22.0 REQUIREMENTS RESULTING FROM FUKUSHIMA NEAR-TERM TASK FORCE RECOMMENDATIONS

This FSAR chapter addresses the requirements resulting from the Fukushima Near-Term Task Force (NTTF) recommendations that are applicable to the South Texas Project (STP) Units 3 and 4 Combined License (COL) application. The applicable recommendations address four topics: a reevaluation of the seismic hazard (related to Recommendation 2.1), mitigation strategies for beyond-design-basis external events (related to Recommendation 4.2), spent fuel pool (SFP) instrumentation (related to Recommendation 7.1), and emergency preparedness staffing and communications (related to Recommendation 9.3).

Background

In response to the events at Fukushima resulting from the March 11, 2011, Great Tohoku Earthquake and Tsunami in Japan, the U.S. Nuclear Regulatory Commission (NRC) established the NTTF to conduct a systematic and methodical review of NRC processes and regulations to determine whether the agency should make additional improvements to its regulatory system and to make recommendations to the Commission for its policy direction. In July 2011, the NTTF issued a 90-day report, SECY-11-0093 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11186A950), "Near Term Report and Recommendations for Agency Actions Following the Events in Japan," in which it made 12 recommendations. On September 9, 2011, in SECY-11-0124 (ADAMS Accession No. ML11245A144), "Recommended Actions to Be Taken Without Delay From NTTF Report," the staff provided to the Commission for its consideration NTTF recommendations that can and, in the staff's judgment, should be initiated, in part or in whole, without delay. In SECY-11-0124 the staff identified and concluded that the following subset of actions had the greatest potential for safety improvement in the near-term:

1. Recommendation 2.1: Seismic and Flood Hazard Reevaluations

2. Recommendation 2.3: Seismic and Flood Walkdowns

3. Recommendation 4.1: Station Blackout Regulatory Actions

4. Recommendation 4.2: Equipment covered under Title 10 of the *Code of Federal Regulations* (10 CFR) 50.54(hh)(2)

5. Recommendation 5.1: Reliable Hardened Vents for Mark I Containments

6. Recommendation 8: Strengthening and Integration of Emergency Operating Procedures, Severe Accidents Management Guidelines, and Extensive Damage Mitigation Guidelines

7. Recommendation 9.3: Emergency Preparedness Regulatory Actions (staffing and communications).

On October 3, 2011, in SECY-11-0137, "Prioritization of Recommended Actions to Be Taken in Response to Fukushima Lessons Learned," (ADAMS Accession No. ML11272A203) the staff identified two actions in addition to the actions discussed in SECY-11-0124 which had the greatest potential for safety improvement in the near-term. The additional actions are:

1. Inclusion of Mark II containments in the staff's recommendation for reliable hardened vents associated with NTTF Recommendation 5.1

2. The implementation of SFP instrumentation proposed in Recommendation 7.1

The staff also prioritized the NTTF recommendations into Tier 1, Tier 2, and Tier 3, where the recommendations in Tier 1 represent those that the staff determined should be started without unnecessary delay, while recommendations in Tier 2 are those that could not be initiated in the near term, and recommendations in Tier 3 require further study to support regulatory action.

On February 17, 2012, in SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," (ADAMS Accession No. ML12039A103) the staff provided the Commission with proposed orders and requests for information to be issued to all power reactor licensees and holders of construction permits.

On March 9, 2012, and as described below, the Commission approved issuance of the proposed orders with some modifications in the staff requirements memorandum (SRM) to SECY-12-0025. On March 12, 2012, the NRC issued two orders, namely EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" and EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" to the appropriate licensees and permit holders (ADAMS Accession Nos. ML12054A679 and ML12054A735). The Commission determined that the requirements of EA-12-049 were necessary to provide adequate protection to the public health and safety, and EA-12-051 was issued to provide enhanced protection under an administrative exemption to the Backfit Rule in 10 CFR 50.109.

The staff also issued the request for information pursuant to 50.54(f) regarding Recommendations 2.1, 2.3 and 9.3, as described in SECY-12-0025, to the appropriate licensees and permit holders in letters dated March 12, 2012 (ADAMS Accession No. ML12053A340).

The following Tier 1 recommendations in SECY-11-0137 as addressed in SECY-12-0025 were considered in determining those that are applicable to the STP Units 3 and 4 COL review:

1. Recommendation 2.1: Seismic and Flood Hazard Reevaluations

2. Recommendation 2.3: Seismic and Flood Walkdowns

3. Recommendation 4.1: Station Blackout Regulatory Actions

4. Recommendation 4.2: Equipment covered under 10 CFR 50.54(hh)(2)

5. Recommendation 5.1: Reliable Hardened Vents for Mark I and Mark II Containments

6. Recommendation 7.1: Spent Fuel Pool Instrumentation

7. Recommendation 8: Strengthening and Integration of Emergency Operating Procedures, Severe Accidents Management Guidelines, and Extensive Damage Mitigation Guidelines

8. Recommendation 9.3: Emergency Preparedness Regulatory Actions (staffing and communications)

Staff determined that the following four recommendations were applicable and should be addressed by the STP Units 3 and 4 COL applicant:

1. Recommendation 2.1: Seismic reevaluations - Order licensees to reevaluate the seismic hazards at their sites against current NRC requirements and guidance, and if necessary, update the design basis and structures, systems, and components important to safety to protect against the updated hazards.

2. Recommendation 4.2: Mitigation Strategies for Beyond-Design-Basis External Events - Order licensees to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment and SFP cooling capabilities following a beyond-design-basis external event, including, among other things, for a multi-unit event.

3. Recommendation 7.1: Spent fuel pool instrumentation - Order licensees to provide reliable spent fuel pool level instrumentation.

4. Recommendation 9.3: Emergency preparedness regulatory actions (staffing and communications) - Order licensees to do the following until rulemaking is complete:

- Determine and implement the required staff to fill all necessary positions for response to a multi-unit event.

- Provide a means to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones and satellite telephones) during a prolonged station blackout.

The staff determined that the remaining Tier 1 recommendations did not need to be further considered in the STP COL review. The applicant evaluated the flood hazard using the current guidance and methodologies, and staff has, therefore, determined that the flood reevaluation portion of Recommendation 2.1 has already been addressed. Therefore, there are no additional requirements to address Recommendation 2.1 for flooding reevaluation applicable for the STP Units 3 and 4 COL application. Additionally, the staff determined that Recommendation 2.3 was not applicable to the STP COL because the plant is not yet constructed, and Recommendation 5.1 was not applicable because it applies to boiling water reactor (BWR) type plant designs with Mark I and Mark II Containments, which differ significantly from the ABWR containment. Recommendations 4.1 and 8 did not need to be further considered because SECY-11-0137 and its associated SRM direct that regulatory action associated with them be initiated through rulemaking.

In SECY-12-0025, the staff stated that it would request all COL applicants to provide the information required by the orders and request for information letters through the review process. Accordingly, for the STP COL application, the staff issued request for additional information (RAI) Letter No. 417 (ADAMS Accession No. ML121230021), dated May 2, 2012, related to Implementation of Fukushima Near-Term Task Force Recommendations pertaining to seismic hazard reevaluation, mitigation strategies for beyond design- basis external events, spent fuel pool instrumentation, and emergency preparedness based on Recommendations 2.1, 4.2, 7.1, and 9.3, as modified by SRM-SECY-12-0025. The following sections of this chapter present the staff's safety evaluation related to these areas.

22.1 Recommendation 2.1 Seismic Hazard Reevaluation

22.1.1 Introduction

SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," Enclosure 7, Attachment 1 to Seismic Enclosure 1 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML12039A103), related to seismic hazard reevaluation, specifies the use of NUREG–2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities," in a site probabilistic seismic hazard analysis (PSHA) and describes an updated cumulative absolute velocity (CAV) filter methodology. The staff issued NUREG–2115 in January 2012, as a replacement for the Electric Power Research Institute-Seismic Owners Group (EPRI-SOG) (EPRI 1986, 1989) and the Lawrence Livermore National Laboratory (LLNL) (Bernreuter et al., 1989) seismic source models for the central and eastern United States (CEUS). NUREG–2115 describes the implementation of a Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 assessment process for developing the new regional seismic source characterization model for the CEUS (CEUS-SSC). Consistent with SECY-12-0025, as well as with the need to consider the latest available information in the PSHA for the STP site, the staff requested the applicant to evaluate the seismic hazards at the STP site using the CEUS-SSC in a PSHA.

This safety evaluation report (SER) section provides the staff's evaluation of the seismic hazards at the STP site performed in accordance with SECY-12-0025. The information discussed in this SER section supports the staff's evaluation in SER Sections 2.5.2, "Vibratory Ground Motion"; 2.5.4, "Stability of Subsurface Materials and Foundations"; and 3.7, "Seismic Design."

Summary of the CEUS-SSC Model

In this section, the staff summarizes the CEUS-SSC model that the applicant used for the seismic hazard reevaluation in response to the request for additional information (RAI) Letter No. 417 dated May 2, 2012 (ML121230021). This summary focuses on the parts of the CEUS-SSC model that are applicable to the STP site's seismic hazard and provides background and a framework for the staff's technical evaluation of the applicant's seismic hazard reevaluation in SER Section 22.1.4. In SER Section 22.1.4, the staff describes and evaluates the specific deviations taken by the applicant during model implementation from the as-is model published in NUREG–2115.

On January 31, 2012, the United States (U.S.) Nuclear Regulatory Commission (NRC), U.S. Department of Energy (DOE), and EPRI issued a new seismic source characterization model and report for use in seismic hazard assessments of nuclear facilities in the CEUS. This cooperative project replaces seismic source models developed in the 1980s by the EPRI-SOG (EPRI 1986, 1989) and the LLNL (Bernreuter et al., 1989).

The new model addresses the need for an up-to-date regional seismic source characterization model for the CEUS that includes (1) a full assessment and incorporation of uncertainties; (2) a range of diverse technical interpretations from the informed scientific community; (3) an up-to-date earthquake database; (4) proper and appropriate documentation; and (5) a comprehensive, participatory peer review. The cooperative project for this new model was conducted using processes described in the SSHAC guidance in NUREG/CR–6372, "Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts." The model was developed using a SSHAC Level 3 assessment process with the goal of representing the center, body, and range of technically defensible interpretations of the available data; models; and methods.

The CEUS-SSC model is a new seismic source model for the CEUS, the broad region of the United States east of the Rocky Mountains. The CEUS-SSC study region is shown in Figure 22.1-1 of this SER. The CEUS-SSC Project resulted in products and methodological improvements that will be valuable to future users for (1) data evaluation and data summary tables that identify all the data considered by the project team and indicate the team's views of the quality of the data and the degree of reliance placed on any given data set; (2) geologic, geophysical, and seismological databases; (3) earthquake catalogs with uniform moment — magnitudes (**M**); (4) updated paleoseismicity data and guidance; and (5) recommendations regarding future applications of the seismic source characterization model. For purposes of demonstrating the CEUS-SSC model, the project also incorporated sample calculations at the seven sites identified in Figure 8.1-1 of NUREG–2115—including the Houston Test Site shown in Figure 22.1-1.

