

2.5S Geology, Seismology, and Geotechnical Engineering

The following site-specific supplement addresses COL License Information Items 2.23, 2.27, and 2.30.

Presented in this section is information on the geological, seismological, and geotechnical characteristics of the STP 3 & 4 site and the region surrounding the site. Note that references to the “STP 3 & 4 site” contained in Section 2.5S, are intended to mean the location of STP Units 3 & 4 within the STP Site. The data and analyses in this section documents STP’s evaluation of the suitability of the site. Section 2.5S provides sufficient information to support evaluation of the site-specific ground motion response spectra and provides information to permit adequate engineering solutions to geologic conditions and seismic effects at the proposed site.

Section 2.5S is organized as outlined in Regulatory Guide (RG) 1.206:

- 2.5S.1 Basic Geologic and Seismic Information (conducted by Bechtel Power Corporation supported by William Lettis & Associates, Inc.)
- 2.5S.2 Vibratory Ground Motion (conducted by Bechtel Power Corporation supported by William Lettis & Associates, Inc. and Risk Engineering, Inc.)
- 2.5S.3 Surface Faulting (conducted by William Lettis & Associates, Inc.)
- 2.5S.4 Stability of Subsurface Materials and Foundations (Conducted by Bechtel Power Corporation supported by MACTEC Engineering and Consulting, Inc.)
- 2.5S.5 Stability of Slopes (Conducted by Bechtel Power Corporation)

Subsection 2.5S.1.1 describes the geologic and tectonic setting of the site region (200 mi radius), and Subsection 2.5S.1.2 describes the geology and structural geology of the site vicinity (25 mi radius), site area (5 mi radius), and site (0.6 mi radius). The geological and seismological information was developed in accordance with the guidance presented in RG 1.206 and RG 1.208, and is intended to satisfy the requirements of 10 CFR 100.23 (c). The geological and seismological information presented in this section is used as a basis for evaluating the detailed geologic, seismic, and man-made hazards at the site.

Borings at the site provided the geologic and geotechnical data to characterize the soil, underlying rock, and shear wave velocities. The field investigation program was supplemented by a laboratory testing program to characterize material properties of the soil.

Subsection 2.5S.2 describes the methodology used to develop the ground motion response spectrum for the STP 3 & 4 site. RG 1.208 further requires that the geological, seismological, and geophysical database is updated and any new data are evaluated to determine whether revisions to the 1986 EPRI seismic source model are required (presented in Subsection 2.5S.2). This section, therefore, provides an update of the geological, seismological, and geophysical database for the STP 3 & 4 site,

focusing on whether any data published since 1986 indicates a significant change to the 1986 EPRI seismic source model.

The review of regional and site geologic, seismic, and geophysical information and an evaluation of the updated earthquake catalog confirmed the use of appropriate EPRI seismic sources and seismic parameters as a starting point for developing the Ground Motion Response Spectrum (GMRS). However, the EPRI methodology did not originally incorporate contributions from seismic sources in the Gulf of Mexico except along the immediate coast. Special attention was focused on characterization of the Gulf of Mexico seismicity for this reason and because of the recent occurrence of two moderate earthquakes in the Gulf.

In addition, the Rio Grande and New Madrid fault zone source areas were evaluated. Rather than revise the Rio Grande source, faults in the Rio Grande rift were incorporated into the Probabilistic Seismic Hazard Analysis (PSHA). A revised New Madrid source zone was incorporated into the PSHA as well.

Bechtel Power Corporation, supported by William Lettis & Associates, Inc. and Risk Engineering, Inc. conducted an assessment of ground motion at the STP site using the guidance provided in RG 1.208. The starting point for this site assessment is the EPRI-SOG probabilistic seismic hazard analysis (PSHA) evaluation (Reference 2.5S.1-17). RG 1.208 incorporates developments in: ground motion estimation models; updated models for earthquake sources; methods for determining site response; and new methods for defining a site-specific, performance-based earthquake ground motion that satisfy the requirements of 10 CFR 100.23 and lead to the establishment of the safe shutdown earthquake (SSE) ground motion. The purpose of Subsection 2.5S.2 is to develop the site-specific ground motion response spectrum (GMRS) characterized by horizontal and vertical response spectra determined as free-field motions on hard rock using performance-based procedures. The GMRS represents the first part in development of an SSE for a site as a characterization of the regional and local seismic hazard under Regulatory Position 5.4 of RG 1.208. In the case of the STP 3 & 4 site, the GMRS is used to determine the adequacy of the Certified Seismic Design Response Spectra (CSDRS) for the GE ABWR Design Certification Document (DCD). The CSDRS are the SSE for the site, the vibratory ground motion for which certain structures, systems, and components are designed to remain functional, pursuant to Appendix S of 10 CFR part 50.

Subsection 2.5S.3 documents an evaluation of the potential for tectonic and non-tectonic surface deformation at the STP 3 & 4 site. The data developed as a result of literature and data reviews, interpretations of aerial and satellite imagery, field, and aerial reconnaissance and discussions with current researchers and an analysis of seismicity with respect to geologic structures indicate that there are no Quaternary faults or capable tectonic sources within 25 mi of the site.

Subsection 2.5S.4 describes the site subsurface investigation which consisted of 119 soil and rock borings, 31 cone penetrometer tests, 4 test pits, and geophysical logging including P-S suspension logging. Laboratory testing of soil and rock samples provided data on geotechnical/geoengineering parameters. A liquefaction analysis was

performed using state-of-the-art procedures outlined in Subsection 2.5S.4-5. SPT data points, 3389 total, were analyzed from 120 borings, from which 99.6% of the calculated FOSs exceeded 1.10. A detailed examination of the SPT, CPT, and V_s data points analyzed that had $FOS < 1.10$, revealed that the affected soils were not an issue with respect to safety of the STP 3 & 4 site.

Constructed slopes at the site consist of the existing Main Cooling Reservoir (MCR) embankment slopes, which were constructed as a part of the original STP site development, and a new earth berm proposed to surround the UHS Basin. The UHS earth berm is unlikely to fail and is not a significant risk to the safety of the UHS Basin structure or any other Seismic Category I structure.

The temporary slopes that will be installed for plant construction will not adversely affect the safety of the nuclear power plant facilities. Additional details with regard to slope stability are contained in Subsection 2.5S.5.

Appendix D of the RG 1.165 (Reference 2.5S.1-1) provides guidance for the recommended level of investigation at different distances from a proposed nuclear facility site.

- The site region is that area within 200 mi of the site location (Figure 2.5S.1-1 [References 2.5S.1-2 and 2.5S.1-3])
- The site vicinity is that area within 25 mi of the site location (Figure 2.5S.1-2 [Reference 2.5S.1-4])
- The site area is that area within 5 mi of the site location (Figure 2.5S.1-3 [Reference 2.5S.1-5])
- The site is that area within 0.6 mi of the site location (Figure 2.5S.1-4 [Reference 2.5S.1-6])

These terms - site region, site vicinity, site area, and site - are used in Subsection 2.5S.1 through Subsection 2.5S.3 to describe these specific areas of investigation and are not applicable to other sections of the FSAR.

