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

June 25, 2003

L-2003-157
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: 2003-002-00
Date of Event: April 30, 2003
Two Flaws Identified During Reactor
Pressure Vessel Head Inspections

The attached Licensee Event Report 2003-002 is being submitted pursuant to the requirements of 10 CFR § 50.73 to provide notification of the subject event.

Very truly yours,

William Jefferson, Jr.
St. Lucie Nuclear Plant

WJ/KWF
Attachment

IE22

NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 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. If 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)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
St. Lucie Unit 2	05000389	Page 1 of 4

4. TITLE

Two Flaws Indentified During Refueling Outage Reactor Pressure Vessel Head Inspections

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	30	2003	2003	- 002 -	00	06	25	2003	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	6
10. POWER LEVEL	000

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

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

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Kenneth W. Frehafer, Licensing Engineer	(772) 467 - 7748

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	AB	NZL	C490	YES	-	-	-	-	-

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

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

On April 30, 2003, St. Lucie was in a refueling outage and the reactor pressure vessel head surface and associated penetration nozzles were being inspected in accordance with NRC Order EA-03-009. Although the head surface visual examination revealed no evidence of reactor coolant system boundary leakage, ultrasonic testing revealed an axial flaw in each of the nozzles for reactor pressure vessel head penetrations 18 and 72. No other indications were found during the inspection activities.

The most likely cause of the nozzle flaws was attributed to primary water stress corrosion cracking. The subject nozzles were replaced during the refueling outage. St. Lucie will continue to perform reactor pressure vessel head surface and associated penetration nozzle inspections in accordance with the requirements of the NRC Order.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
St. Lucie Unit 2	05000389	2003	- 002	- 00	Page 2 of 4

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

Description of the Event

On April 30, 2003, St. Lucie was in a refueling outage in Mode 6 operation. The reactor pressure vessel head (RPVH) was being inspected in accordance with the NRC Order, EA-03-009, that required inspection of pressurized water reactor RPVHs and associated penetration nozzles [EIIS:AB:RPV:NZL]. The St. Lucie Unit 2 RPVH had approximately 14.0 effective degradation years (EDY) at the start of the spring 2003 refueling outage, therefore the Order inspection category for this plant is High (susceptibility). As a High category plant, FPL committed to (as amended by subsequent Order relaxation requests) a bare metal visual inspection of the RPVH and ultrasonic testing (UT) on all of the 102 RPVH penetration nozzles, which includes 91 control element drive mechanism (CEDM) nozzles, 10 in-core instrument (ICI) nozzles, and 1 vent nozzle. These inspections are required every refueling outage.

The visual inspection results for the RPVH showed that the overall condition of the St. Lucie Unit 2 RPVH was clean with no evidence of leakage from the 102 RPVH penetrations or wastage of the RPVH surface.

On April 30, 2003, the RPVH UT inspection identified an axial indication in CEDM penetration 72. An 8-hour non-emergency ENS notification was made per 10 CFR 50.72(b)(3)(ii)(A). On May 2, 2003, a second axial indication was identified in CEDM penetration 18, and the ENS notification was updated. The defects were OD surface connected, extending into the nozzle material below and adjacent to the J-groove weld between the nozzle and RPVH. The axial flaw in nozzle 18 also extended partially above the J-groove weld. The indication details are provided in the table below.

Nozzle Number	Flaw Location /Type	Flaw Length	Flaw Depth	Distance Below Weld
18	OD Axial	2.98"	0.26"	0.71"
72	OD Axial	0.96"	0.28"	0.35"

Neither flaw extended through the wall of the nozzle. Neither nozzle had evidence of reactor coolant system (RCS) pressure boundary leakage from the annulus between the nozzle and the RPVH associated with the indications.

The UT examination method used on all 102 RPVH penetration nozzles was the option identified in section IV.C.(1)(b)(i) of the NRC Order (as amended by subsequent Order relaxation requests). The inspection scope included the nozzle base material from 2" above the J-groove weld, down to the bottom end of all of the penetrations for the 10 ICI nozzles and 1 vent nozzle. The 91 CEDM nozzles have inside-threaded ends that are used to permanently attach externally-threaded guide cones. This arrangement prevented the extent of UT examination from the weld to the bottom of the nozzle as mandated by the Order. The relaxation request, subsequently approved by the NRC, proposed UT inspection for the 91 CEDM nozzles from 2" above the J-groove weld, down to the maximum extent practical to include 0.41" below the weld as a minimum. In addition to the CEDM nozzle UTs, and in support of the one-time only relaxation request, FPL committed to and performed additional supplemental dye penetrant examination (PT) on selected nozzles that had reduced UT coverage of less than 0.41" below the weld. No indications were identified by the PTs.

