REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

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FACIL:50-335 St. Lucie Plant, Unit 1, Florida Power & Light Co. 05000335
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UHRIG,R.E. Florida Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
EISENHUT,D.G. Division of Licensing

SUBJECT: Forwards response to NRC 810413 request for addl info re adequacy of station electric distribution sys voltages.List of correspondence & telcons encl.

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FLORIDA POWER & LIGHT COMPANY

July 23, 1981
L-81-308

Office of Nuclear Reactor Regulation
Attention: Mr. Darrell G. Eisenhut, Director
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Eisenhut:

RE: St. Lucie Unit 1
Docket No. 50-335
Adequacy of Station Electric
Distribution System Voltages

The subject of the adequacy of station electric distribution system voltage has been discussed in numerous letters and telephone conversations between FPL and your staff. Enclosure B is a response to the questions that were identified during the exchanges. A listing of the letters and phone conversations is attached as Enclosure A for your convenience and used for reference.

Very truly yours,

Robert E. Uhrig
Vice President
Advanced Systems & Technology

REU/JEM/ras

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

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ENCLOSURE A

RECORD OF CORRESPONDENCE & TELEPHONE CONVERSATIONS REGARDING

ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES

Reference 1: Florida Power & Light (R. E. Uhrig) letter L-81-44 to NRC (D. G. Eisenhut), dated February 10 1981.

2. NRC letter to Florida Power & Light (R.E. Uhrig), dated April 13, 1981.

3. NRC (C. Nelson) conference telephone conversation with FP&L (D. Evans, et al.), April 28, 1981.

4. FPL (R. E. Uhrig) letter L-79 - 324 to the NRC (W. Gammill) dated
November 9, 1979.

5. NRC (C. Nelson) conference telephone conversation with FP&L (D. Evans, et al.) April 29, 1981.

6. FP&L (R.E. Uhrig) letter L-80 - 304 to the NRC (D. Eisenhut), dated September 12, 1980.

Listed below are the clarifications (Reference 3, 4) and response to NRC letter request for additional information, Ref. 2.

Question 1: Transient analysis demonstrating that the Class 1E motors are starting within their design voltage ratings (case 2, Ref. 3).

Discussion: References 2, 3, or 4 did not provide the analytical results for the terminal voltage at the Class 1E motors during starting conditions. Submit the terminal voltage for the Class 1E motors during load starting (case 2) to verify that the motors are starting within the design voltage ratings. Also submit the minimum starting voltage rating for the 4KV Class 1E motors (Ref. 2, page 1). The analytical results must include Class 1E equipment, instrumentation and control circuits at the 120VAC level.

Response to Question 1:

Per our telephone conversation, Ref. 3, it was clarified that the analytical results submitted in the tables, (case 2, Ref. 1), are the terminal voltages for the class 1E motors during load starting (case 2), i.e. transient analysis. This transient analysis demonstrates that the Class 1E motors are starting within their capability. Instead, the new request (Ref. 3) is for the steady-state terminal voltage conditions for the worst-case Class 1E motors (case 2, Ref. 1) and 120VAC worst-case MCC control circuit voltages for the same motors during transients and steady state conditions.

Table A provides the steady-state bus and terminal voltages for the worst-case Class 1E motors (Ref. 2, case 2) as requested. Table B provides the MCC Class 1E, 120VAC control circuit level voltages for the same worst-case Class 1E motors during transients (table A, Ref. 1) and steady state conditions.

The analytical results in table A demonstrate that the steady-state voltage analysis for the worst-case Class 1E motors are within their design operating voltage ratings, Ref. 4. Table B shows that the calculated voltages are acceptable for the Class 1E MCC 120VAC control circuits operation.

Review of other Class 1E 120VAC instruments, equipment and control circuits, confirm that they are supplied from D.C. busses or inverters, as previously stated (Ref. 6), and therefore are not affected by the AC voltages.

Question 1 also requested the minimum starting voltage rating for the 4KV Class 1E motors, Ref. 1. These motors are capable of accelerating their load with 75% of rated voltage (3600 volts) at their terminals.

Question 2: Analytical results verifying that the Class 1E low voltage (120 volts) AC equipment and control circuits are operating within their design voltage ratings during steady state.