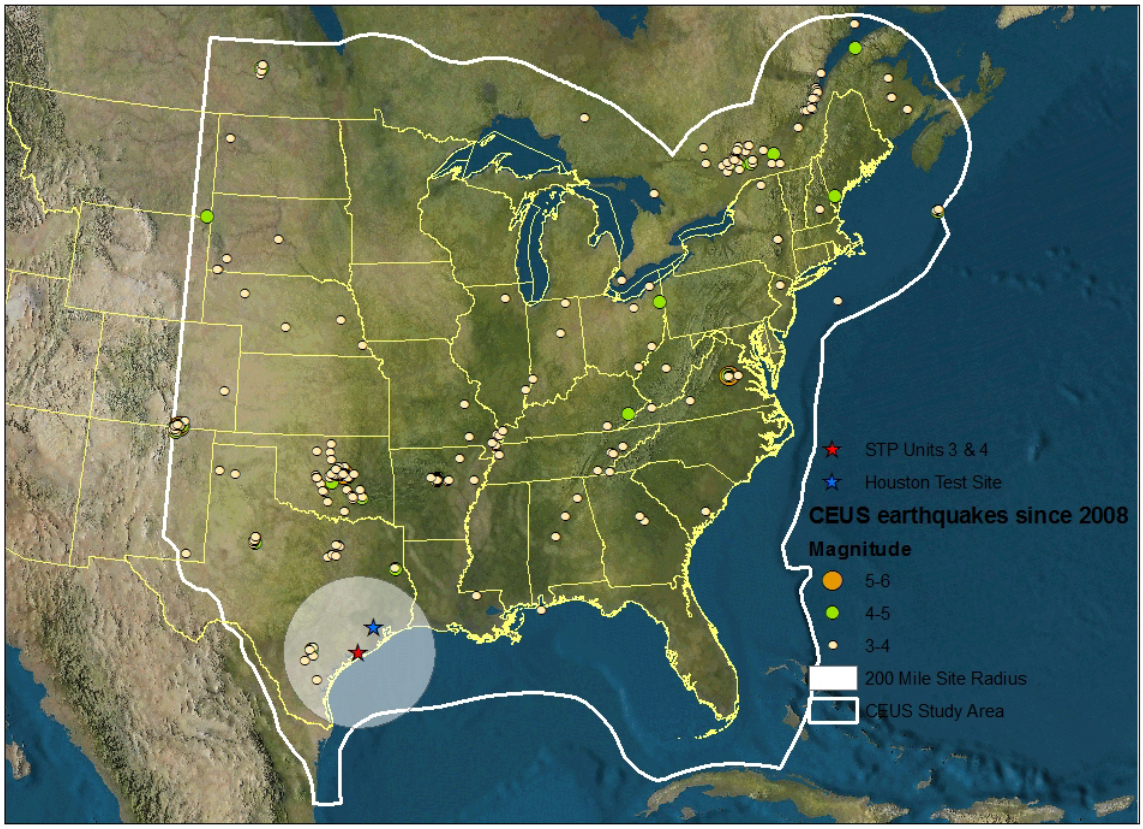

Figure 22.1-1 Map Showing the Locations of the CEUS Study Region, STP Units 3 and 4, and the Houston Test Site.

The applicant used the EPRI-SOG model in the STP Units 3 and 4 Final Safety Analysis Report (FSAR) evaluation of vibratory ground motion in Section 2.5S.2. In accordance with Regulatory Guide (RG) 1.208, "A Performance-Based Approach To Define the Site-Specific Earthquake Ground Motion," recent licensing applications for nuclear facilities submitted to the NRC—including the STP application—used the EPRI-SOG model as a starting point and updated the model, as appropriate, on a site-specific basis for the application's PSHA. Although the applicant has updated the EPRI-SOG model on a site-specific basis, there has not been a systematic update of the full model in more than 20 years. The project to develop the CEUS-SSC model created an up-to-date CEUS seismic hazard model that takes into account data used to develop the previous two models, new data and information developed in the interim years, and

other information and hazard analyses developed as part of the licensing actions for proposed and existing nuclear power facilities. Lastly, the CEUS-SSC model contains updated methods for evaluating the data and for quantifying uncertainties in the PSHA model. Because the STP applicant submitted the COL application to the NRC for review in September 2007, before the CEUS-SSC model was published in NUREG–2115 in January 2012, the applicant used the EPRI-SOG model in the initial application. The applicant later updated the application to include a sensitivity evaluation of the seismic hazard for the STP site using the newer CEUS-SSC model.

The CEUS-SSC model consists of three models of seismic sources—the M_{max} zones model, the seismotectonic zones model, and the repeated large magnitude earthquake (RLME) sources model. First, the CEUS-SSC model characterizes the CEUS study area using two conceptual source models to assess the spatial and temporal distribution of future seismicity. These are the M_{max} zones models and the seismotectonic zones model, which represent the background or distributed seismicity in the CEUS using two different approaches to characterize future earthquakes.

The M_{max} zones model is based on average or "default" characteristics that are representative of large areas of the CEUS, or the entire study area; M_{max} zones thus cover large areas and are based on historical seismicity and broad-scale geologic and tectonic data.

The seismotectonic zones model includes information that allows for an assessment of spatial variations of future earthquake characteristics at a finer scale than in the M_{max} zones model. The seismotectonic zones model uses historical seismicity and regional-scale geologic and tectonic data to characterize seismic source zones.

Finally, the RLME sources model is the third type of seismic source. The RLME sources model is not based on distributed seismicity within an areal source as in the M_{max} and seismotectonic zones models. The RLME sources model is defined primarily by paleoseismic evidence and, as its name suggests, it represents the sources where repeated large magnitude earthquakes occur.

Figure 22.1-2 of this SER shows where the three types of source zones appear on the CEUS-SSC model master logic tree. As described in NUREG–2115, the RLME sources are characterized by historical and paleoseismic records and are defined as having experienced two or more earthquakes with a moment magnitude of at least **M** 6.5. Figure 22.1-3 of this SER shows the geographic locations of the RLME sources.

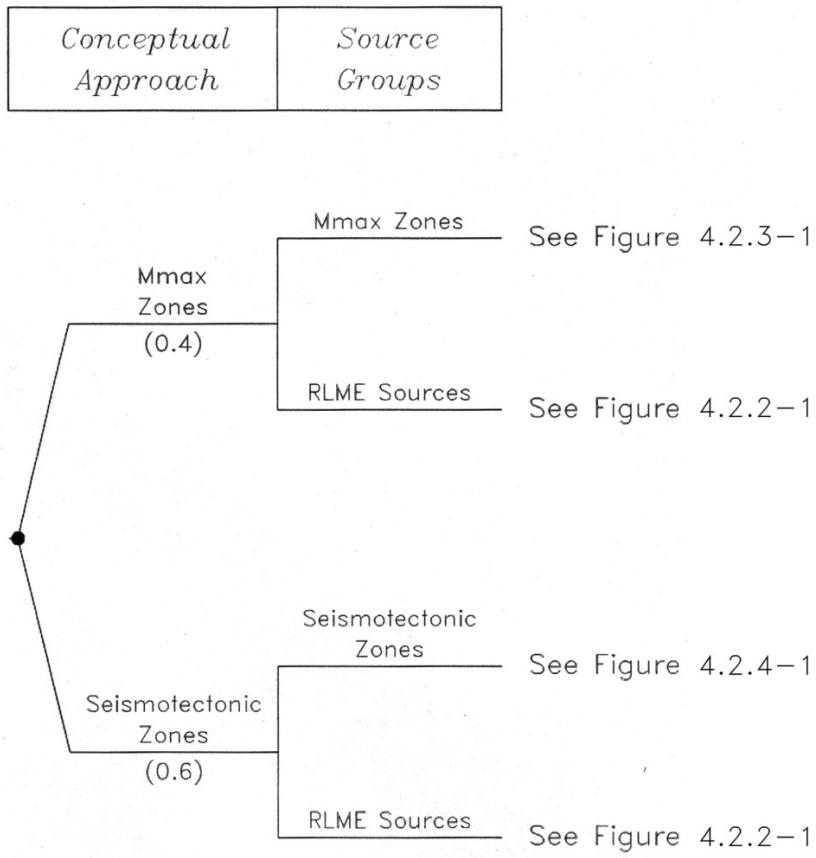

Figure 22.1-2 CEUS-SSC Master Logic Tree

(Taken from Figure 4.2.1-1 of NUREG–2115)

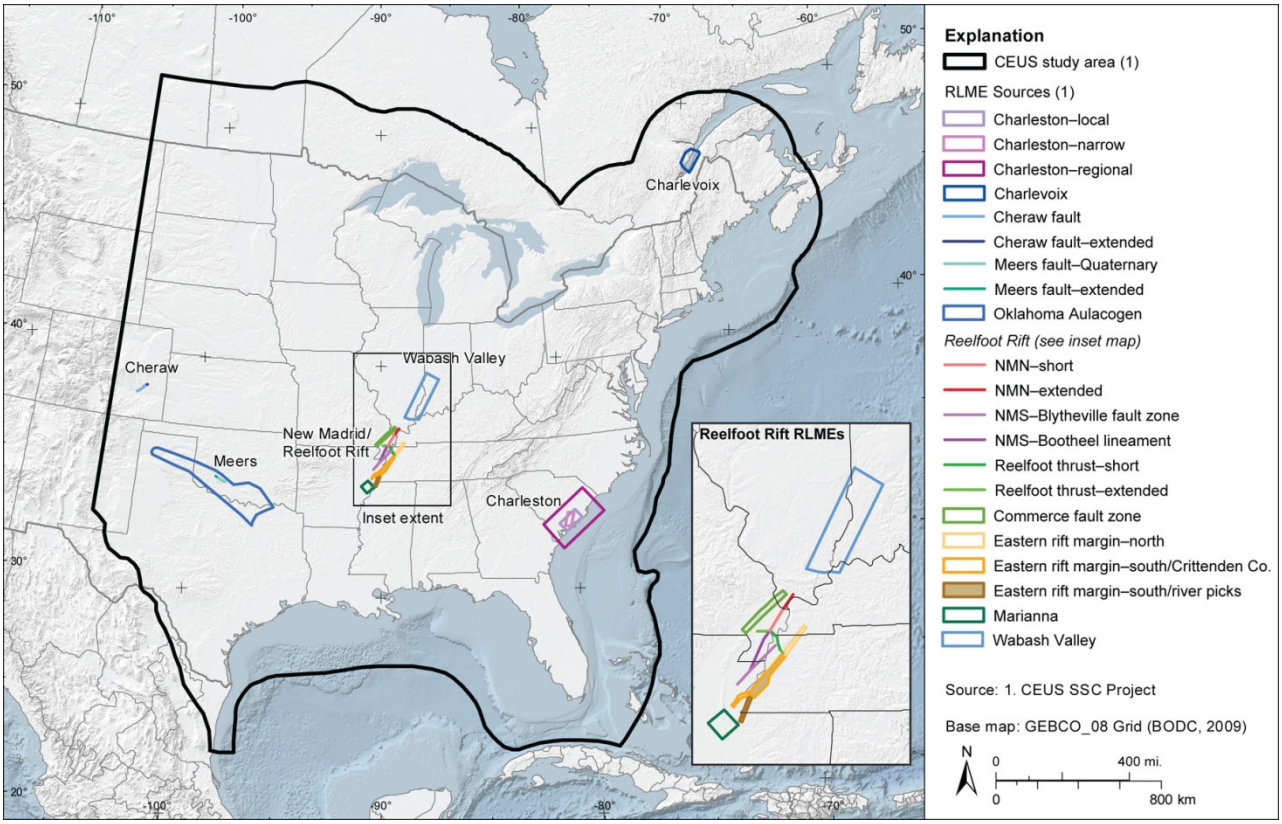

Figure 22.1-3 The Geographic Locations of the RLME Sources

(Taken from Figure 4.2.3-2 of NUREG–2115)

Each seismic source in the M_{max} zones, seismotectonic zones, and RLME sources models is defined by a source geometry; a set of maximum magnitude (M_{max}) distributions; a set of recurrence parameters (rate and b-values) or methods; and uncertainties. These source characteristics explain where earthquakes may occur, how large the events may be, how often they are expected, and how uncertain those characterizations are, respectively. There are five alternate sources characterized as M_{max} zones, 17 sources characterized as seismotectonic zones, and 10 RLME sources. Each of the seismic source zones can have multiple alternative characterizations (geometries, M_{max} distributions, recurrence parameters), so the CEUS-SSC logic tree weights each source and each alternative—as determined through the SSHAC Level 3 process—and combines them to create the whole model. New to the CEUS-SSC model is the use of M as the input magnitude unit; the EPRI-SOG model used body-wave magnitude (m_b) as its input unit. Additionally, each CEUS-SSC areal source has recurrence parameters specified in cells of 0.25-degree longitude by 0.25-degree latitude or 0.5-degree longitude by 0.5-degree latitude. The EPRI-SOG model used cells that were 1-degree longitude by 1-degree latitude. The smaller cell size used in the CEUS-SSC model achieves a higher resolution, which is particularly important for more active regions.

