NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104

EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Millstone Nuclear Power Station Unit 2	05000336	1 OF 3

TITLE (4)

Auxiliary Feedwater Pump Performance Degraded

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
03	16	98	98	-- 004 --	01	10	30	98	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	000	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 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)
R. G. Joshi, MP2 Regulatory Compliance Manager	(860) 440-2080

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
B	BA	P	I075	YES						

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 March 16, 1998, while reviewing post modification test data for the "A" Auxiliary Feedwater Pump, it was discovered that the pump performance was degraded such that the required flow rates could not be met. A high flow post modification test was performed following the recent installation of a cavitating venturi on the auxiliary feedwater supply to each steam generator. The comparison of the pump performance to manufacturers pump curve indicated minor degradation at minimum flow. However, at increased flow rates the degradation is more pronounced. The test results have been evaluated and determined to be inadequate to meet accident analyses assumptions.

Review of Inservice Test (IST) data over the last six years indicates that following replacement of the pump impellers in May of 1995, a small reduction in pump performance was noted. However, since the reduction was small and was within the acceptance criteria for IST and Technical Specification requirements, it was deemed acceptable. The IST test data was obtained from the IST pump performance tests, at minimum flow, following pump maintenance, modification, and at scheduled IST test intervals. The pump was returned to the vendor whose analysis determined underfiling (reshaping the pump vane tips) was not performed when the stainless steel impellers were manufactured, which caused deficient pump performance. The causes of this condition were the vendor's failure to perform underfiling during manufacture of the stainless steel impeller and the plant's failure to detect this condition by not performing pump high flow testing following installation of the replacement impellers.

As a result of this condition, the pump will be returned to operable status, which will include high flow testing, the Inservice Test program will be revised, and auxiliary feedwater pump high flow testing will be performed periodically.

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

I. Description of Event

On March 16, 1998, while reviewing post modification test data for the "A" Auxiliary Feedwater [BA] Pump [P], it was discovered that the pump performance was degraded such that required flow rates could not be met. A high flow post modification test was performed following the recent installation of a cavitating venturi on the auxiliary feedwater (AFW) supply to each steam generator. The comparison of the pump performance to manufacturers pump curve indicated minor degradation at minimum flow. However, at increased flow rates the degradation is more pronounced. The test results have been evaluated and determined to be inadequate to meet accident analyses assumptions. At the time of discovery the plant was defueled.

Review of Inservice Test (IST) data over the last six years indicates that following replacement of the pump impellers in May of 1995, a small reduction in pump performance was noted. However, since the reduction was small and within the acceptance criteria for IST and Technical Specification requirements, it was deemed acceptable. The IST test data was obtained from the IST pump performance tests, which are performed at minimum flow following pump maintenance, modification, and at a regularly scheduled IST test interval. The "A" AFW Pump, an Ingersoll-Rand type 2HTMA-8, was modified in 1995 by replacing the cast iron impellers with stainless steel impellers. The pump vendor, Ingersoll-Dresser, recommended changing the impeller material as the result of cracking found on the cast iron impellers, which were originally supplied with the pump. The impeller material change was accomplished using the plant design change process. The post modification testing was performed at minimum flow in accordance with the plant procedure. The results indicated reduced performance from previous tests, but the flow and pressure were within the acceptance criteria.

The IST Program surveillance requires operating each pump and verifying that the pump develops adequate discharge pressure at minimum recirculation flow. High flow testing is not required. The IST program will be revised to include periodic high flow testing of each AFW and Emergency Core Cooling System pump.

The pump was removed and sent to the vendor for analysis and correction. It was determined during initial pump testing that the original cast iron impellers required underfiling (reshaping the pump vane tips) to produce the necessary flow. This manufacturing requirement was included in the vendors internal documentation, but was not sent to the site. Underfiling was not performed on the stainless steel impellers when they were manufactured. Upon completion of the underfiling, pump performance was restored to the original pump curve. In-system pump performance will be confirmed by high flow testing.

This condition is being reported pursuant to 10 CFR 50.73(a)(2)(ii)(B), as a condition that was outside of the design basis of the plant.

II. Cause of Event

The causes of this condition were the vendor's failure to perform underfiling during manufacture of the stainless steel impeller and the plant's failure to detect this condition by not performing pump high flow testing following installation of the replacement impellers.

III. Analysis of Event

The AFW system is designed to provide feedwater to the steam generators for the removal of sensible and decay heat from the Reactor Coolant System in the event of loss of normal feedwater flow. The AFW system is used to mitigate transients and accidents such as: Loss of Normal Feedwater, Loss of Coolant Accident, Anticipated

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Transient Without Scram, and Station Black Out. The system has two redundant electric motor driven pumps (each one can supply adequate feedwater capacity for decay heat removal) and one turbine driven pump (rated at twice the capacity of one electric motor driven pump). An automatic initiation signal starts both electric motor driven pumps. The turbine driven pump is manually initiated by a control room operator.

The plant safety analysis assumed an allowable pump degradation of 5 percent for adequate removal of decay heat. However, the pump high flow test results indicated that the pump has degraded by approximately 10 percent. With the motor driven pump in its degraded condition, the required flow may not be available. However, the other motor driven pump, and the turbine driven pump were available and operable. Assuming a single failure of one of the remaining pumps, there would still be an operable AFW pump available to supply water to the steam generators for heat removal. Although a system vulnerability to a single failure of a Direct Current (DC) Bus was recently discovered, the DC buses are highly reliable. In addition, abnormal and emergency operating procedures provide direction should the DC bus failure occur. Therefore, the safety consequences were low.

IV. Corrective Action

As a result of this condition:

1. The pump will be returned to operable status, which will include high flow testing, prior to entering Mode 3 from the current outage.

2. The Inservice Test program will be revised prior to entering Mode 4 from the current outage, and auxiliary feedwater pump high flow testing will be performed on a periodic basis.

V. Additional Information

Similar Events

There are no previous similar events involving flow degradation of an AFW Pump.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].