3.7.2 Seismic System Analysis

3.7.2.4 Soil-Structure Interaction

Add the following at the end of the first paragraph.

EF3 SUP 3.7-4

This subsection of the Referenced DCD, including associated Appendix 3A in its entirety, is incorporated by reference with the following supplement for the Fermi 3 site-specific soil-structure interaction (SSI) analyses for the RB/FB and CB. The site-specific SSI analyses for the RB/FB and CB were performed using the direct method of the SASSI2000 computer program. The SSI analysis approach and the structural models are the same as presented in Appendix 3A of the Referenced DCD.

The FWSC is essentially a surface founded structure in the Referenced DCD, Subsection 3.7.1.1 and there are no embedded walls for the FWSC. Therefore, the Referenced DCD backfill requirements surrounding Seismic Category I structures are not applicable to FWSC embedded basemat (embedded 2.35 m (7.7 feet)). The FWSC is founded on fill concrete which meets the Referenced DCD requirements for backfill underneath Seismic Category I structures. Therefore, there is no site-specific SSI analysis performed for the FWSC.

Add the following subsections following Subsection 3.7.2.4.

3.7.2.4.1 Fermi 3 Site-Specific Soil-Structure Interaction Analysis

This subsection presents the Fermi 3 site-specific SSI analyses performed in accordance with SRP 3.7.2 for the Seismic Category I RB/FB and CB. The Fermi 3 site-specific foundation input response spectra (FIRS) developed in Subsection 2.5.2 is in accordance with Regulatory Guide 1.208. The Fermi 3 site-specific FIRS developed in Subsection 3.7.1 is in accordance with Regulatory Guide 1.208 and NRC Interim Staff Guidance (DC/COL-ISG-017) for ensuring hazard-consistent seismic input for site response and soil-structure interaction analyses. The Fermi 3 site-specific FIRS developed in Subsection 2.5.2 and Subsection 3.7.1 are fully enveloped, in all cases, by the ESBWR CSDRS as presented in Subsection 2.5.2.6.4 and Subsection 3.7.1.1.4.5, respectively. Therefore, the Fermi 3 site-specific SSI analyses were not performed to address an exceedance of the

CSDRS by the FIRS; rather, the Fermi 3 site-specific SSI analyses were performed to address the following Fermi 3 site-specific conditions:

- Partial embedment in the Bass Islands Group bedrock of the RB/FB and CB Seismic Catagory I structures, as shown on Figure 2.5.4-202 and Figure 2.5.4-203, to confirm that the Referenced DCD design is applicable for this case.
- To demonstrate that the Referenced DCD requirements for the backfill surrounding Seismic Catagory I structures can be neglected for RB/FB and CB with the RB/FB and CB partially embedded in the bedrock at the Fermi 3 site.

The Fermi 3 site-specific SSI analyses follow the same methodology used in the Referenced DCD for SSI analyses for the ESBWR Standard Plant using the direct method of the SASSI2000 computer program. The SASSI2000 structural models are developed from the Referenced DCD lumped-mass stick models coupled with the Fermi 3 site-specific strain compatible dynamic subsurface properties developed in Subsection 3.7.1. In the SASSI2000 model for the Fermi 3 site-specific SSI analyses, the RB/FB and CB are modeled as partially embedded into the Bass Islands Group bedrock. The backfill above the top of the Bass Islands Group bedrock at Elevation 168.2 m (552.0 ft) NAVD 88 surrounding the RB/FB and CB was not included in the model. Therefore, the Fermi 3 site-specific SSI analyses do not take credit for the benefits provided by the backfill surrounding the RB/FB and CB. Fill concrete is used to backfill the gap between the RB/FB and CB and excavated bedrock up to the top of Bass Islands Group bedrock at Elevation 168.2 m (552.0 ft) NAVD 88. The gap between the RB/FB and the CB up to the top of the Bass Islands Group bedrock is also filled with fill concrete as shown on Figure 2.5.4-202 and Figure 2.5.4-203.

The site-specific SSI analyses results are presented and compared with the Referenced DCD seismic responses in the following subsections to confirm the applicability of the ESBWR Standard Plant for the RB/FB and CB. In addition, the foundation stability and the dynamic bearing pressure demands are evaluated in Subsection 3.8.5 for the RB/FB and CB based on the Fermi 3 site-specific SSI analyses results.

3.7.2.4.1.1 Strain Compatible Dynamic Subsurface Material Properties

The geology of the Fermi 3 site is discussed in detail in Subsection 2.5.1. The subsurface materials encountered and the engineering properties of subsurface materials at Fermi 3 site are discussed in detail in Subsection 2.5.4.

