REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

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FACIL:50-250 Turkey Point Plant, Unit 3, Florida Power and Light C 05000250
50-251 Turkey Point Plant, Unit 4, Florida Power and Light C 05000251

AUTH.NAME	AUTHOR AFFILIATION
UHRIG,R.E.	Florida Power & Light Co.
RECIP.NAME	RECIPIENT AFFILIATION
VARGA,S.A.	Operating Reactors Branch 1

SUBJECT: Forwards voltage analysis of 120-volt ac sys in response to Question 5 of 811022 request,per 820224 commitment.Response to 820319 ltr re adequacy of electrical distribution sys encl.

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FLORIDA POWER & LIGHT COMPANY

May 20, 1982
L-82-211

Office of Nuclear Reactor Regulation
Attention: Mr. S.A. Varga, Chief
Operating Reactors Branch #1
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Varga:

Re: Turkey Point Units 3 & 4
Docket Nos. 50-250 and 50-251
Adequacy of Station Electrical Distribution System Voltages

In our letter (L-82-65) dated February 24, 1982, we stated that we would provide a voltage analysis of the 120 volt AC system in order to respond to Question 5 of your October 22, 1981 request. That analysis is attached as Enclosure 1.

Enclosure 2, to this leter, is our response to your letter dated March 19, 1982 concerning the adequacy of station electrical distribution system voltages.

Very truly yours,

Jack E. Vessely for

Robert E. Uhrig
Vice President
Advanced Systems & Technology

REU/JEM/mbd

cc: J.P. O'Reilly, Region II
Harold F. Reis, Esquire

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Re: Turkey Point Units 3 & 4
Docket Nos. 50-250, 50-251
Adequacy of Station Electrical
Distribution System Voltages

In response to NRC letter dated October 22, 1981

RE: Request for additional information (Round 3) Turkey Point-Units 3 & 4 (TAC Nos. 12964 & 12965) Adequacy of Station Electric Distribution System Voltages.

Ref. 1: FPL letter (R. Uhrig) to NRC (S. Varga), dated February 24, 1982 (L-82-65)

Ref. 2: Florida Power & Light letter (R. Uhrig) to NRC (S. Varga), dated December 18, 1980. (L-80-411)

As stated in our letter L-82-65 dated February 24, 1982 (Ref. 1), in answer to the subject NRC letter to R. Uhrig dated October 22, 1981, a portion of the response to question 5 was deferred to allow for an extended voltage analysis. Contained herein is the requested voltage analysis of the plant's 120VAC system.

Our letter L-82-65 (Ref. 1) provided the manufacturer's guaranteed pick-up voltage for the motor starters. Tests were conducted on the motor starters and control power transformers to determine the actual pick-up voltages. Considering the cable and control transformer voltage drops, calculation were then performed to obtain the minimum bus voltages required. These voltages are provided in Attachment A. Note that no size 3 starters are used in safety related applications. The minimum required bus voltages are all less than the transient voltages experienced on start of all safety motors provided in attachment C of our letter L-80-411 dated December 18, 1980 (Ref. 2).

Voltage Analysis Results

Minimum Bus Voltages Required to Pick-Up Starters

BUS VOLTAGES	UNIT 3	UNIT 4
480V MCC A	332*	386
480V MCC B	381	381
480V MCC C	394	332*
480 MCC D	392	+

+ Not on Unit 4

* These MCC's utilize only size 1 starters, all other MCC's utilize size 1, 2 and 4 starters.

Re: Turkey Point Units 3 & 4
Docket Nos. 50-250, 50-251
Adequacy of Station Electrical
Distribution System Voltages

In response to NRC letter to Florida Power & Light dated March 19, 1982.

RE: Request for Additional Information (Round 4) Turkey Point Units 3 & 4 Adequacy of Station Electric Distribution System Voltages.

Ref. 1: Florida Power & Light letter (R. Uhrig) to NRC (S. Varga), dated December 18, 1980.

2: NRC letter to Florida Power & Light dated August 8, 1979.

