

# CATEGORY 1

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 9704100008      DOC. DATE: 97/03/31      NOTARIZED: NO      DOCKET #  
 FACIL: 50-335 St. Lucie Plant, Unit 1, Florida Power & Light Co.      05000335  
 AUTH: NAME      AUTHOR AFFILIATION  
 BENKEN, E.J.      Florida Power & Light Co.  
 STALL, J.A.      Florida Power & Light Co.  
 RECIP. NAME      RECIPIENT AFFILIATION

SUBJECT: LER 97-003-00: on 970304, automatic RT resulted from loss of electrical power to 1A2 RC pump. RCP breaker was replaced & pump was returned to svc. W/970331 ltr.

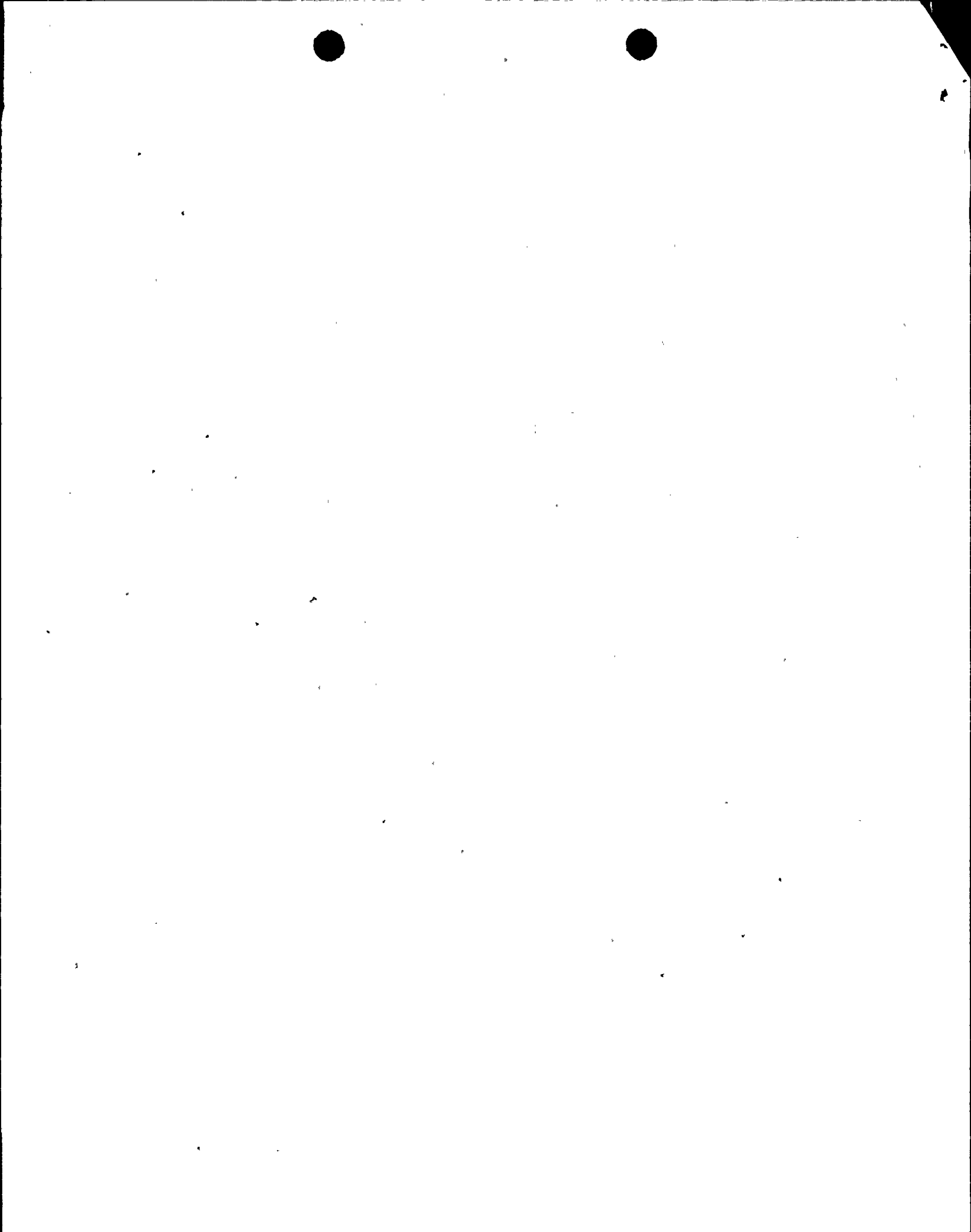
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MAR 31 1997

