Justin T. Wheat
Nuclear Licensing Manager

Southern Nuclear
Operating Company, Inc.
40 Inverness Center Parkway
Post Office Box 1295
Birmingham, AL 35242

Tel 205.992.5998
Fax 205.992.7601

SOUTHERN NUCLEAR
A SOUTHERN COMPANY

AUG 10 2016

Docket Nos.: 50-321
50-366

NL-16-1136

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Edwin I. Hatch Nuclear Plant – Units 1 and 2
Fukushima Near-Term Task Force Recommendation 2.1 Seismic
Limited-Scope Low Frequency Evaluation

References:

1. NRC Letter, "Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated March 12, 2012.
2. Letter to NRC, "Edwin I. Hatch Nuclear Plant – Units 1 and 2, Seismic Hazard and Screening Report for CEUS Sites," dated March 31, 2014.
3. NRC Letter, "Edwin I. Hatch Nuclear Plant – Units 1 and 2, Staff Assessment of Information Pursuant to 10 CFR 50.54(f) Seismic Hazard Reevaluations Relating to Recommendation 2.1 of the NTTF Review of Insights from the Fukushima Dai-ichi Accident," dated April 27, 2015.
4. NRC Letter, "Final Determination of Licensee Seismic Probabilistic Risk Assessments under the Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 "Seismic" of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated October 27, 2015.

Ladies and Gentlemen:

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Reference 1 to all power reactor licensees and holders of construction permits in active or deferred status. Enclosure 1 of Reference 1 requested each addressee in the Central and Eastern United States (CEUS) to submit a Seismic Hazard Evaluation and Screening Report. The requested information was submitted to the NRC for the Edwin I. Hatch Nuclear Plant Units 1 and 2 (HNP) by Southern Nuclear Operating Company (SNC) on March 31, 2014 (Reference 2). On April 27, 2015, SNC received the NRC's staff assessment of the HNP seismic hazard and the resulting Ground Motion Response Spectra (GMRS) (Reference 3).

The NRC issued the final determination of licensee seismic probabilistic risk assessment on October 27, 2015 (Reference 4). This NRC letter requested that HNP perform a limited-scope low frequency evaluation consistent with the seismic evaluation guidance provided in the Screening, Prioritization and Implementation Details (SPID). SNC has performed the subject evaluation as an assessment of risk significance of HNP using the principles from the SPID. The enclosure provides an overview of HNP's assessment for why the exceedance at the seismic

low frequency content is not risk-significant to HNP. This letter is the formal and final response to Fukushima Near-Term Task Force Recommendation 2.1 Seismic limited-scope low frequency evaluation as requested in the NRC's final determination letter (Reference 4). This information was communicated to the NRC by conference call on May 31, 2016.

This letter contains no new NRC commitments. If you have any questions, please contact John Giddens at 205.992.7924.

Mr. J. T. Wheat states he is the Nuclear Licensing Manager for Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and, to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

J. T. Wheat
Nuclear Licensing Manager

JTW/JMG/MRE

Sworn to and subscribed before me this 10th *day of* August, *2016.*

Laura L. Crapps
Notary Public

My commission expires: 10-8-2017

Enclosure: Edwin I. Hatch Nuclear Plant - Units 1 and 2
NTTF 2.1 - Seismic Limited-Scope Low Frequency Evaluation

cc: Southern Nuclear Operating Company
Mr. S. E. Kuczynski, Chairman, President & CEO
Mr. D. G. Bost, Executive Vice President & Chief Nuclear Officer
Mr. D. R. Vineyard, Vice President – Hatch
Mr. M. D. Meier, Vice President – Regulatory Affairs
Mr. D. R. Madison, Vice President – Fleet Operations
Mr. B. J. Adams, Vice President – Engineering
Mr. G. L. Johnson, Regulatory Affairs Manager – Hatch
RTYPE: CHA02.004

U.S. Nuclear Regulatory Commission
Mr. W. M. Dean, Director of the Office of Nuclear Reactor Regulations
Ms. C. Haney, Regional Administrator
Mr. M. D. Orenak, NRR Project Manager – Hatch
Mr. D. H. Hardage, Senior Resident Inspector – Hatch

