July 11, 2006

Mr. L. M. Stinson
Vice President - Farley Project
Southern Nuclear Operating
  Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2 — ISSUANCE OF AMENDMENTS FOR BEST ESTIMATE LOSS-OF-COOLANT ACCIDENT (LOCA) ANALYSES USING ASTRUM (TAC NOS. MC8588 AND MC8589)

Dear Mr. Stinson:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 174 to Renewed Facility Operating License No. NPF-2 and Amendment No. 167 to Renewed Facility Operating License No. NPF-8 for the Joseph M. Farley Nuclear Plant, Units 1 and 2. The amendments consists of changes to the Technical Specifications (TS) in response to your application dated October 6, 2005, as supplemented April 17, 2006.

The amendments revise TS Section 5.6.5, "Core Operating Limits Report (COLR)," to reflect the addition of the methodology in WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," and provide a new large break LOCA analyses for Farley Units 1 and 2.

A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

Robert E. Martin, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

Enclosures:
1. Amendment No. 174 to NPF-2
2. Amendment No. 167 to NPF-8
3. Safety Evaluation

cc w/encl: See next page

July 11, 2006

Mr. L. M. Stinson
Vice President - Farley Project
Southern Nuclear Operating
  Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2 — ISSUANCE OF AMENDMENTS FOR BEST ESTIMATE LOSS-OF-COOLANT ACCIDENT (LOCA) ANALYSES USING ASTRUM (TAC NOS. MC8588 AND MC8589)

Dear Mr. Stinson:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 174 to Renewed Facility Operating License No. NPF-2 and Amendment No. 167 to Renewed Facility Operating License No. NPF-8 for the Joseph M. Farley Nuclear Plant, Units 1 and 2. The amendments consists of changes to the Technical Specifications (TS) in response to your application dated October 6, 2005, as supplemented April 17, 2006.

The amendments revise TS Section 5.6.5, "Core Operating Limits Report (COLR)," to reflect the addition of the methodology in WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," and provide a new large break LOCA analyses for Farley Units 1 and 2.

A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

Robert E. Martin, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

Enclosures:
1. Amendment No. 174 to NPF-2
2. Amendment No. 167 to NPF-8
3. Safety Evaluation

cc w/encl: See next page

<u>DISTRIBUTION:</u> See next page

Package Number No. ML061810306 Tech Spec Number: ML061930419
Amendment No. ML0611810338 NRR-058

OFFICE	NRR/LPL2-1/PM	NRR/LPL2-1/LA	OGC	NRR/LPL2-1/BC
NAME	RMartin	CSola	SETurk	EMarinos
DATE	7/7/06	7/5/06	06/20/06	7/11/06

OFFICIAL RECORD COPY

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2 — ISSUANCE OF AMENDMENTS FOR BEST ESTIMATE LOSS-OF-COOLANT ACCIDENT (LOCA) ANALYSES USING ASTRUM (TAC NOS. MC8588 AND MC8589))

Date: July 11, 2006

DISTRIBUTION:
Public
LPL2-1 r/f
RidsNrrDorl
RidsNrrDorlLpl2-1 (EMarinos)
RidsNrrPMRMartin(Hard Copy)
RidsNrrLACSola(Hard Copy)
RidsOgcRp
RidsAcrsAcnwMailCenter
G. Hill, OIS (4 Hard Copies)
RidsNrrDirsItsb (TBoyce)
RidsRgn2MailCenter (SShaeffer)
RidsNrrDorlDpr
F. Orr, NRR

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

ALABAMA POWER COMPANY

DOCKET NO. 50-348

JOSEPH M. FARLEY NUCLEAR PLANT, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 174
Renewed License No. NPF-2

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

   A. The application for amendment by Southern Nuclear Operating Company, Inc. (Southern Nuclear), dated October 6, 2005, as supplemented April 17, 2006, 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 license 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, the license is amended by changes to the Technical Specifications, as indicated in the attachment to this license amendment; and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-2 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 174, are hereby incorporated in the license. Southern Nuclear shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Evangelos C. Marinos, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Renewed License No. NPF-2
and the Technical Specifications

Date of Issuance: July 11, 2006

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

ALABAMA POWER COMPANY

DOCKET NO. 50-364

JOSEPH M. FARLEY NUCLEAR PLANT, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 167
Renewed License No. NPF-8

