

CATEGORY 1

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 9610010274 DOC. DATE: 96/09/26 NOTARIZED: NO
 FACIL: 50-335 St. Lucie Plant, Unit 1, Florida Power & Light Co.
 AUTH. NAME: BENKEN, E.J. AUTHOR AFFILIATION: Florida Power & Light Co.
 STALL, J.A. Florida Power & Light Co.
 RECIP. NAME: RECIPIENT AFFILIATION:

DOCKET # 05000335

SUBJECT: LER 96-012-00: on 960831, manual reactor trip caused by increased gas accumulation in 1B main transformer. Detailed insp of 1B main transformer cooling sys & affected oil cooler replaced, transformer 1B mods performed. W/960926 ltr.

DISTRIBUTION CODE: IE22T COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 7
 TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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L-96-237
10 CFR 50.73

SEP 26 1996

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

Re: St. Lucie Unit 1
Docket No. 50-335
Reportable Event: 96-012
Date of Event: August 31, 1996
Manual Reactor Trip due to Increasing Gas
Accumulation Indicated on the 1B Main Transformer

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

Very truly yours,

A handwritten signature in black ink, appearing to read 'J. A. Stall'.

J. A. Stall
Vice President
St. Lucie Plant

JAS/EJB

Attachment

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

Handwritten initials in black ink, possibly 'JEB' or similar, with a vertical line to the right.

9610010274 960926
PDR ADOCK 05000335
S PDR

LICENSEE EVENT REPORT (LER)

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

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-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.

FACILITY NAME (1) ST LUCIE UNIT 1	DOCKET NUMBER (2) 05000335	PAGE (3) 1 OF 6
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TITLE (4)
Manual Reactor Trip due to Increasing Gas Accumulation Indicated on the 1B Main Transformer

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
08	31	96	96	012	00	09	26	96	N/A	
									N/A	

OPERATING MODE (9) 1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
POWER LEVEL (10) 58		20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(ix)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)	X 50.73(a)(2)(iv)	OTHER
		20.2203(a)(2)(iii)	50.38(c)(1)	50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)	50.38(c)(2)	50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME Edwin J. Benken, Licensing Engineer	TELEPHONE NUMBER (include Area Code) (561) 467 - 7156
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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
X	EL	CLR	M175	N					

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 August 31, 1996, St. Lucie Unit 1 was operating in Mode 1 at 100 percent reactor power. At 1848, accumulated gas was detected in the 1B main transformer and a Unit shutdown was commenced as required by plant operating procedures. During the plant shutdown, gas accumulation in the 1B main transformer continued to increase, and the reactor and turbine were manually tripped at 2018 to preclude a potential failure of the main transformer. The reactor trip was uncomplicated and all systems functioned as designed.

The cause of the increased gas accumulation in the transformer was attributed to the intrusion of outside air into the transformer oil cooling system through a leak in an oil cooler. This was confirmed by oil analysis which was conducted following the Unit shutdown.

Corrective actions include: 1) A detailed inspection was performed of the 1B main transformer cooling system and the affected oil cooler was replaced. 2) A modification was performed on the 1B main transformer to reduce negative pressure areas within the cooling system susceptible to air in-leakage. 3) The main transformer was pressure tested to verify leak tightness and returned to service. 4) Metallurgical analysis is being performed to determine the leak failure mechanism. 5) Additional monitoring of transformer gas accumulation is being performed. 6) Additional transformers are being evaluated for generic applicability. 7) Substation guidelines for transformer assembly and pre-installation testing are being reviewed and revised as necessary.



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		YEAR 96	SEQUENTIAL -- 012	REVISION -- 00	

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

DESCRIPTION OF THE EVENT

On August 31, 1996, St. Lucie Unit 1 was operating in Mode 1 at 100 percent reactor power. At approximately 1848, annunciator C-37(EIIS:IB), "1B Main Transformer Local Panel" alarmed in the control room. A utility senior reactor operator and a non-licensed operator were sent to investigate the cause of the alarm.

At 1851, the operators reported that 1B main transformer (EIIS:EL) gas detector alarm light was illuminated. This alarm is designed to alert operating personnel to the presence of accumulated gas in the main transformer. The control room crew entered the "Main Transformer Off Normal Operating Procedure," (ONOP) 1-0910031, which instructs the operators to perform a Unit shutdown if the gas detector is in alarm.

At 1903, a plant shutdown was commenced in accordance with ONOP 1-0910031 and Normal Operating Procedure NOP 1-0030125, "Turbine Shutdown-Full Load to Zero Load." The goal of the shutdown was to remove the main transformer from service in order to prevent the possibility of damage within the transformer.

During the Unit shutdown, the local gas detector gauge at the 1B main transformer was being closely monitored for increasing gas accumulation. Additionally, FPL Transmission and Distribution (T&D) personnel were contacted to assist in assessing the condition of the transformer. At 2018, following reports that the gas accumulation was increasing in the 1B main transformer, the operating crew manually tripped the reactor and turbine, with reactor power at approximately 58 percent. Based on the increasing gas accumulation in the transformer, the decision to manually trip the Unit was made to ensure that equipment and personnel safety was maintained. Increasing gas accumulation in a main transformer may be indicative of significant degradation and possible transformer failure.

Following the manual reactor trip, the control room operating crew entered Emergency Operating Procedure (EOP) 01, "Standard Post Trip Actions." Main feedwater was used to maintain steam generator (SG) levels above the actuation set point for the auxiliary feedwater actuation system (AFAS) (EIIS:BA), and all safety related systems responded as designed during the event. Following the completion of standard post trip actions, the operators entered EOP-02, "Reactor Trip Recovery," and stabilized the plant in Mode 3. EOP-02 was then exited at 2045 with all safety functions being met.

