May 29, 1987

Docket No. 50-389

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Mr. C. O. Woody
Group Vice President
Nuclear Energy
Florida Power & Light Company
P. O. Box 14000
Juno Beach, Florida 33408

Dear Mr. Woody:

The Commission has issued the enclosed Amendment No. 21 to Facility Operating License No. NPF-16 for the St. Lucie Plant, Unit No. 2. This amendment consists of changes to the license in response to your application dated April 12, 1986, as supplemented October 7, 1986 and April 10, 1987.

This amendment deletes License Condition 2.C.(19) which limited the burnup of spent fuel in the spent fuel pool to 38,000 MWD/MTU.

A copy of the Safety Evaluation is also enclosed. The notice of issuance will be included in the Commission's bi-weekly Federal Register notice.

Sincerely,

/s/

E. G. Tourigny, Project Manager
Project Directorate II-2
Division of Reactor Projects-I/II

Enclosures:
1. Amendment No. 21 to NPF-16
2. Safety Evaluation

cc w/enclosures:
See next page

LA:PDII-2	PM:PDII-2	D:PDII-2	OGC
DMiller	ETourigny:bg	LRubenstein	
5/18/87	5/ /87	5/29/87	5/20/87

Initialed version to SE

Mr. C. O. Woody
Florida Power & Light Company

St. Lucie Plant

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

FLORIDA POWER & LIGHT COMPANY

ORLANDO UTILITIES COMMISSION OF

THE CITY OF ORLANDO, FLORIDA

AND

FLORIDA MUNICIPAL POWER AGENCY

DOCKET NO. 50-389

ST. LUCIE PLANT UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 21
License No. NPF-16

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Florida Power & Light Company, et al. (the licensee), dated April 21, 1986, as supplemented October 7, 1986 and April 10, 1987, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, Facility Operating License No. NPF-16 is amended by deleting paragraph 2.C.(19).

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

L S Rubenstein

Lester S. Rubenstein, Project Director
Project Directorate II-2
Division of Reactor Projects-I/II

Date of Issuance: May 29, 1987

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 21

TO FACILITY OPERATING LICENSE NO. NPF-16

FLORIDA POWER & LIGHT COMPANY, ET AL.

ST. LUCIE PLANT, UNIT NO. 2

DOCKET NO. 50-389

1.0 INTRODUCTION

By letter dated April 21, 1986, as supplemented October 7, 1986 and April 10, 1987, the licensee requested deletion of License Condition 2.C.(19). The current License Condition 2.C.(19) in Facility Operating License NPF-16 for St. Lucie Unit 2 requires that:

> "Prior to storing extended burnup fuel in the modified spent fuel pool (greater than 38,000 Mw-days/Metric ton) the licensee must submit and obtain approval of a new analysis that addresses the potential of large gap releases for the extended burnup fuel."

This license condition was imposed as a result of NRC's review of the fuel storage rerack analysis (Ref. 1) that Combustion Engineering (C-E) provided for St. Lucie Unit 2. The NRC concern from this review was that the radioactive gas release from the fuel-cladding gap of extended burnup fuel rods during a fuel handling accident in the spent fuel pool might be greater than that specified in the NRC Regulatory Guide 1.25 and assumed in the St. Lucie Unit 2 FSAR. In order to address this license condition, the licensee has submitted a safety evaluation (Ref. 2) of gap-activity release from fuel at extended burnups up to 60,000 MWd/MTM (rod average).

As stated above, the application was supplemented on October 7, 1986 and April 10, 1987. Because these submittals provided clarifying information and corrected minor errors in safety analysis, they do not alter the action noticed in the Federal Register on May 21, 1986 and do not affect the staff's no significant hazards determination.

The staff's evaluation of the safety analysis for the deletion of License Condition 2.C.(19) from the Facility Operating License NPF-16 for St. Lucie Unit 2 follows.

