



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

July 19, 2001

L-2001-169  
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: 2001-006-00  
Date of Event: May 22, 2001  
Degraded EDG Radiator Lead to Operation  
of Facility Prohibited by Technical Specifications

The attached Licensee Event Report 2001-006 is being submitted pursuant to the requirements of 10 CFR § 50.73 to provide notification of the subject event.

Very truly yours,

A large, stylized handwritten signature in black ink, appearing to read 'D. Jernigan', is written over the typed name and title.

Donald E. Jernigan  
Vice President  
St. Lucie Nuclear Plant

DEJ/EJW/KWF  
Attachment

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

IE22

**FACILITY NAME (1)** St. Lucie Unit 1

**DOCKET NUMBER (2)** 05000335

**PAGE (3)** Page 1 of 4

**TITLE (4)**  
Degraded EDG Radiator Lead to Operation of Facility Prohibited by Technical Specifications

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	
05	22	2001	2001	006	00	07	19	2001	FACILITY NAME	DOCKET NUMBER	
<b>OPERATING MODE (9)</b> 1											
<b>POWER LEVEL (10)</b> 100											
<b>THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)</b>											
			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)			X 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)			50.73(a)(2)(ii)(A)			50.73(a)(2)(viii)(B)		

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

NAME: Kenneth W. Frehafer, Licensing Engineer

TELEPHONE NUMBER (Include Area Code): (561) 467 - 7748

**COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)**

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
E	LB	HX	Y021	Yes	-	-	-	-	-

**SUPPLEMENTAL REPORT EXPECTED (14)**

YES (If yes, complete EXPECTED SUBMISSION DATE). X NO

**EXPECTED SUBMISSION DATE (15)**

MONTH DAY YEAR

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

On May 22, 2001, St. Lucie Unit 1 was in Mode 1 at 100 percent reactor power. During the performance of the monthly Technical Specification (TS) surveillance run, FPL discovered that the 1B2 emergency diesel generator (EDG) had a radiator leak. Corrosion of the EDG radiator cooling fins resulted in a loss of structural support of the radiator flat tubes that ultimately caused the failure of the soldered mechanical tube joints.

Corrective actions included replacement of the 1B2 EDG radiator, preventive maintenance program and procedure revisions, training, and planned replacement of the 1A2 EDG radiator.

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

**Description of the Event**

On May 22, 2001, St. Lucie Unit 1 was in Mode 1 at 100 percent reactor power. During the performance of the monthly Technical Specification (TS) surveillance run, FPL discovered that the 12 cylinder 1B2 emergency diesel generator (EDG) had a radiator leak [EIIS:LB:HX]. The subsequent inspection identified a split in the vertical seam of one of the radiator flat tubes located in the outermost row on the inlet face of the radiator. This leak was repaired and the 1B2 EDG radiator was pressure tested (to ~9 psig which is higher than its normal operating pressure). No additional leaks were identified during the pressure tests and the 1B EDG was returned to service after successfully completing its Technical Specification surveillance run. The radiator was scheduled for replacement during the next refueling outage. As a conservative interim corrective action, FPL increased the surveillance frequency for the 1B EDG to twice a month.

On June 11, 2001 during the first of the bi-monthly surveillance runs, the 1B2 EDG radiator developed another leak. The 1B2 EDG was declared out of service (OOS) pending replacement of the EDG radiator cores. Replacement cores were not available on site and were procured in an expedited manner. On June 15, replacement cores for the 1B2 EDG radiator were received on site, the cores were replaced, and the 1B EDG was returned to service on June 17, 2001.

**Cause of the Event**

Corrosion of the EDG radiator cooling fins from the humid salt-laden atmosphere resulted in a loss of structural support of the radiator flat tubes. This corrosion was originally identified by FPL during the St. Lucie Unit 1 spring 2001 refueling outage, SL1-17. The loss of structural support, combined with the thermal and pressure cycles experienced by the radiator, allowed the flat tubes to swell and vibrate and ultimately caused the failure of the soldered mechanical tube joints. There were several contributing factors that lead to this event.

The failure mechanism was not well understood. FPL operating experience with similar EDG radiator corrosion was applied to the material condition of the St. Lucie 1B2 radiator. FPL believed that considerably more fin degradation was required in order for radiator tube failures to occur and that corrective actions implemented following the first failure, along with the rigorous post maintenance testing, demonstrated adequate operating margin.

Additionally, the preventive maintenance program did not address the expected life or recommend a replacement interval for the EDG radiators. Past EDG radiator replacement was based and predicated on the loss of thermal performance. Although the 1B2 radiator showed evidence of corrosion, it was not experiencing adverse thermal performance.

