SUBMITTAL-ONLY SCREENING REVIEW OF THE FARLEY NUCLEAR PLANT INDIVIDUAL PLANT EXAMINATION FOR EXTERNAL EVENTS

(Seismic Portion)

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Brookhaven National Laboratory

1. INTRODUCTION

1.1 Purpose

In response to the NRC issued Supplement 4 to Generic Letter (GL) 88-20, Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities - 10 CFR 50.54(f), the Southern Nuclear Operating Company (SNC) performed an IPEEE for the Farley Nuclear Plant (FNP), and submitted the IPEEE results to NRC. Brookhaven National Laboratory (BNL), as requested by NRC, has performed the submittal-only screening review to verify the technical adequacy of the seismic portion of SNC IPEEE submittal. This Submittal-only Screening Review presents the results and conclusions of the BNL review and evaluation.

BNL's methodology utilized for the review followed the guidelines provided in the document titled Guidance for the Performance of Screening Reviews of Submittals in response to USNRC Generic Letter 88-20, Supplement 4" (Draft, Oct. 24, 1996).

1.2 Background

FNP is located in southeast Alabama on the west side of the Cattahoochee River, about 16.5 miles east of Dothan, Alabama. The FNP units are essentially identical and share a common site.

Both units are a three-loop pressurized water reactor (PWR) manufactured by Westinghouse, with an electric output of 861 MWe. Unit 1 began commercial power operation in December 1977, and Unit 2 began operation in July 1981.

The safe shutdown earthquake (SSE) for the site is 0.1g, and the plant is binned in the reduced-scope category.

1.3 Licensee's IPEEE Process and Licensee's Insights

The FNP reduced-scope seismic margin assessment (SMA) was performed using the EPRI SMA methodology as part of a combined IPEEE and USI A-46 Program. Since FNP is categorized as a reduced-scope plant, the SSE ground response spectra with a PGA of 0.1g were used as the IPEEE RLE. For the component screening and evaluation, the Seismic Qualification Utility Group (SQUG) Generic Implementation Procedure (GIP) was used for both units. For items not covered by the SQUG GIP, the guidances from EPRI NP-6041 were used.

The site is located within an area that has infrequent seismic activity. The evaluations of potential soil failure and relay chatter are not required for the plant. However, a USI A-46 relay evaluation was performed for Unit 1, and the results are included in a separate report already submitted to the NRC in May 1995. After walkdowns, a total of 498 equipment/components for Unit 1 and 389 for Unit 2 were selected in the SSEL. As a result of screening, a total of 117 outliers were identified, and listed in the submittal together with the reasons for retention in such as an anchorage problem.

In accordance with the SMA methodology, preferred and alternate success paths were selected for each unit. Both success paths assume loss of offsite power (LOOP) and a small LOCA, and are identical in equipment

configuration. The only difference is that the preferred path is for the A-train RHR system, and the alternate path utilizes the B-train.

The IPEEE analysis concluded that installed equipment is generally rugged and well anchored. A limited number of anchorage and interaction concerns were identified with regard to the evaluation criteria. However, it was concluded that none of these concerns were determined to impair component operability, and all are scheduled for resolution.

2. REVIEW FINDINGS

2.1 IPEEE Format and Methodology Documentation

The submittal was organized in a format consistent with the guidelines of NUREG-1407, and the methodology used in the seismic analysis was described in sufficient detail. All major IPEEE related issues and certain generic issues were addressed. Therefore, it was concluded that the IPEEE format and methodology documentation are adequate.

2.2 Seismic Review Team (SRT) Selection

The seismic review team (SRT) consisted of personnel from the Southern Nuclear Operating Company (SNC), who were the subcontractor for the IPEEE seismic analysis, and personnel from the FNP, who were familiar with the system and operation procedures. Detailed descriptions on the team members' background are provided in the submittal, and it is concluded that the SRT selection meets the NUREG-1407 objectives.

2.3 Seismic Input

Since FNP is categorized as a reduced-scope plant, the SSE ground spectra with a PGA of 0.1g was used as the IPEEE review level earthquake (RLE). When IRS were required, a factor of 1.5 was applied to the SSE spectra to represent the building IRS for components located less than 40 ft above grade with a natural frequency above 8 Hz. New IRS were developed for other components with a lower natural frequency. It is concluded that the methodology meets the guidelines of NUREG-1407.

2.4 Success Path Selection and Safe Shutdown Equipment List (SSEL)

In accordance with the EPRI SMA methodology, a primary and an alternate success path were selected for each unit. Success path logic diagrams (SPLDs) for both the primary and alternate paths are provided in the submittal (Figures 3-16 and 3-17, respectively). Both the success paths assume loss of offsite power and a small LOCA. They are identical in equipment configuration, but are independent of each other with the exception of the control rod drive (CRD) system. A detailed description of the functions of all the systems along the paths, as well as the SSEL are provided in the submittal. It is concluded that the selection of the success path is consistent with the guidelines of NUREG-1407.

The success paths contain secondary cooling via steam generators using auxiliary feedwater, RCS makeup by charging pumps, and long term cooling by the residual heat removal (RHR) system or by recirculation from the containment sump. For a measure of diversity, feed and bleed cooling is also evaluated as a backup to the secondary cooling, with charging pumps and PORVs operating to remove the decay heat.

Even though the two paths use the same systems, there is sufficient diversity because both a small LOCA and a LOOP are considered in both paths, and feed and bleed cooling is considered as an alternative to the steam generator cooling.

