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P. A. Morris, Director, Division of Reactor Licensing

FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3 NUCLEAR GENERATING PLANT, DOCKET NO. 50-302

The enclosed questions were prepared by the DRS Electrical Systems Branch for submittal to the applicant.

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ESB-103
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FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3 NUCLEAR GENERATING PLANT

DRS ELECTRICAL SYSTEMS BRANCH QUESTIONS

7.0 INSTRUMENTATION AND CONTROL SYSTEMS

7.1 Provide information requested in the Commission's Information Guide 2, "Instrumentation and Electrical Systems" (10/27/71). If the requested information is presently contained in the FSAR or its amendments, the response should identify the specific location of the information and augment same, as required, to meet the requirements of the Information Guide. The response to the following questions of the Information Guide should:

a. Question 1.C. - Describe the degree of conformance of the protection system to the provisions of IEEE Std 338-1971, "IEEE Trial Use Criteria for the Periodic Testing of Nuclear Power Generating Station Protection Systems." Describe and justify all exceptions to this standard.

b. Question 3 - Describe the degree of conformance of your seismic testing program to IEEE Std 344-1971, "IEEE Guide for Seismic Qualification of Class I Electric Equipment for Nuclear Power Generating Station." Describe and justify all exceptions to this standard. The response should include the results of tests of the batteries (cells), in addition to those of auxiliary equipment such as racks, and any necessary extrapolation that accounts for all degradation due to time.

c. Question 4 - Describe the degree of conformance to IEEE Std 336-1971, "IEEE Standard Installation, Inspection, and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations" during the construction phase of the plant. Describe and justify all exceptions to this standard.

d. Question 5.a. - Discuss your criteria regarding maximum percentage fill in trays and wireways, and minimum spacing between same. Describe and justify all exceptions to the criteria.

e. Question 5.c. - Describe the methods used to preserve the independence of safety related loads served by E.S. Bus 3B. The response should account for all potential conflicts created by using E.S. Bus 3B to serve safety and non-safety related loads.

f. Question 11 - Discuss the indications available to the control room operator which allow him to recognize that a protection system or subsystem has been placed on test. bypassed for operation or maintenance purposes, or removed from service for any cause. The response should list all such bypasses and verify that they have been designed to meet the requirements of Paragraph 4.12 of IEEE 279.

g. <u>Question 12</u> - Refer to IEEE Std 308-1971 in lieu of IEEE 308 as stated in the Guide. (Note: Where a conflict exists between the "eight hour" provision of Section 5.2.3.4 of IEEE Std 308-1971 and General Design Criterion 17, the applicable provisions of Criterion 17 govern.) Also discuss the use of automatic transfer switches (Figure 8-9), and the effects of the stated voltage dips (30 percent) of the diesel-generators on loads that require high starting torque such as motor operated valves.

7.2 Identify and provide justification for any aspects of the design that do not conform to Safety Guide 11, "Instrument Lines Penetrating Primary Reactor Containment" (3/10/71).

7.3 Describe the methods for periodically testing the reactor protection system's response time for the trip parameters. The response should be parametric in nature to show the change in response time as a function of the level of the parameter and as a function of the rate of change of the parameter. Include a discussion of the response times in relation to the safety limits and state the worst case margin in terms of time.

7.4 State the criteria and design bases which established the heat tracing requirements, temperature control, monitoring, and power requirements for the boric acid tanks, borated water storage tanks, and spray additive tanks, and related piping of the chemical addition system. Discuss the consequences of a single failure in the heat tracing of each of the above mentioned systems.

7.5 The FSAR states that pump interlocks insure against accidental startup of a cold loop if reactor power is greater than 15 percent. Discuss the consequences of an interlock failure and the criteria to which these interlocks are designed.

7.6 Identify all trip set points of the reactor protection system and engineered safety feature system instruments which are within 10% of the high or low end of the calibrated range. Provide a worst case error analysis that verifies that each output signal is always conservative when viewed from a safety standpoint.