L-97-85  
10 CFR 50.73

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D. C. 20555

Re: St. Lucie Unit 1  
Docket No. 50-335  
Reportable Event: 97-003  
Date of Event: March 4, 1997  
Automatic Reactor Trip Resulting from the Loss of Electrical  
Power to the 1A2 Reactor Coolant Pump

The attached Licensee Event Report is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

Very truly yours,

J. A. Stall  
Vice President  
St. Lucie Plant

JAS/EJB

Attachment

cc: Regional Administrator, USNRC Region II  
Senior Resident Inspector, USNRC, St. Lucie Plant

9704100008 970331  
PDR ADOCK 05000335  
S PDR



<b>NRC FORM 366</b> (4-95)	<b>U.S. NUCLEAR REGULATORY COMMISSION</b>	APPROVED BY OMB NO. 3150-0104 EXPIRES 04/30/98  <small>ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 60.0 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 20565-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.</small>
<b>LICENSEE EVENT REPORT (LER)</b> (See reverse for required number of digits/characters for each block)		

<b>FACILITY NAME (1)</b> <p style="text-align: center;">ST LUCIE UNIT 1</p>	<b>DOCKET NUMBER (2)</b> <p style="text-align: center;">05000335</p>	<b>PAGE (3)</b> <p style="text-align: center;">1 OF 4</p>
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**TITLE (4)**  
 Automatic Reactor Trip Resulting from the Loss of Electrical Power to the 1A2 Reactor Coolant Pump

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	04	97	97	003	00	03	31	97	N/A	
									N/A	

<b>OPERATING MODE (9)</b> 1	<b>THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)</b>					
<b>POWER LEVEL (10)</b> 100	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)		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)		X 50.73(a)(2)(iv)	OTHER
	20.2203(a)(2)(iii)		50.38(c)(1)		50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.38(c)(2)		50.73(a)(2)(vii)	

**LICENSEE CONTACT FOR THIS LER (12)**

<b>NAME</b> E. J. Benken, Licensing Engineer	<b>TELEPHONE NUMBER (include Area Code)</b> (561) 467 - 7156
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**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
X	JB	RLY	S440	N					

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

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

On March 4, 1997, St. Lucie Unit 1 was in Mode 1 at 100 percent reactor power. An automatic reactor trip was initiated from the Reactor Protective System (RPS) following the loss of a reactor coolant pump (RCP). Operation of the RCP was interrupted when the electrical supply breaker for the pump opened. Following the trip, a main feedwater regulating valve failed to close as designed and operator action was taken to mitigate excess feedwater flow. The plant was stabilized in Mode 3 and subsequently returned to Mode 1 operation on March 7, 1997, following replacement of the RCP breaker and repair of the main feedwater regulating valve control circuit relay.

The automatic reactor trip was caused by the loss of the 1A2 RCP when an electrical supply breaker for the pump opened. Loss of the RCP resulted in a valid actuation of the RPS low reactor coolant flow trip. The opening of the supply breaker was evaluated by FPL and an experienced vendor and a specific cause was not determined. Corrective actions were taken for the potential root causes identified. The failure of the main feedwater regulating valve to close was caused by the malfunction of a K2 relay in the control circuitry for the valve.