2.0 SUMMARY OF LICENSEE'S SAFETY ANALYSIS

The licensee has presented a safety evaluation of the impact of radioactive gas released from the fuel-cladding gap of a St. Lucie Unit 2 fuel rod as a result of a fuel handling accident. Activity releases have been calculated by C-E and submitted by the licensee for rod average burnups up to 60,000 MWd/MTM. The licensee and C-E have stated that the primary contributor to the dose calculation for this accident is iodine-131.

The NRC-approved C-E fuel performance code, FATES3A (Refs. 3 and 4), along with a bounding rod power history for St. Lucie Unit 2 was used to calculate the fuel temperatures for this analysis. The licensee has stated that the power history used for this analysis "is expected to generically bound the fuel rod power history for future cycles" of St. Lucie Unit 2. The power history was developed by C-E using a methodology (Ref. 5) that has been approved by the NRC (Ref. 6) for evaluating rod pressures and fission gas releases during normal operation up to extended burnup levels. The power history includes both maximum steady-state power operation and transient power excursions that may occur during normal operation.

The calculated fuel temperatures from the peak axial nodes were input into the ANS 5.4 release model (Ref. 7) in order to calculate the iodine-131 release fractions and equivalent gap inventory for the peak rod and assembly, respectively, at three extended burnup levels of 43.4, 52.8, and 60 MWd/kgM (rod average). The licensee has compared the equivalent gap inventory of the peak assembly calculated at these extended burnup levels to the equivalent gap inventory calculated in the St. Lucie Unit 2 FSAR (Ref. 8). The FSAR inventories were based on the release fractions of the fuel rods as recommended in NRC Regulatory Guide 1.25. From this comparison, the licensee has concluded that there is a factor of 3.3, 21 and 23 reduction in iodine-131 gap inventory at rod average burnup levels of 43.4, 52.8 and 60 MWd/kgM, respectively, when compared to the gap inventory calculated in the FSAR. The reason for the decrease in gap inventory at extended burnup levels from those presented in the FSAR for a lower burnup level is due to several factors: (1) the Regulatory Guide release fractions were very conservative for this plant, (2) the maximum linear heat generation rates (LHGRs) were reduced from those assumed in the FSAR analysis, and (3) the maximum LHGRs decrease significantly at extended burnups due to fission material burnout.

From this, the licensee has concluded that the gap activities provided in the St. Lucie Unit 2 FSAR for the fuel handling accident bound those calculated from this analysis of St. Lucie Unit 2 fuel rods with rod average burnups up to 60 MWd/kgM. The licensee proposes, therefore, elimination of License Condition 2.C.(19) that limits the fuel burnup in the spent pool to 38 MWd/kgM.

3.0 EVALUATION OF LICENSEE'S SAFETY ANALYSIS

The evaluation of the licensee's safety analysis examined (1) the licensee's assumption that iodine-131 is the primary dose contributor to the fuel handling accident, (2) the licensee's assumption that the power history used by C-E in the FATES3A calculation of fuel temperature is bounding for St. Lucie Unit 2, and (3) the licensee's conclusion that iodine-131 release fractions and dose equivalent calculated by C-E with the ANS 5.4 model are valid and bounded by the St. Lucie Unit 2 FSAR. Prior to discussing these issues, the applicability of the FATES3A code and the ANS 5.4 model for this licensing application will be discussed briefly. The FATES3A code has been approved by the NRC (Ref. 4) for licensing analyses that require a calculation of steady-state fuel temperatures from normal operation and, thus, is found to be acceptable for this application. The ANS 5.4 release model has been developed by a panel of experts and adopted as an ANSI/ANS Standard "Method for Calculating the Fractional Release of Volatile Fission Products from Oxide Fuel" under steady-state temperature conditions. The NRC has given a de facto approval for the use of the ANS 5.4 model to determine the radioactive release fractions that exist in the gap of fuel rods under steady-state operating conditions and, thus, this model is found acceptable for this licensing application.

