



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS SUBMITTAL

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-348 and 50-364

1.0 INTRODUCTION

On June 28, 1991, the NRC issued Generic Letter (GL) 88-20, Supplement 4 (with NUREG-1407, Procedural and Submittal Guidance) requesting all licensees to perform individual plant examinations of external events (IPEEE) to identify plant-specific vulnerabilities to severe accidents and to report the results to the Commission together with any licensee-determined improvements and corrective actions. In a letter dated June 28, 1995, Southern Nuclear Operating Company, Inc. (SNC), submitted its response to the NRC.

The staff contracted with Brookhaven National Laboratory and Sandia National Laboratory (SNL) to conduct screening reviews in the seismic and fire areas, respectively, of SNC's IPEEE submittal and its associated documentation. The NRC staff conducted a screening review of the high winds, floods, and other external events (HFO) area of the submittal. In July 1997, the IPEEE Senior Review Board (SRB) met to discuss the review results in the seismic and fire areas. The HFO review results were discussed during a September 1997, SRB meeting. The SRB is comprised of the NRC's Offices of Nuclear Regulatory Research (RES) and Nuclear Reactor Regulation staff and RES consultants (SNL) with probabilistic risk assessment (PRA) expertise in external events. Based on the results of the review, the staff concluded that the aspects of seismic, fires, and HFO were adequately addressed and that a request for additional information was not necessary. The staff's and contractor's review findings are summarized in Section 2.0 of this Safety Evaluation (SE). Details of the staff's and contractors' findings are presented in the three technical evaluation reports attached to this SE.

In accordance with Supplement 4 to GL 88-20, SNC also proposed to resolve in its IPEEE submittal generic safety issues (GSIs) GSI-57, "Effects of Fire Protection System Actuation on Safety-Related Equipment," GSI-103, "Design for Probable Maximum Precipitation (PMP)," GSI-131, "Potential Seismic Interaction Involving the Movable In-Core Flux Mapping System used in Westinghouse Plants," Unresolved Safety Issue (USI) A-45, "Shutdown Decay Heat Removal Requirements" and the Sandia Fire Risk Scoping Study (FRSS) issues. The staff's and contractor's review findings regarding these issues are included in this SE.

Enclosure

9810140037 981001  
PDR ADOCK 05000348  
P PDR

9810140037

## 2.0 EVALUATION

The Joseph M. Farley Nuclear Plant (Farley) consists of two units, each unit a Westinghouse 3-loop pressurized-water reactor (PWR) with an electric output of 861 megawatts electric. The site is located in southeast Alabama on the west side of the Chattahoochee River, about 16 miles east of Dothan, Alabama. The plant was originally categorized in NUREG-1407 as a 0.3g focused-scope plant. Farley was recategorized as a reduced-scope plant for the seismic analysis since it is in a low seismicity area (see References 1 and 2.). Accordingly, a safe shutdown earthquake (SSE) ground response spectra with a peak ground acceleration of 0.1g was used as the IPEEE review level earthquake. For fire events, SNC performed an assessment using the Electric Power Research Institute Fire-Induced Vulnerability Evaluation (EPRI FIVE) methodology with a PRA quantification of core damage frequency (CDF) estimates. For the analyses of HFO, SNC used the progressive screening procedure as described in NUREG-1407 and focused on demonstrating that the plant was in conformance with the 1975 Standard Review Plan (SRP) criteria although the plant was constructed too early to be an SRP plant.

### Core Damage Frequency Estimates

Since SNC used the seismic margin approach for the IPEEE seismic analysis, there is no estimate for the seismic contribution to CDF at Farley. SNC estimated a CDF of  $1.6E-4$ /RY (reactor-year) for Unit 1 and  $1.2E-4$ /RY for Unit 2 due to internal fires. SNC also estimated that the contribution from other external events (i.e., external floods, high winds, transportation, and industrial events) are insignificant at the Farley site. SNC estimated that the CDF due to internal events is about  $1.3E-4$ /RY for each unit, including internal flooding.

These CDF estimates compare reasonably with those of other plants.

### Dominant Contributors

Since SNC used the seismic margins approach for the seismic assessment, an identification of dominant seismic contributors to plant CDF was not made.

The fire CDF is dominated by fires in the switchgear rooms and electrical penetration rooms, which contribute about 70 percent of the total fire-induced CDF. The important system/equipment contributors to the estimated fire CDF that appear in the top sequences are mostly associated with the loss of reactor coolant pump (RCP) seal cooling, component cooling water, auxiliary feedwater, and service water.

SNC's IPEEE assessment appears to have examined the significant initiating events and dominant accident sequences.

### Containment Performance

SNC has assessed containment performance under seismic conditions at Farley focussing on containment isolation. SNC stated that the assessment was performed consistent with NUREG-1407 and that no new vulnerabilities were identified.

SNC has also assessed the containment failure modes that could be caused by fire, specifically an interfacing system loss-of-coolant accident resulting from RCP seal overheating, and failure and loss of containment isolation. SNC concluded that there were no new scenarios and vulnerabilities affecting containment performance due to fire.