7.7 The FSAR, in describing the core flooding system, states that the electric motor-operated stop valves between the core flooding tanks and the primary coolant system are open during reactor power operation, and that valve position is indicated in the control room. Discuss the design features of the control circuits of these valves, including the assurance provided by the design that the valves will be open when required. The inclusion of the following features would provide an acceptable design:

a. Automatic opening of the valves whenever the primary coolant system pressure exceeds a preselected value (specified in the Technical Specifications).

b. Automatic removal (override) by a safety injection signal of any bypass feature that may be provided to allow a motor operated valve to be closed, for short periods of time, when the primary system is at pressure (in accordance with the provisions of the Technical Specifications).

c. Valve position visual indication that is actuated by sensors on the valves ("open" and "closed").

d. Audible alarms, independent of item c., that are actuated by sensors on the valves when the valves are not in the fully open position.

If the design, or planned modifications, are based on criteria different from those stipulated above, submit the criteria and necessary documentation that verify that the equivalent degree of protection is afforded.

7.8 The FSAR states that flexibility of controlling reactivity rate is provided by a patch panel that permits the patching of any rod into any group except those of Group 8. Describe the interlocks and/or administrative procedures used to insure that the resultant changes of rods between various groups are correct, and the consequences of a failure in the interlock system.

7.9 Describe in more detail the design features and administrative procedures used to insure proper operations of the residual heat removal (RHR) system isolation valves. Your description should verify that these valves remain closed during normal operation. The inclusion of the following features would provide an acceptable design:

a. At least two valves in series, with each valve interlocked to prevent valve opening unless the primary system pressure is below the RHR system pressure.

b. Interlocks of diverse principles, and designed to meet the intent of IEEE 279.

c. Automatic closure of the two series valves whenever the pressure in the primary coolant system exceeds a selected fraction of the design pressure of the RHR system. These closure devices should be designed to the intent of IEEE 279.

If the design, or planned modifications, are based on criteria different from those stipulated above, submit the criteria and necessary documentation that verify that the equivalent degree of protection is afforded.

7.10 Several sections of the FSAR (e.g., 1.4.19, 1.4.38, 7.1.1.1) restrict the scope of GDC 21 and IEEE 279 by using terms such as "single component failures" and "single failures of an active component" rather than the more extensive term "single failures". All relevant sections of the FSAR should be revised to conform with GDC 21 and IEEE 279.

7.11 The FSAR (Section 1.6) states that the protection and control systems are being analyzed for possible common failure modes. Identify and discuss the results of the analyses. If the analyses have not been completed, state the scheduled completion date, and indicate your commitment to modify the design, if required, as a consequence of the analyses.

7.12 The discussion of the operational sequence of the engineered safeguards system is incomplete and not sufficiently detailed to permit evaluation. Submit a more comprehensive description and logic diagram, with nomenclature that is consistent with the other subordinate drawings, that delineate all the required inputs and sequential actions. The discussion should be explicit with regard to the timing network for the various load blocks, including the effect of a sustained low voltage condition on the diesel-generator (i.e., low voltage for a period longer than that of the 15 second timing network). Discuss the consequences of such a condition and the means used to prevent the simultaneous energization of load blocks 2, 3 and 4.

7.13 In your design, either low reactor coolant pressure or high reactor building pressure will initiate safety injection; however, of these two signals, only the low reactor coolant pressure initiates reactor trip. Since your analysis of the effectiveness of safety injection takes credit for reactor trip, discuss the bases for not using high building pressure to trip the reactor.

7.14 Identify and discuss the selected alarm conditions mentioned in Section 7.1.3.2.5 that are annunciated.

7.15 Describe more completely the rod position-display system. The discussion should as a minimum address: (1) the capability to display simultaneously the position of each rod including any constraints therein, and (2) the display and annunciation of an out-of-symmetry condition.