An inspection of the 1B main transformer was performed following the plant trip to determine the cause of the increased gas accumulation in the transformer. On September 1, 1996, it was determined from oil sample analysis that the source of the gas detection alarm received on the 1B main transformer was from air intrusion into the transformer oil, with no other abnormal gas levels being detected. Leakage of outside air through the number three transformer cooler was subsequently determined to be the source of this increased gas accumulation. No internal damage or degradation of the 1B main transformer was found during follow up inspection.

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DESCRIPTION OF THE EVENT Continued

Additional Background

During the 1996 Unit 1 refueling outage, and prior to this event, the transformer coolers in positions three and four on the 1B main transformer were replaced. The replacement coolers installed were not new coolers, but were spare coolers obtained from another FPL plant. To facilitate this replacement, adjacent coolers had to be removed and subsequently reinstalled. Gaskets and o-rings were replaced where connections had to be reassembled during this evolution.

CAUSE OF THE EVENT

The manual reactor trip was initiated as a result of a decision by the control room operating crew to expeditiously remove the 1B main transformer from service due to increasing gas accumulation detected in the transformer. An increasing accumulation of gas can be indicative of potential transformer failure.

The increase in gas for the 1B main transformer was determined to be caused by outside air leakage into the main transformer forced oil cooling system. Analysis of the transformer oil confirmed that, with the exception of air, no other abnormal gas levels were present in the system. An extensive inspection of the 1B main transformer cooling system determined that the most probable source of air in-leakage into the cooling system was through a leak found in the number three oil cooler. Inspections confirmed that a leak, which was located in the number three oil cooler tube sheet, corresponded to an area in the cooling system where a negative pressure existed during normal system operation.

During the inspection and repair of the 1B main transformer, additional condition deficiencies were found which contributed to a delay in returning the transformer to service. Corrosion and pitting was found in the area of the flanged mating surfaces on the oil cooler top flanges. These flanges contain a spacer plate which mounts between a flapper valve flange and the oil cooler flange, and contains an o-ring seal. The spacer plates showed evidence of corrosion and scratching and the oil cooler flanges were found to have pitting in the o-ring sealing area. The flanges had to be resurfaced to ensure that the manufacturer's specifications were met prior to reassembly of the transformer coolers.

ANALYSIS OF THE EVENT

This event is reportable under 10 CFR 50.73 (a) (2) (iv), as "any event or condition that resulted in the manual or automatic actuation of any engineered safety feature (ESF) including the reactor protective system..." Utility licensed operators manually tripped the reactor and turbine in accordance with the "Main Transformer Off Normal Operating Procedure," 1-0910031.

St. Lucie Unit 1 has two main transformers connecting the main generator to the system grid. Each main transformer is equipped with a forced oil and air cooling system that consists of six finned cooling tube oil coolers connected to an upper and lower manifold (see figure 1). The system functions to remove heat from the main transformer windings during operation by circulating oil through the transformer and back to the oil coolers via six centrifugal pumps while fans force air through the cooler fins. The main transformers are not required for the safe shutdown of the plant.

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ANALYSIS OF THE EVENT Continued

The plant response during the reactor trip was observed to be normal and all safety related systems functioned as designed. This event is bounded by section 15.2.7 of the Unit 1 Updated Final Safety Analysis Report (UFSAR) which assumes a large reduction of power demand on the reactor due to a loss of electrical load or turbine stop valve closure. The plant response during this event is more conservative than that described in the UFSAR analysis for the following reasons: 1) The Unit was operating at reduced power at the time of the trip (approximately 58 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 1B main transformer was electrically isolated from the system to facilitate inspection and repair. St. Lucie Unit 1 was returned to service at a reduced power level using the 1A main transformer.
2. FPL performed pressure tests on the 1B main transformer and associated cooling system to determine potential sources of air in-leakage. The number three oil cooler, in which a leak was detected, and two additional oil coolers were replaced and the transformer cooling system was pressure tested to ensure leak tightness.
3. Metallurgical analysis will be performed on the area of the number three cooler where leakage was detected to determine the exact failure mechanism. Counter measures will be applied as necessary based on the results of the analysis.
4. FPL implemented a modification which raised the level of the oil conservator tanks on the 1B main transformer in order to increase the operating pressure within the system and reduce the potential for negative pressure areas during system operation.
5. Additional transformers will be evaluated at St. Lucie to determine the presence of negative pressure areas in the transformers' cooling systems and consider modifications to eliminate those areas.

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CORRECTIVE ACTIONS Continued

6. Following the completion of all inspection and repairs, the 1B main transformer was returned to service on September 15, 1996.
7. FPL will continue to monitor for gas accumulation in the 1B main transformer once each shift for a period of time sufficient to ensure that air in-leakage is no longer occurring.
8. FPL Substation instructions for transformer and cooling system assembly will be reviewed and revised as necessary to enhance the guidance related to the pre-installation testing of the transformer oil coolers. Seal maintenance, alignment and torquing instructions will be included in the review.

ADDITIONAL INFORMATION

Failed Component Identification

Manufacturer: McGraw Edison
 Model: Type 4 / Cooler (Transformer model - C-07046-5-1)
 Device: Main Transformer Cooler

Previous Similar Occurrences

None

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FIGURE 1
1B MAIN TRANSFORMER COOLING SYSTEM
(SIMPLIFIED)



