NRC Form 366 (6-1998) 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 06/30/2001

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Cook Nuclear Plant Unit 1	05000-315	1 of 4

TITLE (4)

Auxiliary Feedwater System Unable to Meet Design Flow Requirements During Special Test

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
11	03	98	98	– 046 –	00	12	03	98	DC Cook - Unit 2	05000-316
									FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	00	20.2201 (b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)	X 50.73(a)(2)(ii)	50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
		20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Mr. Joel Gebbie, Safety Related Mechanical Engineering Supervisor	616/465-5901, x1543

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

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

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

On November 3, 1998, with Unit 1 in Mode 5, a special test was conducted on the Unit 1 West Motor Driven Auxiliary Feedwater (MDAFW) Pump to determine the potential effect on suction strainer loading when Essential Service Water (ESW) is used as the suction source. The 1 West MDAFW pump had been specifically chosen as having the highest risk for strainer plugging. Approximately 60 seconds into the test the differential pressure across the strainer exceeded the maximum allowed, flow dropped below the design flow value, and the test was terminated. The AFW system was declared inoperable, and an ENS notification was made at 1649 hours EST in accordance with 10 CFR 50.72(b)(2)(i), for a degraded condition found while shutdown. This LER is therefore submitted in accordance with 10 CFR 50.7(a)(2)(ii).

The root cause of this condition is a failure to consider all aspects of system operation in the design of the suction basket strainers. The system will be redesigned to perform its design function while taking suction from the ESW system. Broad scope preventive actions are being performed under the Engineering Issues Review to assess the scope and quality of actions being taken to address system, structure, and component performance including operability, design and licensing basis issues.

The safety significance of this condition was evaluated considering the result of both the initial test and a second test. Based on a postulated short duration low flow condition, and the AFW design utilizing the Condensate Storage Tank as primary suction source with ESW as a backup, it was determined that the condition did not pose a threat to the health or safety of the public.

FACILITY NAME (1)	DOCKET NUMBER(2)	LER NUMBER (6)					PAGE (3)
		YEAR	SEQUENTIAL NUMBER			REVISION NUMBER	
Cook Nuclear Plant Unit 1	05000-315	98	--	046	--	00	2 of 4

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

Conditions Prior to Event
Unit 1 was in Mode 5, Cold Shutdown
Unit 2 was in Mode 5, Cold Shutdown

Description of Event
On September 21, 1998, a Safety System Function Inspection (SSFI) self-assessment of the Auxiliary Feedwater (AFW) system began, using SSFI techniques in accordance with NRC Inspection Procedure 93801, "Safety System Functional Inspection". The inspection team utilized a vertical slice review in the functional areas of engineering design and configuration control, operations, maintenance, surveillance and testing, and quality assurance and corrective actions. The self-assessment concluded on October 23, 1998.

During the SSFI, it was noted that the AFW system had not been evaluated for operation using the Essential Service Water System (ESW) as the suction source. ESW is Lake Michigan water, which contains some amount of sand, silt, and debris. Certain design basis scenarios require switchover of the AFW system water supply from the Condensate Storage Tank (CST) to ESW. The original specification for the AFW pump suction strainers did not identify the ESW system as a supply source. The suction strainers were specified for the clean water normally supplied by the CST, therefore, the concern arose as to whether or not the strainers would become loaded with sand, silt, and other debris more quickly than a fouled strainer basket could be cleaned and returned to service.

As a result of this concern, a special test was written to determine the loading rate of a suction strainer basket while aligned to ESW. The test was run on November 3,1998, and an initial ESW flow rate of approximately 560 gallons per minute (gpm) was established through the strainer for the Unit 1 West motor driven AFW pump. After 60 to 80 seconds the silt and debris which was resident in the ESW line loaded the strainer, causing the differential pressure across the basket strainer to exceed 10 psid. Due to the high differential pressure, the test was terminated. During the 60 to 80 seconds of the test, the ESW flow rate decreased from its maximum value of 560 gpm to approximately 400 gpm. As the design flow rate for ESW to the AFW system is 450 gpm, the AFW system was declared inoperable.

After the test was terminated, the strainer basket was removed and inspected to determine the nature and quantity of debris. Several live zebra mussels were found in the basket, along with a quantity of crushed zebra mussel shells, and sand.

Cause of Event
The root cause of this condition is a failure to consider all aspects of system operation in the design. The original design of the suction basket strainers did not take into account that the backup source of water for the pumps was lake water.

Documentation from 1970 shows that the original purchase order for the Motor Driven Auxiliary Feedwater (MDAFW) pump directed the supplier to provide a suction strainer sized for condensate. There is no indication that the strainers could potentially be required to operate utilizing lake water as a suction source.

Contributing to this condition is the design configuration of the ESW supply lines to the AFW pumps. These lines, especially to the West MDAFW pump, were installed such that debris tends to collect in them. The lines for the East MDAFW pump and the Turbine Driven AFW (TDAFW) pumps tap off the side of the main 20 inch ESW header. These 2 pumps comprised the original AFW design. The West MDAFW pump, which was added to the units in 1978, ties into the ESW system at an elbow where the 20 inch ESW header turns upward. The ESW supply line extends downward from the elbow, and is therefore an ideal debris trap.

