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ACCESSION NBR:9001020138 DOC.DATE: 89/12/22 NOTARIZED: NO DOCKET #
FACIL:50-302 Crystal River Nuclear Plant, Unit 3, Florida Power Co 05000302
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SUBJECT: LER 89-013-02:on 890409,inadequate design analysis leads to excessive demand on ES bus alternate power supply.

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Florida Power
CORPORATION

December 22, 1989
3F1289-19

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

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Licensee Event Report No. 89-013-02

Dear Sir:

Enclosed is a supplement to Licensee Event Report (LER) 89-013 which was previously submitted in accordance with 10 CFR 50.73.

Should there be any questions, please contact this office.

Very truly yours,

Rolf C. Widell
Director, Nuclear Operations Site Support

WLR:mag

Enclosure

xc: Regional Administrator, Region II
Senior Resident Inspector

IE22

NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
CRYSTAL RIVER UNIT 3	0 5 0 0 0 3 0 2	1 OF 0 4

TITLE (4) INADEQUATE DESIGN ANALYSIS LEADS TO EXCESSIVE DEMAND ON ES BUS ALTERNATE POWER SUPPLY AND DIESEL GENERATOR START

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 NAMES	DOCKET NUMBER(S)
									N/A	0 5 0 0 0
0 4	0 9	8 9	8 9	— 0 1 3	— 0 2	1 2	2 2	8 9	N/A	0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)					
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)		
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)		
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)		
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)			
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)			
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)			

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
L. W. Moffatt, Nuclear Safety Supervisor	9 0 4 — 7 9 5 - 6 4 8 6

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	

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 fifteen single-space typewritten lines) (16)

On April 9, 1989 Crystal River Unit 3 was in OPERATIONAL MODE 5 (COLD SHUTDOWN) for repair of Reactor Coolant Pumps. Maintenance was being performed on the Unit 3 Start-Up Transformer. The 4160V Engineered Safeguards (ES) Buses were being supplied through an underground connection by the Unit 1 and 2 (Coal Fired Plants) Start-Up Transformer. The voltage of the ES buses degraded to the setpoint for actuation of the Second Level Undervoltage Relays and these time delay relays actuated. When the time delay was satisfied and the voltage had not recovered, an Emergency Diesel Generator (EGDG) start signal was initiated. The voltage remained degraded long enough for the EGDG to come up to full speed. However, the voltage did not stay degraded long enough to require the diesel to pick up the ES Buses. The Operator verified automatic start of both EGDGs and recovery of the ES Bus voltage to the required value. The EGDGs were returned to standby status. Addition of the Second Level Undervoltage Relays to the ES Buses was done without a thorough engineering evaluation of the loads and capabilities of the transformer to supply the required loads at the required voltages. Administrative control of the loading of the transformer has been established. A modification to the electrical distribution system will install a separate transformer in the 230Kv yard to act as the primary alternate power supply for the E.S. Buses.

EVENT DESCRIPTION:

On April 9, 1989 Crystal River Unit 3 was in **OPERATIONAL MODE 5 (COLD SHUTDOWN)** for repair of Reactor Coolant Pumps [AB,P]. Maintenance was being performed on the Unit 3 Start-Up Transformer [EA,XFMR]. The 4160V Engineered Safeguards (ES) Buses [EB,BU] were being supplied through an underground connection by the Unit 1 (Coal Fired Plant) 4160V buses. At 2349 the voltage of the ES buses degraded to the setpoint for actuation of the Second Level Undervoltage Relay System [EB,2] (SLURS) and the time delay relays actuated. When the time delay was satisfied (5 sec) and the voltage had not recovered above SLURS reset point, an Emergency Diesel Generator [EK,DG] (EGDG) engine start signal was initiated. The voltage remained degraded for greater than 10 seconds which was long enough for both of the EGDGs to come up to full speed. However, the voltage did not stay degraded long enough, 18 seconds, to require stripping of the ES Buses in preparation for placing them on the EGDG. Appropriate Operator action was accomplished to verify automatic start of both EGDGs and to verify recovery of the ES Bus voltage to the required value. Both EGDGs were returned to standby condition.

CAUSE:

The cause of the automatic start of the EGDGs was a degraded voltage on the ES 4160v buses for a period of time sufficient for the Second Level Undervoltage Relays to initiate a diesel start signal. The degraded voltage resulted from an inability of the Unit 1 & 2 Start-Up Transformer, the primary alternate offsite power source, to supply all attached loads with the required voltage. The capability of the transformer to supply the loads with adequate voltage was not assured during design of the SLURS. With the transformer loaded to greater than 1.5 Million Volt Amps (MVA) on the X winding, it does not have sufficient capacity to handle the demands of large load starting and running while maintaining the voltage level required to avoid actuation of the SLURS.