Corrective actions include: 1) The RCP breaker was replaced and the pump was returned to service. 2) Breaker inspection and testing was performed. 3) Similar breakers were inspected and adjusted. 4) Visual monitoring was installed in the RCP breaker area. 5) The feedwater regulating valve was returned to service following replacement of a failed relay in the valve control circuit. 6) Additional failure analysis is being performed for a relay which was replaced in the feedwater valve circuitry. 7) Unit 2 main feedwater regulating valve testing will be performed during the next scheduled refueling outage.

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

DESCRIPTION OF THE EVENT

On March 4, 1997, St. Lucie Unit 1 was operating in Mode 1 at 100 percent reactor power. At 1222, an automatic reactor trip occurred following the loss of the 1A2 Reactor Coolant Pump (RCP) [EIS:AB:P]. The automatic reactor trip was initiated from the Reactor Protective System (RPS) [EIS:JC] as a result of low reactor coolant flow following the loss of the RCP. A main turbine trip was automatically initiated following the reactor trip in accordance with system design.

Immediately following the reactor and turbine trip, utility licensed operators implemented Emergency Operating Procedure 1- EOP-01, Standard Post Trip Actions. During performance of 1-EOP-01, the operators identified that the 1B main feed water regulating valve (FCV 9021) [EIS:JB:FCV] for the 1B steam generator had failed to close as expected, coincident with the turbine trip. Operators performed manual actions to secure the 1B main feedwater (MFW) pump [EIS:SJ:P] and close the isolation valve for the 1B feedwater regulating valve. The 1A MFW pump subsequently tripped as designed due to high level in the 1B steam generator. Level in the 1B steam generator stabilized at an indicated maximum value of approximately 88 percent wide range and was subsequently returned to normal value (approximately 65 percent).

Following the plant trip, at 1228, Auxiliary Feed Water (AFW) for the 1A steam generator (AFAS-1) [EIS:BA] actuated as designed to supply feedwater to the 1A steam generator. AFAS-2, for the 1B steam generator, was not required and did not actuate as a result of the higher water level present in the 1B steam generator due to the failure of the MFW regulating valve to close.

At 1232, 1- EOP-01 was completed with all safety functions met and operators implemented the Reactor Trip Recovery Procedure, 1- EOP-02. The plant was stabilized and maintained in Mode 3 pending the completion of a post trip review. St. Lucie Unit 1 was subsequently returned to Mode 1 operation on March 7, 1997.

CAUSE OF THE EVENT

The automatic reactor trip was generated by the RPS as a result of low reactor coolant flow sensed by a minimum of two-out-of-four RPS measurement channels. The reactor coolant system (RCS) low flow trip protects the core against a departure from nucleate boiling in the event of a coolant flow decrease. The low reactor coolant flow condition was caused by the loss of the 1A2 RCP. Operation of the RCP was interrupted when the 6.9 KV electrical supply breaker for the pump opened (tripped).

Based upon recorded data, it was established that the RCP breaker trip was the initiating incident for this event. A visual inspection of the RCP breaker did not identify any flags set on the breaker protective relays, and the protective relays for the breaker were tested and demonstrated to function properly. FPL also performed megger testing of the RCP motor and associated electrical cables with acceptable results.

Additional root causes were evaluated for the breaker trip including the possibility of protective relay actuation, control circuit actuation, and control and protection circuit equipment failures. The RCP breaker was inspected and tested on site with the assistance of a vendor representative. The breaker

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CAUSE OF THE EVENT Continued

was found to be in good condition and to function properly when tested. One discrepancy which was identified during the breaker inspection was a misadjustment of a floor tripper mechanism. This mechanism is designed to trip the breaker if an attempt is made to remove the breaker under load. An additional test was performed to determine whether this misadjustment could have resulted in a breaker spurious trip, however the condition could not be demonstrated. The possibility of unauthorized local breaker operation was also examined by FPL security personnel and no physical evidence was found to substantiate this as a cause.