In accordance with SRP 3.7.2, three subsurface material profiles, a best estimate (BE) profile, a lower bound (LB) profile, and an upper bound (UB) profile, were developed and used in the SSI analyses to account for variability in the subsurface materials properties at the Fermi 3 site. The development of the Fermi 3 site-specific strain compatible dynamic subsurface material properties associated with the BE, LB, and UB profiles is discussed in Subsection 3.7.1.3. The strain compatible dynamic subsurface material properties of the BE, LB, and UB subsurface profiles used in the Fermi 3 site-specific SSI analyses are provided in Table 3.7.1-217 through Table 3.7.1-219. To demonstrate that the backfill surrounding the Seismic Category I RB/FB and CB above the top of the Bass Islands Group bedrock can be neglected, the BE, LB, and UB subsurface profiles used for the Fermi 3 SSI analyses do not include backfill that will be placed during construction above the Bass Islands Group bedrock at Elevation 168.2 m (552.0 ft) NAVD 88 to finished ground level grade at Elevation 179.6 m (589.3 ft) NAVD 88.

3.7.2.4.1.2 FIRS Compatible Ground Motion Time HIstory

Subsection 3.7.1.1.5 describes development of the Fermi 3 site-specific ground motion time histories used in the SSI analyses. The Fermi 3 site-specific SSI analyses used three orthogonal components (two horizontal and one vertical) of a single ground motion time history that were developed to be in-column motions at the bottom of RB/FB and CB basemat levels. The site-specific ground motion time histories are compatible with the SSI FIRS developed in Subsection 3.7.1 and are used as input motions applied at the bottom of RB/FB and CB basemat levels in the Fermi 3 site-specific SSI analyses.

3.7.2.4.1.3 Soil-Structure Interaction Analysis Method

The Fermi 3 site-specific SSI analysis follows the methodology presented in DCD Section 3A.5.2 using the direct method of the SASSI2000 computer program. The SASSI2000 program uses finite elements with complex moduli for modeling the structure and foundation properties and is based on the frequency domain complex response method. The lumped mass-beam model described in DCD Section 3A.5.1 is coupled with the soil model using site-specific strain compatible dynamic subsurface properties in SASSI2000. Structural responses in terms of accelerations, forces, and moments are computed directly. Floor response spectra are obtained from the calculated response acceleration time histories.

The SSI analyses for the three directional ground motion time history components are performed separately. The maximum co-directional responses for each of the three ground motion time history components are combined using the algebraic sum in the time domain. The SASSI2000 RB/FB and CB structural models are described in Subsection 3.7.2.4.1.4.

3.7.2.4.1.4 **Soil-Structure Interaction Analysis Structural Models**

The Fermi 3 site-specific SSI SASSI2000 structural models for the RB/FB and CB are constructed from the building stick models coupled with the foundation finite element model in the manner described in Referenced DCD Subsection 3A.7.3. The RB/FB and CB seismic models are shown in Referenced DCD Figures 3A.7-4 and 3A.7-6, respectively. The overall Fermi 3 site-specific SSI SASSI2000 models are shown on Figure 3.7.2-201 through Figure 3.7.2-203 for the RB/FB, and on Figure 3.7.2-204 through Figure 3.7.2-206 for the CB. The Fermi 3 site-specific SSI SASSI2000 structural model configurations are the same as those shown on Referenced DCD Figures 3A.7-8 through 3A.7-10 for the RB/FB and Figures 3A.7-11 through 3A.7-13 for the CB, except that the vertical spacing of the wall nodes between the top of the Bass Islands Group bedrock (Elevation –6770 mm in Figure 3.7.2-202 and Figure 3.7.2-205) and the foundation basemat, (i.e., the embedded portion of the RB/FB and CB), are adjusted for a closer match with the Fermi 3 site-specific subsurface profile layers.

The subsurface layer thicknesses used in the RB/FB and CB Fermi 3 site-specific SSI analyses satisfy the SASSI2000 requirement that the subsurface layer thicknesses be limited to less than 20 percent of the shear wave length of the subsurface material the wave is passing through at the highest frequency of interest in the analysis (f_n). For the Fermi 3 site-specific SSI analyses, f_n is 50 Hz.

The SASSI2000 model X-direction and Y-direction represent plant north-south (NS) and east-west (EW) directions, respectively, at the Fermi 3 site. The SASSI2000 model Z-direction represents the vertical direction.

