event

Unit 1 – Mode 1, 100 percent power
Unit 2 – Mode 1, 100 percent power

Description of Event

At 0045 hours on July 22, 2002, Unit 2 tripped due to low condenser vacuum. Prior to the trip, operators were performing a flush of the "A," "B," and "C" main condenser (EIIS:SG) water boxes in preparation for the upcoming biocide treatment of the circulating water system. At the time of the unit trip, flushing of the "C" North condenser water box was in progress. The main condenser vacuum failed to stabilize as it had during flushing of the "A" and "B" condenser water boxes. Main condenser vacuum degraded rapidly and the main turbine tripped on "low-low" condenser vacuum of 20.3 inches (in) mercury (Hg), followed by a reactor trip. The shift immediately entered procedure 02-OHP-4023-E-0, "Reactor Trip or Safety Injection."

All control rods fully inserted making the Unit 2 reactor subcritical and normal nuclear instrumentation response was observed through the intermediate range and source range. The "C" main turbine stop valve exceeded its expected closure time by about one second, but this performance was determined to be acceptable. The main steam lines were manually isolated to stop the reactor coolant system cooldown and depressurization when pressurizer pressure reached 1930 pounds per square inch gauge (psig) to avoid an inadvertent safety injection. The main feedwater isolation tripped the main feedwater pumps and isolated the normal steam generator feedwater supply. Auxiliary feedwater (AFW) actuated and supplied normal AFW flow to the steam generators. The Unit 2 generator separated from the electrical grid and offsite power automatically transferred to the reserve feed supply.

In accordance with 10 CFR 50.72 (b)(2)(iv)(B), a four-hour ENS notification (Event #39081) was made to the NRC on July 22, 2002, at 0233 hours for a condition that resulted in an actuation of the reactor protection system (RPS) when the reactor is critical. As such, this Licensee Event Report (LER) is being submitted in accordance with the requirements of 10 CFR 50.73 (a)(2)(iv)(A) for a condition that resulted in an actuation of the RPS system.

Cause of Event

The apparent cause of the event is a previously unrecognized steam side heat transfer anomaly in "C" main condenser that has resulted in "C" North water box removing significantly more heat than in "C" South water box. Closure of the "C" North water box inlet valve during the flush resulted in a significant drop in "C" condenser vacuum. The cause of this anomaly, which will require close examination of steam side of the condenser, cannot be determined with the unit operating.

Analysis of Event

The procedure in use at the time of this event was 02-OHP-4021-057-006, Revision 11, "Operation of Main and Feed Pump Condensers," Attachment 9, "Flushing of Circulating Water Side of Condenser Halves." According to that procedure, at any one time a flush could be performed on only one of the six water box halves of the three ("A," "B," & "C") condensers.

The water box flush process began by first taking main condenser circulating water (CW) box differential pressure (D/P) readings and placing hotwell level control in manual. These procedure steps were followed by the closure of the inlet valve for a single main condenser water box half, monitoring the expected drop in individual condenser vacuum (and other pertinent parameters) and reopening the water box half inlet valve after approximately five minutes. After conditions had stabilized, these latter steps would be repeated for another main condenser water box half until all six water box halves had been flushed. As-left CW water box D/P readings would then be taken and hotwell level control returned to automatic.

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All of the involved personnel on shift had previously performed this evolution and both the shift manager and unit supervisor had successfully performed the evolution during summer months. The same evolution had been successfully performed without incident approximately three weeks earlier on Unit 1. The shift did not expect that there would be any difficulty performing the condenser flush under the existing conditions. Because a small drop in generator megawatt output was expected, the shift waited to perform the evolution until just before midnight.

At 2330 hours on July 21, 2002, the shift commenced 2-OHP-4021-057-006, Attachment 9, "Flushing of Circulating Water Side of Condenser Halves", beginning with water box "A." No condenser vacuum anomalies were noted during the flushing of the "A" and "B" condenser water boxes. Shift personnel considered the overall results to be normal. As operators prepared to perform the flush of "C" North water box, they expected similar results for that water box as well. The flush of "C" North water box appeared to begin as the others had. The "C" main condenser vacuum dropped as the inlet valve for "C" North water box approached full closed. Operators monitored megawatts and individual condenser vacuum and had expected the vacuum reduction of about 3 in. Hg. However, vacuum dropped faster than had been expected. The closure of the "C" North water box inlet valve caused a decidedly more significant reaction than had closure of the inlet valves for the "A" and "B" condensers and resulted in a "low-low" condenser vacuum condition and subsequent reactor trip.

The Unit 1 main condenser "A," "B," and "C" steam volumes are connected by plenums with a relatively large cross-sectional area, permitting some load sharing via pressure equalization. Unit 2 main condenser steam volumes are independent of one another, and each main condenser half can only be assisted by its sister half. In the event of a similar condition in Unit 1 (removing a better performing condenser half, and relying on the performance of lesser performing condenser half), the plenums provide the assistance of at least one of the unaffected main condenser sections. As a consequence, Unit 1 would be less susceptible to the condition identified on Unit 2.

Plant systems responded per design with no significant anomalies noted. Condenser vacuum did not decrease to the point where the preferred method of post-trip RCS cooling was disabled. A large margin remained to the point at which the steam dump system would be lost (steam dump is disabled when vacuum is less than 10.6 in. Hg.). Immediately following the reactor trip, condenser "C" vacuum recovered and stabilized at 28.7 in. Hg. Plant procedures and operator training provided sufficient direction for control room personnel to shutdown the plant and maintain it in a safe shutdown condition. Based on the discussion above, the safety significance of this event was minimal. There was no impact on the health and safety of the public as a result of this event.

Corrective Actions

Corrective actions to prevent recurrence of this event will be determined by an equipment root cause investigation to be performed after the steam side of the "C" main condenser has been inspected during the next Unit 2 outage of sufficient duration. Additional corrective actions, including preventive actions, may be developed based on the results of the investigation. If significant changes are identified as a result of completion of the root cause investigation, an update to this LER will be submitted. As a compensatory action, the main condenser water box flushing and isolation procedure has been revised to provide improved guidance for performing these activities to minimize the possibility of a unit trip. Also, Engineering will provide Operations management with a tool to determine the amount power must be reduced to allow a safe margin for water box isolation or flushing with the steam side heat transfer degradation in "C" main condenser. A separate corrective action will review steam jet air ejector (SJAE) performance and the degree to which improved SJAE performance could improve main condenser vacuum.

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Previous Similar Events

LER 315/2001-001-00: On February 15, 2001, the Unit 1 East MFP tripped due to high condenser back pressure (i.e., loss of vacuum). As a result, Unit 1 was manually tripped. The cause of this event was due to the low circulating water flow and fouled condenser tube sheets. The debris that was removed from the tube sheets consisted of metallic flakes determined to have originated from the inside of the vertical circulating water line leading to the FW pump turbine condenser. Some zebra mussels and sand were also present. The extended shutdown of Unit 1 and 2 allowed corrosion products (i.e., metallic flakes) to develop on the vertical portion of the lines leading to the condensers.

LER 315/2002-005-00: On June 14, 2002, Unit 1 was manually tripped following the trip of the East main feedwater (FW) pump (MFP). The East MFP tripped due to a loss of main feed pump turbine condenser vacuum caused by an influx of debris following the start of the a circulating water (CW) pump. The cause of this event was the transport of debris (primarily zebra mussel shells and sand) into the East MFP turbine condenser upon the start of the CW pump.

Corrective actions from these two previous events would not have prevented this event due to the differences in causes for each of the events.