

# CATEGORY 1

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 9802170140      DOC.DATE: 98/02/09      NOTARIZED: NO  
 FACIL: 50-335 St. Lucie Plant, Unit 1, Florida Power & Light Co.  
 AUTH.NAME                      AUTHOR AFFILIATION  
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 STALL, J.A.                     Florida Power & Light Co.  
 RECIP.NAME                    RECIPIENT AFFILIATION

DOCKET #  
05000335

SUBJECT: LER 98-003-00: on 980110, manual RT due to DEH leak at turbine test block was noted. Caused by o-ring extrusion. Shortened bolts by about 0.125" & reinstalling at correct torque values. W/980209 ltr.

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Florida Power & Light Company, 6351 S. Ocean Drive, Jensen Beach, FL 34957

February 9, 1998

L-98-034  
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: 98-003  
Date of Event: January 10, 1998  
Manual Reactor Trip Due to a Digital Electro-Hydraulic (DEH)  
Leak at the Turbine Test Block

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

Very truly yours,

J. A. Stall  
Vice President  
St. Lucie Plant

JAS/ptq

Attachment

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

9802170140 980209  
PDR ADOCK 05000335  
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IE22/1

<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-8 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.</small>
<b>LICENSEE EVENT REPORT (LER)</b>  (See reverse for required number of digits/characters for each block)		

<b>FACILITY NAME (1)</b>  ST LUCIE UNIT 1	<b>DOCKET NUMBER (2)</b>  05000335	<b>PAGE (3)</b>  1 OF 5
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**TITLE (4)**  
 Manual Reactor Trip Due to a Digital Electro-Hydraulic (DEH) Leak at the Turbine Test Block

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
01	10	98	98	003	00	02	09	98	N/A	05000
									N/A	05000

<b>OPERATING MODE (9)</b> 1	<b>THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more) (11)</b>										
<b>POWER LEVEL (10)</b> 60	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)(iii)			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)(iii)			20.2203(a)(4)			X 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)**

<b>NAME</b>  Paul T. Quillen, Licensing Engineer	<b>TELEPHONE NUMBER (Include Area Code)</b>  (561) 467 - 7161
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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
B	TG	SEAL	WSTNGHSE	N					

<b>SUPPLEMENTAL REPORT EXPECTED (14)</b>				<b>EXPECTED SUBMISSION DATE (15)</b>		
YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

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

On January 10, 1998, St. Lucie Unit 1 was operating in Mode 1 at 60 percent reactor power. The Unit 1 reactor was manually tripped in response to Digital Electro-Hydraulic (DEH) system alarms, which indicated that a fault had occurred within the DEH system. An operator observed and reported a DEH oil leak immediately prior to the alarms. The plant was stabilized in Mode 3. Following the Unit 1 manual trip, it was observed that both main feedwater pumps had tripped due to low pump flow conditions. The DEH test block leakage was repaired and the unit was returned to Mode 1 operation.

The root cause of the DEH test block leakage was determined to be o-ring extrusion caused by inadequate joint closure between the test block and the trip block. During the investigation of the leakage, a gap was discovered under the test block, indicating that the test block was not fully seated to the trip block. O-ring groove machining and the length of the original bolting did not allow for proper closure of the joint.

Corrective Actions include: 1) Shortening the bolts by 0.125" and reinstalling at the correct torque values. 2) Increasing the trip block bolt holes depth from 1.00" to 1.25" per the drawing. 3) Revising Maintenance Procedures to include a step for verifying, with feeler gauges, that the test blocks are completely mated to the trip blocks, and that appropriate torque values are applied. 4) Reviewing the event for inclusion in the Instrument and Control Maintenance continuing training program. 5) Evaluating potential plant changes to prevent loss of Main Feedwater Pumps following a reactor trip.

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

DESCRIPTION OF THE EVENT

On January 9, 1998, a Digital Electro-Hydraulic (DEH) oil leak was reported on the turbine trip test block for solenoid valve SE22140. The leak was reported to be approximately one drop per minute. The Operations department established a continuous watch to monitor the leakage. On January 10, 1998, further investigation of the leakage revealed a gap under the test block, indicating that the test block was not fully seated to the turbine DEH block. Leakage had increased to approximately 42 drops per minute. With reactor power at 60 percent, the test block seal failed.

The main turbine DEH system (EISS: TG) uses high pressure hydraulic oil to position the turbine valves. The main DEH fluid trip system utilizes a normally closed solenoid valve to dump pressure from the DEH emergency trip header for rapid closure of all turbine valves. In order to test the solenoid valve on line, a test block was installed between the solenoid valve (SE22140) and the main turbine trip block. During the recent Unit 1 outage, the test block was removed and the o-ring grooves measured. The test block o-ring gland depth was inadequate and was machined deeper. The gland grooves were cut to a depth of 0.104" to allow for proper o-ring crush for sealing a nominal 0.125" diameter o-ring. The test block was reinstalled using new o-rings and the original four hold down bolts were torqued to the required 90 ft-lbs. The trip solenoid valve was reinstalled on the test block using new o-rings and backing ring.

As part of the investigation for leakage on January 10, 1998, the accessible bolts were checked for break away torque at 90 ft-lbs. No movement of bolting was observed in the test block that was leaking. A plan was established to remove the solenoid valve and check the torque on the remaining test block bolting. Before this could be accomplished, the operator reported increased DEH oil leakage to the control room.

The Unit 1 reactor was manually tripped at 2018 on January 10, 1998, in response to DEH system alarms and the report of increased leakage rate by the operator monitoring the leakage. Both main feedwater pumps (MFP) (EISS: SJ) tripped following reactor trip due to low pump flow conditions. The Auxiliary Feedwater Actuation System (EISS: BA) initiated on 1A and 1B steam generator low level, as required. Approximately ten minutes after the reactor trip, one MFP was manually restarted. The plant was stabilized in Mode 3.

