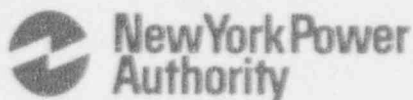


James A. FitzPatrick
Nuclear Power Plant
P.O. Box 41
Lycoming, New York 13093
315 342-3840



Harry P. Salmon, Jr.
Resident Manager

May 5, 1993
JAFF-93-0271

United States Nuclear Regulatory Commission
Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

SUBJECT: DOCKET NO. 50-333
LICENSEE EVENT REPORT: 93-006-01 - Inoperability of
Fire Pumps

Dear Sir:

This report is submitted in accordance with 10CFR50.73(a)(2)(i). This report is also submitted as a special report required by Technical Specifications 3.12.A.1.c, 3.12.A.1.d.2 and 6.9.B.2.

This report has been revised to correct the time and date that the Electric Motor Driven Fire Pump was declared inoperable and to correct a number of minor editorial errors.

Questions concerning this report may be addressed to Mr. W. Verne Childs at (315) 349-6071.

Very truly yours,

for Robert J. Barrett
HARRY P. SALMON, JR.

HPS:WVC:tld

Enclosure

cc: USNRC, Region I
USNRC Resident Inspector
INPO Records Center

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ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

PAGE (3)

0	5	0	0	0	3	3	3	1	OF	1	3
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OTHER FACILITIES INVOLVED IN

DOCKET NUMBER(S)

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THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §. (Check one or more of the following) (11)

23.73(b)

73.71(c)

☒ OTHER (Specify in Abstract below and in Text, NRC Form 3664)

Special Report

Special Report

Special Report

LICENSEE CONTACT FOR THIS LER (12)

TELEPHONE NUMBER _____

3, 1, 5, 3, 4, 9, -6, 0, 7, 1

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

SUPPLEMENTAL REPORT EXPECTED 1/14

EXPECTED
SUBMISSION
DATE (Y5)

MONTH	DAY	YEAR
-------	-----	------

☐ YES (If yes, complete EXPECTED SUBMISSION DATE)☐ NO

ABSTRACT 11-14 to 1400 spaces (i.e. approximately fifteen single-spaced typewritten lines) (16)

Update Report - Previous Report Date March 12, 1993

EIIS Codes are in []

The plant was shutdown and in the cold condition for a maintenance outage. Fire Pump [KP] 76P-2 was declared inoperable due to inadequate pump discharge pressure and Fire Pump 76P-1 was declared inoperable when engine overheating was evident during a pump test. A backup source of fire suppression water was provided by a third full capacity fire pump. Fire Pump 76P-1 was replaced with a new pump and Fire Pump 76P-2 will be replaced with a new or rebuilt pump. Procedure revisions and continued trending of performance data will reduce the probability of recurrence. No similar events involving inoperability of both fire pumps have occurred at this facility.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1) James A. FitzPatrick Nuclear Power Plant	DOCKET NUMBER (2) 0 5 0 0 0 3 3 3 9 3	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		0 0 6	0 1	0 2	OF	1 3

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Update Report - Previous Report Date March 12, 1993

EIIIS Codes are in []

Event Description:

The plant was shutdown and in the cold condition for a short maintenance outage. The Reactor had been shutdown at 0140 hours on February 25, 1993, due to partial blocking of the cooling water intake structure [KE] with ice. A planned maintenance outage of approximately nine days was scheduled to start during the evening of February 26, 1993. The decision was made to commence outage work one day early. Refer to LER-93-004 for additional information concerning the partial blockage of the intake structure and resulting forced reactor shutdown.

On February 25, 1993, at 1820 hours an Occurrence Report (an internal event documentation and report form) was initiated to document the results of an engineering evaluation of the performance of Electric Motor Driven Fire Pump 76P-2. The engineering evaluation noted that pump performance test data indicated a pump discharge pressure of 122.4 psig with pump flow at 2500 gallons per minute (gpm). Technical Specification 4.12.A.1.e.3 requires a flow of at least 2500 gpm at a discharge pressure of 125 psig.