Cause of the Event

The cause of the axial flaws is primary water stress corrosion cracking (PWSCC), a mechanism well documented by the industry. PWSCC can occur in Alloy 600 materials provided that three conditions are present: susceptible material, high tensile stress greater than a threshold value (residual, applied, or combination), and an aggressive environment (e.g., high temperature, pure primary water). PWSCC is also a thermally activated process that is strongly linked to operating time at temperature.

PWSCC of Alloy 600 material does not readily lend itself to specific corrective actions to prevent recurrence in this application. Alternatively, FPL will follow its existing commitments to NRC RPVH inspection requirements.

Penetrations 18 and 72 were repaired by removing the lower portion of the existing nozzle containing the flaw indication and relocating the pressure boundary weld to the inside of the penetration. The ambient temperbead weld repair process, repair configuration and post repair inspection technique relief requests were approved by the NRC.

Analysis of the Event

This event is reportable under 10 CFR 50.73(a)(2)(ii)(A) as any event or condition that resulted in the condition of the power plant, including its principle safety barriers, being seriously degraded. Even though no leakage occurred, NUREG 1022 guidance states that material defects that can not be found acceptable under ASME Section XI flaw evaluation techniques are reportable under this criterion.

Analysis of Safety Significance

The NRC identified two safety significant concerns as the basis for the inspection program; circumferential cracking that could lead to RPVH nozzle ejection, and boric acid wastage of the RPVH material. Safety significant circumferential cracking of an RPVH nozzle is cracking that is at or above the root of the nozzle J-groove attachment weld. This type of cracking has only been identified as initiating from the OD of the nozzle after that surface is exposed to primary water. The only two ways that this surface can be exposed to primary water is for a through wall axial crack to occur in the nozzle or a flaw in the weld to occur.

Other than the flaws detected on RPVH penetrations 18 and 72, there were no indications identified in any of the other 100 RPVH penetrations in the St. Lucie Unit 2 RPVH. The Order required that the RPVH penetration nozzle UT results be assessed to determine if leakage has occurred into the interference fit zone. The Framatome-ANP assessment to determine if leakage occurred into the interference fit zone concluded that there was no evidence of a "leak path" signature for any of the 101 interference fit RPVH penetrations examined. The RPVH vent line is a clearance fit nozzle so visual inspection techniques, backed by a PT examination, provide a direct determination that no leakage has occurred from this nozzle. Based on the above, FPL concludes that there was no RCS pressure boundary leakage that could have lead to circumferential cracking and subsequent RPVH nozzle ejection, and that the bare visual inspection results determined that there was no boric acid wastage of the RPVH material. Furthermore, with respect to nozzle ejection, should one postulate that an axial flaw develops into an active leak site, Westinghouse flaw analysis techniques show that it would take a time period much greater than the existing refueling inspection interval before an OD circumferential flaw could initiate and

propagate to a point where the integrity of the CEDM penetration nozzle would be affected.

FPL conducted an evaluation that demonstrates that continued operation with PWSCC susceptible nozzles is justified until the next refueling RPVH inspection. Based on the extent of UT coverage obtained and the supplemental PT examination results, the time for a postulated flaw to reach the pressure boundary has been calculated (using the WCAP-16038-P flaw analysis approach) to be 37.4 months for the worst case unexamined location. This period significantly exceeds the 18-month operating cycle after which another RPVH inspection will be implemented.

Therefore, FPL concludes that the continued operation for the next operating cycle is bounded by Westinghouse flaw analysis techniques. Additionally, there was no RCS pressure boundary leakage associated with RPVH penetrations 18 and 72 indications, therefore, past operation with the identified flaws had no impact on the health and safety of the public.

In the fall of 2002, St. Lucie Unit 1 performed a RPVH inspection during its last refueling outage. The RPVH inspection activities consisted of a visual examination and UT of the penetrations. No flaws were discovered. Additionally, Westinghouse flaw tolerance methodology was used to justify continued operation through St. Lucie Unit 1's current operating cycle.

Corrective Actions

1. Penetrations 18 and 72 were repaired during the spring 2003 St. Lucie Unit 2 refueling outage.
2. Both St. Lucie units are committed to performing RPVH inspections during their next refueling outage.
3. FPL is considering RPVH replacement as the means to ultimately replace the susceptible nozzle material with a more robust material.

Additional Information

Failed Components Identified

Component: RPVH nozzle
Manufacturer: Standard Steel
Heat Numbers: A6785 and EO3045

Similar Events

LER 50-335/2001-003-00, Titled "Reactor Coolant System Instrument Nozzle Leakage Caused by Primary Water Stress Corrosion Cracking." This LER describes a PWSCC caused through-wall leak on the St. Lucie Unit 1 3/4-inch 1B hot leg instrument nozzle RC-126. St. Lucie Unit 2 has completed the replacement of all pressurizer and RCS hot leg Alloy 600 nozzles. The planned replacement of Alloy 600 penetration nozzles that are susceptible to PWSCC for St. Lucie Unit 1 is still in progress.