Discussion: Ref. 3, page 2 states that Class 1E instruments are fed from inverters but does not address euqipment or control circuits. Submit the analytical results for steady state operation for the cases analyzed. Also submit the upper design voltage rating for Class 1E 120VAC equipment, instrumentation and control circuits.

Response to Question 2:

Table B provides the MCC 120VAC control circuit voltage levels for transients and steady-state operation for the worst-case Class 1E motors analyzed. The 120VAC control circuits for the worst-case Class 1E motors analyzed are powered from 480/120 volt transformers. These transformers are over-sized; 150VA is used for size 1 and 2 starters and 500VA for size 3 and 4. The highest pick up voltage required on any size MCC contactor is 95.2 volts. The highest drop out voltage is 74.8 volts, Ref. 4. As can be seen from table B, the 120VAC Class 1E low voltage levels for the case analyzed are above the pickup and drop out voltages.

Question 3: Transient analysis on the effect of starting a large non-Class 1E load after the Class 1E buses are fully loaded.

Discussion: Ref. 4 states that an analysis of the plant's condition would be made before a condensate pump would be manually shed and restarted. Are there existing written plant procedures which would prohibit the starting of a large non-class 1E motor if it were spurious tripped off line or manually shed? Actuation of the second-level protection scheme is stated to occur if the worst case conditions are assumed (case 2 plus starting of non-Class 1E load). What would the analytical results be if the starting of the large non-Class 1E load were to occur approximately 10 minutes after the accident condition following load reduction of auxiliary loads which are not required? The results should address relay and motor contactor dropout.

Response to Question 3:

As previously stated in response to question 6, Ref. 1, if the highly unlikely sequence of events occurred and the largest 4KV non-class 1E load (condensate pumps) required restarting, the operator would have to analyze the plants conditions prior to restarting the pumps. Based on the options given in Ref. 5, our procedures will be modified to ensure an assessment of plant conditions will be made prior to starting the condensate pumps. This will minimize the possibility of a transfer of load (during accident conditions with a degraded grid voltage) to the emergency power source as a result of the pump's starting current.

Question 4: Request review of the electrical distribution system for compliance with GDC 17.

Discussion: In Ref. 3, page 2, FPL states the requested review for compliance with GDC 17 is provided in Chapter 8 of the FSAR (Sections 8.1.2.1 and 8.2.2). The requested review should address such items as potential source overloading caused by load transfers, system modifications or additions (i.e. protective relaying logic, setpoints, etc.) or system design changes made or proposed to ensure adequate system distribution voltages.

Response to Question 4:

Based on the telephone conversation, Ref. 3, question 4 was redefined. Instead, the request is to compare and review the St. Lucie Unit #1 distribution system with Arkansas Nuclear One (ANO) station electric distribution system. In the circumstances experienced at ANO, the failure of one of the two offsite electric power circuits resulted in failure of the other electric power circuit. GDC-17 requires, in part, that (1) electric power from the transmission network to the onsite distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and environmental conditions and (2) provision shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear unit, or the loss of power from the transmission network.

The following describes the St. Lucie Unit 1 station electric distribution system.

At St. Lucie Unit 1 there are two start-up transformers (1A & 1B). Each start-up transformer is sized to accomodate the auxiliary loads of the unit under any operating or accident condition (response to Question 1, Ref. 1). They are supplied from two physically independent, overhead lines from the switchyard. Each line has been sized to be capable of carrying the auxiliary loads of the unit under any operating or accident condition. All lines and support towers have been designed for hurricane winds. Spacing between towers is such that failure or collapse of one structure can not affect any other line of structure. The switchyard is fed from three independent 240KV circuits from the grid system. These circuits have been designed to the same criteria stated above. Furthermore, since each circuit is sized for 1000MVA (100 times station auxiliary load), any two circuits may be interrupted and the remaining circuit will be capable of carrying the full station output.

In addition to the above each start-up transformer is connected through motor operated disconnect switches to a separate main bus. These provisions permit the following:

Any circuit can be switched under normal conditions without affecting another circuit.

Any single circuit breaker can be isolated for maintenance without interrupting the power or protection to any circuit.

Short circuits in a single main bus will be isolated without interrupting service to any circuit, other than to the start-up transformer connected to the faulted bus.