The surveillance test procedure used for performance testing of 76P-2 contained steps for calculation of the pump Total Developed Head (TDH). That is, the indicated pump discharge pressure was corrected for the elevation difference between the discharge pressure gauge and the elevation of the water in the pump suction bay. The test method was consistent with tests of Residual Heat Removal Service Water (RHRSW) [BI], Emergency Service Water (ESW) [BI] system and other safety related pumps.

Operations personnel reviewed the results of the Engineering evaluation that indicated inadequate discharge pressure; however, they did not declare Fire Pump 76P-2 inoperable because the test data indicated that the pump produced more than 125 psi at 2500 gpm. It was not recognized that the test procedure acceptance criteria was in TDH while the Technical Specifications required discharge pressure.

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FACILITY NAME (1) James A. FitzPatrick Nuclear Power Plant	DOCKET NUMBER (2) 0 5 0 0 0 3 3 3	LER NUMBER (6) <table border="1"><thead><tr><th data-bbox="1032 269 1131 312">YEAR</th><th data-bbox="1131 269 1296 312">SEQUENTIAL NUMBER</th><th data-bbox="1296 269 1379 312">REVISION NUMBER</th></tr></thead><tbody><tr><td>9 3</td><td>0 0 6</td><td>0 1</td></tr></tbody></table>	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	9 3	0 0 6	0 1	PAGE (3) 0 3 OF 1 3
YEAR	SEQUENTIAL NUMBER	REVISION NUMBER							
9 3	0 0 6	0 1							

TEXT (If more space is required, use additional NRC Form 366A's) (17)

On February 26, 1993, at 0207 hours, the West Diesel Engine Driven fire Pump (76P-1) was declared inoperable when engine overheating was evident during a pump test. The Limiting condition for Operation (LCO) action statement (Technical Specification 3.12.A.1.c) for one inoperable Fire Pump (76P-1) was entered. The "immediate" action required by 3.12.A.1.c was to restore the pump to an operable status within seven days.

During the day shift of February 26, 1993, the inoperability of Fire Pump 76P-1 and the status of Fire Pump 76P-2 was the subject of discussions between the Operations Department, Engineering personnel and Senior Plant Management. During these discussions, the differences between the surveillance test procedure acceptance criteria and Technical Specification 4.12.A.1.e.3 was recognized and Fire Pump 76P-2 was declared inoperable at 1700 hours. Since Fire Pump 76P-1 had been declared inoperable at 0207 hours on February 26, 1993, the declaration of Fire Pump 76P-2 as inoperable resulted in entry into Technical Specification 3.12.A.1.d. Technical Specification Action Statement 3.12.A.1.d requires:

1. Establishment of a backup fire suppression water system within 24 hours, and,
2. Submittal of a Special Report to the NRC by telephone within 24 hours, and,
3. Facsimile (or similar) confirmation of the telephone notification no later than the first work day following the event, and,
4. Submittal of a written Special Report within 14 days of the event. (Submittal of Revision 0 of Special Report was made to satisfy the 14 day requirements of Technical Specification 3.12.A.1.d.2.c and 6.9.B.2.)

At the time that the second fire pump was declared inoperable, a backup fire pump (76P-4) was already inservice. Fire Pump 76P-4 is permanently installed to serve as a backup to Fire Pumps 76P-1 and 76P-2, as well as to provide additional fire protection capability to buildings such as the warehouses and training center. The third Fire Pump is briefly discussed in Technical Specification Bases 3.12.A/4.12.A and the NRC Safety Evaluation for Technical

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1) James A. FitzPatrick Nuclear Power Plant	DOCKET NUMBER (2) 0 5 0 0 0 3 3 3 9 3	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	OF	
			0 0 6	0 1	0 4	1 3

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Specification Amendment 142 dated October 23, 1989. Fire Pump 76P-4 is essentially identical to the West Diesel Fire Pump (76P-1). It was designed and manufactured by the same vendor, has the same capacity, will automatically start when the fire water header pressure decreases to 85 psig, and can supply 100 percent of the potential demands on the High Pressure Water Fire Protection System in the event of fire. It should also be noted that when Electric Fire Pump 76P-2 was administratively declared inoperable on February 26, 1993, at 1700 hours, it was not physically removed from service. The pump remained capable of automatic starting should the Fire Water Header Pressure decrease to approximately 105 psig.