3.7.2.4.1.5 Soil-Structure Interaction Analysis Cases

The Fermi 3 site-specific SSI analyses cases are summarized in Table 3.7.2-201 and Table 3.7.2-202 for the RB/FB and CB, respectively. To account for variability in the subsurface material properties at the Fermi 3 site, the BE, LB, and UB profiles were used in the site-specific SSI analyses. Each analysis case consists of three directions of excitation (two horizontal and one vertical) applied separately to the Fermi 3 site-specific SSI SASSI2000 model. The calculated resulting co-directional floor response spectra in the X-, Y-, and Z-directions are combined using the SRSS method. The resulting co-directional structural loads responses from each direction of excitation for each case are combined using algebraic sums in the time domain to obtain the total response.

3.7.2.4.1.6 Soil-Structure Interaction Analysis Results

In the following subsections, the results of the Fermi 3 site-specific SSI analyses for the BE, LB, and UB subsurface profiles are presented and compared at key locations with the seismic design envelopes specified in Referenced DCD Subsection 3A.9 for maximum seismic structural loads and floor response spectra.

3.7.2.4.1.6.1 SSI Enveloping Maximum Structural Loads

For the RB/FB model, the enveloping seismic loads from the Fermi 3 site-specific SSI analyses based on the BE, LB, and UB subsurface profiles (herein called Fermi 3 site-specific SSI enveloping seismic loads) are presented in Table 3.7.2-203a through Table 3.7.2-203e.

The Fermi 3 site-specific SSI enveloping seismic loads for the RB/FB stick model are presented in Table 3.7.2-203a. The Fermi 3 site-specific SSI enveloping seismic loads are compared with the Referenced DCD enveloping seismic loads provided in Referenced DCD Table 3A.9-1a for the RB/FB stick model. Table 3.7.2-203a also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping seismic loads to the Referenced DCD enveloping seismic loads for the RB/FB stick model. Table 3.7.2-203a shows that the Fermi 3 site-specific SSI enveloping seismic loads for the RB/FB stick model are lower than the Referenced DCD enveloping seismic loads, with a maximum percentage ratio of approximately 43 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping seismic load is approximately 43 percent of the enveloping seismic loads used in the ESBWR Standard Plant for the RB/FB.

The Fermi 3 site-specific SSI enveloping seismic loads for the Reinforced Concrete Containment Vessel (RCCV) stick model are presented in Table 3.7.2-203b. The Fermi 3 site-specific SSI enveloping seismic loads are compared with the Referenced DCD enveloping seismic loads provided in Referenced DCD Table 3A.9-1b for the RCCV stick model. Table 3.7.2-203b also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping seismic loads to the Referenced DCD enveloping seismic loads for the RCCV stick model. Table 3.7.2-203b shows that the Fermi 3 site-specific SSI enveloping seismic loads for the RCCV stick model are lower than the Referenced DCD enveloping seismic loads, with a maximum percentage ratio of approximately 45 percent. This indicates that the greatest Fermi 3 site specific SSI enveloping seismic load is approximately 45 percent of the enveloping seismic loads used in the ESBWR Standard Plant for the RCCV.

The Fermi 3 site-specific SSI enveloping seismic loads for the Vent Wall/Pedestal stick model are presented in Table 3.7.2-203c. The Fermi 3 site-specific SSI enveloping seismic loads are compared with the Referenced DCD enveloping seismic loads provided in Referenced DCD Table 3A.9-1c for the Vent Wall/Pedestal stick model. Table 3.7.2-203c also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping seismic loads to the Referenced DCD enveloping seismic loads for the Vent Wall/Pedestal stick model. Table 3.7.2-203c shows that the Fermi 3 site-specific SSI enveloping seismic loads for the Vent Wall/Pedestal stick model are lower than the Referenced DCD enveloping seismic loads, with a maximum percentage ratio of approximately 37 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping seismic load is approximately 37 percent of the enveloping seismic loads used in the ESBWR Standard Plant for the Vent Wall/Pedestal.

The Fermi 3 site-specific SSI enveloping seismic loads for the Reactor Shield Wall (RSW) stick model are presented in Table 3.7.2-203d. The Fermi 3 site-specific SSI enveloping seismic loads are compared with the

Referenced DCD enveloping seismic loads provided in Referenced DCD Table 3A.9-1d for the RSW stick model. Table 3.7.2-203d also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping seismic loads to the Referenced DCD enveloping seismic loads for the RSW stick model. Table 3.7.2-203d shows that the Fermi 3 site-specific SSI enveloping seismic loads for the RSW stick model are lower than the Referenced DCD enveloping seismic loads, with a maximum percentage ratio of approximately 40 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping seismic load is approximately 40 percent of the enveloping seismic loads used in the ESBWR Standard Plant for the RSW.

