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August 1, 1978

Docket No. 50-302

Florida Power Corporation
ATTN: Mr. W. P. Stewart
Director, Power Production
P. O. Box 14042, Mail Stop C-4
St. Petersburg, Florida 33733

Gentlemen:

We have reviewed your submittals of January 9, and March 3 and 22, 1978, regarding expansion of the spent fuel storage facilities at Crystal River Unit No. 3 and have determined that the additional information requested in the enclosures is necessary to continue our review. You are requested to provide this information within 60 days of the date of this letter.

Sincerely,

Robert W. Reid, Chief
Operating Reactors Branch #4
Division of Operating Reactors

Enclosures:
1. Request for Additional Information
2. Request for Additional Information
3. Request for Additional Information

cc w/enclosures:
See next page

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Florida Power Corporation

cc: Mr. S. A. Brandimore
Vice President and General
Counsel
P. O. Box 14042
St. Petersburg, Florida 33733

Crystal River Public Library
Crystal River, Florida 32629

ENCLOSURE 1

REQUEST FOR ADDITIONAL INFORMATION

CR-3 SPENT FUEL POOL MODIFICATION

1. Discuss the occupational exposure expected during the SFP modification including the preparatory work and considering the pool is contaminated. Address the expected dose rates, numbers of workers (including divers, if necessary) and occupancy times for each phase of the operation. Include removal and disassembly (or crating) and disposal operations of the low density spent fuel racks and installation of the new high density racks. Provide the resultant man-rem exposure.

2. If the low density racks are to be cut up for disposal, explain why the exposures received by personnel would be as low as reasonable achievable (ALARA) as compared to crating the low density racks intact.

3. Identify the principal radionuclides and their respective concentration in the spent fuel pool as a result of placing the core in the pool during steam generator repair operations.

4. Provide the dose rates above and around the spent fuel pool from the concentrations of the radionuclides identified in 3 above. Also, provide the estimated dose rate of the contaminated racks when they are removed from the spent fuel pool.

5. Discuss the capability of the Spent Fuel Pool Cooling System to keep the actual spent fuel pool bulk water temperature at or below the FSAR design of 120°F during normal refuelings until the modified pool is filled. If the bulk water temperature is expected to be above the FSAR design value, discuss when this will occur and for what period of time. Discuss also the impact of any expected higher than design value pool temperatures on the gaseous releases of radioiodines and tritium from the pool.

6. Provide the estimated volume of contaminated material (e.g., spent fuel racks, seismic restraints) expected to be removed from the spent fuel pools during the modification and shipped from the plant to a licensed burial site.

7. Provide a list of typical loads that might be carried near or over the spent fuel pool. Provide the weight and dimensions of each load. Discuss the load transfer path, including whether the load must be carried over the pool, the maximum height at which it could be carried and the expected height during transfer. Provide a description of any written procedures instructing crane operators about loads to be carried near the pool. Provide the number of spent fuel assemblies that could be damaged by dropping and/or tipping each typical load carried over the pool.

8. Discuss the instrumentation to indicate the spent fuel pool water level and water temperature. Include the capability of the instrumentation to alarm and location of the alarms.

9. Your March 3 and 22, 1978 submittals did not address the impact of the proposed SFP modification on the environment. Discuss in some detail the impact of the proposed SFP modification on the following:

   a. radioactive gaseous effluents from the pool, and

   b. radioactive liquid effluents from the plant, including leakage of water from the pool and the SFP leak collection system.

10. Your March 3 and 22, 1978 submittal did not propose changes to the SFP purification system. Discuss in some detail why the present SFP purification is adequate for the proposed SFP modification. Include the experience of operating the SFP with a full core in the pool during steam generator repair operations with the typical dose rates in the vicinity of the pool and the frequency of replacing the demineralizer resin and filters.

11. At present there are four spent fuel assemblies in the pool which might remain in the pool during the modification. Discuss what effects these four assemblies have on implementing the pool modification including exposure to workers and the possibility of dropping heavy loads on spent fuel.

