Florida Power Corporation

January 6, 1977

Mr. John Stolz
Branch Chief
Light Water Reactors Branch I
Division of Project Management
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Florida Power Corporation
Crystal River Unit #3
Docket No. 50-302

Dear Mr. Stolz:

On October 4, 1976, we received your October 1, 1976 Request for Additional Information concerning equipment failures during a degraded grid voltage condition.

Specifically, you requested Florida Power Corporation to evaluate the design of the CR#3 Class IE electrical distribution system to determine if the operability of safety related equipment, including associated control circuitry or instrumentation, can be adversely affected by short term or long term degradation in the grid system voltage.

Attached are forty (40) copies of our response to the questions contained in Enclosure No. 2 of your October 1, 1976 letter. Our response is in question and answer format to facilitate your review.

If further discussion of this matter is required, please do not hesitate to contact this office.

Very truly yours,

J. T. Rodgers
Asst. Vice President

JTR/iw
Attachments.

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IN WITNESS WHEREOF, the applicant has caused its name to be hereunto signed by J.T. Rodgers, Assistant Vice President, and its corporate seal to be hereunto affixed by Betty M. Clayton, Assistant Secretary, thereunto duly authorized the 6th day of January, 1977.

FLORIDA POWER CORPORATION

By J T Rodgers
J.T. Rodgers
Assistant Vice President

ATTEST

Betty M Clayton
Betty M. Clayton
Assistant Secretary

(CORPORATE SEAL)

Sworn to and subscribed before me this 6th day of January, 1977.

Deborah A. Moylemen
Notary Public

My Commission Expires:

Notary Public State of Florida at Large
My Comission Expires July 9, 1978

QUESTION 1.a:

Describe the plant conditions under which the plant auxiliary systems (safety related and non-safety related) will be supplied by offsite power. Include an estimate of the fraction of normal plant operating time in which this is the case.

RESPONSE:

The unit is provided with one full size Auxiliary Transformer and one full size Start-up Transformer. The Auxiliary Transformer is connected to the Generator and will serve as the normal source of power to the non-safety related buses. The start-up transformer is connected to the 230 KV substation and serves as the normal source for the safety related buses as well as providing a source of power for start-up, shut down and after shutdown requirements. Each of the transformers has two isolated secondary windings, one at 6900 volts and one at 4160 volts. Each transformer is capable of supplying the normal full load requirements of the unit. Transfer capability is provided so that upon loss of the unit voltage, the non-safety related buses will automatically be transferred to the Start-up Transformer.

Based on the above, the percentage of time the buses are supplied from offsite power during normal operation is as follows:

Safety Related Buses	100%
Non-Safety Related Buses	0%

QUESTION 1.b:

The voltage used to describe the grid distribution system is usually a "nominal" value. Define the normal operating range of your grid system voltage and the corresponding voltage values at the safety related buses.

RESPONSE:

Normal operating range of 230 KV grid system is 238 KV to 242 KV. Nominal value is 240 KV. The corresponding voltage values at the safety related buses are as follows:

GRID VOLTAGE	4160V BUS	480V BUS
238 KV	4200 V	485 V
240 KV	4235 V	489 V
242 KV	4270 V	493 V

QUESTION 1.c:

The transformers utilized in power systems for providing the required voltage at the various system distribution levels are normally provided with taps to allow voltage adjustment. Provide the results of an analysis of your design to determine if the voltage profiles at the safety related buses are satisfactory for the full load and no load conditions on the system and the range of grid voltage.

RESPONSE:

The voltage values at the safety related buses for no load and full load conditions and the range of grid voltage are as follows:

	No Load		Full Load	
GRID VOLTAGE	4160 V BUS	480 V BUS	4160 V BUS	480 V BUS
238 KV	4200 V	485 V	3961 V	451 V
240 KV	4235 V	489 V	3994 V	454 V
242 KV	4270 V	493 V	4027 V	458 V

These voltage values are satisfactory for the full load and no load conditions on the system and the range of grid voltage.

QUESTION 1.d:

Assuming the facility auxiliary loads are being carried by the station generator, provide the voltage profiles at the safety buses for grid voltage at the normal maximum value, the normal minimum value, and at the degraded conditions (high or low voltage, current, etc.) which would require generator trip.