EVENT ANALYSIS:

Crystal River Unit 3 uses power from the Unit 1 and 2 Start-Up Transformer (S/UX) as an alternate offsite source of power to the 4160v Engineered Safeguards Buses. Units 1 & 2 are adjacent to Unit 3 and the Unit 1 & 2 S/UX is supplied from the 230 Kv switchyard. The S/UX has two secondary windings referred to as "X" and "Y". The alternate offsite power source for Unit 3 4160v ES Buses is the "X" winding of the Unit 1 & 2 S/UX. The normal offsite power source to the ES Buses is the Unit 3 S/UX supplied directly from the 230kv switchyard. That power source was not available because maintenance was being performed on the Unit 3 S/UX. Unit 2 was on line at full power while Unit 1 was starting up. When the boiler feed pump at Unit 1, which is a 3500 Hp motor, was started, the Unit 1 and 2 S/UX was not able to supply all the required power without a significant voltage decrease. Voltage, as measured at

the Unit 3 4160v ES buses, decreased from 4200v to 3680v instantaneously. With the approximately 500v decrease, the protective circuits on the ES buses were actuated and a time delay relay was started. It should be noted that the safeguards control centers starters have been specified to hold in down to 65% of rated voltage for a period of two (2) seconds. None of the safeguards equipment was lost in this event.

When the Unit 3 Final Safety Analysis Report (FSAR) was prepared prior to receipt of a license, certain conditions were assumed which allowed us to specify that the Unit 1 & 2 S/UX was capable of supplying the necessary power (6.59 MVA) for Unit 3 ES loads. This assumption was stated in Chapter 8 "ELECTRICAL SYSTEMS" Section 8.2.3 "SOURCES OF AUXILIARY POWER" pages 8-17 through 8-27. This specification was based on the stated assumptions that Unit 2 was in steady state operation, Unit 1 was starting up, and Unit 3 was in an emergency condition with its ES loads already loaded on the Unit 1 & 2 Start-Up Transformer. The limits assumed in the analysis were that Unit 1 and 2 S/UX was to be carrying one fully loaded (6.65 MVA) bus, Bus 2B, from Unit 2 and one 70% loaded (3.54 MVA) bus (Bus 1B) from Unit 1.

In 1985 analyses were performed which showed that it was undesirable to allow voltage to drop to significantly less than 95% of nominal voltage at the ES 4160v Buses. For that reason, SLURs was installed on the Unit 3 4160v ES Buses. The SLURS are time delayed relays. The installation of SLURS put a lower limit of acceptability of 3780V on the ES Buses which had not been there before. While protecting the loads from attempting to function with a significant level of degraded voltage, the time delay relay's function is to allow some slight and temporary voltage fluctuations without immediately starting the EGDGs. Many unnecessary EGDG starts are avoided by allowing a few seconds time for the voltage to recover before initiating a start of an EGDG.

On the date of this event, the loads on the ES Buses totaled approximately 1670 Kw (1.8 MVA) which, because there was no emergency condition, is far below the FSAR assumed ES loads of 5930 Kw (6.59 MVA). Unit 2 was operating and Unit 1 was performing a start of a boiler feed pump motor (3500 Hp). This large load was being carried by the Unit 1 4160v Bus 1B. Four (4) buses, 1A, 1B, Start-Up Buses A, and B, instead of two as stipulated in the FSAR assumptions, were being carried on the Unit 1 & 2 S/UX. Bus 1B and Start-Up Bus B were connected to the "X" winding of the S/UX in parallel with Unit 3 ES Buses. The "Y" winding was carrying Bus 1A and Start-Up Bus A and any loads on these buses also contributed to the load on the transformer. This excessive demand on the transformer resulted in a significant voltage drop at the Unit 3 4160v ES buses even without full ES loads being on the Unit 3 ES Buses. Consequently, when Unit 3 was dependent on the power supply from Units 1 & 2 Start-Up Transformer, it was found to be inadequate.

Power to the ES buses was always available. There was no decrease in the margin of safety for the public caused by this event. None of the safety functions of plant equipment were compromised. All in-plant equipment functioned as designed and all plant procedures were adequate for the situation. All actions by the operators were proper and timely. If this event had occurred subsequent to an ES actuation there could have been some impact on the amount of time required to supply High Pressure Injection [BQ] (HPI) water to the reactor core. The delay of HPI would have been a maximum of a few seconds beyond the FSAR assumed delay of 25 seconds for water to reach the core following an HPI Engineered Safeguards actuation. A thermo-hydraulic reanalysis has shown that a delay of several minutes would not have any significant effect on the capability of HPI to properly ccol the core.

CORRECTIVE ACTION:

The Emergency Diesel Generators were returned to standby status after verifying the ES buses were being properly supplied. No corrective action is required for responding systems/components. Corrective actions include agreement between the Directors of the Nuclear and Fossil Units as to actions required when the Unit 1 & 2 Start-Up Transformer is loaded to greater than 1.5 MVA. This agreement has been issued to the operating shifts as a Memorandum of Understanding and provides the appropriate administrative controls to assure that this transformer is not relied upon as a Technical Specification offsite power supply when its configuration will not provide sufficient capacity. An annunciator alarm has been added to the Main Control Board to provide notification to the Nuclear Operator that the Unit 1 and 2 Start-up transformer is loaded to greater than 1.5 Mva. A modification is being processed to establish a new transformer located in the 230Kv yard to replace our use of the Unit 1 & 2 S/UX as the primary alternate power supply for Unit 3 Engineered Safeguards Buses.

PREVIOUS EVENTS:

An unplanned start of an EGDG has previously occurred seven times in the 12 year operating history of the plant. The last event was reported in LER 87-007. This event is the first time the diesel has started due to actual degraded voltage conditions. All other events were either start circuitry problems or total loss of voltage situations.