ENCLOSURE 2

REQUEST FOR ADDITIONAL INFORMATION

CR-3 SPENT FUEL POOL MODIFICATION

A. In Florida Power Corporation's March 3, 1978 submittal, it is stated that Carborundum Company's B_4C/Polymer Composite material was selected for the Crystal River storage racks and that the Carborundum Company has initiated a qualification test program similar to that performed for the B_4C crabon plates which were used in several other storage racks such as those for the Haddam Neck plant. However, due to the recent experience with those racks, this qualification program needs to be reexamined in detail. The following information is needed for this reexamination:

1. Will any sources of neutrons other than spent fuel assemblies be stored in the spent fuel pool? If so, at what rate will they emit neutrons?

2. What is the melting temperature of the boron containing material in the unirradiated condition?

3. What will the maximum integrated neutron and gamma flux be in the boron containing material over the lifetime of the racks? What spent fuel assembly power density and burnup, and what rack life were assumed in calculating these maximum integrated fluxes? What is the assumed energy spectrum for the gamma flux?

4. What will the maximum temperature be in the center of the boron material, assuming the highest neutron and gamma flux and the worst accident conditions?

5. What will the chemical composition of the boron containing material be after receiving the design dose of irradiation?

6. What will the physical properties such as the density, the modulus of rupture, the modulus of elasticity, and the compressive strength of the boron containing material be after it receives the design dose of irradiation in the spent fuel pool?

7. Provide data to show that, under the combined effects of irradiation and immersion in borated fuel pool water, the leachability of the boron will not be synergistically enhanced over the life the high density storage racks.

ENCLOSURE 2

8. Describe the surveillance program that will be performed to show the continued presence of the boron in all of the boron plates over the complete life of the storage racks, and also show how a detected decrease of boron in the plates could be safely taken care of.

9. Provide data that shows that the high dose rates used for accelerated irradiation tests have the same effect on the boron plates as the lower dose rates that will be received in the spent fuel pool.

B. The following information is needed to supplement NES report number 81A0521, entitled "Nuclear Design Analysis Report for the Crystal River Unit 3 Spent Fuel Storage Racks," which was submitted on March 22, 1978:

1. Provide the number of grams or uranium-235 per axial centimeter of fuel assembly that was used in your criticality calculations. We intend to incorporate this information as a Technical Specification limit on fuel assemblies that are to be placed in these high density storage racks. In this regard, it appears that your criticality calculations are based on the average mass of uranium dioxide per assembly, which is listed on Table 7.1 as 528 kilograms, rather than the maximum, which is listed as 536.94 kilograms. Is the uranium-235 loading that you used in the calculations high enough to permit the future storage of fuel assemblies with maximum loading and maximum enrichment without exceeding this intended technical specification limit?

2. On page 7-1 it is stated that the diffusion theory method was checked on a KENO calculation with 16-group Hansen-Roach cross sections. Provide documentation on the validity of this KENO calculational method for this type of boron plate calculation.

3. On page 7-2 it is stated that the nominal cell pitch of 10.5 inches will be maintained within $\pm$ 1/16 inch. However, the dimensional specifications given in Table 7.4, which is entitled "Reference Case", show that the cell pitch for this calculation is

$$\frac{13.492 \text{ cm.} \times 2}{2.54 \text{ cm/inc.}} = 10.62 \text{ inches.}$$

What is the cause of this apparent discrepancy?

4. On Figure 7.2 on page 7-15 it appears that the boron region is too thick by a factor of ten. Is this correct?

5. If it will be possible to place a fuel assembly between the outer periphery of the storage rack modules and the fuel pool walls, what will the closest possible distance to a stored fuel assembly be? What will the maximum neutron multiplication factor in the pool be when it is assumed that the outside assembly is in its most reactive position and when it is also assumed that the storage racks are filled with the most reactive fuel assemblies and there is no boron in the water?