On January 11, 1998, solenoid valve (SE22140) was removed from the test block. An investigation revealed that the bolts connecting the test block to the trip block were bottomed out, causing a gap between the blocks. The bolts were shortened by 0.125" and reinstalled. Following repair of the affected test block leakage, Unit 1 was returned to Mode 1 power operation at 1701 on January 11, 1998.

CAUSE OF THE EVENT

The root cause of the leak was determined to be o-ring extrusion caused by inadequate joint closure. According to the manufacturer's drawing for the aluminum trip block, the holes should be 1.125" deep.

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CAUSE OF THE EVENT (Continued)

The four bolt holes measured in range from a maximum of 1.000" to 0.920". This inadequate depth of the bolt holes did not allow for proper closure of the trip block to test block joint. The machining of the test block o-ring grooves during the outage lessened the o-ring crush, and allowed the bolting to bottom out in the trip block bolt holes.

Upon disassembly of the test block, the o-rings were examined and showed signs of extrusion failure. The bolting was placed back in the test block and measurements were taken for thread engagement with the trip block. The data indicated that the bolts had bottomed out in the trip block holes. The decision was made to remove 0.125" from the bolts and reassemble using new o-rings. After reassembly, feeler gauge readings verified that test block to trip block joint did not have a gap.

A calculation was performed to determine the proper bolt torquing, based on the most limiting material (aluminum trip block). The calculation revealed that the 45,000 psi (90 ft lbs.) values were acceptable; however, a 30,000 psi (60 ft lbs.) value was recommended by engineering based on actual field loading of the joint and safety factors. The blocks were torqued to 60 ft-lbs and the system returned to service.

ANALYSIS OF THE EVENT

This event is reportable per 10CFR 50.72 (b) (2) (ii) and 10CFR 50.73 (a) (2) (iv) .... as any event or condition that results in the manual or automatic actuation of any engineered safety feature (ESF), including the Reactor Protection System (RPS)....

After placing Unit 1 on line following a refueling outage, a DEH fluid leak was identified at the turbine trip test block. With reactor power at 60 percent, the test block seal failed.

Associated with the DEH fluid system are several protective tripping schemes. In accordance with section 7.7.1.4 of the Updated Final Safety Analysis Report (UFSAR), the turbine control system is designed to automatically control turbine power, trip the turbine during occurrences that could cause equipment damage, and trip the reactor during a turbine trip. The Unit 1 control room received annunciator D-46, DEH Return Pressure High, annunciator D-37, DEH Pump 1A/1B Filter D/P Hig , and annunciator D-57, DEH Reservoir Level High/Low. The reactor was manually tripped due to the alarms and a reported significant DEH oil leak.

Analysis of Safety Significance

The following anomaly occurred which required operator action. Both main feedwater pumps (MFPs) which had been running prior to the trip, indicated off. Both MFPs tripped following reactor trip due to low pump flow conditions.

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Analysis of Safety Significance (Continued)

Concerning the MFPs, the low flow trip will occur if low flow conditions are present for greater than ten seconds. During the plant trip, the main feedwater regulating valves close and the MFP recirculation valves are stroked to the open position in approximately eight seconds. The feedwater pump recirculation valves open to ensure minimum recirculation flow through the MFPs. Past events involved tripping one of the two pumps. In these cases, the plant trips were usually from 100 percent power, where the main feedwater regulating valves were near fully open, providing for more recirculation valve opening response time. The additional response time allowed the pump with the slightly higher discharge head to remain operating by driving the other pump off on low flow. In this case however, the plant was at 60 percent power and the main feedwater regulating valves were approximately half open, providing less than adequate time for either recirculation valve to respond.

This anomaly is not a safety concern because the MFPs are not credited to provide feedwater to the steam generators during such transients. Auxiliary feedwater initiated as required.

With the exception of the MFP trips, the plant response during the reactor trip was observed to be normal and all safety related systems functioned, as designed. This event is bound by section 15.2.7 of the Unit 1 UFSAR which assumes a large reduction of power demand on the reactor due to a loss electrical load or turbine stop valve closure. The plant response during this event is more conservative than that in the UFSAR analysis for the following reasons: 1) the unit was operating at reduced power at the time of the trip (60 percent). 2) the reactor and turbine were manually tripped, and 3) the pressurizer code safety valves and the main steam line safety valves were not challenged during the plant trip. In addition, both St. Lucie Unit 1 startup transformers remained operable at all times during the event, and offsite or emergency power sources were not impacted.

Based on the above, the health and safety of the public were not adversely affected by this event.

CORRECTIVE ACTIONS

- 1) The hold down bolts were shortened by 0.125" and reinstalled to correct torque values.
- 2) The trip block bolt holes depth will be increased from 1.000" to 1.250" as specified by the manufacturer's drawing.
- 3) Maintenance Procedures will be revised on both units to include a step for checking and verifying, with feeler gauges, that the test blocks are completely down on the trip blocks, and that appropriate torque values are applied.
- 4) This event will be reviewed by the Training Review Committee for inclusion in Instrument and Control Maintenance continuing training.
- 5) FPL will evaluate potential plant changes to prevent loss of Main Feedwater Pumps following a reactor trip.

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ADDITIONAL INFORMATION

Failed Components Identified

- 1) Component: Solenoid Valve (SE22140) Test Block O-ring  
Material: O-ring; Ethylene Propylene; Westinghouse

Previous Similar Events

None

