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

June 19, 2001

L-2001-147
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: 2001-005-00
Date of Event: April 22, 2001
Faulty CSAS Re-Sequencing Circuit Led to
Operation Prohibited by Technical Specifications

The attached Licensee Event Report 2001-005 is being submitted pursuant to the requirements of 10 CFR § 50.73 to provide notification of the subject event.

Very truly yours,

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

NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 6-30-2001

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)

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TITLE (4)

Faulty CSAS Re-Sequencing Circuit Led to Operation 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
04	22	2001	2001	- 005 -	00	06	19	2001	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	5
POWER LEVEL (10)	000

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

	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	TELEPHONE NUMBER (Include Area Code)
Kenneth W. Frehafer, Licensing Engineer	(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
X	JE	2	C649	YES		-	-	-	-	-

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

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

On April 22, 2001, St. Lucie Unit 1 was in the spring 2001 refueling outage (SL1-17) in Mode 5. FPL identified a safeguards test failure of the "A" train containment spray actuation signal (CSAS) re-sequence circuit due to a sticking CSAS actuation relay. St. Lucie Unit 1 experienced a similar CSAS re-sequence circuit safeguards test failure during the previous refueling outage (SL1-16). Although no definitive cause was determined during the SL1-16 outage, a sticking CSAS actuation relay would have accounted for the observed behavior during the SL1-16 safeguards testing. Therefore it is reasonable to assume that the CSAS actuation relay was inoperable during the last St. Lucie Unit 1 operating cycle.

This test failure was caused by a sticking relay. The subject relay was replaced, and forensic analysis will be performed to determine if any other corrective actions are necessary based on the results of the analysis.

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

Description of the Event

On April 22, 2001, St. Lucie Unit 1 was in the spring 2001 refueling outage (SL1-17) in Mode 5. FPL identified a safeguards test failure of the "A" train containment spray actuation signal (CSAS) re-sequence circuit. During performance of OP 1-0400050, "Periodic Test of the Engineered Safety Features," Section 8.4 (safety injection actuation signal (SIAS), containment isolation signal (CIS), and CSAS with loss of offsite power (LOOP)), the testing did not demonstrate that a required 0.5 second delay occurred on the 15-second and 18-second load blocks. Subsequent troubleshooting revealed that the CSAS actuation relay K-521A [EIIS:JE:2] failed to immediately change contact state on demand (i.e., failed to close) that accounted for the observed behavior during the safeguards testing. The relay was replaced and applicable post maintenance and safeguards testing were satisfactorily completed.

St. Lucie Unit 1 experienced a similar safeguards test failure of the "A" train CSAS re-sequence circuit during the previous refueling outage (SL1-16). The problem could not be duplicated when the issue was investigated. However, during troubleshooting, components were replaced and post-maintenance testing was performed. CSAS actuation relay K-521A was not replaced as part of these troubleshooting/repair efforts. Based on the latest troubleshooting FPL determined that the post maintenance test methodology used during the last outage would not have been able to detect whether or not CSAS actuation relay K-521A was the cause of the previous outage failed safeguards test. Although no definitive cause was determined last outage, in retrospect, a sticking CSAS actuation relay would have also accounted for the observed behavior during the SL1-16 safeguards testing.

Cause of the Event

This event was caused by a sticking CSAS actuation relay, K-521A. Industry and plant operating experience was reviewed and no failure trend was indicated for this relay model. Additional failure analysis will be performed to confirm the failure mode associated with the relay. The results of this analysis will be reviewed for generic applicability and to determine whether additional corrective actions are necessary.

Analysis of the Event

This event is reportable under 10 CFR 50.73(a)(2)(i)(B) as "Any operation or condition which was prohibited by Technical Specifications." There is no firm evidence that CSAS actuation relay K-521A was sticking during the last operating cycle. However, it is reasonable to assume that relay K-521A could have been the cause of the previous outage CSAS re-sequence circuit test failure because the post maintenance test was inadequate to reveal whether or not the relay was in a degraded condition. Therefore, the CSAS re-sequence circuit may have been inoperable during the last operating cycle and the allowed outage time for emergency safety feature actuation systems (ESFAS) would have been exceeded.