For the M_{max} zones model, the CEUS-SSC logic tree for the M_{max} zones is shown in Figure 4.2.3-1 of NUREG–2115 and four source geometries are shown in Figures 4.2.3-2 and 4.2.3-3 of NUREG–2115; the fifth M_{max} zone covers the entire CEUS study region (See Figures 22.1-1 and 22.1-3 in this SER). The STP site is located in the “Mesozoic-and-younger extension” (MESE) M_{max} zone, where MESE-N and MESE-W distinguish between narrow (N) and wide (W) geometry

interpretations. Figure 22.1-4 of this SER depicts the narrow MESE and Non-Mesozoic (NMESE) Zones.

For the seismotectonic zones model, the CEUS-SSC logic tree for the seismotectonic zones is shown in Figures 4.2.4-1(a) and 4.2.4-1(b) of NUREG–2115; the source geometries are shown in Figures 4.2.4-2 through 4.4.4-5 of NUREG–2115. The STP site is located in the "extended continental crust-Gulf Coast" (GHEX) seismotectonic source zone. Figure 22.1-5 of this SER shows the seismotectonic zones in the case where the Rough Creek Graben is not part of the Reelfoot Rift (RR), and the Paleozoic Extended Zone is narrow (PEZ-N).

For the RLME model, the CEUS-SSC logic trees for the Meers and New Madrid fault system (NMFS) RLME sources are shown in Figures 6.1.4-2 and 6.1.5-1, respectively, of NUREG–2115. The NMFS and the Meers RLME sources are the closest RLME sources to the STP site. Each of the 10 RLME sources (See Figure 22.1-3) has a logic tree defining the uncertainty in its characterization. The characterization of the NMFS RLME source in the CEUS-SSC model is similar to the updated New Madrid Seismic Zone (NMSZ) seismic source (Exelon, 2006) used by the applicant in FSAR Subsection 2.5S.2.4 and discussed and evaluated in Subsection 2.5.2.2 and Subsection 2.5.2.4, respectively, of this SER.

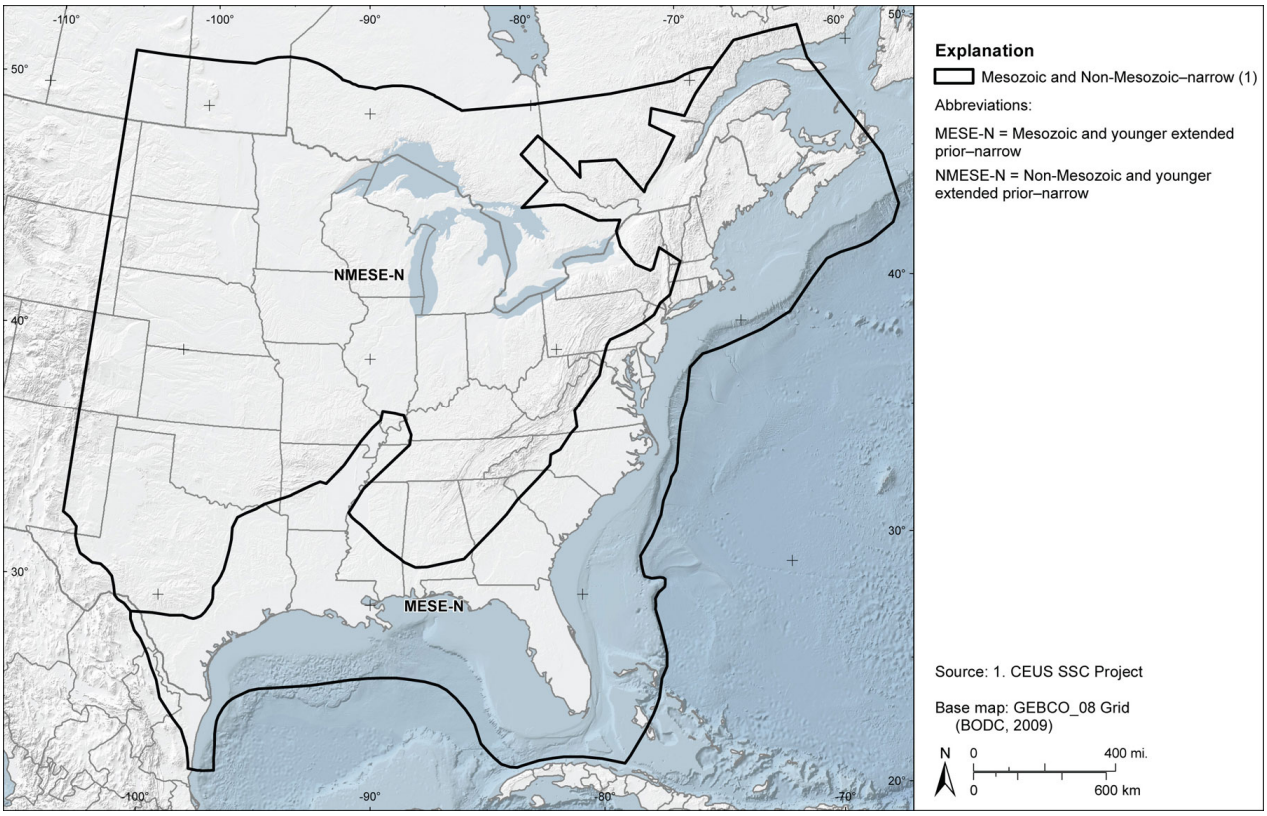

Figure 22.1-4 Mesozoic-and-Younger Extension Zone (MESE) and Non-Mesozoic-and-Younger zone (NMESE), where MESE-N and NMESE-N Refer to the Narrow (N) Geometry Interpretation (Taken from Figure 4.2.3-2 of NUREG–2115)

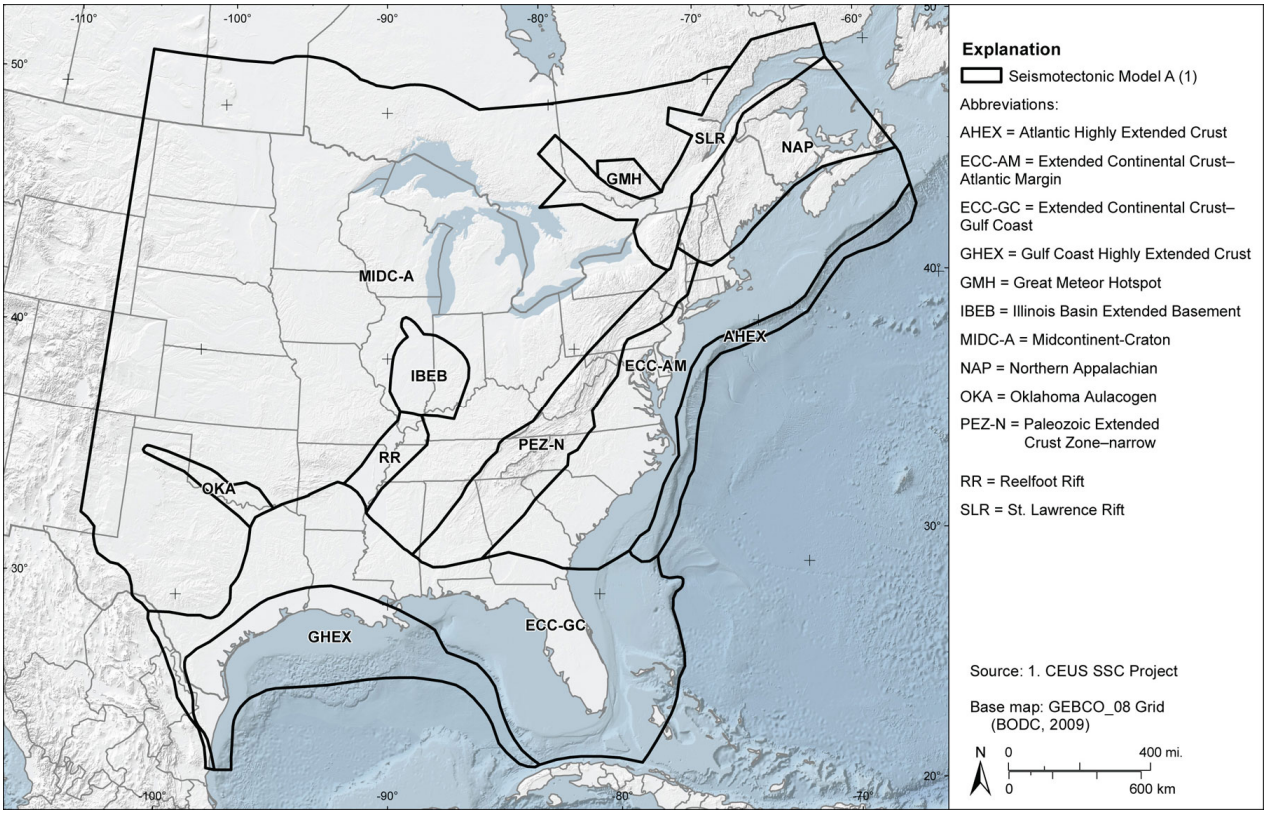

Figure 22.1-5 The Seismotectonic Zones in the Case where the Rough Creek Graben Is Not Part of the Reelfoot Rift (RR), and the Paleozoic Extended Zone Is Narrow (PEZ-N) (Taken from Figure 4.2.4-2 of NUREG–2115)

22.1.2 Summary of the Application

The applicant provided information to evaluate the seismic hazard at the STP site against current NRC requirements and guidance. The information was in the response to RAI Letter No. 417 (RAI 01.05-1) dated May 2, 2012 (ML121230021), which requested the applicant to evaluate the seismic hazard at the STP site against current NRC requirements and guidance as described in SECY-12-0025 Enclosure 7, Attachment 1 to Seismic Enclosure 1 (ML12039A188). The RAI also requested the applicant—if necessary—to update the design basis and the structures, systems, and components (SSCs) important to safety to protect against the updated hazards. The applicant responded to RAI 01.05-1 in a letter dated December 6, 2012 (ML12346A445). The applicant's response proposed to incorporate changes into FSAR Appendix 1E, "Response to NRC Post-Fukushima Recommendations." Specifically, the applicant provided the seismic reevaluation in Subsection 1E.2.1.1 of Appendix 1E.

The applicant subsequently incorporated the proposed changes into Revision 10 of the STP COL FSAR.

22.1.3 Regulatory Basis

The applicable regulatory requirements for the seismic hazard reevaluation are established and described as follows:

- Title 10 of the *Code of Federal Regulations* (10 CFR) 100.23, "Geologic and Seismic Siting Criteria," with respect to obtaining geologic and seismic information necessary to determine site suitability and to establish site geologic and site characteristics as bases for design.

- 10 CFR 52.79(a)(1)(iii), as it relates to consideration of the most severe natural phenomena historically reported for the site and the surrounding area and with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data were accumulated.

- 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities"; Appendix A, "General Design Criteria for Nuclear Power Plants"; General Design Criterion (GDC) 2, "Design bases for protection against natural phenomena," which requires, in part, that SSCs important to safety be designed to withstand the effects of natural phenomena—such as earthquakes—so the SSCs do not lose their capabilities to perform their safety functions.