The NRC Emergency Operations Center was notified via the Emergency Notification System (ENS) telephone of the inoperability of Fire Pumps 76P-1 and 76P-2 at approximately 1900 hours on Friday, February 26, 1993. On Monday, March 1, 1993, the facsimile transmission of a letter which briefly described inoperability of fire pumps and establishment of a backup fire suppression water supply was completed to provide confirmation of the telephone notification.

Fire Pump 76P-1 was restored to an operable status at 1655 hours on March 4, 1993, after pump replacement and performance testing. This action resulted in the following conditions and status:

1. West Diesel Fire Pump 76P-1 operable (in a normal standby condition) in accordance with Technical Specification requirements.
2. Electric Fire Pump 76P-2 inoperable in accordance with Technical Specification requirements (but available for service in a normal standby condition and capable of delivering 2,500 gpm at slightly less than the required 125 psig).
3. Diesel Fire Pump 76P-4 (which is not required by Technical Specifications) available for service and capable of delivering rated flow and pressure following an automatic start at a fire header pressure of equal to or greater than 85 psig.

The sequence of events which ultimately resulted in Fire Pumps 76P-1 and 76P-2 being inoperable at the same time was different for each pump and is described below.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1)

DOCKET NUMBER (2)

LER NUMBER (6)

PAGE (3)

James A. FitzPatrick
Nuclear Power Plant

YEAR SEQUENTIAL REVISION

NUMBER NUMBER NUMBER

0 5 0 0 0 3 3 3 9 3 - 0 0 6 - 0 1 0 5 OF 1 3

TEXT (If more space is required, use additional NRC Form 386A's) (17)

Electric Motor Driven Fire Pump 76P-2

In November, 1992, plant Performance Engineering personnel completed an evaluation of 76P-2, which included trending of performance test data. It was concluded that 76P-2 had shown a steady decline in performance over the preceding time period of approximately seven years and would require replacement or rebuild to restore the pump to new (or nearly new) capability.

During performance testing of 76P-2 in the Fall of 1992, the pump was considered operable based on a measured flow of equal to or greater than 2,500 gpm and a total developed head of equal to or greater than 125 psig. Engineering evaluation of performance test data resulted in the pump being declared inoperable on February 26, 1993, after it was determined that calculation of the pump performance test data included a correction for the elevation difference between the pump discharge pressure gage and water level in the forebay area. This elevation difference of approximately 13 feet resulted in correction of the observed discharge pressure by adding 0.433 psi for each foot of elevation difference to the observed discharge pressure. The actual correction should have been based on the elevation difference between the discharge pressure gage and the center line elevation of the pump discharge. The properly calculated pump discharge pressure was 122.4 psig compared to the minimum Technical Specification 4.12.A.1.e.3 requirement of 125 psig at 2,500 gpm.

It should be noted that calculation of the pump test data which includes correction for the elevation difference between the discharge pressure gage and the forebay level yields the total head produced by the pump. The total head value is the information necessary to compare pump performance against the pump curve to provide useful trend data. It is essentially the same method used to obtain performance data for safety related system pumps such as core spray [BM] or Residual Heat Removal/Low Pressure Coolant Injection (RHR/LPCI) [BO] pumps.