SNC's containment performance analyses for seismic and internal fire events appeared to have considered important severe phenomena and are consistent with the intent of Supplement 4 to GL 88-20.

### Generic Safety Issues

As a part of the IPEEE, a set of generic and unresolved safety issues (USI A-45, GSI-131, GSI-103, GSI-57, and the Sandia FRSS issues) were specifically identified during the initial planning of the IPEEE program and explicitly discussed in Supplement 4 to GL 88-20 and its associated guidance in NUREG-1407 as needed to be addressed in the IPEEE. The staff's evaluations of these issues are provided below.

#### 1. USI A-45, "Shutdown Decay Heat Removal Requirements"

SNC addressed USI A-45 by referring to its IPE evaluation in the seismic area. In that evaluation it was indicated that multiple paths were available for decay heat removal (DHR) and that the components associated with DHR may be screened out for the review level earthquake of 0.1g. In the fire area, SNC performed a qualitative evaluation citing redundant DHR system equipment generally located in separate fire compartments. Based on its review, the staff finds that SNC's USI A-45 evaluation is consistent with the guidance provided in Section 6.3.3.1 of NUREG-1407.

#### 2. GSI-131, "Potential Seismic Interaction Involving the Movable In-Core Flux Mapping System Used in Westinghouse Plants"

For this issue, SNC made reference to a documented Westinghouse evaluation of the seismic capacity of the flux mapping system. As a result of that evaluation, SNC implemented modifications to improve the seismic capacity of the cart supporting assemblies of the flux mapping system. The staff finds that SNC's GSI-131 evaluation and improvements are consistent with the guidance provided in Section 6.2.2.1 of NUREG-1407.

#### 3. GSI-103, "Design for Probable Maximum Precipitation"

SNC has assessed GSI-103 and concluded that the new Probable Maximum Precipitation criteria will not have any impact on Farley. The staff finds that SNC's GSI-103 evaluation is consistent with the guidance provided in Section 6.2.2.3 of NUREG-1407.

#### 4. GSI-57, "Effects of Fire Protection System Actuation on Safety-Related Equipment"

SNC has assessed the impact of inadvertent actuation of fire protection systems on safety systems, which is also one of the issues identified in the FRSS. The submittal states that safe shutdown equipment is located away from sprinkler heads or has been designed to

preclude water damage. It was also a conclusion of the seismic walkdown that seismic activation of the fire suppression system was extremely unlikely. The staff finds that SNC's GSI-57 evaluation is consistent with the guidance provided in EPRI's FIVE, which was accepted by the NRC staff.

## 5. Fire Risk Scoping Study Issues

SNC has addressed the FRSS issues. SNC has followed the EPRI guidance on FRSS issues. The staff finds that SNC's evaluation is consistent with the guidance provided in NUREG-1407.

In addition to those safety issues previously discussed that were explicitly requested in Supplement 4 to GL 88-20, four GSIs were not specifically identified as issues to be resolved under the IPEEE program; thus, they were not explicitly discussed in Supplement 4 to GL 88-20 and NUREG-1407. However, subsequent to the issuance of the generic letter, the NRC evaluated the scope and the specific information requested in the generic letter and the associated IPEEE guidance, and concluded that the plant-specific analyses being requested in the IPEEE program could also be used, through a satisfactory IPEEE submittal review, to resolve the external event aspects of these four safety issues.

The following discussions summarize the staff's evaluation of these safety issues at Farley.

### 1. GSI-147, "Fire-Induced Alternate Shutdown/Control Room Panel Interactions"

SNC's IPEEE submittal contains a brief discussion addressing this issue in Section 4.8 of the submittal on FRSS issues. In the discussion, SNC states that the functional requirements for this issue are identical to those covered by its treatment of Appendix R cable spreading room fire requirements. On the basis that no vulnerability associated with this issue was identified in the IPEEE submittal, the staff considers this issue resolved.

### 2. GSI-148, "Smoke Control and Manual Fire-Fighting Effectiveness"

SNC's IPEEE submittal contains information addressing this issue in Section 4.8. SNC performed a review of the Farley fire protection program against the evaluation guidance provided in EPRI's FIVE on this issue. SNC concluded that the Farley fire protection program provides adequate assurance that fire will not significantly increase plant risk. Based on the results of the IPEEE submittal review, the staff considers that SNC's process is reasonable and is capable of identifying potential vulnerabilities associated with this issue. On the basis that no vulnerability associated with this issue was identified in the IPEEE submittal, the staff considers this issue resolved.

### 3. GSI-156, "Systematic Evaluation Program (SEP)"

The plant is not an SEP plant and is not subject to this issue.