State of Georgia
Mr. J. H. Turner, Director – Environmental Protection Division

Edwin I. Hatch Nuclear Plant – Units 1 and 2
Fukushima Near-Term Task Force Recommendation 2.1 Seismic

Enclosure

Limited-Scope Low Frequency Evaluation

Edwin I. Hatch Nuclear Plant – Units 1 and 2
NTTF 2.1 - Seismic
Limited-Scope Low Frequency Evaluation

On March 12, 2012, the Nuclear Regulatory Commission (NRC) requested each addressee in the Central and Eastern United States (CEUS) to submit a Seismic Hazard Evaluation and Screening Report (Reference 1). The requested information was submitted to the NRC for the Edwin I. Hatch Nuclear Plant Units 1 and 2 (HNP) by Southern Nuclear Operating Company (SNC) on March 31, 2014 (Reference 2). On April 27, 2015, SNC received the NRC's staff assessment of the HNP seismic hazard and the resulting Ground Motion Response Spectra (GMRS) (Reference 3).

The NRC issued the final determination of licensee seismic probabilistic risk assessment on October 27, 2015 (Reference 4). That NRC letter requested that HNP perform a limited-scope low frequency evaluation consistent with the seismic evaluation guidance provided in the Screening, Prioritization and Implementation Details (SPID) (Reference 5).

On May 31, 2016, SNC presented to the NRC the status and results of the limited-scope low frequency (LF) evaluations. That presentation provided a comprehensive overview for why the exceedance at the seismic low frequency content is not risk-significant to HNP. This letter/enclosure serves as the formal and final submittal in response to Fukushima Near-Term Task Force Recommendation 2.1 Seismic limited-scope low frequency evaluation as requested in the NRC's final determination letter (Reference 4).

1 Approach for the Seismic Low Frequency Evaluation

SNC used the guidance provided in the SPID (Reference 5) section 3.2.1.1 "GMRS Comparisons and Screening of Plants at Low Seismic Hazard Sites" to perform LF evaluations for HNP. Previous and ongoing seismic evaluations were used to screen for structures, systems, and components (SSCs) that are potentially susceptible to LF considerations. High confidence of a low probability of failure (HCLPF) capacities from these seismic evaluations were used to demonstrate that there are no safety significant SSCs with vulnerabilities due to the low frequency exceedance of the HNP Design Basis Earthquakes (DBE) by the HNP GMRS.

2 Previous and Ongoing Seismic Evaluations

Several previous and ongoing seismic evaluations provided useful information in screening for LF vulnerabilities. In particular, the Seismic Margin Assessment (SMA), the USI A-46 evaluations, the Expedited Seismic Evaluation Process (ESEP) evaluations and potential work 10 CFR 50.69 work were reviewed. Figure 1 (provided within this Enclosure) shows the various spectra compared to the HNP GMRS. These previous and ongoing seismic evaluations were selected as they used seismic inputs that were comparable to the GMRS and projects that evaluated numerous SSCs.

SMA and IPEEE: HNP Unit 1 completed a full scope SMA including relay and soil failure assessments as a pilot for the EPRI Seismic Margin Assessment methodology (Reference 6).

HNP Unit 2 completed a focus scope SMA. Both of these SMAs were used for the IPEEE-seismic submittals (Reference 7). The seismic demand for the IPEEE is based on in-structure response spectra (ISRS) from seismic re-analysis of all safety related structures using a NUREG/CR-0098 type median input ground motion with a peak ground acceleration (PGA) of 0.3g which is called the Seismic Margin Earthquake (SME). Numerous SSCs were reviewed as a part of these projects, including items that could potentially be considered low frequency sensitive.

USI A-46: In addition, both HNP units performed further seismic evaluations following the SQUG GIP to respond to USI A-46 (References 8 & 9). The ISRS used for resolution of USI A-46 were half (0.5) of the SME ISRS but conservatively defined as "median-centered realistic" ISRS. This required use of all the SQUG GIP factors that increase the seismic demand depending on type of *capacity to demand* comparison being performed. The USI A-46 project reviewed numerous SSCs, including items that could potentially be considered low frequency sensitive.