- 10 CFR Part 50, Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants."

In addition, the geologic and seismic characteristics of the STP site should be determined in accordance with the appropriate sections from the following guidance:

- NUREG–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)," Section 2.5.2, "Vibratory Ground Motion," Revision 4.

- RG 1.60, Revision 1, "Design Response Spectra for Seismic Design of Nuclear Power Plants."

- RG 1.132, Revision 2, "Site Investigations for Foundations of Nuclear Power Plants."

- RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

- RG 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion."

- Design Certification (DC)/COL Interim Staff Guidance (ISG)-017, "Interim Staff Guidance on Ensuring Hazard-Consistent Seismic Input for Site Response and Soil Structure Interaction Analyses."

- SECY-12-0025, which states, in part, that the staff will also request all COL applicants to provide the information required by the specified orders and request for information letters described in that paper, as applicable, through the review process. Enclosure 7 to SECY-12-0025 contains a request for the information letter addressing NTTF Recommendation 2.1 for a seismic reevaluation; and Enclosure 7, Attachment 1 to Seismic Enclosure 1, which describes an acceptable process for developing the information requested.

22.1.4 Technical Evaluation

This SER section provides the staff's evaluation of the applicant's responseto RAI Letter No. 417 (RAI 01.05-1) dated December 6, 2012 (ML12346A445), as it relates to the applicant's evaluation

of the seismic hazard at the STP site against current NRC requirements and guidance as described in SECY-12-0025 Enclosure 7, Attachment 1 to Seismic Enclosure 1 (ML12039A188). To address the guidance described in SECY-12-0025, the applicant evaluated potential seismic hazards at the STP site using the CEUS-SSC model (in NUREG–2115) and then performed a sensitivity study comparing the results with those that the applicant had previously generated using the EPRI-SOG model.

22.1.4.1 Implementation of the CEUS-SSC Model and Sensitivity Evaluation

The applicant evaluated the potential impact of the CEUS-SCC model on the characterization of seismic hazards at the STP site. For this evaluation, the applicant relied on the 1-, 10-, and 100-Hertz (Hz) hazard curves for the nearby Houston Test Site in Chapter 8 of NUREG–2115 because both sites share similar geologic and tectonic settings. The applicant noted that both sites have similar activity rates for the average of the STP-updated EPRI-SOG Earth Science Teams (ESTs) and for the CEUS-SSC. The applicant provided the results in Figures 2a, 2b, 3a, and 3b of the response to RAI 01.05-1 (ML12346A445). The applicant obtained the values for the CEUS-SSC rock spectral accelerations at the 10^{-4} and 10^{-5} mean annual exceedance from the curves in Figures 8.2-3d, 8.2-3e, and 8.2-3f of NUREG–2115 for 1, 10, and 100 Hz. The applicant estimated 10^{-4} and 10^{-5} spectral accelerations at 30 Hz by using the ratio of 100-Hz to 30-Hz rock motions from the STP Units 3 and 4 FSAR and then applying this ratio to the CEUS-SSC peak ground acceleration (PGA) value. The applicant asserted that the ratio of 100-Hz to 30-Hz spectral acceleration developed for the STP Units 3 and 4 site would closely approximate the Houston Test Site because (1) this ratio is stable for a wide range of critical magnitudes and distances (McGuire et al., 2001); (2) both the CEUS-SSC and STP Units 3 and 4 PSHA models use the EPRI (2004, 2006) ground motion models (GMMs); (3) the resulting 1-, 10-, and 100-Hz hazard curves in both models are very similar; and (4) the seismic hazard in the Houston-STP region varies slowly with location.

Using the procedure recommended in RG 1.208, the applicant then developed a hard rock GMRS at frequencies of 1, 10, 30, and 100 Hz. Next, the applicant scaled the hard rock GMRS by the STP site-specific amplification factors (i.e., from FSAR Table 2.5S.2-21) at the corresponding frequencies. The applicant's GMRS values are in Figure 22.1-6 of this SER, in addition to the STP COL application GMRS and the STP site-specific safe-shutdown earthquake (SSE) ground motion. Based on this comparison, the applicant concluded that the estimated CEUS-SSC STP GMRS is very close to—and not significantly above—the STP COL application GMRS, while the site-specific SSE envelopes the GMRS from both. The applicant further concluded that because the STP Units 3 and 4 COL application GMRS and the estimated CEUS-SSC results for the STP site are not significantly different, the STP Units 3 and 4 COL seismic design basis does not need to be revised.

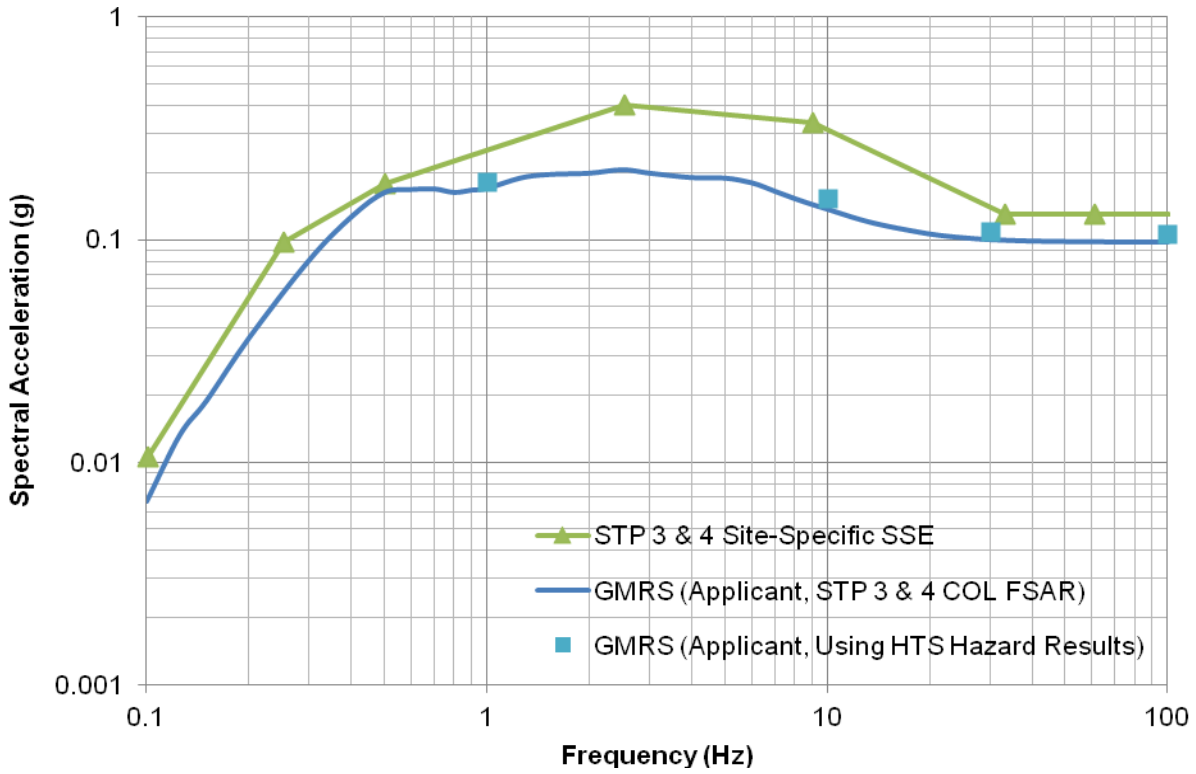

Figure 22.1-6 Comparison of the Horizontal STP Units 3 and 4 Site-Specific SSE—the STP Units 3 and 4 COL Application GMRS—and the Houston Test Site CEUSSSC GMRS

(Taken from Figure 6 in the response to RAI 01.05-1 Dated December 6, 2012 [ML12346A445])

In order to confirm the applicant's assumption that the Houston Test Site hazard curves are appropriate for estimating reference rock seismic hazard curves at the STP site, the staff performed a confirmatory PSHA for the STP site and the Houston Test Site and compared the results with those in NUREG–2115 for the Houston Test Site. The staff used the CEUS-SSC model (NUREG–2115) with the EPRI (2004, 2006) GMM. The staff used the NUREG-2115 Houston Test Site distributed seismicity sources in this confirmatory PSHA. The staff compared the confirmatory 1-, 10-, and 100-Hz hazard curve results for both the STP site and the Houston Test Site with the Houston Test Site results in the NUREG–2115 report for the distributed seismicity sources. The staff determined that the two sets of results are almost identical. This comparison is illustrated in Figures 22.1-7 through 22.1-9 of this SER. The figures show the PSHA hard rock seismic hazard curve results for 1, 10, and 100 Hz, respectively, for the distributed seismicity sources. These figures also show a comparison of the staff's results for the STP site and the Houston Test Site, which indicates that the STP hazard curves are close to or less than the Houston Test Site hazard curves at frequencies of 1, 10, and 100 Hz.

Based on the above assessment, the staff concludes that the COL applicant's use of the NUREG–2115 hazard curves for the Houston Test Site at 1 Hz, 10 Hz, and 100 Hz is an adequate substitute for performing hazard calculations for the STP site using the CEUS-SSC model. Because the RLME sources are quite distant from both the Houston and STP sites, the staff only used the distributed seismicity sources in the confirmatory PSHA analysis. Including

the RLME sources (i.e., the NMFS) would result in the same conclusion, because the STP site is located slightly further from the NMFS than the Houston Test Site is.

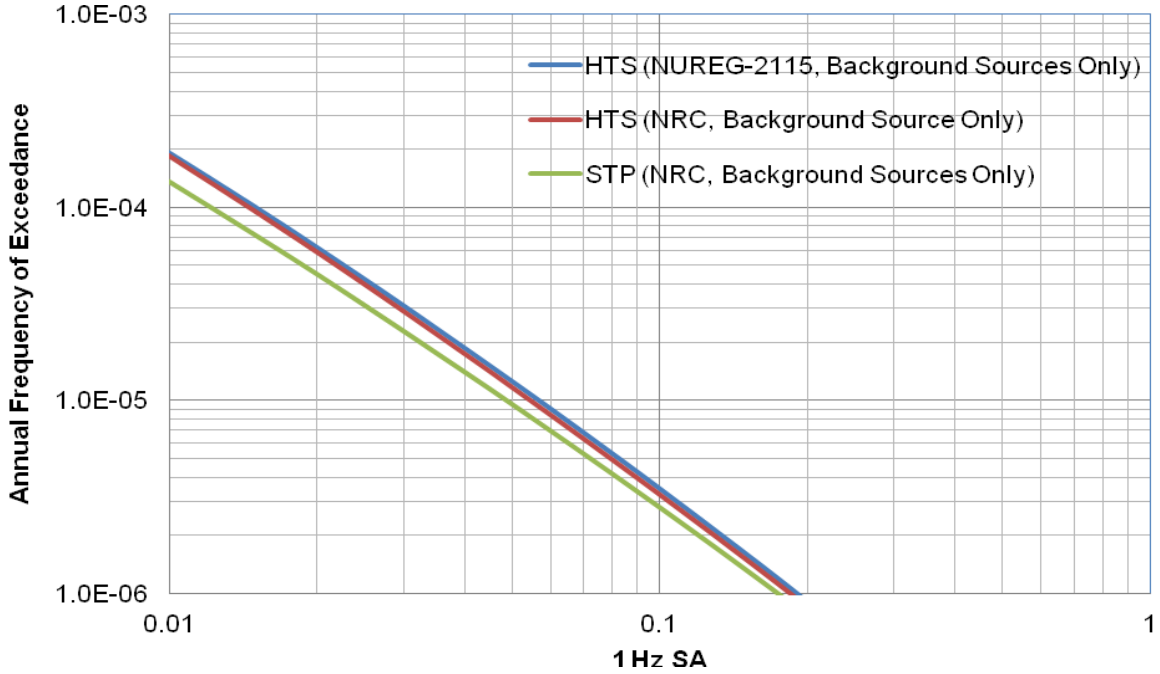

Figure 22.1-7 Plot Comparing the Staff's 1-Hz Total Mean Hazard Curves for the Distributed Seismicity Source Zones for the STP Site and the Houston Test Site (HTS). (Also Shown Is the NUREG–2115 1-Hz Total Mean Hazard Curve for the Distributed Seismicity Source Zones for the Houston Test Site)