Short circuit failure of a single bay breaker will not result in the permanent loss of any transmission line of any start up transformer.

Based on the above configuration of the St. Lucie Unit 1 station electric distrubution system, the circumstances that occurred at ANO can not be possible at St. Lucie. In summary, no single back-up, start-up transformer is shared in the unit. Failure of any single component (start-up transformer, switchyard lines/structure, 240KV lines/structure, etc.) will not inhibit the capability to safely shutdown the unit during any operating or accident condition. Since sufficient redundancy exists in the system to ensure the above, the requirements in GDC 17 are met.

Question 5: Requested test verification on the validity of the analytical results submitted.

Discussion: Ref. 3, page 2, states that the analytical results were within 2% of actual plant configuration data obtained by standard plant tests. Further clarify the plant tests described in Ref. 4 as to the exact methods and procedures used to obtain the test data. It is not clearly understood from the submittal which readings are being averaged (is more than one test made?), the basis for the averaging, or actual plant operating and bus loading conditions. The test verification method should include verification for both steady state and transient conditions. With the Class 1E buses at least 30% loaded for a given operating condition, the actual measured bus and load terminal voltages should be compared to the analytical results to produce a deviation error percentage. The error percentage should reflect at each system level whether the deviation is a plus or minus value. Submit both actual measured and analytical voltages with deviations for the plant operating condition under test.

Response to Question 5:

Based on the telephone conversation, Ref. 3, Question 5 was redefined; the only information requested was further clarification on the method utilized to obtain the final averaged reading submitted in Table B, Ref. 1.

As previously stated, Ref. 1, the data was obtained using standard plant test methodology. This included the use of volt. meters to measure the secondary voltages of the potential transformer for the 4.16KV swgr. and 480V load centers. The bus amperes and the 480V MCC voltages were read from the cabinet's panel board meters. It must be made clear here, that the measured secondary voltages for the 4.16KV swgr, and 480V load centers, as well as the 480V MCC voltages, read from panel board meters represented per phase voltage readings. These readings were then averaged and their respective transformer ratios were used to calculate the actual voltage and current on the bus. These actual bus voltages and currents were then compared with the analytical data calculated, taking into consideration the plant status condition during the measured readings. As stated in Reference 6, analytical results were within 2% of actual results, using the same methods and assumptions, and actual plant status.

TABLE A

STEADY STATE BUS AND TERMINAL VOLTAGES

	Voltages	
	Bus	Terminal
4.16 KV swgr. 1A-3 Aux. FW Pump 1A	3982.68	3976.47
4.16 KV swgr. 1B-3 Aux. FW Pump 1B	3982.68	3978.13
480 V swgr. 1A-2 Charge pump 1A	452.24	432.13
480 V swgr. 1B-2 Charge pump 1B	452.24	434.98
480 V MCC 1A-5 FW Pump 1A dish vlv. MC-09-1	441.21	427.33
480 V MCC 1B-5 REA Purge Fan HVE-8B	441.32	429.92
480 V MCC 1A-6 Shield Bldg. Exh. Fan HVE-6A	440.66	435.04
480 V MCC 1B-6 FW pump 1A/1B dish to S/G 1A MV-09-7/8	440.66	436.1
480 V MCC 1A-7 Fuel tranfer pump 1A	440.47	437.31
480 V MCC 1B-7 Fuel tranfer pump 1B	440.47	437.31

TABLE B

120VAC MCC CONTROL TRANSFORMER
SECONDARY VOLTAGE

	Transient Volt (Case 2, Ref.1)	Steady-State Volt (Table A)
<u>480V MCC 1A-5</u> FV pump 1A dish vlv. MC-09-1	97.38	106
<u>480V MCC 1B-5</u> REA Purge Fan HVE-8B	98.28	106.83
<u>480V MCC 1A-6</u> Shield Bldg. Exh. Fan HVE-64	98.14	106.71
<u>480V MCC 1B-6</u> FU Pump 1A/1B dish to S/G 1A MV-09-7/8	98.14	106.71
<u>480V MCC 1A-7</u> Fuel tranfer pump 1A	97.37	105.88
<u>480V MCC 1B-7</u> Fuel tranfer pump 1B	97.37	105.88