Figure 1 (provided within this Enclosure) shows the IPEEE SME ground spectrum and the 0.5 SME ground spectrum compared to the HNP GMRS. Note that the Hatch IPEEE SME ground spectrum is also called the Hatch HCLPF spectrum since the Hatch SMA demonstrated that all SSCs evaluated had a HCLPF capacity defined by this ground motion spectrum. The HNP SMAs and the USI A-46 evaluations were peer reviewed by consultants that participated in developing these seismic assessment methodologies. These peer reviews concluded that the HNP seismic evaluations were of high quality.

ESEP: The ESEP equipment list consisted of a selection of various types of equipment throughout the plant. Except for the Condensate Storage Tanks (CSTs),the HNP Expedited Seismic Evaluation Process (ESEP) (Reference 10) used the full HNP SME ISRS for the seismic assessment of the Expedited Seismic Evaluation equipment. Since the CSTs are founded directly on soil at plant grade, they were evaluated using the HNP GMRS..

10 CFR 50.69: SNC's Risk Informed Engineering group is currently performing risk assessments for HNP for possible risk-informed applications (10 CFR 50.69). The seismic demand is based on a seismic hazard consistent with the HNP 2.1 seismic hazard GMRS submittal. Information from this ongoing risk assessment was used to supplement, as needed, the screening for low frequency sensitive SSCs.

3 Comparison of the GMRS to Design Basis Ground Motions (DBEs) and Ground Motions used for IPEEE and USI A-46

Figure 1 provides a graphical representation and comparison of the various spectra used in previous seismic evaluations as well as the HNP GMRS and DBEs. The peak spectral acceleration (SA_P) of the HNP GMRS is 0.32g, which is well below the SPID Low Hazard Threshold (LHT) defined as 0.4g. The LHT is shown in Figure 1 and pictorially demonstrates that the HNP is a low seismic hazard site. Figure 1 also shows the HNP Unit 1 and 2 DBEs. Figure 1 shows that the 0.5 SME ground motion spectra used for the USI A-46 evaluations is equal to or greater than the DBEs for Unit 1 and Unit 2. The HNP Unit 2 DBE is basically identical to the 0.5 SME at approximately 6 Hz and below. It should be noted that HNP Unit 1 and Unit 2 have shared structures, the DBE ISRS for both units are similar, and both units were

subsequently evaluated for ground motions of the SME for IPEEE and 0.5 SME for USI A-46. Based on these facts, the low frequency exceedance range is considered to be 2 Hz (f_L) and below (f_L<2 Hz); i.e. the low frequency range where the GMRS exceeds the 0.5 SME and the Unit 2 DBE ground motion spectra.

4 Identification of SSCs that potentially have Low Frequency Failure Modes

SPID section 3.2.1.1 lists examples of SSCs that could potentially be susceptible to damage from spectral accelerations at low frequencies. Screening for these and other potential low frequency vulnerabilities was performed using previous and ongoing seismic evaluations. In particular, the SMA/IPEEE and the ESEP were used as well as ongoing work within SNC for possible use in risk-informed (10 CFR 50.69) applications. In addition, insights from the HNP USI A-46 evaluations were used to search for SSCs that potentially could be susceptible to damage from spectral acceleration at low frequencies.

5 Seismic Capacity (HCLPF) to Demand (GMRS) Evaluation

Previous and ongoing evaluations were used to compare the seismic capacity of various low frequency SSCs to the seismic demand. This information demonstrated a high confidence of a low probability of failure (HCLPF) for various SSCs that is greater than the GMRS. These HCLPF values are defined as PGA values for the specified input ground motion spectral shape. SPID section 3.2.1.1 lists five examples of SSCs and failure modes that are potentially susceptible to damage from spectral accelerations at low frequencies. Information from past evaluations and the ongoing risk-informed application evaluations provided insights for other SSCs that should be added to the five listed in the SPID section 3.2.1.1.

The following sections provide results of the screening for SSCs that could potentially be susceptible to damage from spectral accelerations at low frequencies:

5.1 Liquid sloshing in atmospheric pressure storage tanks:

CSTs are normally the weakest link in a plant SMA evaluation. The Hatch CSTs were part of the ESEP and were evaluated using the GMRS as the input. Since the Unit 1 CST HCLPF is equal to 0.15g PGA (as shown in the HNP ESEP report (Reference 10)), the HCLPF is equal to or greater than the GMRS. Since the Unit 2 CST HCLPF is equal to 0.18g PGA (as shown in the HNP ESEP report (Reference 10)), the HCLPF is greater than the GMRS. The ongoing risk-informed evaluations have not identified any other low frequency sensitive atmospheric storage tanks.