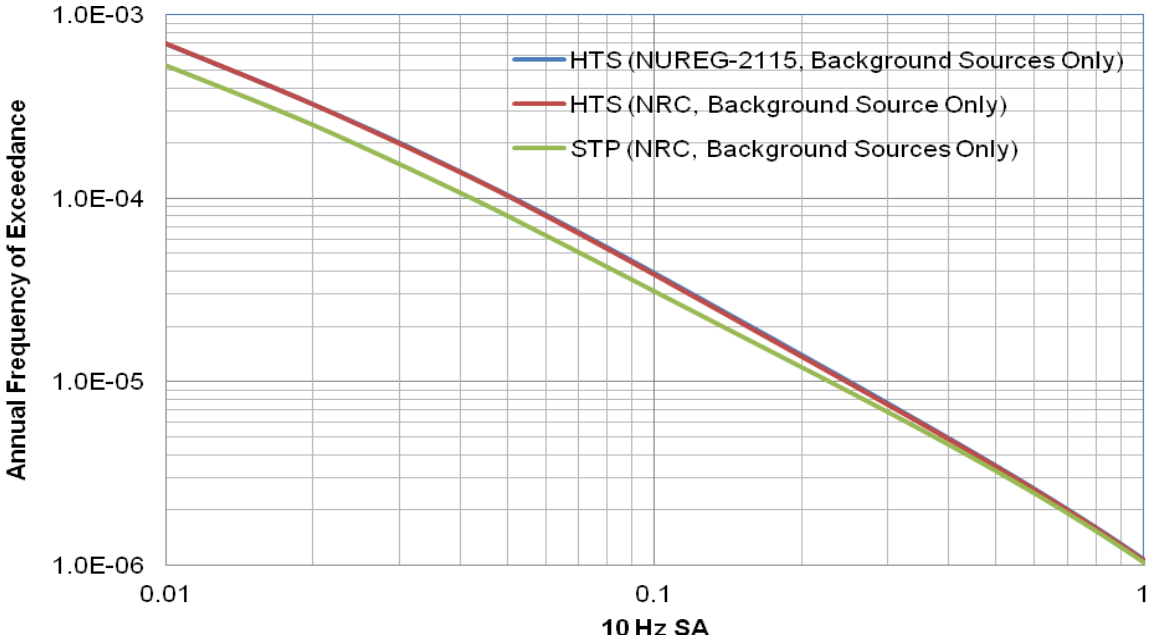

Figure 22.1-8 Plot Comparing the Staff's 10-Hz Total Mean Hazard Curves for the Distributed Seismicity Source Zones for the STP Site and the Houston Test Site (HTS). (Also Shown Is the NUREG–2115 10-Hz Total Mean Hazard Curve for the Distributed Seismicity Source Zones for the Houston Test Site)

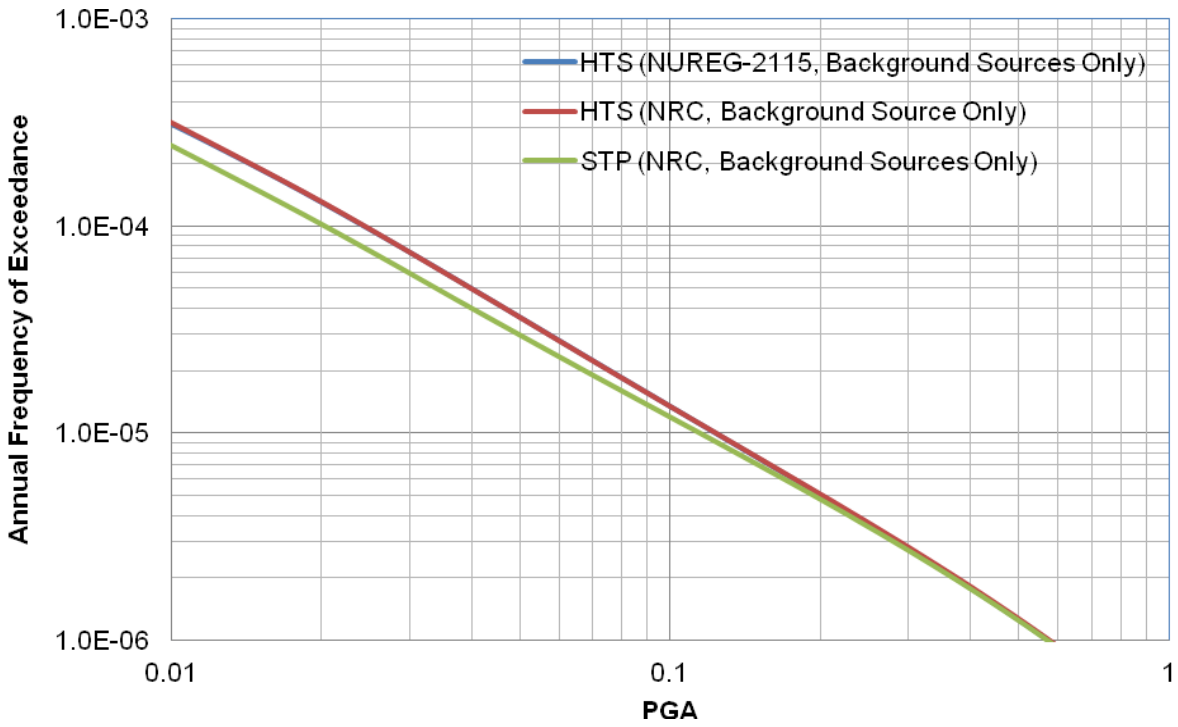

Figure 22.1-9 Plot Comparing the Staff's 100-Hz Total Mean Hazard Curves for the Distributed Seismicity Source Zones for the STP site and the Houston Test Site (HTS). (Also Shown Is the NUREG–2115 100-Hz Total Mean Hazard Curve for the Distributed Seismicity Source Zones for the Houston Test Site)

The staff also performed confirmatory site response calculations to determine the adequacy of the applicant's GMRS. For these calculations, the staff used the information on static and dynamic soil properties in COL FSAR Subsection 2.5S.2.5. The staff used 7 spectral frequencies and 11 input rock amplitudes. Figure 22.1-10 of this SER shows a comparison of the staff's mean site amplification function results with the COL applicant's results.

As shown in Figure 22.1-10, the COL applicant's and the staff's results are similar. The staff then used the amplification functions and the CEUS-SSC hard rock hazard curves for the Houston Test Site to develop probabilistic soil hazard curves that adhere to the methodology described in EPRI Technical Report 102587, "Seismic Evaluation Guidance," (EPRI, 2012) and NUREG/CR–6728, "Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-Consistent Ground Motion Spectra Guidelines," (McGuire, et al., 2001). The staff then developed a GMRS at seven spectral frequencies using an approach that is consistent with RG 1.208. The staff's GMRS is depicted in Figure 22.1-11 of this SER.

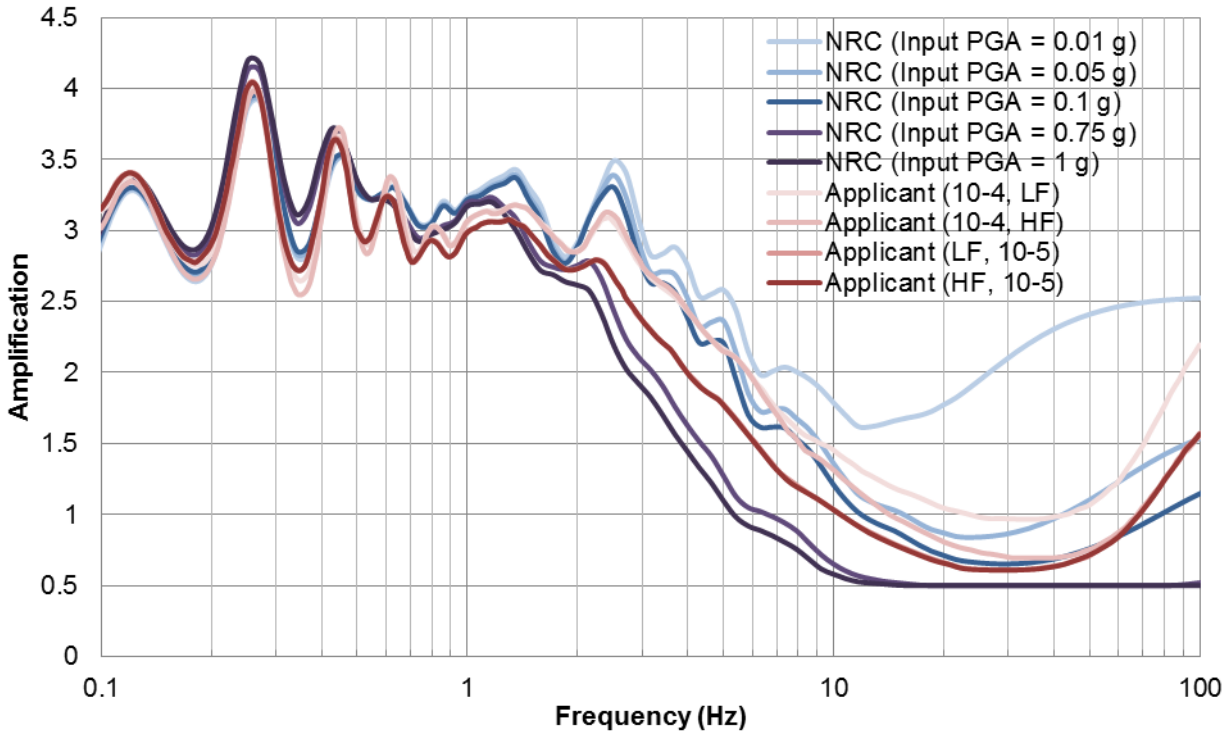

Figure 22.1-10 Comparisons of the Staff's Site Response Amplification Functions with the COL Applicant's Amplification Functions (Taken from FSAR Figures 2.5S.2-39, 2.5S.2-41, 2.5S.2-43, and 2.5S.2-45)

In a letter dated August 28, 2013 (ML13233A102), the NRC stated that the updated GMM is an acceptable model for use by CEUS plants in developing a plant-specific GMRS. The staff calculated the STP GMRS using the CEUS-SSC Houston Test Site hazard results with the Updated EPRI (2004, 2006) GMM (EPRI, 2013). This GMRS is plotted in Figure 22.1-11 of this SER (the light brown curve) and is lower than the STP Units 3 and 4 COL application site-specific GMRS (dark blue curve) for the entire 0.5- to 100-Hz frequency range with the exception of 10 Hz. Although the STP Units 3 and 4 GMRS is exceeded by the staff's CEUS-SSC GMRS at 10 Hz by ~20 percent, the CEUS-SSC GMRS developed by the staff falls well below the STP Units 3 and 4 site-specific SSE. The staff notes that it used a different site response method to develop the CEUS-SSC GMRS than the COL applicant used to develop the STP Units 3 and 4 GMRS. The COL applicant used Approach 2 while the staff used Approach 3, which are described in NUREG/CR-6728. Using either Approach 2 or Approach 3 is consistent with the guidance provided in RG 1.208. Unlike Approach 3, however, Approach 2 does not explicitly incorporate the amplification function uncertainty into the development of the soil UHRS and subsequent GMRS. In a sensitivity calculation, the staff determined that neglecting the amplification function uncertainty resulted in a reduced GMRS across the entire frequency range and at 10 Hz, the STP Units 3 and 4 GMRS is exceeded by the staff's CEUS-SSC GMRS by ~10 percent. In sum, the applicant's GMRS, which is set forth in FSAR Section 2.5S.2.6, and the staff-calculated GRMS are within the limits of uncertainty, and both sets of results are bounded by the site-specific SSE. Based on the above comparison, the staff accepts the applicant's decision not to update the STP Units 3 and 4 COL application site-specific GMRS and its site-specific SSE.

