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

March 22, 2011

L-2011-080
10 CFR 50.73

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

Re: St. Lucie Unit 2
Docket No. 50-389
Reportable Event: 2009-003-01
Date of Event: July 13, 2009
Reactor Coolant Pump 2B2 Lower Seal Cavity Line Leak

The attached Licensee Event Report (LER) 2009-003-01 supplement is being submitted pursuant to the requirements of 10 CFR 50.73. Added or revised text is marked with revision bars.

This supplement supersedes in its entirety the previously submitted LER 2009-003 by Florida Power & Light (FPL) letter L-2009-203, dated September 11, 2009.

If there are any questions, please call Eric Katzman, Licensing Manager, at (772) 467-7734.

Respectfully,

Richard L. Anderson
Site Vice President
St. Lucie Plant

RLA/dlc

Attachment

IE22
NRR

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010

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.

# LICENSEE EVENT REPORT (LER)

| 1. FACILITY NAME | 2. DOCKET NUMBER | 3. PAGE |
|---|---|---|
| St. Lucie Unit 2 | 05000389 | 1 OF 3 |

**4. TITLE**
RCP 2B2 Lower Seal Cavity Line Leak

| 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 |
| 07 | 13 | 2009 | 2009 | - 003 - | 01 | 03 | 22 | 2011 | FACILITY NAME | DOCKET NUMBER |

**9. OPERATING MODE**
1

**10. POWER LEVEL**
100%

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

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☒ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☐ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

**12. LICENSEE CONTACT FOR THIS LER**

| NAME | TELEPHONE NUMBER (Include Area Code) |
|---|---|
| Donald L. Cecchett - Licensing Engineer | 772-467-7155 |

**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 |
|---|---|---|---|---|---|---|---|---|---|
| B | AB | PSF | N/A | 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 July 12, 2009 at 21:32, St. Lucie Unit 2 was in Mode 1 at 100% power when the reactor was down powered and manually tripped (on July 13 at 00:38), in accordance with plant rapid down power procedures, due to an increasing trend in reactor coolant system (RCS) unidentified leakage rate.

The RCS leak source was identified as a cracked weld where lower cavity seal line I-3/4"-RC-228 connects to the 2B2 RCP seal cartridge. The J- weld was cut from the RCP seal housing and metallurgical failure analysis was performed. The analysis concluded the failure mechanism was outside diameter (OD) initiated, low stress high cycle fatigue caused by resonance vibration. The analysis did not identify any original welding or material deficiencies as contributors to the failure.

Corrective actions include replacing cracked seal housing; cutting and capping the RCP seal lines susceptible to resonance vibration, including seal injection on all four RCPs and the upper seal cavity lines on two RCPs; installation of additional vibration monitoring equipment on seal piping on three of the four St. Lucie Unit 2 RCPs; and as a long term corrective action, eliminate RCP seal injection and remove the vibration-vulnerable piping.

| FACILITY NAME (1) | DOCKET NUMBER (2) | LER NUMBER (6) | | | |
|---|---|---|---|---|---|
| | | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | |
| St. Lucie Unit 2 | 05000389 | 2009 | - 003 | - 01 | Page 2 of 3 |

NARRATIVE

**Description of the Event**

On July 8, 2009 during 100% power operation, control room operators noted a small increase in the St. Lucie Unit 2 reactor coolant system (RCS)[EIIS:AB] unidentified leakage rate. Operating crews started an RCS leakage investigation and confirmed the increasing trend. The unidentified leakage continued to rise to approximately 0.16 gpm by 0400 hrs on July 12, 2009. Reactor containment building (RCB) entries determined the RCS leak source as a cracked weld where the lower cavity seal Line I-3/4"-RC-228 attaches to the 2B2 reactor coolant pump (RCP) seal cartridge. The reactor was down powered to 25% and manually tripped in accordance with plant procedures on 7/13/09.

**Cause of the Event**

The RCS leak source was identified as a cracked weld where lower cavity seal Line I-3/4"-RC-228 attaches to the 2B2 RCP seal cartridge. The J- weld was cut from RCP seal housing and metallurgical failure analysis performed. The analysis concluded the failure mechanism was outside diameter (OD) initiated, low stress high cycle fatigue due to resonance vibration. The analysis did not identify any original welding or material deficiencies as contributors to the failure.

**Analysis of the Event**

This event is reportable under 10 CFR 50.73(a)(2)(ii)(A), as any event or condition resulting in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded.

**Analysis of Safety Significance**

The failure analyses that were performed concluded it was Line I-3/4-RC-228 resonance that magnified the vibration levels. The identified failure mechanism on the lower seal cavity line J- weld was outside diameter (OD) initiated, low stress high cycle fatigue.

The RCS leakage was discovered during daily RCS leakage rate calculations which identified the increased leakage prior to a significant degradation of the piping. Experience has demonstrated that with this weld failure mechanism, there is ample time from the discovery of increased RCS leakage to allow a controlled shutdown to cold shutdown conditions without challenging the emergency core cooling system (ECCS) or small break loss-of-coolant accident analysis (SBLOCA).

Although stainless steel components are not susceptible to boric acid corrosion, the spray from the cracked weld deposited wet boric acid onto the external surfaces of numerous carbon and low alloy steel components, including pressure retaining bolting. Inspection subsequent to cleaning of the affected areas revealed minor surface corrosion with no measurable material degradation or wastage. The inspection results were consistent with the expected corrosion rates provided in the industry guidelines for the specific leak parameters such as temperature and boric acid concentration.

Based on the above, the safety consequences of the event are low and there was no adverse impact on the health and safety of the public.

NARRATIVE

**Corrective Actions**

The corrective actions and supporting actions are entered into the site corrective action program. Any changes to the proposed actions will be managed under the corrective action program.

Action taken prior to restart:

1. Replaced the cracked seal housing.
2. Cut and capped the RCP seal lines that were susceptible to this failure mechanism, including seal injection on all four RCPs and the upper seal cavity lines on two of the RCPs as short term corrective action.
3. Installed additional vibration monitoring equipment on three of the four Unit 2 RCPs seal piping.

Long Term Corrective Action:

1. Seal injection via the chemical volume control system is being removed on all RCPs by cutting and capping the seal injection lines, thereby removing that portion of the vibration-vulnerable piping. The remaining RCP vibration-vulnerable seal lines will be modified with flexible piping. This work will be completed by the end of the Spring 2011 Unit 2 refueling outage, SL2-19.

**Similar Events**

There have been (3) three similar failure events at St. Lucie Unit 2 involving cracked RCP seal lines: 1) Inside diameter initiated low stress high cycle fatigue of the 2B1 RCP lower seal injection line socket weld; 2) outside diameter initiated low stress high cycle fatigue of the 2B2 RCP seal injection vendor J groove weld; 3) inside diameter initiated environmental assisted cracking under cyclic loading.

A search of the INPO Operating Experience database, Industry Owner Groups, and other Utilities identified multiple plant events involving RCP seal injection lines with cracked welds relating to vibration, environmental, water chemistry, and weld material. These failure mechanisms independently or collectively contributed to these types of events within the nuclear industry.

**Failed Components**

RCP 2B2 Lower Seal Cavity piping $\frac{3}{4}$ inch schedule 160 304 SS piping J-weld at the seal housing.