Therefore, no low frequency vulnerabilities of atmospheric pressure storage tanks were identified.

5.2 Very flexible distribution systems with frequencies less than 2 Hz:

Using information from previous evaluations, three categories of flexible distribution systems were identified: Cable tray and conduit supports, HVAC supports, and Rod hung B31 piping.

Cable tray and conduit supports: The HNP IPEEE SMA report stated the cable tray and conduit supports have a HCLPF of at least 0.3g PGA. Cable tray and conduit support evaluations from the USI A-46 project were also reviewed. That review identified only one support that could possibly be considered potentially susceptible to low frequency accelerations. It was reevaluated using the GMRS and still demonstrated significant margin. Therefore, the cable tray and conduit supports have a HCLPF greater than the GMRS.

HVAC supports: The HNP IPEEE SMA report stated the HVAC supports have a HCLPF of at least 0.3g PGA. Therefore, the HCLPF is greater than the GMRS.

Rod hung B31 piping: As part of the HNP IPEEE SMA all adjacent and overhead non-safety rod hung piping was evaluated and no failure or seismic interactions were identified for ground motions up to the full HNP SME. The IPEEE SME is greater than the GMRS; therefore the potential rod rung piping seismic interactions would have a HCLPF greater than the GMRS.

Therefore, no low frequency vulnerabilities of very flexible distribution systems have been identified.

5.3 Sliding and rocking of unanchored components:

HNP has procedures in place that require all safety related (Seismic Category 1) components to be anchored. While non-Category 1 components are typically anchored, they are required to be anchored if they are adjacent to Category 1 components. Any unanchored non Category 1 component must be located in an area where any sliding, rocking, or overturning of the component would not impact a Category 1 component.

Therefore, there is no low frequency vulnerability associated with sliding and rocking of unanchored components.

5.4 Fuel assemblies inside the reactor vessel:

The IPEEE evaluations for both HNP Unit 1 and HNP Unit 2 have detail assessments of the NSSS which included fuel assemblies. Information was obtained from General Electric to support those IPEEE evaluations. In both cases the seismic margin assessment demonstrated the NSSS HCLPF is greater than 0.3g PGA (SME).

After completion of the HNP IPEEE a shroud repair was installed due to potential horizontal cracking of the shroud. A seismic margin assessment performed of a typical Hatch shroud repair demonstrated the HCLPF was still greater than 0.3g PGA. Therefore the HNP NSSS HCLPF is much greater than the GMRS.

Therefore, no low frequency vulnerabilities have been identified associated with fuel assemblies.

5.5 Soil liquefaction:

The IPEEE SMA evaluated settlement, differential settlement, and slope stability. The HNP Unit I project included a seismic margin assessment of soil liquefaction at the plant for a

ground motion equal to the IPEEE SME which is greater than the GMRS. Since the result of that seismic margin assessment demonstrated a HCLPF of 0.3g PGA the HNP site soil liquefaction HCLPF is much greater than the GMRS.

Therefore, no low frequency vulnerabilities have been identified associated with soil liquefaction.

5.6 Other SSCs:

Information from previous evaluations and the ongoing risk-informed application project provided insights for other SSCs to be added to the five listed in the SPID section 3.2.1.1 to be considered for HNP.

During the HNP IPEEE SMA, new soil-structure interaction analyses were performed (References 6 and 7). Updated soil profiles were developed and used in these SMA analyses. These updated soil profiles represent a better understanding of the HNP dynamic soil properties. In general the updated soil profiles had lower shear wave velocities than those used in the original DBE SSI analyses. In some cases these SMA SSI analyses produced ISRS that showed a shift in the frequency range of the peak spectral acceleration when compared to the original DBE ISRS. The HNP IPEEE SMA report (Reference 7) states the following:

> "*The Seismic Review Team (SRT) reviewed the original plant design criteria, loading conditions, and typical construction details to ensure that the Seismic Category I structures can be screened out. The soil structure interaction (SSI) performed for the SMA indicated that the maximum response of the reactor building and the control building is in the 1-to 3-Hz range, which was not predicted in the original design. To ensure the structures could be prescreened with this difference in response, a sample of the maximum SME responses was compared to the original DBE responses for these buildings. Based on this comparison and the original plant design and construction, the SRT concluded there is no concern with these structures surviving the SME. Therefore, based on the SMA screening guidelines and review by the SRT, Plant HNP Seismic Category I structures have a HCLPF level of at least 0.3g PGA.*"

Therefore, HNP Category I structures evaluated in the HNP IPEEE SMA have HCLPFs greater than the GMRS.