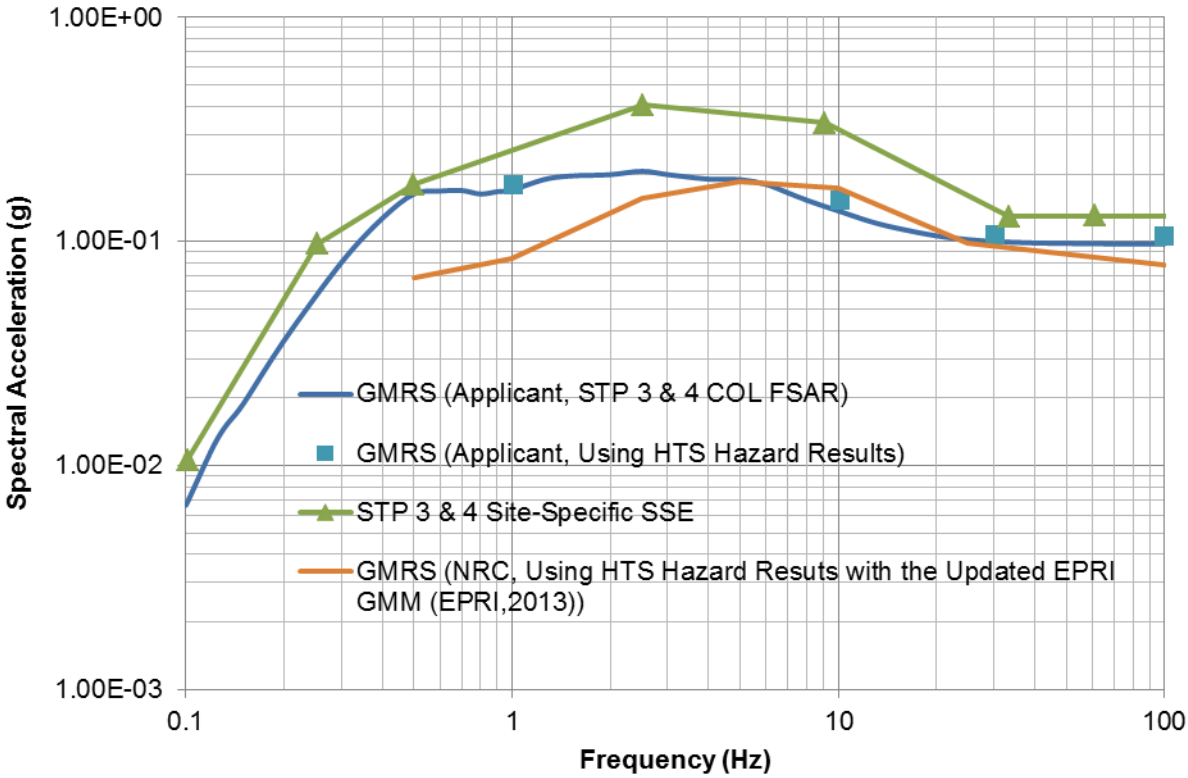

Figure 22.1-11 Comparisons of the Horizontal STP Units 3 and 4 Site-Specific SSE (Green Curve), the STP Units 3 and 4 COL Application GMRS (Dark Blue Curve), the Applicant's GMRS Based on the Houston Test Site CEUS-SSC Hazard Results (Blue Squares), and the NRC Staff's GMRS Using the Houston Test Site CEUS-SSC Hazard Results with the Updated EPRI GMM (EPRI, 2013) (Light Brown Curve)

22.1.4.2 NRC Staff's Conclusions Regarding the CEUS-SSC Sensitivity Calculations

The staff reviewed the applicant's response to RAI 01.05-1 (ML12346A445). Based on the staff's technical evaluation, which is set forth above, the staff reached the following conclusions:

1. The applicant's use of the NUREG–2115 demonstration hazard calculations for the Houston Test Site—instead of directly performing hard rock seismic hazard calculations for the STP site—is adequate because the staff's confirmatory analysis results showed that the CEUS-SSC hazard results at the STP site are similar to, or lower than, the hazard at the Houston Test Site.

2. The applicant adequately calculated the STP site-specific GMRS at 1, 10, 30, and 100 Hz using the CEUS-SSC model and the minimum magnitude cutoff of **M** 5, as recommended in SECY-12-0025, Enclosure 7, Attachment 1, to Seismic Enclosure 1 (ML12039A188).

3. The staff's site-specific GMRS, which is based on the CEUS-SSC model used for the Houston Test Site and the Updated EPRI (2004, 2006) GMM, is well below the STP Units 3 and 4 COL FSAR GMRS calculated by the applicant using the updated EPRI-SOG model for the entire 0.5- to 100-Hz frequency range with the exception of 10 Hz. The staff concludes that the ~20 percent exceedance of the STP Units 3 and 4 GMRS by the staff's

CEUS-SSC GMRS at 10 Hz is within the limits of uncertainties. Therefore, no revisions to the STP Units 3 and 4 COL FSAR GMRS are necessary.

22.1.5 Post Combined License Activities

There are no post COL activities related to this section.

22.1.6 Conclusion

NRC staff reviewed the information submitted by the applicant in response to SECY-12-0025 regarding a reevaluation of the seismic hazard. As set forth above, the staff confirmed that the applicant has addressed the required information and has adequately evaluated the seismic hazards at the STP site against current NRC guidance in NUREG–0800, RG 1.60; RG 1.132, RG 1.206; RG 1.208; and DC/COL ISG-017, and the NRC requirements in 10 CFR 100.23; 10 CFR 52.79(a)(1)(iii); 10 CFR Part 50, Appendix A, GDC 2; 10 CFR Part 50 Appendix S; 10 CFR Part 52, Appendix A, Section VIII.B.6.

22.2 Mitigation Strategies (Recommendation 4.2)

(LATER)

22.3 Reliable Spent Fuel Pool Instrumentation (Recommendation 7.1)

22.3.1 Introduction

On March 11, 2011, a magnitude 9.0 earthquake struck off the coast of the Japanese island of Honshu. The earthquake resulted in a large tsunami that is estimated to have exceeded 14 meters (45 feet) in height, which inundated the Fukushima Dai-ichi Nuclear Power Plant site. The tsunami caused extensive damage to site facilities and resulted in a complete loss of all ac electrical power at 5 of the 6 units on the site. In responding to and managing this damage, the plant operators lacked, among other things, reliable instrumentation to determine the water level in the spent fuel pools (SFPs) on the site. This lack, combined with the operators' inability to visually observe the spent fuel pools because of the conditions in the plant, raised concerns that at least one pool may have boiled dry—resulting in fuel damage—and highlighted the need for reliable SFP instrumentation.

The current SFP water level instrumentation at United States (U.S.) nuclear power plants typically has a narrow range and is therefore only capable of monitoring normal and a narrow range of off-normal conditions. Although the likelihood of a catastrophic event affecting nuclear power plants and the associated SFPs in the United States remains very low, beyond-design-basis external events could challenge the ability of existing spent fuel pool instrumentation to provide emergency responders with reliable information on the condition of SFPs. A reliable and available indicator is essential to ensure that plant personnel can effectively prioritize emergency actions.

A Commission paper SECY-12-0025 (ML12039A111), "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," states that for design certifications and combined license applications submitted under 10 CFR Part 52 that are currently under active staff review, the staff plans to ensure that the Fukushima actions approved by the Commission are addressed before certification or licensing. The staff will request all COL applicants to provide the information required by the orders and request for information letters described in this SECY paper through the review process.

The Japan Lesson-Learned Project Directorate-Interim Staff Guidance (JLD-ISG)-2012-03 Revision 0 (ML12221A339), "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," endorses with exceptions and clarifications the methodologies described in the Nuclear Energy Institute (NEI) industry guidance document NEI 12-02 (ML122400399) Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," and provides an acceptable approach for satisfying the applicable requirements.

22.3.2 Summary of Application

By letter dated April 25, 2012 (ML121080046), the U.S. Nuclear Regulatory Commission (NRC) informed the applicant that the staff has been directed by the Commission to implement the Fukushima Near-Term Task Force (NTTF) recommendations in SECY-12-0025. This request for additional information (RAI) specifically addresses Recommendation 7.1, "Reliable Spent Fuel Pool Instrumentation." The staff requested the applicant to address each of the provisions for monitoring key SFP parameters as described in the March 12, 2012, Order EA-12-051 (ML12054A679), including any proposals for changes to the current application.

The applicant responded to the staff's RAI in letters dated June 25 and December 6, 2012 (ML121850710 and ML12346A445, respectively), and March 14, 2013 (ML13079A343). As part of the RAI response, the applicant proposed to enhance the SFP level instrumentation to ensure that it provides a reliable indication of the water level in the spent fuel storage pool and that the instrumentation will indicate the SFP level as described in EA-12-051. The applicant's response describes site-specific inspections, tests, analyses, and acceptance criteria (ITAAC) to verify the proper installation of the instruments and that these instruments have all of the design functions described in FSAR Appendix 1E, Section 1E.2.6.

22.3.3 Regulatory Basis and Guidance

The relevant requirements for reliable spent fuel pool instrumentation are established or described in the following:

- SRM-SECY-12-0025, "Staff Requirements – SECY-12-0025 – Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," dated March 9, 2012, approves the issuance of orders for reliable SFP instrumentation under an administrative exemption to the Backfit Rule and the issue finality requirements in 10 CFR 52.63 and 10 CFR Part 52 Appendix D, Paragraph VIII.

- Atomic Energy Act of 1954 as amended (the Act), Section 161, authorizes the Commission to regulate the utilization of special nuclear material in a manner that is protective of public health and in accordance with common defense and security.

The relevant guidance for reliable spent fuel pool instrumentation is set forth in JLD-ISG-2012-03, which endorses NEI 12-02 Revision 1, with exceptions and clarifications.

22.3.4 Technical Evaluation

In light of SECY-12-0025, the staff issued RAI letter 417, in which the staff requested additional information in relation to the lessons learned from Great Tohoku Earthquake and Tsunami. In RAI 01.05-2, the staff requested the applicant to:

> address each of the provisions for monitoring key spent fuel pool parameters as described in the March 12, 2012 Order, EA-12-051 (ML12054A679), including any proposals for changes to your current application.

Commission Order EA-12-051 describes the key parameters used to determine whether level instrument is considered reliable. NEI 12-02, Revision 1 provides an acceptable approach for satisfying the applicable requirements. The staff evaluated the applicant's response to RAI 01.05-2 and determined that additional information was needed. The staff issued RAI 01.05-6 and RAI 01.05-7, in which the staff requested the applicant to provide further clarification of the level instrument design criteria and related programmatic aspects. In the response to these RAIs dated March 14, 2013 (ML13079A343), the applicant provides additional design information, indicates that it will follow the guidance of NEI 12-02, and concludes, therefore, that the SFP level instrument is designed to be reliable. The staff's evaluation of these responses is discussed below.

Instruments:

Commission Order EA-12-051, Attachment 2, Section 1.1, states that the SFP level instrumentation shall consist of a permanent, fixed primary instrument channel and a backup instrument channel. The backup instrument channel may be fixed or portable. Portable instruments shall have capabilities that enhance the ability of trained personnel to monitor the SFP water level under conditions such as partial structural damage, high radiation levels, or high heat and humidity.