#### 4. GSI-172, "Multiple System Responses Program (MSRP)"

SNC's IPEEE submittal contains information directly addressing the following external events-related MSRP issues: effects of fire protection system actuation on safety-related equipment (Section 4.8), smoke control and manual fire-fighting effectiveness (Section 4.8), effects of hydrogen line rupture (Section 4.8), seismically induced spatial interactions (Section 3.1.1.4 discussed as a part of the seismic walkdown and Section 4.8), seismic-fire interactions and seismically induced fire suppression system actuations (Section 3.1.4.7), nonsafety-related control system/safety-related protection system dependencies (Sections 3.1.1.4, 3.1.4.7, and 4.8), seismically induced flooding (Sections 3.0.2, 3.1.1.4.1, and 3.1.4.6) specifically including failures of dams and dikes (Section 3.1.1.5.6), and seismically induced relay chatter (Sections 3.0.2, 3.1.1.4.1, and 3.1.4.6 as a part of the GSI A-46 evaluation, and in Section 3.1.4.5 it is stated that a separate evaluation of relay chatter is being performed for Unit 2.)

During its review, the staff was unable to find any specific reference to all or part of the following three MSRP issues:

- (1) IPEEE-related aspects of common cause failures associated with human errors. Human errors occurring as part of recovery actions during certain fire scenarios were addressed in Section 4.6.4, but common cause related human errors were not addressed for seismic events.
- (2) Effects of flooding and/or moisture intrusion on nonsafety-related and safety related equipment. The effects of flooding and/or moisture intrusion on safety related equipment were addressed in SNC's HFO evaluation, but such effects on nonsafety-related equipment were not addressed.
- (3) Evaluation of earthquake magnitude greater than the SSE. In accordance with Section 3.2.4.5 of NUREG-1407, reduced-scope plants (i.e., sites where the seismic hazard is low) should use the SSE ground response spectra in their seismic margins methodology. Therefore, evaluation of an earthquake greater than the SSE did not need to be addressed for Farley, which is a reduced-scope plant.

Based on the overall results of the staff's IPEEE submittal review, with the possible exception of Items 1 and 2 of the MSRP issues previously discussed, the staff considers that SNC's process is capable of identifying potential vulnerabilities associated with GSI-172. The need for any additional assessment or actions related to the resolution of these two MSRP issues will be addressed by the NRC staff separately from the IPEEE program. For the MSRP issues that were addressed, on the basis that no potential vulnerabilities associated with these issues were identified in the IPEEE submittal, the staff considers the IPEEE-related aspects of these issues to be resolved.

#### Unique Plant Features, Potential Vulnerabilities, and Improvements

SNC reported no unique safety features at the plant.

The Nuclear Management and Resources Council (NUMARC) recommended that a potential severe accident vulnerability be defined as having any component, system, operator action, or accident sequence that contributes more than 50 percent to the CDF or has a CDF greater than  $1E-4/RY$ . SNC used this definition and did not identify any potential vulnerabilities associated with external events; thus, no improvements related to external events were considered as necessary. However, a number of plant-specific improvements were implemented by SNC as a result of the seismic and fire assessments. These procedural and design improvements will improve the seismic and fire safety by reducing the potential for seismic and fire vulnerabilities at Farley.

### 3.0 CONCLUSIONS

On the basis of the overall review findings, the staff concludes that: (1) SNC's IPEEE is complete with regard to the information requested by Supplement 4 to GL 88-20 (and associated guidance in NUREG-1407), and (2) the IPEEE results are reasonable given the Farley design, operation, and history. Therefore, the staff concludes that SNC's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities, and therefore, that the Farley IPEEE has met the intent of Supplement 4 to GL 88-20 and the resolution of specific GSIs discussed in this SE.

As indicated in Section 2.0 of this SE, there are two issues under the Multiple System Response Program (MSRP/GSI-172) that SNC did not appear to address in its submittal. The need for any additional assessment or actions related to the resolution of the remaining two MSRP issues will be addressed by the NRC staff separately from the IPEEE program.

It should be noted, that the staff focused its review primarily on SNC's ability to examine Farley for severe accident vulnerabilities. Although certain aspects of the IPEEE were explored in more detail than others, the review was not intended to validate the accuracy of SNC's detailed findings (or quantification estimates) that underlie or stemmed from the examination. Therefore, this SE does not constitute NRC approval or endorsement of any IPEEE material for purposes other than those associated with meeting the intent of Supplement 4 to GL 88-20 and the resolution of specific GSIs discussed in this SE.

Principal Contributor: B. Hardin

Date: October 1, 1998

Attachments: As stated (3)

REFERENCES

1. Letter dated August 5, 1992, from Stephen Hoffman, U.S. Nuclear Regulatory Commission (USNRC) Project Manager, Project Directorate II-1, Division of Reactor Projects, Office of Nuclear Reactor Regulation, to W. G. Hairston, III, Executive Vice President, Southern Nuclear Operating Company (SNC), "Review of Response to Generic Letter No. 88-20, Supplement No. 4 - Individual Plant Examinations for External Events - Joseph M. Farley Nuclear Plant, Units 1 and 2 (TAC Nos. M83619 and M83620)."
2. Letter dated September 14, 1992, from J. D. Woodard, Vice President, Farley Project, SNC, to the USNRC, Document Control Desk, "Supplemental Response to Generic Letter No. 88-20, Supplement 4."

**Attachment 1**

**FARLEY NUCLEAR PLANT  
INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS (IPEEE)  
TECHNICAL EVALUATION REPORT  
SEISMIC EVENTS**