7.16 The FSAR states that control rod-drive motor rotation in the wrong direction is detected by a motor rotation fault detector. Discuss the capability to detect failure to rotate upon a demand signal, and the provisions which prevent such an occurrence from being erroneously displayed and from being cumulative.

7.17 Section 7.4.6 states that several actions occur automatically upon loss of offsite power, including the tripping of the main feedwater pumps and the reactor coolant pumps. In light of the above, discuss the consequences of loss of offsite power and how full load rejection is accomplished.

7.18 Discuss more completely the protective system with regard to partial loop operation. As a minimum, the response should address the following: (1) the envelope of the permissible operating limits for the three pump and the two pump (one per loop) case as a function of flow and power imbalance; (2) the method used to automatically reset reactor trip to a power level commensurate with the number of pumps in operation, actual flow, and power imbalance; (3) the method used to discriminate between only two pumps operating in one loop and one pump in each loop; (4) whether the operating limits (trip) delineated in Table 7-4 should be restricted when operating in a partial loop mode; and (5) the basis for apparently not using breaker auxiliary contacts to provide the logic for reactor trip and operating limits.

7.19 The schematic diagram for motor operated valves (Figure 7-10) shows that overload protection (O/L) is used. Discuss the bases for the O/L's and any provisions for bypassing the O/L's, especially during emergency conditions. Discuss the effect of low bus voltage (e.g., during diesel operation) on motor torque, and the possibility for causing O/L trip prior to valve operation.

8.0 ELECTRICAL POWER SYSTEMS

8.1 Describe more fully the auxiliary equipment of the emergency diesel generator system. The description should include the fuel storage and transfer system; the source of power for control; the starting system and number of start attempts provided; method of cooling and warming the engine; and the control and protection system including relevant schematic diagrams.

8.2 The tabulation of connected loads to the diesels, as shown in Table 8-1 of the FSAR, is not sufficient to evaluate the adequacy of the design with respect to regulatory position 4 of Safety Guide 9. Data that are required include actual starting KVA loads rather than the nameplate data and the time required for the various loads to reach full speed. To correlate these data with the capability of the diesel generator, the following information should be provided:

a. A load profile during a LOCA showing the timing sequence and the time duration of the various loads subsequent to diesel start. The anticipated starting KVA requirements for the various loads should be superimposed on the load profile at the appropriate time, and the computed effect of each load transient (system voltage and speed, and voltage and speed recovery time for each step) should be indicated.

b. The maximum loads that can be incrementally added to the various block plateaus, without exceeding the recommendations of Safety Guide 9.

c. The continuous, 2000 hr., and 30 min. rating of diesel engine.

d. The generator's X_d, X'_d, X''_d, and SCR and the unit's WR^2. The type of excitation system provided should be discussed, including the response time of same for voltage regulation during the various step load changes.

8.3 Discuss the design criteria for the diesel generator rooms with respect to ability to preclude missiles, explosions and fires in one unit from affecting the redundant counterpart.

8.4 Identify the sources of control power to the 230 and 500 KV switchyard breakers. Submit an analysis to show that no single failure in these power sources, control circuits and protective relaying will negate the ability to provide offsite power to the engineered safety features.

8.5 Describe the monitoring features provided to continuously ensure that the capability of a battery to supply power is not degraded. Consider the relevance of the monitored parameters to the actual charge stored in the battery, and discuss the limitations of the system to ensure disclosure of battery degradation, including protection against overcharging.

8.6 Discuss your plans for converting the 500 KV bus from a ring configuration to a breaker-and-a-half system.

8.7 The design of the 6900 volt auxiliary system initiates automatic transfer from the preferred source to an alternate source upon loss of the preferred power source. Discuss the effect on availability of offsite power resulting from switching four 9000 HP pump motors from one source (dead) to another (live). Address the effect of the transfer occurring before the motor field has collapsed but at such time that the back EMF does not oppose that of the source. The concern here is that such transfer could approach that of paralleling generators that are out of phase.