The applicant's response to RAI 01.05-6 states that the instrumentation will consist of two permanent and fixed instrument channels with level indication from the top of the fuel racks to above the normal operating level of the SFP. Level instrumentation will include high and low water level alarms that indicate and annunciate in the control room, in addition to level indications independent of the process computer at the remote shutdown system panel or other appropriate and accessible locations. The level channels will be functional in all plant operating modes. The applicant's RAI response also provides marked-up FSAR changes.

The staff evaluated the applicant's proposed instrument description and the FSAR changes and determined that crediting two permanently installed instruments as primary and backup channels complies with the design features identified in the guidance in JLD-ISG-2012-03 and called for in Commission Order EA-12-051. Therefore, this part of the RAI 01.05-06 is resolved. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-6 is resolved and closed.

Arrangement:

Commission Order EA-12-051, Attachment 2, Section 1.1, states that the SFP level instrument channels shall be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP. This protection may be provided by locating the safety-related instruments to maintain instrument channel separation within the SFP area, and to utilize inherent shielding from missiles provided by existing recesses and corners in the spent fuel pool structure.

The applicant's response to RAI 01.05-6 states that the SFP level instrument channels will be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP. This protection will be provided by maintaining instrument channel separation within the spent fuel pool area and will utilize inherent shielding from missiles provided by existing corners in the spent fuel pool structure. The channel separation guidance in NEI 12-02, Revision 1 Section 3.2, will be considered in determining sensor locations. The applicant's response also provides marked-up FSAR changes.

The staff evaluated the applicant's proposed instrument location description and the proposed changes to FSAR Appendix 1E, Section 1E.2.6. The staff determined that the applicant's proposal to follow the channel separation guidance in NEI 12-02, Rev. 1, Section 3.2, and to place the instrumentation in the corners of the spent fuel pool satisfies EA-12-051 in regard to protection of the instrumentation from missiles. The staff thus concludes that these features conform to the guidance in JLD-ISG-2012-03 and comply with Commission Order EA-12-051 in regard to missile protection. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-6 is resolved and closed.

Mounting:

Commission Order EA-12-051, Attachment 2, Section 1.3, states that the installed instrument channel equipment within the SFP shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the SFP structure.

The applicant's response to RAI 01.05-6 states that the seismic design of the instrument mounting will be consistent with the SFP seismic design. In addition, an evaluation of other hardware stored in the SFP will be conducted to ensure that it will not create adverse interactions with the fixed instrument locations.

The staff evaluated the RAI response and the proposed instrument mounting description in the FSAR. The staff determined that designing the instrument mounting with the same seismic classification as the SFP liner (Seismic Category I) will ensure that the mounting will retain its configuration following a seismic event. The applicant also proposes to evaluate other equipment in the vicinity of the SFP to verify that a failure of the equipment will not create adverse interactions with the instruments. Accordingly, the staff concludes that these features conform to the guidance in JLD-ISG-2012-03 and comply with Commission Order EA-12-051 in regard to the seismic design of the mountings. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-6 is resolved and closed.

Qualification:

Commission Order EA-12-051, Attachment 2, Section 1.4, states, in part, that the primary and backup instrument channels shall be reliable at temperature, humidity, and radiation levels consistent with the SFP water at saturation conditions for an extended period.

The applicant's response to RAI 01.05-6 states that the instrument channels will be reliable at temperature, humidity, and radiation levels consistent with normal operation; an accident event; and post-event conditions. In addition, the applicant states that these instrument channels will be included in the Design Reliability Assurance Program (D-RAP).

The staff reviewed the applicant's response and the proposed FSAR changes. Since the SFP instrument channels will be included in the DRAP, the staff concludes that the instruments will be designed to remain operational during all anticipated conditions, and these capabilities will be demonstrated in accordance with the guidance in JLD-ISG-2012-03. Accordingly, the staff finds that these features comply with Commission Order EA-12-051. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-6 is resolved and closed.

Independence:

Commission Order EA-12-051, Attachment 2, Section 1.5, states that the primary instrument channel shall be independent of the backup instrument channel.

The applicant's response to RAI 01.05-6 and the proposed FSAR changes clarify that the instrument channels are physically and electronically independent.

The staff reviewed the applicant's response along with the proposed FSAR changes. The staff verified that the physical separation of the primary and backup channels will be sufficient to establish physical independence, and that the channels are not electronically connected.

Accordingly, the staff concludes that this feature conforms to the guidance in JLD-ISG-2012-03 and complies with Commission Order EA-12-051 in regard to independence. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-6 is resolved and closed.

Power Sources:

Commission Order EA-12-051, Attachment 2, Section 1.6, states, in part, that permanently installed instrumentation channels shall each be powered by a separate power supply. Permanently installed and portable instrumentation channels shall provide for power connections from sources independent of the plant alternating current (ac) and direct current (dc) power distribution systems, such as portable generators or replaceable batteries.

The applicant's response to RAI 01.05-6 indicates that the level instrument channels will be powered by Class 1E batteries. These batteries are designed to provide power for more than 76 hours post-event utilizing deep load shedding and division cross-connection strategies. Flex equipment (480 Volt [V]ac portable generators) is credited to recharge the batteries and power other engineered safety feature (ESF) loads

The staff reviewed the applicant's response and the proposed FSAR changes. The staff identified that the level instrument channels are powered by separate Class 1E batteries capable of powering the instruments for more than 76 hours. The applicant credits the use of a 480 Vac portable generator to recharge the batteries and to power the instrumentation 36 hours after event initiation. The staff's evaluation of the FLEX equipment capability and availability is in Section 22.2 of this safety evaluation report (SER).

The 480 Vac FLEX diesel generator is credited with the capability to recharge the Class 1E batteries and to power other ESF loads. The applicant's response states that since the Class 1E batteries can power the instruments continuously, there is no need for a backup power supply. The staff noted that this statement is true only if the 480 Vac FLEX diesel generator is available. The staff has determined that the 480 Vac FLEX generator is independent of the plant ac and dc power distribution systems since the FLEX generator can power the instrumentation directly. Accordingly, the design complies with the RA12-051 requirements for power connections to the instrument channels. Based on the evaluation of the applicant's response and the proposed FSAR changes, the staff concludes that these design features conform to the guidance in JLD-ISG-2012-03 and comply with Commission Order EA-12-051 in regard to power supplies. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-6 is resolved and closed.

Accuracy:

Commission Order EA-12-051, Attachment 3, Section 1.4, states that the instrument shall maintain its designed accuracy following a power interruption or change in power source without recalibration.

The applicant's response to RAI 01.05-6 states that the instrument channels will maintain their designed accuracy following a power interruption or a change in power source without recalibration. The applicant also stated that considerations in determining required instrument accuracy should include SFP conditions (e.g., saturated water or steam conditions). Instrument accuracy will also be sufficient to allow trained personnel to determine when the actual level

reaches the specified lower level of each indicating range (Levels 1, 2, and 3) without a conflicting or ambiguous indication.

The staff reviewed the applicant's response and the proposed FSAR changes. The accuracy of the instruments as installed will be verified through testing, which will be confirmed through ITAAC 3.0-28, as discussed below. Accordingly, the staff concludes that these design features comply with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-6 is resolved and closed.

Testing:

Commission Order EA-12-051, Attachment 2, Section 1.8, states that the instrument channel design shall provide for routine testing and calibration.

The applicant's response to RAI 01.05-6 states that the instrument channel design will provide for routine testing and calibration, which can be accomplished in situ.

The staff reviewed the applicant's system description and the proposed FSAR changes. The staff identified that the permanently installed instrument channels are normally used to monitor the SFP level and will be subject to routine testing and calibration in accordance with plant procedures. Accordingly, the staff concludes that these design features comply with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-6 is resolved and closed.

Display:

Commission Order EA-12-051, Attachment 2, Section 1.9 states that trained personnel shall be able to monitor the SFP water level from the control room, the alternate shutdown panel, or another appropriate and accessible location. The display shall provide on-demand or continuous indication of SFP water level.

The applicant's response to RAI 01.05-6 states that trained personnel will be able to monitor the spent fuel pool water level from the control room, the remote shutdown system panel, or other appropriate and accessible locations. The display will provide on-demand or continuous indications of the SFP water level.

The staff reviewed the applicant's system description and the proposed FSAR changes. The location of the level indication display, as installed**,** will be confirmed through ITAAC 3.0-28, as discussed below. Accordingly, the staff concludes that these design features comply with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-6 is resolved and closed.

Programs:

Commission Order EA-12-051, Attachment 2, Section 2, states that the SFP instrumentation shall be maintained available and reliable through appropriate development and implementation of a training program, procedures, and a testing and calibration program. Personnel shall be trained in the use of the primary and backup instrument channels, provision of alternate power to each channel and testing and calibration of each channel. Procedures shall be established

and maintained for the testing, calibration, and use of the primary and backup spent SFP instrument channels. Processes shall be established and maintained for scheduling and implementing testing and calibration of the primary and backup SFP level instrument channels sufficient to maintain them at the design accuracy.

The applicant's response to RAI 01.05-7 states that FSAR Appendix 1E, Section 1E.2.6, will be revised to identify that the SFP instrumentation will be maintained to be available and reliable through the appropriate development and implementation of the following programs:

- Training: Personnel will be trained to perform job-specific functions necessary for their assigned tasks (maintenance, calibration, surveillance, etc.).

- Procedures: Procedures shall be established and maintained for testing, calibrating, and using the spent fuel pool level instrument channels. These procedures will also address any known potentially abnormal response issues associated with the instrumentation.

- Testing and Calibration: Processes will be established and maintained for scheduling and implementing necessary testing and calibration of the spent fuel pool level instrument channels so as to maintain the instrument channels at the design accuracy. Additionally, the-out-of-service provisions in NEI 12-02, Revision 1 Section 4.3, will be implemented for the SFP level channels. The spent fuel pool level instrument channels will be included in the Design Reliability Assurance Program (DRAP).

The applicant's response also reflects the consideration that the activities intended to support the development of procedures and training for the enhanced SFP instrumentation are already covered by the existing commitment in Section 13.5 of the FSAR.

The staff evaluated the applicant's RAI response and the proposed FSAR changes. The staff finds that the program descriptions in the proposed FSAR Appendix 1E, Section 1E.2.6, conform to the guidance in JLD-ISG-2012-03, which calls for the development of procedures for testing and calibration of the primary and backup SFP level instrument channel, and therefore comply with Commission Order EA-12-051 . The staff notes that procedures relating to the use and installation of FLEX equipment are evaluated in Section 22.2 of this SER. The staff has also determined that the existing commitments in FSAR Section 13.5 already cover the procedures described in FSAR Appendix 1E, Section 1E.2.6. Therefore, no new commitment is needed for the development of these procedures. Accordingly, the staff concludes that the applicant's response is acceptable, and RAI 01.05-7 is resolved. Staff also confirmed that the proposed FSAR changes have been incorporated in Revision 9 of the FSAR. Therefore, this issue in RAI 01.05-7 is resolved and closed.

ITAAC:

The applicant's response to RAI 01.05-6 proposes to create a new site-specific ITAAC in COL application Part 9, "Inspections, Tests, Analyses, Acceptance Criteria," Section 3.0 (Site-Specific ITAAC) Table 3.0-28 (as shown below), to ensure that the SFP level instrumentation will be designed and installed as described in FSAR Appendix 1E.

Spent Fuel Pool Level Instrumentation ITAAC

Design Requirement	Inspections, Tests, Analyses	Acceptance Criteria
The spent fuel pool level instrumentation channels are properly installed, in the correct locations, and meet all design features in FSAR Appendix 1E.	Inspections will be performed to verify that the spent fuel pool level instrument channels are properly installed, in the correct locations, and meet all design features in FSAR Appendix 1E.	The results of inspections and tests confirm that the spent fuel pool level instrument channels are properly installed, in the correct locations, and meet all design features in FSAR Appendix 1E, Subsection 2.6.