The licensee and C-E have stated that the primary contributor to dose from the activity released from the fuel-cladding gap is iodine-131. The staff's consultant has examined the dose contribution from other radioactive gases in the gap and found this to be a valid conclusion. The total dose contribution from the other radioactive isotopes of iodine are only 1/6 of the iodine-131 dose and it is proportional to any decrease or increase in the iodine-131 dose from the gap. The dose contribution from the other radioactive noble gases of xenon and krypton are several orders of magnitude lower than for iodine-131 and, thus, their contribution is negligible.

Several questions were presented to the licensee to assure that the fuel rod power history used to calculate the fuel temperatures and, thus, the radioactive release fractions were bounding for St. Lucie Unit 2. In response to one of these questions, the licensee has stated that axial peak steady-state powers were used by C-E to calculate the fuel temperatures and release fractions, rather than the rod average powers, as stated in the original submittal. Consequently, Figure 1 of the original submittal (Ref. 2) is not the peak rod average LHGR versus burnup, as stated in the submittal, but is the axial peak LHGR of the peak power rod versus burnup. The licensee has further stated that the axial peak steady-state rod powers used for these analyses are "expected to generically bound the fuel rod power history for future cycles" of St. Lucie Unit 2. The application of these axial peak LHGRs and the resulting calculated fuel temperatures by C-E to the calculation of the iodine-131 release fraction for the entire rod is found to be conservative.

The licensee was also questioned about using the steady-state LHGR for calculating the fuel temperatures and iodine-131 release fractions immediately prior to discharge, rather than the more conservative operational transient values used intermittently in their power history. The licensee has responded that the effect of these transients have been included in the degradation of the gap conductance by the inclusion of transient powers and, thus, transient fission gas release at various burnup levels throughout the power history of the peak steady-state rod. The licensee has also stated that the transient capability of the fuel at these high burnups was relatively low, thus implying the transient impact on iodine-131 release is small prior to fuel discharge at these burnups.

In order to evaluate the effect of an operational transient immediately prior to fuel discharge, the staff's consultant performed an audit calculation. This audit calculation was performed with the GT2R2 fuel performance code (Ref. 9) using as input the St. Lucie Unit 2 steady-state peak powers provided in Figure 1 of the licensee's submittal, plus power transients superimposed throughout this power history (as done by C-E) and a transient immediately prior to discharge (not included in the C-E analysis). The transient LHGRs superimposed on the steady-state power history were equal to the Technical Specification limit for LHGRs up to about 30 MWd/kgM and then were decreased in proportion to the steady-state power reduction versus burnup given in Figure 1 of the submittal. Consequently, the transient LHGR at 60MWd/kgM prior to shutdown was assumed to be:

$$\frac{\text{steady-state LHGR at 60 MWd/kgM}}{\text{steady-state LHGR at 30 MWd/kgM}} * \text{Technical Specification LHGR Limit}$$

The reduction in transient LHGR with burnup simulates the reduction in transient power capability of the fuel due to fissile material burnout. This estimate of the transient LHGR and resultant fuel temperatures are considered to be conservative and thus will bound operational transients from normal operation in St. Lucie Unit 2. These transient temperatures were input into the ANS 5.4 model and iodine-131 release fractions were calculated to be a factor of two to three higher than those calculated with GT2R2 and ANS 5.4 from the steady-state rod powers. These iodine-131 release fractions are still lower than those assumed in the St. Lucie Unit 2 FSAR.

The iodine-131 release fractions calculated with GT2R2 and the ANS 5.4 model using the licensee's steady-state power history were observed to be greater than those calcuated by C-E for the licensee at rod average burnups of 52.8 and 60 MWd/kgM. This was surprising because the GT2R2 calculated fuel temperatures were lower than those calculated by C-E with the FATES3A code (Figures 2 and 3 from the submittal). A second audit calculation was performed by inputing the C-E FATES3A temperatures from Figures 2 and 3 of the submittal into the ANS 5.4 model. This resulted in a factor of three to four higher release fractions at burnups of 52.8 and 60 MWd/kgM than those calculated by C-E. The iodine-131 release fraction

calculated by C-E for the licensee at a burnup of 43.4 MWd/kgM, however, did agree within 20% of our audit calculation. (This is considered satisfactory considering the uncertainty in interpolating fuel temperatures from the figures). Further discussions with the licensee and C-E have discovered that a factor of seven was inadvertently omitted by C-E from their calculation of iodine diffusion coefficients for the release fractions at burnups of 52.8 and 60 MWd/kgM. The release fraction at a burnup of 43.4 MWd/kgM, however, did include the factor of seven in this calculation.

