



Florida Power & Light Company, 6501 S. Ocean Drive, Jensen Beach, FL 34957

August 24, 2010

L-2010-190  
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: 2010-007  
Date of Event: June 25, 2010  
Latent Failure of Steam Driven AFW Pump Led to Operation Prohibited by TSs

The attached Licensee Event Report 2010-007 is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

Respectfully,

A handwritten signature in black ink that reads "Richard L. Anderson". The signature is written in a cursive style with a large, prominent initial "R".

Richard L. Anderson  
Site Vice President  
St. Lucie Plant

RLA/KWF

Attachment

LEAD  
NRR

**LICENSEE EVENT REPORT (LER)**

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

<b>1. FACILITY NAME</b> St. Lucie Unit 1	<b>2. DOCKET NUMBER</b> 05000335	<b>3. PAGE</b> 1 OF 5
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**4. TITLE**  
Latent Failure of Steam Driven AFW Pump Led to Operation Prohibited by TSs

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
06	25	2010	2010	007	00	08	24	2010	FACILITY NAME	DOCKET NUMBER

**9. OPERATING MODE**  
3

**10. POWER LEVEL**  
0%

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)**

<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

**12. LICENSEE CONTACT FOR THIS LER**

NAME Ken Frehafer - Licensing Engineer	TELEPHONE NUMBER (Include Area Code) 772-467-7748
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
C	BA	65	W290	YES					

**14. SUPPLEMENTAL REPORT EXPECTED**  
 YES (If yes, complete 15. EXPECTED SUBMISSION DATE)       NO

**15. EXPECTED SUBMISSION DATE**

MONTH	DAY	YEAR

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

On June 25, 2010, St. Lucie Unit 1 was in Mode 3 when the steam driven 1C auxiliary feedwater (AFW) pump failed to reach rated speed during a Technical Specification surveillance. Operations locally tripped the 1C AFW pump and declared the 1C AFW pump out of service.

The failure of the pump was caused by debris binding the turbine governor assembly. The debris was generated from the degrading atmospheric steam dump valve (ADV) silencers.

The governor was repaired and the 1C AFW pump returned to service. Other corrective actions include steam driven AFW pump inspections post ADV operation, the erection of an interim housekeeping enclosure, procedural guidance for as-left and as-found governor condition, and scheduling the ADV silencers for replacement during the next refueling outage, SL1-24.

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**NARRATIVE**

**Description of the Event**

On June 25, 2010, St. Lucie Unit 1 was in Mode 3 making preparations for startup from a forced outage due to control rod drive failures. At 0925 hours, Operations commenced testing the steam driven 1C auxiliary feedwater (AFW) pump [EIIS:BA:P] in accordance with plant procedures. The field operator at the pump observed that the turbine speed ramped up slowly from zero to 700 RPM on the local tachometer and leveled off. Normally, the AFW turbine ramps to approximately 2000 rpm before the governor valve closes to control the ramp to normal operating speed of 3550 to 3650 rpm. Operations locally tripped the 1C AFW pump and declared the 1C AFW pump out of service based on its inability to reach rated speed.

Troubleshooting by Maintenance and System and Component Engineering (SCE) was completed by 1830 hours on June 25, 2010. After repairs were complete, the 1C AFW pump completed its post maintenance test (PMT) and code run successfully by 1124 hours on June 26, 2010, and the 1C AFW pump was declared back in service.

**Cause of the Event**

The AFW pump governor valve linkage inspection performed after Operations tripped the pump revealed that the governor cam assembly had particulate debris resembling corrosion/wear products in the gap between the cam slot and the cam follower. With the turbine in the tripped condition the governor valve would normally be in the full open position. However, the debris caused binding that resulted in the governor valve cam plate being raised to a position consistent with a partially closed governor valve. Therefore, the AFW pump slow start and surveillance failure was caused by the governor [EIIS:BA:P:TRB:65] being bound by the debris.

The AFW pump governor valve linkage was disassembled, cleaned, lubricated, and reassembled. The governor was exercised manually after cam reassembly. The cam and valve shaft moved normally without binding. The AFW pump was successfully tested and returned to service.

FPL determined that the debris binding the AFW pump governor assembly originated from the St. Lucie Unit 1 steam generator atmospheric dump valve (ADV) silencers [EIIS:SB:SIL]. St. Lucie Unit 1 operated in Mode 3 conditions from May 29, 2010, and through most of the month of June. The ADVs were used to remove heat from the reactor coolant system (RCS) during Mode 3 operations. The material condition of the ADV silencers was degraded to the extent that extended operation of the ADVs allowed debris to collect on the AFW pump governor assembly. Although the ADV silencers were known to be in a degraded state and were planned for eventual replacement, there had been no prior indication that continued ADV operation could affect the 1C AFW pump governor assembly.

The work orders to replace the Unit 1 ADV silencers have since been coded as Yellow work orders and are the major drivers for returning the main steam system health report to an acceptable status. The ADV silencer replacement is scheduled for the next refueling outage, SL1-24. Until the ADV silencers are replaced, a temporary enclosure subject to shift operator walkdowns and weekly SCE walkdowns was established around the 1C AFW pump to enhance housekeeping in the area. Additionally, the AFW system engineer revised the system monitoring plan to require inspection of the turbine driven AFW pump governor and trip throttle valve condition following operation of the ADVs until repairs are completed. The surveillance test

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procedures will be revised to include precautions, notes, and steps related to the verification of proper governor valve as-found and as-left position and condition.