2.5 Plant Walkdown Approach

The seismic capacity walkdown for SSEL components was performed according to the requirements of the EPRI SMA methodology and the SQUG GIP. A sheet was added to the GIP forms to address the relay walkdown, which is required for A-46, and seismic interaction for flooding. Evaluation of components was performed on 1) adequacy of anchor bolts and weld anchorage 2) quick conservative calculation of seismic capacity based on weight, natural frequency, and anchorage strength 3) seismic spatial interaction. A total of 498 components for Unit 1 and 389 components for Unit 2 were evaluated during the walkdown. The results of the walkdown were summarized on the screening verification data sheets (SVDS). A total of 117 outliers were identified and listed in the submittal (Appendix 3H). The procedure used in walkdowns to address the IPEEE/A-46 requirements appears adequate.

2.6 Structural Analysis and HCLPF Calculation

Although reduced scope plants are not required to perform a HCLPF calculation, a rather detailed evaluation of the seismic capacity of structures and components was conducted and described in the submittal. Most of the components were evaluated based on the SSE GRS per table 4-3 of the SQUG GIP. New SSI analyses were conducted for the DG and SW intake structures, which are supported on cast-in-place caissons.

2.7 Soil Evaluation

New soil evaluation analyses were not performed in the IPEEE study because soil failure analyses are not required for reduced-scope plants.

2.8 Relay Chatter Evaluation

Because FNP is categorized as a reduced-scope IPEEE plant, an evaluation of relay chatter is not required by NUREG-1407. However, an USI A-46 relay evaluation was performed per the SQUG GIP for FNP Unit 1, and the results are included in a separate report, which was submitted to the NRC in May 1995. Although not required, an evaluation of relay chatter is being performed for Unit 2 as a prudent measure.

2.9 Containment Performance

The earlier FNP IPE study concluded that the plant is not vulnerable to early containment failure. Based on this finding, only containment isolation failure was addressed as part of the IPEEE seismic analysis. A set of screening criteria were used to evaluate containment penetrations larger than 2 inches in diameter. The submittal concluded that all containment isolation valves included on the SSEL were demonstrated to possess a seismic capacity of at least 0.1g PGA. It is concluded that the containment performance evaluation procedure is consistent with the guidelines of NUREG-1407.

2.10 Nonseismic Failures and Human Actions

Nonseismic failures and human actions were not discussed as a separate subject in the submittal. However, equipment which requires operator actions was included in the seismic evaluation. No credit was given for recovery of offsite power loss.

2.11 Seismic Induced Fires/Floods

As part of the seismic capacity walkdown, all potential internal flooding sources, mainly piping and tanks, were evaluated by the SRT in areas containing SSEL equipment. The submittal concluded that no flooding concerns were identified because piping has a high seismic capacity, and all tanks were well anchored.

The seismic-fire interaction evaluation addressed the interaction concerns: 1) seismically induced fires, 2) seismic actuation of fire suppression systems, 3) seismic degradation of fire suppression systems. Based on walkdown findings and evaluations, the submittal concluded that no seismic-fire interaction issues exist at a seismic capacity of at least 0.1g PGA. It is concluded the above evaluation procedures are consistent with the guidelines of NUREG-1407.

2.12 Unresolved Safety Issues (USIs) and Generic Issues (GIs)

Information in the submittal regarding pertinent USIs and GIs is as follows:

USI A-45 - DHR capability was specifically addressed in Section 3.2.1 of the submittal.

USI A-46 - Issues were addressed in Sections 3.1.1.4.1 and 3.1.1.5.12 of the submittal. The complete evaluation for USI A-46 was included in a separate report.

GI-131 - This was addressed in Section 3.2.2 of the submittal. The flux mapping system (FMP) cart hold-down bolts were replaced to comply with the Westinghouse recommendation.

USI A-17 - The seismic interaction was addressed in the IPEEE seismic analysis.

GI-156 - Settlement of foundations and buried equipment are not concerns for FNP, but detailed valuations of buried structures, piping and ducts were performed. (Section 3.1.4.3 of submittal). Seismic design of structures, systems, and components was addressed in the submittal by performing the SMA.

GI-172 - Most related issues are addressed in the submittal as follows:

1) common cause failures related to human action were not specifically addressed in the submittal.
2) seismic induced spatial interactions are addressed as part of the walkdown in Section 3.1.1.4.
3) seismic induced fires as well as fire suppression system actuation are addressed in Section 3.1.4.7.
4) seismic induced flooding was not specifically addressed, but potential failures of dams and dikes are addressed in Section 3.1.1.5.6.

5) Section 3.1.4.5 states that an A-46 relay evaluation was performed and the results are included in a separate report.

2.13 Vulnerabilities/Plant Improvements

No definition of seismic vulnerability was provided in the submittal, however, a total of 117 outliers were identified and listed. It is stated that many of them have been resolved either through the implementation of design changes or the plant maintenance process. SNC planned to resolve outliers identified in the submittal by December 31, 1995. It is also stated that relays that did not satisfy the SQUG GIP criteria would be resolved. The list of the outliers is attached to this report as Appendix A. Most of the proposed resolutions involve the following types of actions:

1) installing restraining wires for overhead lights,
2) replacing anchor bolts,
3) bolting panels to walls or bolting cabinets together,
4) installing missing screws, and
5) performing additional detailed analysis.

3.0 OVERALL EVALUATION AND CONCLUSIONS

The submittal appears to be consistent with the guidelines of NUREG-1407. The IPEEE seismic evaluation was performed as an extension of the USI A-46 program. The screening review has identified no significant technical drawbacks and the licensee's IPEEE process appears to have met the objectives outlined in Generic Letter 88-20.

Attachment 2

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