The licensee has resubmitted (Ref. 10) the iodine-131 release fractions with the factor of seven included in the diffusion coefficients. These resubmitted results show that the equivalent iodine-131 release fractions for St. Lucie Unit 2 fuel rods at rod average burnups up to 60 MWd/kgM remain significantly less than those assumed in the St. Lucie Unit 2 FSAR for the fuel handling accident and thus the latter analysis is bounding. In addition, independent audit calculations have confirmed (discussed above) that the iodine-131 release fractions for St. Lucie Unit 2 fuel rods up to rod average burnups of 60 MWd/kgM remain below those assumed in the plant FSAR for both steady-state powers and normal operational transients. Consequently, both C-E/licensee and independent audit calculations show that the fuel handling accident presented in the St. Lucie Unit 2 FSAR is bounding for St. Lucie Unit 2 fuel rods with rod average burnups up to 60 MWd/kgM.

4.0 SUMMARY

As discussed above, the staff concludes that, for St. Lucie Unit 2 operating conditions provided in the licensee's submittal, the fuel handling accident is bounded by the analyses presented in the St. Lucie FSAR. Therefore, the deletion of License Condition 2.C.(19) from Facility Operating License NPF-16 is acceptable. This acceptance is based on the following conditions:

1. That rod average burnups do not exceed 60 MWd/kgM.

2. That steady-state operation of the peak rod in St. Lucie Unit 2 is bounded by the power history provided in Figure 1 of the submittal (Ref. 2).

3. That the current Technical Specification LHGR Limit for St. Lucie Unit 2 is not increased.

5.0 ENVIRONMENTAL CONSIDERATION

This amendment involves a change in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The

Commission has previously published a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR §51.22(c)(9). Pursuant to 10 CFR §51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

We have concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Date: May 29, 1987

Principal Contributor: D. Fieno

7.0 REFERENCES

1. Proposed License Amendment - Spent Fuel Pool Rerack, St. Lucie Unit 2 Docket No. 50-389, March 13, 1984.

2. Letter, C.O. Woody (FPL) to A.C. Thadani (NRC), "St. Lucie Unit 2, Docket No. 50-389, NPF-16 License Condition 2.C.19," L-86-173, April 21, 1986.

3. Combustion Engineering, Inc., Improvements to Fuel Evaluation Model, CEN-161(B), July 1981 (Proprietary).

4. Letter from R.A. Clark (NRC) to A.E. Lundvall (BG&E), "Safety Evaluation of CEN-161 (FATES)," March 1983.

5. Combustion Engineering, Inc., Extended Burnup Operation of Combustion Engineering PWR Fuel, CENPD-269-P, Revision 1-P, July 1984.

6. Letter, E.J. Butcher (NRC) to A.E. Lundvall (BG&E), "Safety Evaluation Report for Extended Burnup Operation of Combustion Engineering PWR Fuel, CENPD-269-P, Revision 1-P," October 10, 1985.

7. American Nuclear Society, "Method for Calculating the Fractional Release of Volatile Fission Products from Oxide Fuel," ANSI/ANS-5.4-1982.

8. St. Lucie Unit 2 FSAR.

9. M.E. Cunningham and C.E. Beyer, GT2R2: An Updated Version of GAPCON-THERMAL-2, NUREG/CR-3907 (PNL-4178), September 1984.

10. Letter, C.O. Woody (FPL) to NRC, "St. Lucie Unit 2, Docket No. 50-389, NPF-16 License Condition 2.C.19," L-87-159, April 10, 1987.