Question 1: The analysis results and documentation submitted in Reference 1 and 2 demonstrate that the Class IE motors will successfully start within the minimum starting voltage and that the +10% design voltage rating is not exceeded. However, the results do not verify that the steady state voltage at the terminals of the Class IE equipment is within the -10% design voltage rating. Therefore, submit the "worst case" steady state load terminal voltage at all Class IE voltage distribution levels.

Answer: Attachment A provides the worst case steady state voltages with all safety loads running and after start of the largest non-Class IE motor, assuming the minimum grid voltage of 235KV. The steady state voltages were analyzed for worst cases 2 and 9 presented in our letter L-80-411 dated December 18, 1980 (Ref. 1). Since no voltage is less than minus 10% of 4000 volts (3600 volts) or less than minus 10% of 460 volts (414 volts), proper voltages levels are assured.

Question 2: What is the duration of the starting transient when starting the steam generator feedwater pump (Cases 2 and 13 of Ref. 1)?

Discussion - This duration time with respect to the transient voltage is needed to verify that there will be no spurious actuation of the undervoltage relays during the load starting.

Answer: The starting transient is approximately 7 seconds in duration.

Question 3: Submit details of the test verification performed (i.e, plant operating mode, bus loading percentages, distribution level voltages, etc.) and verify that the "less than 3%" correlation difference (Ref. 1) is applicable to both steady state and transient conditions.

Answer: The plant was operating with both units at full power during the test. Bus voltages and loadings at the time of the test are provided in Attachment B. A mathematical model was developed from transformer nameplate data and cable impedance calculations. A voltage analysis using the measured loads was then performed to calculate the bus voltages based on the model. The results of this analysis and the percent error are provided in Attachment C. The measured values correlated closely with the results of the analysis using the mathematical model, therefore the model is considered accurate. Since the impedence (resistance and reactance) of the system is constant the model can be used to analyze voltage drops due to steady state running loads as well as instantaneous voltage drops due to starting transients.

Question 4: The scope of the voltage analyses to be submitted as outlined in Ref. 4 applies to all available offsite source connections to the onsite distribution system. For the available source connections as defined in Ref. 3, an analysis was submitted only for the units' dedicated startup transformer connection. Since backfeeding through the main transformer and unit auxiliary transformer and the use of the adjacent unit's startup transformer are viable source connections for each unit, a worst case voltage analysis (under-voltage and overvoltage) is required.

Discussion - If documentation can be provided to verify that due to transformer impedances, bus loading conditions and configurations, etc., (following the guidelines in Ref. 4) that the voltage drops experienced (both steady state and transient) do not exceed those already submitted, then the analysis results of these viable source connections need not be submitted. However, documentation should be provided to verify that these source connections were analyzed and that each have the capacity and capability to supply adequate voltage to the Class IE equipment within the design voltage ratings under worst case conditions.

Answer: In accordance with Reference 1, Guideline 3, the voltage analyses were performed assuming all automatic actions occur as designed. The plant's distribution systems are normally powered via the unit auxiliary transformers when the unit is at power. A safety injection signal initiates an automatic fast transfer to the unit's start-up transformer, which then powers all safety related equipment. If the unit were being powered via the main and auxiliary transformer (by removal of the isolated phase bus links to the main generator) and a safety injection signal were to occur, the fast transfer to the start-up transformer would occur, as above. If the unit were being started up or shut down, it would already be connected to it's start-up transformer. In any event, if the start-up transformer were not availble, or its breakers failed to close, the emergency diesel generators would automatically start and sequence safety related loads onto the buses.

The only other possible connection to offsite power is via the adjacent unit's start-up transformer. Only the "A" buses of each unit can be connected in this manner. Such connection requires careful, deliberate, manual action, which would include reduction of load on the buses, and would only be done with the unit shutdown. If a safety injection occured when so connected, the "A" bus safety related equipment would be automatically started from power supplied by the adjacent unit's start-up transformer. However, the small additional impedence from the longer cable run (the transformers are essentially identical) is more than offset by the much reduced loading due to the unit being shutdown. In accordance with the Guidelines of Reference 1, the worst case was analyzed and submitted in our letter of December 18, 1980 (L-80-411, Ref. 1).