C. The following information is needed to supplement Appendix C entitled, "Cooling Considerations" of the January 9, 1978 submittal:

1. Provide the design inlet temperature and the flow rate of the nuclear services closed cycle cooling water through the spent fuel pool heater exchanger.

2. Describe the procedure that would be used for aligning the Decay Heat Removal System for spent fuel pool cooling.

3. Provide the equilibrium spent fuel pool inlet and outlet water temperatures for a heat load of 8.75 X 10^6 BTU/hr and a spent fuel pool cooling system flow rate of 1500 gpm.

ENCLOSURE 3 .

REQUEST FOR ADDITIONAL INFORMATION

CR-3 SPENT FUEL POOL MODIFICATION

1. Page 6 of the spent fuel pool structural analysis states that adjacent structural elements are analyzed to account for the restraint they contribute to the spent fuel pool structure. Provide justification that these elements retain their structural integrity under the imposed loads.

2. Discuss the effect of the water sloshing effects discussed in the rack analysis report on the fuel pool walls.

3. Provide a direct comparison of loads used in pool structural analysis to those obtained from the rack seismic analysis.

4. Provide values in terms of g's used for the structural seismic loadings mentioned in 4.3.3 (b) of the fuel pool structural analysis. Also, indicate the directions of all applied seismic loads.

5. Section 5.7.1 of the fuel pool analysis states that "forces generated by the elastic analysis indicates that the existing reinforcement is insufficient,..." Provide justification for the adequacy of the fuel pool under this loading condition.

6. Provide details showing areas where load and moment averaging is required to justify the structural adequacy of the fuel pool, and provide justification of the structural adequacy of all areas where the limits in the Standard Review Plan have not been met.

7. Quantify the statement in Section 5.7.3, "However, in several isolated areas, generally whenever a sharp change in the mean temperature occurs between adjacent elements, very large stresses exist," and provide analytical justification for the structural adequacy of these areas.

8. Provide an explanation of the statement in the pool structural analysis given on page 28, "The embedment plates to which the fuel racks are attached were not evaluated for increased seismic loading."

9. Provide detailed drawings of the rack seismic bracing including the attachment to the pool wall.

10. The limit for load combination 5 given in Section 5.2 (b) of the rack structural analysis report should be 1.5S.

11. Discuss the effect of the gaps between adjacent rack assemblies and between the rack assembly and the seismic bracing on the seismic analysis results.

12. Provide the deflections of the rack base and fuel cans obtained from the seismic analysis.

13. Provide justification that fuel pool liner will not develop leaks due to the applied loads including thermal loads. Also, provide justification that the stud bolts will not fail under the loadings.

14. Explain how the spacer bars between each storage cell are considered in the seismic analysis model.

15. The mathematical model of the fuel rack assembly shows the feet are assumed anchored to the pool floor. How were the shear loads transmitted to the liner through the feet considered in the analysis of the liner integrity?

16. Provide results of an analysis considering an temperature gradient across the rack structure due to differential heating between a full and empty cell.

17. Discuss the local effects of the impacting fuel assembly on the storage cell and the absorber material.

18. Discuss how the effects of the impacting fuel assemblies were considered in the energy balance used to determine the maximum rack uplife during an SSE. Also, provide stability analysis for other rack assemblies.

19. Discuss the effects of a fuel assembly drop on a spent fuel storage cell which is directly above one of the rack feet. Include the effects on the fuel assembly.

20. Appendix G of the rack structural analysis report gives a calculation of an adjusted frequency of a rack due to support flexibility in the upendor area. Provide a more detailed seismic analysis of the rack structure and seismic bracing.

21. Provide information on the heat treatment requirements and hardness testing results for the 17-4 PH stainless steel used for the leveling pads. Also provide information on the methods used for removing the film coating resulting from the heat treatment.

22. Discuss the fuel pool water chemistry and include the allowable concentrations of fluorides, chlorides and boron.

23. Discuss the measures that will be taken to prevent outgassing from the B_4C absorber material in light of the current problems with stuck fuel assemblies.