On February 25, 1993, at 0000 hours, the plant was operating normally at 100 percent rated thermal power. Between 0000 hours and 0143 hours, the plant cooling water intake structure [KE] located approximately 900 feet from the shore line of Lake Ontario [BS] at a depth of approximately 12 feet below the lake surface apparently became partially blocked with ice. The blockage restricted the cooling water intake flow to an extent that water level in the forebay

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1)

DOCKET NUMBER (2)

LER NUMBER (6)

PAGE (3)

James A. FitzPatrick
Nuclear Power Plant

0 5 0 0 0 3 3 3 9 3 - 0 0 6 - 0 1 0 6 OF 1 3

TEXT (If more space is required, use additional NRC Form 365A's) (17)

area and pump suction bays within the screenhouse was drawn down by the normal operation of three circulating water system [KE] pumps and two normal service water system [KG] pumps. The partial blockage of the intake resulted in water level decreasing to below the minimum suction level for fire pumps (239 feet, 6 inches). The reactor was shutdown, as described in more detail in LER-93-004, to protect the heat sink required for safe shutdown. A sequence of events related to inoperability of the fire pumps is presented below.

February 25, 1993:

- 0000 hours - Normal plant operation at 100 percent rated power. Condenser [SG] inlet temperature after mixing (tempering) with some discharge water was 37F.
- 0100 hours - Condenser inlet temperature had increased to approximately 40F from decrease in forebay level due to partial intake blockage with ice and the warming effect of tempering flow.
- 0125 hours - Electric Fire Pump 76P-2 started automatically on low fire header pressure (105 psig). Apparently forebay water level had decreased to the point where the Fire Header Jockey Pump (76P-3) lost suction momentarily, resulting in a fire header pressure decrease.
- Between 0130 and 0135 hours - Electric Fire Pump 76P-2 was shutdown locally after verification of normal fire header pressure by an operator that had been dispatched to the area.
- Control Room operators noted condenser inlet temperature was 58F.
- Control Room operator noted an increase in circulating water pump motor amperage (which is consistent with decreased suction pressure).

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1) James A. FitzPatrick Nuclear Power Plant	DOCKET NUMBER (2) 0 5 0 0 0 3 3 3	LER NUMBER (6)			PAGE (3)		
		YEAR 9 3	SEQUENTIAL NUMBER 0 0 6	REVISION NUMBER 0 1	0 7	OF	1 3

TEXT (If more space is required, use additional NRC Form 366A's) (17)

- Fire Pumps 76P-1 and 76P-4 started automatically on low fire header pressure at 95 psig and 85 psig respectively.
- Load reduction to allow a reduction in cooling water demand was initiated.
- 0138 hours - Circulating Water Pump 36P-1C shutdown. This reduced the total cooling water demand approximately 30 percent
- 0140 hours - The operator dispatched to the fire pump and greenhouse area reported water level in the forebay area was an estimated 10 feet below normal. The shift supervisor directed an immediate reactor shutdown. No actual measurement of forebay water level was made.
- 0143 hours - Condenser inlet temperature peaked at approximately 67F. Two circulating water system pumps and two normal service water pumps continued in operation as the Control Room personnel were executing Abnormal Operating Procedures (AOPs) for Reactor Scram.
- 0147 hours - Fire Pumps were shutdown by operators and placed in manual to prevent automatic starting and potential pump damage due to loss of suction.
- 0210 hours - Forebay water level had increased to approximately 6 feet below normal (approximately 1 foot above the minimum fire pump suction level). Two Circulating Water System Pumps and two Normal Service Water System Pumps continued in operation.
- 0213 hours - Circulating Water System Pump 36P-1A shutdown. One Circulating Water System Pump and two Normal Service Water Pumps continued in operation. Total cooling water demand was approximately 40 percent of the pre-event flow.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1)

DOCKET NUMBER (2)

LER NUMBER (6)

PAGE (3)

James A. FitzPatrick
Nuclear Power Plant

0 5 0 0 0 3 3 3 9 3 - 0 0 6 - 0 1 0 8 OF 1 3

TEXT (If more space is required, use additional NRC Form 365A's) (17)