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

   A. The application for amendment by Southern Nuclear Operating Company, Inc. (Southern Nuclear), dated October 6, 2005, as supplemented April 17, 2006, 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 license 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, the license is amended by changes to the Technical Specifications, as indicated in the attachment to this license amendment; and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-8 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 167, are hereby incorporated in the license. Southern Nuclear shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Evangelos C. Marinos, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Renewed License No. NPF-8
and the Technical Specifications

Date of Issuance: July 11, 2006

ATTACHMENT TO LICENSE AMENDMENT NO. 174

TO RENEWED FACILITY OPERATING LICENSE NO. NPF-2

AND TO LICENSE AMENDMENT NO. 167

TO RENEWED FACILITY OPERATING LICENSE NO. NPF-8

DOCKET NOS. 50-348 AND 50-364

Replace page 4 of Renewed License No. NPF-2 with the attached revised page 4.

Replace page 3 of Renewed License No. NPF-8 with the attached revised page 3.

Replace the following pages of Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

Remove	Insert
TS Pages	TS Pages
5.6-4	5.6-4
5.6-5	5.6-5
5.6-6	5.6-6

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 174 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-2

AND AMENDMENT NO. 167 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-8

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-348 AND 50-364

1.0 INTRODUCTION

By letter dated October 6, 2005 (Reference 1), as supplemented April 17, 2006 (Reference 2), the Southern Nuclear Operating Company, Inc. (the licensee) submitted a request for changes to the Joseph M. Farley Nuclear Plant, Units 1 and 2 (Farley), Technical Specifications (TS). The requested changes would revise TS 5.6.5, "Core Operating Limits Report (COLR)," to reflect the addition of a methodology for performing analyses of large break (LB) loss-of-coolant accidents (LOCA), and provide new LBLOCA analyses for Farley.

The licensee requested approval to apply the NRC-approved Westinghouse best estimate (BE) LBLOCA methodology as described in WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," January 2005 (Reference 3), at Farley.

The Nuclear Regulatory Commission (NRC) staff reviewed the licensee's analyses of emergency core cooling system (ECCS) performance for Farley that were done in accordance with the ASTRUM methodology. The analyses were performed at 2830.5 megawatts thermal (MWt), which is about 102 percent of the licensed core power of 2775 MWt and the analyses reflected the use of Westinghouse 422 Vantage$^+$ fuel assemblies (422V$^+$).

The Farley units are three-loop, pressurized-water reactors (PWRs) of the Westinghouse Electric design, enclosed within a large, dry containment. The ECCS consists of a residual heat removal system (RHR), Low Pressure Injection flow, high head safety injection flow delivered to the cold legs, and three accumulators with a cover gas pressure of 600 pounds per square inch absolute (psia), also injecting into the cold legs. The shut-off head of the RHR low pressure injection pumps is about 140 psia.

2.0 REGULATORY REQUIREMENTS

The LBLOCA analyses were performed to demonstrate that the system design would provide sufficient ECCS flow to transfer the heat from the reactor core following a LOCA at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling would be prevented, and (2) the clad metal-water reaction would be limited to less than what would compromise cladding ductility and would not result in excessive hydrogen generation. The NRC staff reviewed the analyses to assure that the analyses reflected suitable redundancy in components and features; and suitable interconnections, leak detection, isolation, and containment capabilities were available such that the safety functions could be accomplished, assuming a single failure, for LOCAs. This considered the availability of onsite power (assuming offsite electric power is not available, with onsite electric power available; or assuming onsite electric power is not available with offsite electric power available). The acceptance criteria for ECCS performance are provided in Title 10 of the *Code of Federal Regulations,* Section 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors,” (10 CFR 50.46), and were used by the NRC staff in assessing the acceptability of the Westinghouse ASTRUM methodology for the Farley plants.

The NRC staff also reviewed the limitations and conditions stated in its safety evaluation supporting approval of the Westinghouse ASTRUM methodology, and the range of parameters described in the ASTRUM topical report in its assessment of the acceptability of the methodology for the Farley plants.

3.0 TECHNICAL EVALUATION

In its April 17, 2006, submittal, the licensee provided the following statement:

> Both Southern Nuclear Operating Company (SNC) and its vendor (Westinghouse) have ongoing processes such that the values and ranges of the best-estimate large-break LOCA (BE-LBLOCA) analysis inputs for peak cladding temperature and oxidation-sensitive parameters bound the values and ranges of the as-operated plants for those parameters, in accordance with the approved methodology (WCAP-16009-P-A).