FACILITY NAME (1)	DOCKET NUMBER(2)	LER NUMBER (6)					PAGE (3)
		YEAR	SEQUENTIAL NUMBER			REVISION NUMBER	
Cook Nuclear Plant Unit 1	05000-315	98	--	046	--	00	3 of 4

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

Analysis of Event

This condition was determined to be reportable in accordance with 10 CFR 50.72(b)(2)(i), as a condition which was found while the reactor was shut down, which if it had been found while the reactor was operating, would have resulted in the nuclear power plant being in an unanalyzed condition. An ENS notification was made on November 3, 1998, at 1649 hours EST in accordance with 10 CFR 50.72(b)(2)(i), for a degraded condition found while shutdown. This LER is therefore submitted in accordance with 10 CFR 50.73(a)(2)(ii).

The AFW system provides water to the steam generators when main feedwater is unavailable because of a loss of main feedwater, unit trip, feedwater or steam line break, loss of off-site power, or small break Loss of Coolant Accident (SBLOCA). This water removes core residual heat to prevent the release of primary water through the pressurizer safety or power-operated relief valves and allows the plant to cool down to the point at which Residual Heat Removal (RHR) can be placed in service.

Each unit is equipped with one turbine driven AFW pump and two motor driven AFW pumps. Each pump is equipped with a suction strainer with two baskets. For each unit, the TDAFP serves all four steam generators and each MDAFW pump serves two steam generators. The steam to the AFW pump turbine is supplied from two of the steam generators.

The preferred source of water for the AFW system is the non-safety related CST. Each unit's CST is cross-tied by a normally closed air operated valve to provide condensate to the opposite unit's AFW. If both CSTs are unavailable, water is supplied from Lake Michigan via the safety related ESW system, which is connected upstream of the AFW pump suction strainers. A minimum of 175,000 gallons is required to maintain the unit at hot shutdown for nine hours.

On November 4, 1998, a second strainer test was performed using the same special test procedure, and the suction line for the same MDAFW pump. ESW flow was again established through the suction basket strainer, however, since the debris had been flushed out during the initial test, the flow rate and strainer differential pressurize stabilized at 500 gpm and 0.7 psid, respectively. The test flow was maintained for 7 hours, during which the flow rate and differential pressure remained relatively constant. The results showed that without debris in the suction line, the AFW system would meet its design flow requirements while taking suction from the ESW system.

The only debris removed from the suction line was the debris that had collected in the strainer during the first test. The results of the two tests showed that once the strainer had removed the initial surge of debris from the stagnant suction line, shifting to the spare strainer basket would have enabled the MDAFW pump to meet its design flow requirements while taking suction from the ESW system. The initial debris load could be removed from the first strainer basket so that it could be placed back in service if the second strainer basket became fouled. Since the suction line that was tested was the one most susceptible to debris accumulation, there is reasonable assurance that the performance of the other two suction lines would be equal or better for each unit.

Based on the results of the tests, it is postulated that if the AFW system had been required to mitigate an accident, within a short period of time the accumulated debris in the ESW lines would have loaded the suction strainer basket, bringing in the differential pressure annunciator in the Control Room. An operator would have been sent to switch strainers, placing the clean basket strainer in service in accordance with approved plant procedures. For approximately 10 minutes, the AFW pumps would have provided flow to the steam generators at a lower flow rate than the design of 450 gpm. After the clean strainer basket is placed in service, the flow rate would have increase to some value greater than the design value. Thus, it is anticipated that had the AFW system been required to operate to mitigate the consequences of an accident, the system may have operated at a lower than design flow rate for a short period of time.

FACILITY NAME (1)	DOCKET NUMBER(2)	LER NUMBER (6)					PAGE (3)
		YEAR	SEQUENTIAL NUMBER			REVISION NUMBER	
Cook Nuclear Plant Unit 1	05000-315	98	–	046	–	00	4 of 4

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

Based on the short duration of the identified low flow condition, in combination with the AFW design to take primary suction from the CST and use ESW as a backup suction source, it has been concluded that the condition did not pose a threat to the health or safety of the public.

Corrective Actions

An expedited request for modification was approved to correct this design problem. The request stated that the AFW system must be modified to ensure that is it is capable of maintaining its design flow rate while taking suction from the ESW system. Although more than one potential modification was identified in the request, it is not known at this time precisely how the problem will be resolved. This has been identified as a restart issue.

The Engineering Issues Review Group was chartered to provide an independent review of the actions being taken to bound and address identified engineering issues. The group will assess the scope and quality of actions being taken to address system, structure, and component performance including operability, design and licensing basis issues. The group will also specifically review the results of the AFW SSFI to ensure that the lessons learned from this inspection have been identified and factored into the restart strategies and other corrective actions taken to address engineering issues.

Previous Similar Events

315/98-029-00