- 0215 hours - Forebay water level had increased to approximately one foot below normal.
- Between 0215 and 0430 hours - Fire Jockey Pump 76P-3 was returned to service to maintain normal fire header pressure of approximately 140 psig. Jockey Pump 76P-3 operation appeared to be normal and Fire Pumps 76P-1, 76P-2 and 76P-4 were restored to service with the capability of automatic starting.
- 0430 hours - Forebay water level normal.
- 0940 hours - Testing of Electric Fire Pump 76P-2 and Diesel Fire Pump 76P-4 for 20 minutes on recirculation flow completed with satisfactory results. No unusual noise, vibration or other indications noted.
- 1332 hours - Electric Fire Pump 76P-2 automatic start due to false main turbine bearing fire signal. (The Turbine Bearing Fire Protection Subsystem is a closed head pre-action system. Thus the only flow of water was that necessary to flood the system as none of the sprinkler/spray heads were fused.) No unusual noise vibration or other indications were noted and the pump was shutdown when normal fire header pressure was verified.
- 1820 hours - Occurrence Report 93-076 was written to document Engineering Evaluation of inadequate discharge pressure for Fire Pump 76P-2. As noted above, the pump was not declared inoperable at that time.
- February 26, 1993:
0207 hours - West Diesel Fire Pump 76P-1 declared inoperable due to engine overheating during pump performance testing.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1)

DOCKET NUMBER (2)

LER NUMBER (6)

PAGE (3)

James A. FitzPatrick
Nuclear Power PlantYEAR SEQUENTIAL REVISION
NUMBER NUMBER NUMBER

0 5 1 0 0 0 3 3 3 9 3 - 0 0 6 - 0 1 0 9 OF 1 3

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Fire Pumps 76P-1, 2, and 4 are designed for a minimum level of 239 feet 6 inches above sea level in the pump suction bays. As noted above, partial blockage of the intake resulted in a draw down of forebay and pump suction bays of approximately 10 feet. This resulted in a forebay water level between 236 and 237 feet above sea level. The bottom of the suction bell for fire pumps 76P-1, 76P-2, and 76P-4 are at elevation 234 feet 8.75 inches; approximately 2 feet below the level observed by the operator at 0140 hours. The bottom of the suction bell for Jockey Pump 76P-3 is at elevation 237 feet 2.375 inches which is above the estimated minimum forebay level observed at 0140 hours.

Telephone conversations with fire pump vendor personnel indicate that a forebay water level between 236 and 237 feet elevation would not be expected to cause damage to an operating fire pump for short time period that the pumps were operating. The relatively low flow while a fire pump is operating on recirculation flow (approximately 250 gpm) would not be expected to result in vortices and air being drawn into the pump. It is apparent that the Fire Jockey Pump (76P-3) did have some air drawn into the pump due to level in the pump suction bay decreasing to below the pump suction bell for a short time. This momentary loss of suction was evident from the Fire Header Pressure decrease which resulted in automatic starting of Fire Pumps 76P-1, 76P-2 and 76P-4.

West Diesel Fire Pump 76P-1

On February 26, 1993, Fire Pump 76P-1 was shutdown and declared inoperable when engine overheating was evident approximately seven minutes after engine start for performance testing. Engine cooling is provided by a portion of pump discharge flow which is directed to the engine cooling heat exchanger.

Inspection of a Y-strainer in the cooling water flow path revealed metal pieces which appeared to be from broken pump internal parts. The pump was removed and replaced with a new pump of the same design flow and developed head. Fire Pump 76P-1 was declared operable on March 4, 1993 at 1655 hours following performance testing.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1) James A. FitzPatrick Nuclear Power Plant	DOCKET NUMBER (2) 0 5 0 0 0 3 3 3 9 3	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		OF
			0 0 6	0 1	1 0	1 3

TEXT (If more space is required, use additional NRC Form 386A's) (17)

Cause of Event:Electric Fire Pump 76P-2

The low discharge pressure on Fire Pump 76P-2 is attributed to normal wear. The pump has been inservice since 1973 during the completion of plant construction and preoperational testing. No major maintenance work such as replacement of wear rings or other internal pump parts had been conducted during the past 20 years. Following rebuild of the pump which was formerly in service as 76P-1 (or purchase of a new pump) the Electric Fire Pump will be replaced. The currently installed 76P-2 will then be disassembled and inspected. This inspection may provide additional information concerning the cause of the low discharge pressure.