In addition, the SNC staff working on a possible risk informed application (10 CFR 50.69) was contacted to help identify any other SSCs that potentially have failure modes due to spectral accelerations below 2 Hz. The HNP Main stack, which is supported on piles, was identified as having a low fundamental natural frequency. The calculated natural frequency was determined to be approximately 0.6 Hz. However, the fragility analysis resulted in a HCLPF of 0.56g PGA based on ground motion reported in the HNP 2.1 seismic hazard submitted in March 2014 (Reference 2). The GMRS PGA equals 0.1422g. As a result, it can be concluded the stack structure has a HCLPF greater than the GMRS.

Therefore, no other SSCs, based on previous or ongoing seismic evaluations, have been identified that have low frequency vulnerabilities.

6 Conclusions

In response to Near-Term Task Force Recommendation 2.1 Seismic, a limited-scope low frequency evaluation has been performed for HNP. Previous and ongoing HNP seismic evaluations were used to screen for potentially low frequency vulnerable SSCs. The previous HNP seismic evaluations included the HNP IPEEE SMA and ESEP. Insights from the HNP A-46 SQUG GIP evaluations were used to search for potentially low frequency vulnerable components (but not to define a HCLPF capacity). In addition insights and results from a potential risk-informed application (10 CFR 50.69) were used.

Potentially low frequency sensitive SSCs have been evaluated in previous and ongoing evaluations that used ground motions greater than the GMRS. No low frequency vulnerabilities were identified and all potentially low frequency vulnerable components were found to have a HCLPF greater than the GMRS.

The GMRS exceedance at the seismic low frequency content is not risk-significant to HNP. Therefore, no low frequency vulnerabilities have been identified in response to the NRC request for a NTTF 2.1 Seismic limited-scope low frequency evaluation for HNP.

7 References

The following references support the 2.1 Low Frequency Evaluation in this Enclosure:

1. NRC Letter, "Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated March 12, 2012.
2. Letter to NRC, "Edwin I. Hatch Nuclear Plant – Units 1 and 2, Seismic Hazard and Screening Report for CEUS Sites," dated March 31, 2014.
3. NRC Letter, "Edwin I. Hatch Nuclear Plant – Units 1 and 2, Staff Assessment of Information Pursuant to 10 CFR 50.54(f) Seismic Hazard Reevaluations Relating to Recommendation 2.1 of the NTTF Review of Insights from the Fukushima Dai-ichi Accident," dated April 27, 2015.
4. NRC Letter, "Final Determination of Licensee Seismic Probabilistic Risk Assessments under the Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 "Seismic" of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated October 27, 2015.
5. Electric Power Research Institute (EPRI) Report 1025287, "Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," dated February 2013
6. Electric Power Research Institute (EPRI) Report NP-7217-NL, Vol. 1-3, "Seismic Margin Assessment of the Edwin I. Hatch Nuclear Plant Unit 1," dated June 1991.
7. SNC letter, "Edwin I. Hatch Nuclear Plant Response to Generic Letter 88-20, Supplement 4," dated January 26, 1996 (HL-5102).

8. "Unresolved Safety Issue A-46 Summary Report, Edwin I. Hatch Nuclear Plant Unit 1," Georgia Power Company, May 30, 1995.
9. "Unresolved Safety Issue A-46 Summary Report, Edwin I. Hatch Nuclear Plant Unit 2," Georgia Power Company, May 30, 1995.
10. SNC letter, "Edwin I. Hatch Nuclear Plant – Units 1&2 Expedited Seismic Evaluation Process Report – Fukushima Near-Term Task Force Recommendation 2.1," dated December 30, 2014.

Figure 1. Comparison of the various spectra used in previous seismic evaluations.