RESPONSE:

The normal operating range of the Unit 3 Generator is 22 KV ± 5%, or 20.9 KV to 23.1 KV. The voltage values

at the safety related buses for no load and full load conditions and at the normal operating limits of the generator are as follows:

GEN. VOLTAGE	No Load 4160 V BUS	No Load 480 V BUS	Full Load 4160 V BUS	Full Load 480 V BUS
20.9 KV	4053 V	468 V	3867 V	439 V
22 KV	4267 V	492 V	4071 V	462 V
23.1 KV	4480 V	517 V	4274 V	485 V

The Unit 3 Generator is designed to trip only during an underfrequency trip condition at 58.0 HZ. The underfrequency device is set to trip the unit in 12 seconds at 58.0 HZ. The voltage output is never expected to vary outside the normal operating range of the generator. During an underfrequency condition, the generated voltage may be reduced. To maintain rated KVA at the less-than-rated frequency, a comparable increase in excitation to the generator field windings is required. This is accomplished automatically with the voltate regulation system of the generator.

QUESTION 1.e:

Identify the sensor location and provide the trip setpoint for your facility's Loss of Offsite Power (undervoltage trip) instrumentation. Include the basis for your trip setpoint selection.

RESPONSE:

Each 4160 V and 480 V safety related bus has undervoltage relays. These relays are located in the respective switchgear panels. The 4160 V setpoint is 2375.1 V, or 56.5%. The 480 V setpoint is 271.4 V or 56.5%. The 480 V starters and contactors are capable of withstanding a momentary voltage drop of 55% of rated voltage for a period of 2 seconds without dropping out. This is the basis for an undervoltage trip setpoint of 56.5%.

QUESTION 1.f:

Assuming operation on offsite power and degradation of the grid system voltage, provide the voltage values at the safety related buses corresponding to the maximum value of grid voltage and the degraded grid voltage corresponding to the undervoltage trip setpoint.

RESPONSE:

Maximum value of grid voltage is 242 KV. At this value the voltages at the 4160 V and 480 V buses are respectively 4270 V and 493 V.

The grid voltage corresponding to undervoltage trip on 4160 V bus at 2375.1 V is 142,736 V.

QUESTION 1.g:

Utilizing the safety related bus voltage values identified in (f), evaluate the capability of all safety related loads, including related control circuitry and instrumentation, to perform their safety functions. Include a definition of the voltage range over which the safety related components, and non-safety components, can operate continuously in the performance of their design function.

RESPONSE:

All magnetic devices (contactors and starters) associated with the 480 V safety related buses are designed to operate at 55% of rated voltage for 2 seconds. All safety related and non-safety related components are designed to operate continuously at ± 10% of their rated voltage.

QUESTION 1.h:

Describe the bus voltage monitoring and abnormal voltage alarms available in the control room.

RESPONSE:

Voltmeters are provided in the control room for each of the unit auxiliary buses (safety and non-safety related). Also potential transformer trouble alarms (indicating, for safety related buses, that one out of three undervoltage relays has operated or, for non-safety related buses, that one out of two undervoltage relays has operated) and undervoltage alarms on each of the buses are available in the control room.

QUESTION 2:

The functional safety requirement of the undervoltage trip is to detect the loss of offsite (preferred) power system voltage and initiate the necessary actions required to transfer safety related buses to the onsite power system. Describe the load shedding feature of your design (required prior to transferring to the onsite [diesel generator] systems) and the capability of the onsite systems to perform their function if the load shedding feature is maintained after the diesel generators are connected to their respective safety buses. Describe the bases (if any) for retention or reinstatement of the load shedding function after the diesel generators are connected to their respective buses.

RESPONSE:

Loss of the preferred AC power source will result in undervoltage relay action on the 4160 volt Engineered Safeguards Buses 3A and 3B. Each bus is equippedwith undervoltage relays to provide this action. The operation of these relays will result in tripping all loads connected to the buses except for the Engineered Safeguards Block 1 loads. The operation of these relays will also isolate the two safety related channels entirely from each other.

The load shedding feature is not maintained after the Diesel Generators are connected to their respective buses, therefore, this part of the question is not applicable to Crystal River Unit 3.

QUESTION 3:

Define the facility operating limits (real and reactive power, voltage, frequency and other) established by the grid stability analyses cited in the FSAR. Describe the operating procedures or other provisions presently in effect for assuring that your facility is being operated within these limits.

RESPONSE:

Generator Specifications

989,400 KVA
22 KV
25,965 A
0.9 P.F.
3 Phase
60 HZ
1800 RPM

Operating Limits

Maximum Real Power - 890.46 MW
Maximum Reactive Power - 431.27 MVAR
Voltage Limits - 22 KV ± 5%
Frequency Limit - 58 HZ

The facility will be operated within the above limits as per Crystal River Unit 3 Operating Procedure OP-204 for Power Operation.

QUESTION 4:

Provide a description of any proposed actions or modifications to your facility based on the results of the analyses performed in response to items 1-3 above.

RESPONSE:

There are no actions or modifications necessary on Crystal River Unit 3 based on the above results 1-3.