Personnel did not recognize that the fire pump performance requirement of 2,500 gpm at 125 psig was different than the more common calculation of Total Developed Head (TDH) which is used for monitoring pump performance in systems such as Core Spray, RHR/LPCI, RHRSW or ESW.

West Diesel Fire Pump 76P-1

1. Engine Overheating: Overheating of the engine for Fire Pump 76P-1 was determined to be caused by plugging of the cooling water Y-strainer with broken parts from the pump internals.
2. Pump Failure: The cause of the pump failure is attributed to normal wear. The metal parts found in the engine cooling Y-strainer were from a pump shaft bearing support. The pump would perform normally with the failed bearing support which is intended to reduce harmonic vibration. Other pump bearings were also severely worn and the upper bearing near the pump packing indicated overheating which is attributed to inadequate lubrication (with water) during operation of the pump for a few minutes while the forebay water level was low.

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TEXT in more space is required, use additional NRC Form 956's. (17)

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1) James A. FitzPatrick Nuclear Power Plant	DOCKET NUMBER (2) 0 5 0 0 0 3 3 3 9 3	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
			0 0 6	0 1	1 2	OF	1 3

TEXT (If more space is required, use additional NRC Form 366A's) (17)

3. Fire pump performance test procedures will be revised to provide the proper steps for calculation of pump discharge pressure by the next required performance of that procedure.
4. A procedure for control of the preparation, review and approval of LERs (and other reports and documents to be submitted to the NRC) has been written and is currently in the process of review. Implementation of this procedure is expected to reduce the probability of errors of the nature that resulted in the necessity to update this LER.
5. Additional corrective actions related to detecting and mitigating cooling water intake blockage are discussed in LER-93-004.

Additional Information:

Failed Components: Fire Pump 76P-1, Model FBB

Manufacturer: Johnston Pump Company

Previous Similar Events: No LERs have been previously submitted concerning inoperability of both fire pumps.

Update Plans, Correction of Errors in Prompt Report and Revision 0:

Additional update of this LER is NOT expected unless examination of the fire pumps or other information results in a substantial change in the understanding of the potential consequences or safety significance of the event.

The initial notification of this event made via ENS and the facsimile transmission contained an error. The notifications indicated the following sequence of pump inoperability:

- Diesel Fire Pump 76P-1 inoperable at 0207 on February 26, 1993
- Electric Fire Pump 76P-2 inoperable at 1500 on February 26, 1993

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1)

DOCKET NUMBER (2)

LER NUMBER (6)

PAGE (3)

James A. FitzPatrick
Nuclear Power Plant

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TEXT (If more space is required, use additional NRC Form 386A's) (17)

The actual sequence was:

- Diesel Fire Pump 76P-1 inoperable at 0207 on February 26, 1993
- Electric Fire Pump 76P-2 declared inoperable at 1700 on February 26, 1993

The NRC Resident Inspector and Licensing Project Manager were both informed of the error verbally. The error did not have any effect on response to the event.

During review of Revision 0 of this LER, the NRC Resident Inspector noted discrepancies with respect to when Fire Pump 76P-2 was declared inoperable. Revision 0 indicated that 76P-2 was declared inoperable at the time that the occurrence report was initiated at 1820 hours on February 25, 1993. As noted in the revised Event Description, the pump was not actually declared inoperable until 1700 hours on February 26, 1993. In addition to correcting the error noted by the NRC Resident Inspector, a number of minor errors were corrected. A vertical bar in the right hand margin indicates where text was changed (except where minor editorial or typographical corrections were made).