The NRC staff finds that this statement, along with the generic acceptance of the ASTRUM methodology, provides assurance that ASTRUM and its LBLOCA analyses apply to the Farley plants operated at the power of 2775 MWt.

In its submittal, the licensee provided the results for the Farley 1 and 2 BE LBLOCA analyses at 2830.5 MWt (about 102 percent of the operating power of 2775 MWt) performed in accordance with the ASTRUM methodology. The licensee’s results for the calculated peak cladding temperatures (PCTs), the maximum cladding oxidation (local), and the maximum core-wide cladding oxidation are provided in the following table along with the acceptance criteria of 10 CFR 50.46(b).

TABLE 1: LARGE BREAK LOCA ANALYSIS RESULTS

Parameter	ASTRUM 422 V+ Farley 1 Results	ASTRUM 422 V+ Farley 2 Results	10 CFR 50.46 Limits
Limiting Break Size/Location	DEG/PD	DEG/PD	N/A
Cladding Material	Zirlo	Zirlo	(Cylindrical) Zircaloy or Zirlo
Peak Clad Temperature	1836 °F	1836 °F	2200 °F (10 CFR 50.46(b)(1))
Maximum Local Oxidation	2.9 %	2.9 %	17.0% (10 CFR 50.46(b)(2))
Maximum Total Core-Wide Oxidation (All Fuel)	0.22 %	0.22 %	1.0% (10 CFR 50.46(b)(3))

DEG/PD is a double ended guillotine break at the pump discharge.

In its analyses for Farley 1 and 2, the licensee did not address the concern that present fuel (422 V+) may have pre-existing oxidation that must be considered in its LOCA analyses. In previous reviews of this issue, Westinghouse has responded to the NRC staff's requests for additional information by stating that it considered in its analyses that the zircaloy clad fuel has both pre-existing oxidation and oxidation resulting from the LOCA (pre- and post-LOCA oxidation both on the inside and outside cladding surfaces). Westinghouse and licensees having Westinghouse facilities have also noted that the fuel with the highest LOCA oxidation will likely not be the same fuel that has the highest pre-LOCA oxidation. Westinghouse and the licensees indicated that when the calculated pre-LOCA oxidation was factored into the licensee's BE LBLOCA analyses for the fuel, consistent with the previous Westinghouse methodology for Farley 1 and 2, that even during a fuel pin's final cycle in the core the sum of the calculated pre- and post-LOCA oxidation was sufficiently small that the total local oxidation remained less than the 17 percent acceptance criterion of 10 CFR 50.46(b)(2), as noted above. The NRC staff finds that this appropriately addresses the issue with pre-LOCA oxidation because Farley 1 and 2 are Westinghouse designed, and the computer code (WCOBRA-TRAC) used in the previous methodology is the same code used in the ASTRUM methodology. The NRC staff also considered that the calculated LOCA oxidation is sufficiently low that the pre-accident oxidation would have to be very high (greater than 14 percent) for any power-producing rod in the core to exceed the 10CFR 50.46 (b)(2) total oxidation limit of 17 percent.

The concern with core-wide oxidation relates to the amount of hydrogen generated during a LOCA. Because hydrogen that may have been generated pre-LOCA (during normal operation) will be removed from the reactor coolant system throughout the operating cycle, the NRC staff noted that pre-existing oxidation does not contribute to the amount of hydrogen generated post-LOCA and therefore, it does not need to be addressed when determining whether the calculated total core-wide oxidation meets the 1.0 percent criterion of 10 CFR 50.46(b)(3).

As discussed previously, SNC requested Westinghouse to conduct the BE LBLOCA analyses for Farley 1and 2 at about 102 percent of the licensed power level of 2775 MWt using an NRC approved Westinghouse methodology (ASTRUM). The NRC staff concluded that the results of these analyses (see Table 1) demonstrate compliance with 10 CFR 50.46(b)(1) through (b)(3) for licensed power levels of up to 2775 MWt. Meeting these criteria provides reasonable assurance that, at the current licensed power level, the Farley 1 and 2 cores will remain amenable to cooling as required by 10 CFR 50.46(b)(4). The capability of Farley 1 and 2 to satisfy the long-term cooling requirements of 10 CFR 50.46(b)(5) is assured by satisfaction of 10 CFR 50.46 (b)(1) through (b)(4) and the approved ECCS design.