Analysis of Safety Significance

In the event of a coincident LOOP and SIAS, the emergency diesel generators (EDGs) supply power to those electrical loads which are needed to achieve safe shutdown of the plant or to mitigate the consequences of a loss of coolant accident (LOCA). The UFSAR lists the equipment and loads supplied by the EDGs for accident or safe shutdown LOOP scenarios. In order to preclude overloading the EDGs, the required loads are sequenced onto the EDG at specific times as determined by load sequencing

relays. With a simultaneous LOOP, SIAS, and CSAS, the containment spray (CS) pump is loaded onto the EDG in the 12-second EDG load block, the auxiliary feedwater (AFW) pump is loaded onto the EDG in the 15-second EDG load block, and other miscellaneous loads are loaded onto the EDG in the 18-second EDG load block. This scenario allows starting and running the loads without overloading the EDG. However, if the CSAS signal comes in after the SIAS signal, the CS pump could load anytime after the 12-second load block. This presents the possibility of loading both the containment spray and auxiliary feedwater in the 15-second load block. In order to prevent overloading the EDG, a CSAS re-sequence circuit is provided to reset the 15- and 18-second EDG load block timers to ensure that a CS pump can not be loaded simultaneously with either the loads in the 15- or 18-second EDG load blocks. For the "A" train CSAS re-sequence circuit, this reset function is initiated by the 0.5 second time delay relay, K-521A. For example, should the CSAS occur five seconds after EDG breaker closure, the timers for the 15- and 18-second load groups would reset to zero seconds, and the load blocks would load onto the EDG at 20.5 and 23.5 seconds, respectively, from EDG breaker closure (five seconds (i.e., the time the CSAS occurred after EDG breaker closure) + 0.5 seconds reset time + nominal timer delay (15- and 18-seconds)). This assures that on a delayed CSAS actuation, the AFW pump and CS pump would not be simultaneously loaded on the EDG. Similarly, the 18-second load group is also delayed so as not to start simultaneously with an AFW or CS pump.

During safeguards testing, simultaneous LOOP, SIAS, and CSAS are initiated. The starting times for the CS and AFW pumps and loads in the 18-second load block are used to verify the 0.5 second CSAS reset signal occurred. However, testing during the spring 2001 St. Lucie Unit 1 refueling outage, SL1-17, revealed that the 15- and 18-second load block timers were not being reset for the "A" train. Therefore, based on the above condition the 1A EDG would be susceptible to failure (i.e., too much load applied in one load block) if the CS pump started between 14 and 19 seconds coincident with the loads in either the 15- or 18-second EDG load blocks.

FPL determined that the transient capability of a Unit 1 EDG with simultaneous loading of a CS pump and AFW pump in the 15-second load block could result in EDG failure. Starting the combined loads exceeds the EDG combined starting capability based on the curve provided by the EDG vendor. This curve represents the EDG combined engines and generator load starting capability while maintaining the EDG output within the NRC Regulatory Guide 1.9 limits of 95% frequency and 75% voltage during the loading transient. Therefore, the simultaneous start of a CS pump and AFW pump would result in an EDG output voltage less that 75% of 4160V. Based on the capability and size of these motors, it is doubtful voltage would recover in time for the next load block to be started three seconds later. Therefore, for the described condition, the 1A EDG fails to meet NRC Regulatory Guide 1.9 criteria. However, as discussed below, this condition has a low likelihood of occurrence.

For the CS pump to start in the described load block, an event must occur that results in a CSAS signal being generated and a start of the CS pump within approximately a six second window discussed above. Potential events that could result in a CSAS are LOCAs, main steam line breaks, and main feedline breaks. Since the scenario of concern is related to EDG loading, there must also be a LOOP condition. The initiating event results in a CSAS, either simultaneous with a LOOP, or following the LOOP after normal non-SIAS loading has occurred. If a SIAS occurs while the EDGs are connected to their associated busses, the EDG output breaker will open and reclose and required loads will be re-sequenced on the EDGs.

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FPL performed a risk estimate based on the combination of equipment considered, the sequences, and the conditions necessary to start the CS pump during the subject load blocks. The change in risk assuming the 1A EDG is failed by the CS pump starting during the subject load blocks is less than 1.38 E-07. Since the LOOP frequency is 0.1/yr., the change in core damage frequency (CDF) would be less than 1.38 E-08/yr. The probability of an event of concern occurring which could potentially result in a CSAS during the 14 to 19 second window is also an order of magnitude or more lower than the independent failure probability of an EDG (on the order of 1E-02). Based on the risk assessment, the conservatively calculated change in risk is much less than 1E-6 and is not risk significant. Therefore, this event had no adverse impact on the health and safety of the public.

Corrective Actions

1. The faulty CSAS actuation relay K-521A was replaced and the retest was satisfactorily performed under work order (WO) 31009500.
2. Additional failure analysis will be performed to confirm the failure mode associated with the relay. The results of this analysis will be reviewed for generic applicability and to determine whether additional corrective actions are necessary.
3. This event has been forwarded to the engineering support personnel training review committee.

Additional Information

Failed Components Identified

Manufacturer: Couch Div.

Component: Relay

Model Number: Rotary Cat. No. 4CP36AF

Similar Events

None