The RCP breaker was shipped to a vendor repair facility for disassembly and inspection. No mechanical conditions were found with the breaker which could result in spurious tripping. Additionally, all internal components in the breaker trip mechanism were found to have acceptable wear and operation. A specific cause for the opening of the breaker remained indeterminate following the above inspections.

The failure of the 1B main feedwater regulating valve to close was caused by a malfunction of the K2 relay, which normally actuates coincident with a turbine trip to ground the control signal to the feedwater regulating valve. The failure prevented the relay from grounding the signal to the valve controller which is required for automatic closure of the valve.

ANALYSIS OF THE EVENT

This event is reportable under 10 CFR 50.73 (a) (2) (iv), as "Any event or condition that resulted in a manual or automatic actuation of an engineered safety feature (ESF), including the Reactor Protection System (RPS)...."

The automatic reactor trip was caused by the loss of the 1A2 RCP which resulted in a valid actuation of the RPS low reactor coolant flow trip. The RCS low flow trip protects the core from reductions in coolant flow which could adversely affect DNB margin. A reactor trip on loss of coolant flow is initiated by a low coolant flow rate as determined by a reduction in the sum of the steam generator hot to cold leg differential pressures. At full power operating conditions, the automatic loss of flow trip is required when the reactor coolant flow rate drops to 93 percent of maximum allowed RCS design flow.

The automatic reactor trip, following loss of the RCP, is bounded by the accident analysis provided in St. Lucie Unit 1 Updated Final Safety Analysis Report (UFSAR), section 15.2.5, "Loss of Coolant Flow Accident." The accident analysis evaluates the simultaneous loss of electrical power to all four reactor coolant pumps. The actual plant response during this event is more conservative than that described in the UFSAR, since only a single RCP was tripped, and significant core coolant flow from the remaining three RCPs continued.

Operator actions to secure main feedwater to the 1B SG following the trip mitigated the effect of excessive flow caused by the failure of the 1B main feedwater regulating valve to close. Additionally, an automatic function to trip the 1A MFW pump on high steam generator level operated as designed during the event. Based on the above, the protection of the health and safety of the public was not adversely affected.



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**CORRECTIVE ACTIONS**

Although a specific root cause for the opening of the RCP supply breaker during this event was not determined, appropriate corrective actions have been taken to address the potential root causes which were identified during the event investigation.

1. A replacement breaker was installed for the 1A2 Reactor Coolant Pump, and the pump was returned to service on March 5, 1997.
2. The 1A2 Reactor Coolant Pump breaker which tripped during this event was inspected and tested on site and found to be in satisfactory condition. The breaker was sent to a vendor for additional inspection and disassembly. The results of the vendor inspection did not identify any mechanical condition or other component failure which could result in a spurious trip of the breaker.
3. Additional breaker inspections were performed for the remaining 6.9 KV breakers on Unit 1 and adjustments of the floor tripper mechanisms were made as necessary. Similar inspection and adjustment will be performed for applicable St. Lucie Unit 2 breakers during the upcoming refueling outage.
4. Additional security measures were implemented and visual monitoring equipment was stationed in the Unit 1 and Unit 2 Turbine Switchgear rooms which enclose the RCP 6.9 KV supply breakers.
5. The malfunctioning relay (K2) for the 1B MFW flow control valve (FCV-9021) was replaced and the valve was returned to service following completion of satisfactory testing.
6. The K2 relay which was removed from the 1B MFW regulating valve control circuitry was sent to FPL's examination facility for additional failure analysis. The results of this analysis will be reviewed to determine if further corrective action is necessary.
7. The St. Lucie Unit 2 MFW regulating valve control system will be functionally tested during the next Unit 2 refueling outage to verify proper control circuitry operation.

**ADDITIONAL INFORMATION**

**Failed Components Identified**

Equipment: Control Relay  
 Manufacturer: Struthers Dunn  
 Model: 219BBXP

Previous Similar Events - None