3.1 LBLOCA CONCLUSIONS

The NRC staff's review of the acceptability of the ASTRUM methodology for Farley 1 and 2 focused on assuring that the Farley 1 and 2 specific input parameters or bounding values and ranges (where appropriate) were used to conduct the analyses, that the analyses were conducted within the conditions and limitations of the NRC approved Westinghouse ASTRUM methodology, and that the results satisfied the requirement of 10 CFR 50.46(b) based on a licensed power level of up to 2775 MWt.

This safety evaluation documents the NRC staff review and the bases of acceptance of the Westinghouse ASTRUM best estimate LBLOCA analysis methodology for application to the Farley 1 and 2 nuclear plants, and of the LBLOCA analyses discussed above, which were performed with the ASTRUM methodology for reference at Farley 1 and 2.

Based on its review as discussed above, the NRC staff concludes that the Westinghouse ASTRUM methodology, as described in WCAP-16009-P-A, is acceptable for use for Farley 1 and 2 in demonstrating compliance with the requirements of 10 CFR 50.46(b). The NRC staff's conclusion was based on the assumed core power up to 2775 MWt (plus 2.0 percent measurement uncertainty or 2830.5 MWt).

3.2 Farley 1 and 2 TS 5.6.5 Core Operating Limits Report (COLR)

The revisions to TS 5.6.5 consist of the addition of item 3.c as follows:

> 3.c WCAP-16009-P-A, "Realistic Large-Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty (ASTRUM)," M.E. Nissley, et al., January 2005 (Proprietary).

WCAP–16009-P-A is an acceptable methodology to apply to Farley 1 and 2 as discussed in Section 3.1 of this safety evaluation, and therefore is an appropriate reference for the Farley 1 and 2 LBLOCA analyses.

3.3 Summary

The NRC staff concluded that the licensee's LBLOCA analyses were performed using an approved Westinghouse methodology that applies to Farley 1 and 2. The licensee's LBLOCA calculations demonstrate the following:

- The calculated LBLOCA values for peak cladding temperature (PCT), oxidation, and core-wide hydrogen generation are less than the limits of 2200 $^{\circ}$F, 17 percent, and 1.0 percent, as specified in 10 CFR 50.46(b)(1) through (3), respectively.

- Compliance with 10 CFR 50.46(b)(1) through (3) and (5) assures that the core will remain amenable to cooling as required by 10 CFR 50.46(b)(4).

- The NRC staff finds the licensee's LBLOCA analyses for Farley 1 and 2 acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the State of Alabama official was notified of the proposed issuance of the amendments. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve 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 issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (70 FR 67751). Accordingly, the amendments meet 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 amendments.

6.0 CONCLUSION

The Commission has 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, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. L. M. Stinson (SNC) , to USNRC, ATTN: Document Control Desk, “Joseph M. Farley Units 1 and 2 Technical Specifications Amendment Request to Incorporate Best Estimate LOCA Analysis Using ASTRUM,” October 6, 2005 (Adams No. ML052790671)

2. LM Stinson (SNC), Document Control Desk, “Joseph M. Farley Units 1 and 2 Technical Specifications Amendment Request to Incorporate Best Estimate LOCA Analysis Using ASTRUM, Request for Additional Information,” April 16, 2006 (proprietary pending) (Adams No. ML061080031)

3. WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty (ASTRUM)," January 2005.

Principal Contributor: F. Orr

Date: July 11, 2006

Joseph M. Farley Nuclear Plant, Units 1 & 2

cc:

Mr. J. R. Johnson
General Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 470
Ashford, AL 36312

Mr. B. D. McKinney, Licensing Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. M. Stanford Blanton
Balch and Bingham Law Firm
P.O. Box 306
1710 Sixth Avenue North
Birmingham, AL 35201

Mr. J. Gasser
Executive Vice President
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201

State Health Officer
Alabama Department of Public Health
434 Monroe St.
Montgomery, AL 36130-1701

Chairman
Houston County Commission
P.O. Box 6406
Dothan, AL 36302

Resident Inspector
U.S. Nuclear Regulatory Commission
7388 N. State Highway 95
Columbia, AL 36319

William D. Oldfield
SAER Supervisor
Southern Nuclear Operating Company, Inc.
P.O. Box 470
Ashford, AL 36312