**Analysis of the Event**

The period of time that the 1B2 EDG radiator was susceptible to failure was greater than the 14-day TS allowed outage time (AOT) of TS 3.8.1.1.b and is therefore reportable under 10CFR50.73(a)(2)(i)(B) as a condition prohibited by Technical Specifications.

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**Analysis of Safety Significance**

Each EDG consists of two diesel engines (12 cylinder and 16 cylinder) mounted in tandem with a 3500 kW generator coupled directly between the engines. Each engine in each diesel generator set has a self-contained cooling system which consists of a forced circulation cooling water system which cools the engine directly and an air cooled radiator system which removes the heat from the cooling water. The cooling water pump and radiator fan are driven directly from the engine crankshaft. The St. Lucie Unit 2 EDG radiators are of a different design (i.e., round cooling tubing verses flat cooling tubes), and as such, are not susceptible to the same failure mechanism being reported in this LER. Although the 12 cylinder 1A2 EDG radiator has evidence of corrosion, the corrosion is not to the extent experienced on the 1B2 EDG radiator. FPL plans on replacing the 1A2 EDG radiator on-line during the next suitable work week window.

In retrospect, based on the chronology identified above, it can be concluded that the corrective actions implemented following the first tube failure on May 22, 2001, were insufficient to assure the integrity of the 1B2 EDG radiator and thus, the reliable operation of the 1B EDG. Additionally, based on the failure mode and repeated tube failures in the 1B2 EDG radiator, FPL concludes that at some time between the end of the SL1-17 refueling outage and the surveillance failure on May 22, 2001, there were insufficient operating cycles remaining in the 1B2 EDG radiator to support operation of the 1B2 EDG radiator.

Based on review of the chronological logs, it is judged that the most potentially risk significant structures, systems, or components (SSCs) removed from service at the same time the 1B EDG was assumed not operable were the 1A EDG and the 1A component cooling water (CCW) heat exchanger (Hx). The St. Lucie probabilistic safety assessment (PSA) model was used to estimate the risk significance of the condition reported in this LER. During the period when EDG 1B was out of service, the weather related offsite power events (e.g., hurricane) included in the current PSA model were not credible because the event occurred prior to the active hurricane season. The offsite power recovery model was refined to exclude the weather related offsite power events.

1A EDG OOS:

The risk assessment conservatively assumes a 0.5 non-recovery probability for the 1A EDG if a LOOP occurs while the EDG is connected to the grid. The exposure time (i.e., the total time the 1A EDG was out of service (OOS)) was approximately 6.5 hours. The change in core damage probability over a 6.5 hour exposure is calculated by comparing the risk associated with removal from service of only the 1A EDG for testing and the risk of having the 1A EDG removed from service for testing with the 1B EDG assumed not operable. The estimated change in core damage probability is 3.2E-08.

1A CCW Hx OOS:

The 1A CCW Hx was removed from service for approximately 32 hours. The risk associated with the planned CCW Hx work was assessed and found to be acceptable as part of the configuration risk management program (CRMP). The change in risk assuming the 1B EDG is also OOS would thus be the difference in risk with only the 1A CCW Hx OOS and the risk with the 1A CCW Hx and the 1B EDG OOS over the 32-hour exposure time. Recovery of CCW flow via the 1A CCW pump is not credited. The estimated change in core damage probability is 1.9E-07.

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1B EDG OOS for the Assumed Fault Exposure Time:

FPL conservatively assumed that the time of interest for the risk significance determination of the degraded 1B EDG radiators was the full fault exposure time of approximately 46 days. The estimated increase in core damage probability over this time interval is approximately 8.0E-07. If the common practice (e.g., Maintenance Rule) to use half the fault exposure time is assumed, the estimated increase in core damage probability is approximately 4.0E-7.

Based on the above assessments, the change in core damage probability for this event remained less than 1E-06. Therefore, this event had no significant impact on the health and safety of the public.

**Corrective Actions**

1. The 1B2 EDG radiator was replaced.
2. FPL will incorporate the lessons learned from this event into the continuing engineering personnel training program.
3. The preventive maintenance program and procedures will be revised to provide cleaning and time based replacement criteria for the St. Lucie Unit 1 EDG radiators.
4. The 1A2 EDG radiator is planned for on-line replacement during the next suitable work week.

**Additional Information**

Failed Components Identified

Manufacturer: Young Radiator Company  
 Component: 1B2 EDG Radiator  
 Model Number: Young Radiator Company Drawing D260846

Similar Events

None