VOLTAGE ANALYSIS RESULTS - UNIT #3

Worst Case Steady State Assuming All Safety Loads Running and After Start of Largest Non-Class IE Motor

	Bus Voltages Case 2	Grid at 235KV Case 9
4KV Bus A*	3991	4051
4KV Bus A**	3946	4013
4KV Bus B*	4024	3964
4KV Bus B**	3996	3928
480V LCA	449	456
480V LCB	453	446
480V LCC	449	456
480V LCD	450	441
480V MCC A	447	454
480V MCC B	447	439
480V MCC C	445	452
480V MCC D	436	427

* High - side of current limiting reactor

** Low - side of current limiting reactor

VOLTAGE ANALYSIS RESULTS - UNIT #4

Worst Case Steady State Assuming All

Safety Loads Running and After Start of

Largest Non-Class IE Motor

	Bus Voltages	Grid at 235KV
	Case 2	Case 9
4KV Bus A*	3987	4050
4KV Bus A**	3942	4012
4KV Bus B*	4032	3970
4KV Bus B**	4007	3936
480V LCA	447	455
480V LCB	454	446
480V LCC	450	457
480V LCD	461	451
480V MCC A	444	452
480V MCC B	451	443
480V MCC C	447	455
480V MCC D	+	+

* High - side of current limiting reactor

** Low - side of current limiting reactor

+ Not on Unit #4

Measured Bus Voltages and Loads - Unit #3

	Bus Voltage	Bus KVA
4KV Bus A*	4204	9655
4KV Bus A**	+ +	8484
4KV Bus B*	4207	14122
4KV Bus B**	+ +	4448
480V LCA	467	447
480V LCB	476	270
480V LCC	474	332
480V LCD	470	455
480V MCC A	461	415
480V MCC B	472	209
480V MCC C	472	131
480V MCC D	460	462

* High - side of current limiting reactor

** Low- side of current limiting reactor

++ Bus voltage values not available

Measured Bus Voltages and Loads Unit #4

	Bus Voltage	Bus KVA
4KV Bus A*	4239	9655
4KV Bus A**	+ +	6459
4KV Bus B*	4179	14122
4KV Bus B**	+ +	6133
480V LCA	474	346
480V LCB	478	148
480V LCC	478	132
480V LCD	+ +	427
480V MCC A	469	414
480V MCC B	476	161
480V MCC C	474	248
480V MCC D	+	+

* High - side of current limiting reactor

** Low - side of current limiting reactor

+ Not on Unit #4

++ Bus voltage values not available

CALCULATED BUS VOLTAGES - UNIT #3

	Calculated Bus Voltage	Percent Error From Measured Voltages
4KV Bus A*	4149	-1.3%
4KV Bus A**	4104	+ +
4KV Bus B*	4142	-1.5%
4KV Bus B**	4115	+ +
480V LCA	462	-1.1%
480V LCB	468	-1.7%
480V LCC	467	-1.5%
480V LCD	457	-2.7%
480V MCC A	460	-0.3%
480V MCC B	464	-1.8%
480V MCC C	465	-1.4%
480V MCC D	446	-3.0%

* High - side of current limiting reactor

** Low - side of current limiting reactor

++ Bus measured values not available

CALCULATED BUS VOLTAGES - UNIT #4

	Calculated Bus Voltage	Percent Error From Measured Voltages
4KV Bus A*	4164	-1.8%
4KV Bus A**	4129	+ +
4KV Bus B*	4133	-1.1%
4KV Bus B**	4102	+ +
480V LCA	466	-1.7%
480V LCB	469	-2.0%
480V LCC	471	-1.6%
480V LCD	464	+ +
480V MCC A	463	-1.3%
480V MCC B	467	-1.8%
480V MCC C	469	-1.2%
480V MCC D	+	+

* High side of current limiting reactor

** Low side of current limiting reactor

+ Not on Unit #4

++ Bus measured values not available

[illegible]