The staff reviewed the proposed site-specific ITAAC. The staff finds that the proposed acceptance criteria will confirm that the installed level instrumentation meets the design functions specified in FSAR Appendix 1E, Section 1E.2.6. Therefore, the staff concludes that the proposed site-specific ITAAC is acceptable. Confirmation that the proposed FSAR changes are in the next FSAR revision is being tracked as part of **Confirmatory Item 01.05-6.**

22.3.5 Post Combined License Activities

The applicant identifies the following site-specific ITAAC:

- Site-specific ITAAC Table 3.0-28 ensures that the SFP level instrumentation will be designed and installed as described in FSAR Appendix 1E.

22.3.6 Conclusion

The staff evaluated the applicant's RAI responses to the NRC's request for addressing Recommendation 7.1 in SECY-12-0025. The staff specifically requested the applicant to address each of the provisions for monitoring key SFP parameters—as described in the March 12, 2012, Order EA-12-051 (ML12054A679)—including any proposals for changes to the current application. For the reasons set forth above, the staff' concludes that the applicant has provided adequate information on the SFP water level instrumentation.

As set forth above, the staff has determined that these instruments are designed in accordance with the guidance in JLD-ISG-2012-03. The staff therefore considers these instruments to be reliable, able to withstand design-basis natural phenomena, and capable of monitoring key spent fuel pool level parameters as described in Commission Order EA-12-051.

The staff found that the application will be in compliance with NRC regulations upon the satisfactory resolution of the confirmatory item, with the verification of proposed changes in the COL application.

22.4 Emergency Preparedness (Recommendation 9.3)

22.4.1 Introduction

The accident at Fukushima reinforced the need for an effective Emergency Plan (EP), with the objective of ensuring that the capability exists for a licensee (or COL applicant) to implement measures that mitigate the consequences of a radiological emergency and protect the public. The accident at Fukushima highlighted the need to determine the number of positions in the emergency organization needed to respond to a multi-unit event and fill those positions as part of the emergency plan. Additionally, there is a need to ensure that the communication equipment relied upon to coordinate the event response during a prolonged station blackout has adequate power.

22.4.2 Summary of Application

On April 24, 2013 (ML13119A175), the applicant provided Revision 3 to its response to RAI 01.05-3 regarding NTTF Recommendation 9.3, which covers emergency preparedness communications and staffing. In regard to Application Part 2, Appendix 1E.2.8, "Enhanced Emergency Plan Staffing and Communication (9.3)," the applicant's response states:

> The Emergency Plan for STP 3 and 4 will be part of a site-wide emergency plan for Units 1 through 4. NEI 12-01, Revision 0 (Guidelines for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities) will be used in assessing staff and communications capabilities necessary to respond to a beyond design basis multi-unit event. The results of the assessment will be addressed in the detailed Emergency Plan procedures developed during implementation of operational programs as described in FSAR Section 13.4S and in concert with STP Units 1 and 2. COLA Part 9 Table 4.0-1, Items 5.3, 5.4, 10.3, and 10.4 list the ITAACs applicable to the staffing and communications capability assessments.

In this response, the applicant includes new site-specific EP-ITAAC, which states that at least 2 years before the scheduled initial fuel loading, STP shall perform the following:

1. An assessment of onsite and offsite communications systems and equipment required during an emergency event to ensure that communication capabilities can be maintained during a prolonged station blackout condition.

2. An assessment of the onsite and augmented staffing capability to satisfy the regulatory requirements for response to a multi-unit event.

The applicant indicates that these assessments will be completed in accordance with NEI 12-01, Revision 0 (ML12125A412). In the April 2013 letter, the applicant also includes proposed ITAAC stating that at least 180 days before the scheduled initial fuel loading, the licensee would complete the implementation of "required corrective actions associated with the assessment conducted per ITAAC Table 4.0-1, Item 5.3, including any related emergency plan and implementing procedure changes and associated training," and "[i]dentification of how the augmented staff will be notified given degraded communications capabilities."

22.4.3 Regulatory Basis

The relevant requirements for the EP regarding beyond-design-basis external events are established or described in the following:

- 10 CFR 50.47(b)(6) states that "provisions exist for prompt communications among principal response organizations to emergency personnel and to the public."

- 10 CFR 50.47(b)(1) states, in part, "... and each principal response organization has staff to respond and to augment its initial response on a continuous basis."

- 10 CFR 50.47(b)(2) states, in part:,"... adequate staffing to provide initial facility accident response in key functional areas is maintained at all times, timely augmentation of response capabilities is available, and..."

- Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," to 10 CFR Part 50, "Domestic Licensing for Production and Utilization Facilities," Section IV. E. 9 states that adequate provisions shall be made and described for emergency facilities and equipment, including "at least one onsite and one offsite communications system; each system shall have a backup power source."

The relevant guidance for the EP regarding beyond-design-basis external events are established or described in the following:

- SRM-SECY-12-0025, "Staff Requirements – SECY-12-0025 – Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," dated March 9, 2012, which approves the issuance of orders for beyond-design-basis external events, as necessary, for ensuring continued adequate protection. SECY-12-0025 states, in part, that the staff will also request all COL applicants to provide information required by the orders and information letters described in this paper, as applicable, through the review process.

- NUREG–0696, "Functional Criteria for Emergency Response Facilities," offers guidance on how to meet the requirements of Appendix E to 10 CFR Part 50 and describes the onsite and offsite communications requirements for the licensee's emergency response facilities.

- NEI 12-01, Revision 0 guidance (ML12125A412), which the NRC found to be an acceptable method for licensees to employ when responding to the 10 CFR 50.54(f) letters regarding NTTF Recommendation 9.3 (ML12131A043).

- NUREG–0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," Section B, Onsite Emergency Organization, states in part:

  > 5. Each licensee shall specify... functional areas of emergency activity...These assignments shall cover the emergency functions in Table B-1 entitled, 'Minimum Staffing Requirements for Nuclear Power Plant Emergencies.' The minimum on-shift staffing shall be as indicated in Table B-1. The licensee must be able to augment on-shift capabilities within a short period after declaration of an emergency. This capability shall be as indicated in Table B-1.

22.4.4 Technical Evaluation

By letter dated April 25, 2012 (ML121080046), the U.S. Nuclear Regulatory Commission (NRC or Commission) informed the existing licensees and COL applicants that the staff will issue a request for additional information (RAI) concerning the implementation of the Fukushima Near-Term Task Force (NTTF) recommendations in SECY 12-0025. In RAI 01.05-3, the staff requested the applicant to address Recommendation 9.3, "provisions for enhancing emergency preparedness." The NRC issued this information request regarding the power supplies for communications systems and staffing to determine if additional regulatory action is warranted. This request was based upon Near Term Task Force (NTTF) Recommendation 9.3, which proposed that facility emergency plans provide for a means to power communications equipment needed to communicate onsite and offsite during an extended loss of ac power and staffing to fill all necessary positions to respond to a multi-unit event.

On April 24, 2013 (ML13119A175), the applicant provided Revision 3 to its response to RAI 01.05-3 in which it addressed NTTF Recommendation 9.3 regarding emergency preparedness communications and staffing. In addition, the applicant proposed FSAR changes and committed to include these changes in the next routine revision of the COL application. In this response, the applicant commits to perform assessments of communications and staffing using NEI 12-01, Revision 0, 2 years before the scheduled initial fuel loading of STP Unit 3. By letter from the NRC to the NEI dated May 15, 2012 (ML1213A043), the NRC determined that the guidance in NEI 12-01, Revision 0, provides an acceptable method for licensees to employ when responding to the 10 CFR 50.54(f) letters regarding NTTF Recommendation 9.3. Therefore, the staff finds the applicant's commitment to perform assessments of the staffing and communications capabilities using NEI 12-01, Revision 0, is acceptable.

In this response, the applicant also proposed to include four new ITAAC Items (5.3, 5.4, 10.3, and 10.4) in Table 4.0-1 of Part 9 of the COL application. However, the staff does not agree that these four new ITAAC items are necessary. The staff determined that these items should more appropriately be addressed as license conditions. The staff intends to make these items part of a new license condition discussed below in Section 22.4.5 of this SER.

Based on the above evaluation, the staff finds that the response to RAI-01.05.3 is acceptable except for proposed ITAAC items 5.3, 5.4, 10.3, and 10.4, which are not necessary and will be identified as license conditions. The portion of the response that is acceptable conforms to the guidance in SECY 12-0025, SRM-SECY-12-0025, and NEI 12-01, Revision 0 regarding communications and staffing for NTTF Recommendation 9.3, NUREG–0654/FEMA-REP-1, and NUREG–0696; and meets the applicable requirements in 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50.

Confirmatory Item:

The staff created Confirmatory Item **CI 01.05-3** to incorporate the applicant's proposed revisions to COLA Part 2, Tier 2, Appendix 1E, Subsection 1E.2.8, which includes the staffing and communications capability assessments described in Revision 3 of the applicant's response to RAI-01.05-3.

22.4.5 Post Combined License Activities

As discussed earlier in the technical evaluation, the staff proposed including the following license condition related to emergency planning actions regarding communications and staffing:

License Condition (22-1)

Communications:

At least two (2) years before the latest date set forth in the schedule for completing the inspections, tests, and analyses in the ITAAC submitted in accordance with 10 CFR § 52.99(a), the Licensee shall have performed an assessment of on-site and off-site communications systems and equipment relied upon during an emergency event to ensure communications capabilities can be maintained during an extended loss of ac power. The communications capability assessment shall be performed in accordance with NEI-12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities," Revision 0.

At least one hundred eighty (180) days before the date scheduled for initial fuel load set forth in the notification submitted in accordance with 10 CFR § 52.103(a), the Licensee shall complete implementation of corrective actions identified in the communications capability assessment described above, including any related emergency plan and implementing procedure changes and associated training.

Staffing:

At least 2 years before the latest date set forth in the schedule for completing the inspections, tests, and analyses in the ITAAC submitted in accordance with 10 CFR § 52.99(a), the Licensee shall perform assessments of the onsite and augmented staffing capability to satisfy the regulatory requirements for responding to a multi-unit event. The assessments shall be performed in accordance with NEI 12-01, Revision 0.

At least 180 days before the date scheduled for initial fuel loading set forth in the notification submitted in accordance with 10 CFR § 52.103(a), the Licensee shall revise the Emergency Plan to include the following:

- Incorporation of corrective actions identified in the staffing assessments required by this condition; and

- Identification of how the augmented staff will be notified given degraded communications capabilities.

22.4.6 Conclusion

The staff evaluated the applicant's response to the NRC's request for information addressing NTTF Recommendation 9.3, as discussed in SECY-12-0025. The staff specifically requested the applicant to address each of the provisions for enhancing emergency preparedness as described in SECY-12-0025, Enclosure 7, including any proposals for changes to the current application. These provisions included Near Term Task Force (NTTF) Recommendation 9.3, which proposed that facility emergency plans provide for a means to power communications equipment needed to communicate onsite and offsite during an extended loss of ac power and staffing to fill all positions necessary to respond to a multi-unit event. For the reasons set forth above, the staff concludes that the applicant has provided adequate information on emergency preparedness communications and staffing in connection with NTTF Recommendation 9.3.

Based on the above, subject to resolution of Confirmatory Item **CI 01.05-3**, the staff finds that the license condition described above is necessary and appropriate to assure that the application

conforms to the guidance provided in SECY-12-0025 and NEI 12-01, Revision 0, regarding communications and staffing for NTTF Recommendation 9.3, NUREG-0654/FEMA-REP-1, and NUREG-0696, and accordingly meets the applicable requirements in 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50.