**Analysis of the Event**

The St. Lucie Unit 1 Technical Specifications (TS) require that the 1C steam driven AFW pump pass TS surveillance requirement (SR) 4.7.1.2.c within 24 hours of reaching Mode 3 and prior to entering Mode 2. This testing verifies that the AFW pump developed head at the flow test point meets inservice test (IST) requirements and is performed with local operators stationed at the pump to monitor the condition of the pump during the surveillance. During the spring 2010 SL1-23 refueling outage St. Lucie Unit 1 entered Mode 3 from Mode 4 on May 29, 2010, at 1456 hours, and this surveillance requirement was successfully met on May 30, 2010, at 0412 hours.

Between May 30, 2010, and June 25, 2010, the last time the 1C AFW pump was started and run was on June 1, 2010, at 1924 hours, when the 1C AFW pump was started to satisfy TS SR 4.7.1.2.b.2 (the 18-month AFW pump auto-start verification test). Note that with the 1C AFW pump in standby, the governor valve is open. The governor would have to be actively modulating the AFW pump turbine speed for debris to enter the governor assembly and cause binding. FPL concludes that the extended operation of the ADVs allowed the ADV silencer debris to settle on the 1C AFW pump governor assembly. On June 25, 2010, during the failed surveillance, this debris entered and bound the governor assembly when the governor attempted to modulate the speed of the turbine during the 1C AFW pump start. This is consistent with the observed pump performance during the failed surveillance.

This condition is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B) because it resulted in the operation of the facility in a manner prohibited by TSs for the following reasons:

- TS 3/4.7.1.2 only allows one inoperable AFW pump for 72 hours. This latent failure existed for a time greater than the allowed outage time.
- The 1B emergency diesel generator (EDG) was declared out of service (OOS) on June 17, 2010. If the condition of the steam driven 1C AFW pump had been known at the time, TS 3.8.1.1 ACTION b would have required that the motor driven 1B AFW pump be declared OOS within 4 hours of discovery, placing the unit in TS 3.0.3 for two inoperable AFW pumps.

Although the Unit 2 steam driven 2C AFW pump turbine governor has the same design as Unit 1 1C AFW pump and is susceptible to the same condition, the LER investigation did not identify comparable issues with the Unit 2 ADVs and 2C AFW pump.

**Analysis of Safety Significance**

The AFW system is provided with two motor driven AFW pumps and one steam driven AFW pump. The AFW System is designed to provide feedwater for the removal of sensible and decay heat from the reactor coolant system. The system can cool the reactor coolant system to 325F for normal plant cooldowns or during events where the main condensate pumps or the main feedwater pumps are inoperative due to pump failures or due to a loss of normal electric power.

The AFW system can achieve this design requirement with one operable motor driven AFW pump and one intact steam generator. For this event, only the 1C AFW (steam driven) pump was inoperable. Although the 1B AFW pump would have been considered TS

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inoperable per TS 3.8.1.1 ACTION b four hours after the 1B EDG was declared OOS on June 17, 2010, the 1B AFW pump remained available for use with offsite power. The AFW system is able to meet design requirements with only one motor driven AFW pump, bounding the condition evaluated in this LER.

In addition, the FPL probabilistic risk assessment (PRA) group reviewed the risk associated with the inoperable 1C AFW pump in conjunction with the EDG outage windows and concluded that the risk was "small" as discussed below.

The evaluation concluded that the integrated risk for the plant configuration as described is a "small" risk in accordance with RG-1.174. Core damage probability (CDP) is lower than 1.0E-06 and large early release probability (LERP) is lower than 1.0E-07. As Unit 1 was in Mode 3, it should be noted component failure rates and human failure probability should be at lower values than those of Mode 1. However, no credit was considered as the risk evaluation assumed failure of structures, systems, and components (SSCs) and human failure probabilities at the same level as those of Mode 1 (full power level). If such credit were to be considered, the risk would be considered "very small."

The integrated (cumulative) risk impact for the plant configuration during the entire time (starting June 1, 2010, until June 25, 2010) is estimated to have a conditional core damage probability (CCDP) of 2.06E-07 and conditional large early release probability (CLERP) of 3.47E-08. These values are below the threshold required by RG-1.174 for the risk to be considered "small" (i.e., CDP below 1.0E-6 and LERP below 1.0E-07).

Based on the above, this condition had minimal impact on the health and safety of the public.

**Corrective Actions**

The corrective actions below are being managed by the Corrective Action Program. Any changes to the actions below will be processed in accordance with the St. Lucie Commitment Management Program.

1. The 1C AFW pump governor assembly was disassembled, cleaned, lubricated, reassembled, and the AFW pump was returned to service.
2. The main steam system engineer designated work orders (WOs) 29025873 and 29025874 as Yellow WOs for the replacement of the ADV silencers for Unit 1.
3. The St. Lucie Unit 1 ADVs are scheduled for replacement during the next refueling outage, SL1-24.
4. A temporary enclosure was built around the 1C AFW pump to enhance housekeeping in the area until the ADVs are replaced. This enclosure will be subject to shiftly operator walkdowns and weekly SCE walkdowns.
5. The AFW system engineer will revise the system monitoring plan to include inspection of the turbine driven AFW pump governor and trip throttle valve condition following operation of ADVs until such time that repairs are completed.
6. The AFW System Engineer will revise the steam driven AFW pump surveillance procedures for St. Lucie Units 1 and 2 to include precautions, notes and steps to address as-found and and-left governor valve position/condition.

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**Similar Events**

A search of the corrective action program database identified no similar events in the last three years.

**Failed Components**

1C AFW pump governor assembly

Manufacturer: Woodward Governor

Model Number: PG-PL PSL-modified