The Fermi 3 site-specific SSI enveloping seismic loads for the Reactor Pressure Vessel (RPV) stick model are presented in Table 3.7.2-203e. The Fermi 3 site-specific SSI enveloping seismic loads are compared with the Referenced DCD SSI analysis enveloping seismic loads for the RPV stick model, which are not presented in the Referenced DCD. Table 3.7.2-203e presents the percentage ratio of the Fermi 3 site-specific SSI enveloping seismic loads to the Referenced DCD SSI analysis enveloping seismic loads for the RPV stick model. Table 3.7.2-203e shows that the Fermi 3 site-specific SSI enveloping seismic loads for the RPV stick model are lower than the Referenced DCD SSI analysis enveloping seismic loads, with a maximum percentage ratio of approximately 56 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping seismic load is approximately 56 percent of the enveloping seismic loads actually used in the ESBWR Standard Plant for the RPV.

For the CB model, the Fermi 3 site-specific SSI enveloping seismic loads for CB stick model are presented in Table 3.7.2-204. The Fermi 3 site-specific SSI enveloping seismic loads are compared with the Referenced DCD enveloping seismic loads provided in Referenced DCD Table 3A.9-1f for the CB stick model. Table 3.7.2-204 also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping seismic loads to the Referenced DCD enveloping seismic loads for the CB stick model. Table 3.7.2-204 shows that the Fermi 3 site-specific SSI enveloping seismic loads for the CB stick model are lower than the Referenced DCD enveloping seismic loads, with a maximum percentage ratio of approximately 46 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping seismic load is approximately 46 percent of the enveloping seismic loads used in the ESBWR Standard Plant for the CB.

The vertical loads are expressed in terms of enveloping absolute acceleration. For the RB/FB model, the enveloping maximum vertical acceleration from Fermi 3 site-specific SSI analyses based on the BE, LB, and UB subsurface profiles (herein called Fermi 3 site-specific SSI enveloping maximum vertical accelerations) are presented in Table 3.7.2-205a through Table 3.7.2-205e.

The Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the RB/FB stick model are presented in Table 3.7.2-205a. The Fermi 3 site-specific SSI enveloping maximum vertical accelerations are compared with the Referenced DCD enveloping maximum vertical accelerations provided in Referenced DCD Table 3A.9-3a for the RB/FB stick model. Table 3.7.2-205a also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping maximum vertical accelerations to the Referenced DCD enveloping maximum vertical accelerations for the RB/FB stick model. Table 3.7.2-205a shows that the Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the RB/FB stick model are lower than the Referenced DCD enveloping maximum vertical accelerations, with a maximum percentage ratio of approximately 39 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping maximum vertical acceleration is approximately 39 percent of the enveloping maximum vertical acceleration used in the ESBWR Standard Plant for the RB/FB.

The Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the RCCV stick model are presented in Table 3.7.2-205b. The Fermi 3 site-specific SSI enveloping maximum vertical accelerations are compared with the Referenced DCD enveloping maximum vertical accelerations provided in Referenced DCD Table 3A.9-3b for the RCCV stick model. Table 3.7.2-205b also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping maximum vertical accelerations to the Referenced DCD enveloping maximum vertical accelerations for the RCCV stick model. Table 3.7.2-205b shows that the Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the RCCV stick model are lower than the Referenced DCD enveloping maximum vertical accelerations, with a maximum percentage ratio of approximately 36 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping maximum vertical acceleration is approximately 36 percent of the enveloping maximum vertical acceleration used in the ESBWR Standard Plant for the RCCV.

The Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the Vent Wall/Pedestal stick model are presented in Table 3.7.2-205c. The Fermi 3 site-specific SSI enveloping maximum vertical accelerations are compared with the Referenced DCD enveloping maximum vertical accelerations provided in Referenced DCD Table 3A.9-3c for the Vent Wall/Pedestal stick model. Table 3.7.2-205c also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping maximum vertical accelerations to the Referenced DCD enveloping maximum vertical accelerations for the Vent Wall/Pedestal stick model. Table 3.7.2-205c shows that the Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the Vent Wall/Pedestal stick model are lower than the Referenced DCD enveloping maximum vertical accelerations, with a maximum percentage ratio of approximately 38 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping maximum vertical acceleration is approximately 38 percent of the enveloping maximum vertical acceleration used in the ESBWR Standard Plant for the Vent Wall/Pedestal.

The Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the RSW stick model are presented in Table 3.7.2-205d. The Fermi 3 site-specific SSI enveloping maximum vertical accelerations are compared with the Referenced DCD enveloping maximum vertical accelerations provided in Referenced DCD Table 3A.9-3d for the RSW stick model. Table 3.7.2-205d also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping maximum vertical accelerations to the Referenced DCD enveloping maximum vertical accelerations for the RSW stick model. Table 3.7.2-205d shows that the Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the RSW stick model are lower than the Referenced DCD enveloping maximum vertical accelerations, with a maximum percentage ratio of approximately 36 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping maximum vertical acceleration is approximately 36 percent of the enveloping maximum vertical acceleration used in the ESBWR Standard Plant for the RSW.

The Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the RB/FB Flexible Slab Oscillators are presented in Table 3.7.2-205e. The Fermi 3 site-specific SSI enveloping maximum vertical accelerations are compared with the Referenced DCD enveloping maximum vertical accelerations provided in Referenced DCD Table 3A.9-3e for the RB/FB Flexible Slab Oscillators. Table 3.7.2-205e also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping maximum vertical accelerations to the Referenced DCD enveloping maximum vertical accelerations for the RB/FB Flexible Slab Oscillators. Table 3.7.2-205e shows that the Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the RB/FB Flexible Slab Oscillators are lower than the Referenced DCD enveloping maximum vertical accelerations, with a maximum percentage ratio of approximately 55 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping maximum vertical acceleration is approximately 55 percent of the enveloping maximum vertical acceleration used in the ESBWR Standard Plant for the RB/FB Flexible Slab Oscillators.

For the CB stick model, the Fermi 3 site-specific SSI enveloping maximum vertical accelerations are presented in Table 3.7.2-206. The Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the CB stick model are presented in Table 3.7.2-206. The SSI enveloping maximum vertical accelerations are compared with the Referenced DCD enveloping maximum vertical accelerations provided in Referenced DCD Table 3A.9-3g for the CB stick model. Table 3.7.2-206 also presents the percentage ratio of the Fermi 3 site-specific SSI enveloping maximum vertical accelerations to the Referenced DCD enveloping maximum vertical accelerations for the CB stick model. Table 3.7.2-206 shows that the Fermi 3 site-specific SSI enveloping maximum vertical accelerations for the CB stick model are lower than the Referenced DCD enveloping maximum vertical accelerations, with a maximum percentage ratio of approximately 48 percent. This indicates that the greatest Fermi 3 site-specific SSI enveloping maximum vertical acceleration is approximately 48 percent of the enveloping maximum vertical acceleration used in the ESBWR Standard Plant for the CB.

3.7.2.4.1.6.2 Comparison of the Site-Specific SSI Floor Response Spectra

The site-specific floor response spectra for the BE, LB, and UB subsurface profiles are compared with the enveloping floor response spectra at 5 percent damping in Referenced DCD Subsection 3A.9.2.

For the RB/FB model, the floor response spectra at 5 percent damping obtained from Fermi 3 site-specific SSI analyses for the BE, LB, and UB subsurface profiles (herein called Fermi 3 site-specific SSI floor response spectra at 5 percent damping) are shown on Figure 3.7.2-207a through Figure 3.7.2-207f for the X-direction, on Figure 3.7.2-208a through Figure 3.7.2-208f for the Y-direction, and on Figure 3.7.2-209a through Figure 3.7.2-209f for the vertical direction. The Fermi 3 site-specific SSI floor response spectra at 5 percent damping are compared with the Referenced DCD Subsection 3A.9.2 enveloping floor response spectra at 5 percent damping on Figure 3.7.2-207a through Figure 3.7.2-209f (solid black lines). The Fermi 3 site-specific SSI floor response spectra at 5 percent damping at the locations presented in the Referenced DCD, Subsection 3A.9.2 for the RB/FB model are considerably lower than the DCD enveloping floor response spectra at 5 percent damping, indicating that the ESBWR Standard Plant for the RB/FB is acceptable at the Fermi 3 site.

For the CB model, Fermi 3 site-specific SSI floor response spectra at 5 percent damping are shown on Figure 3.7.2-210a and Figure 3.7.2-210b for the X-direction, on Figure 3.7.2-211a and Figure 3.7.2-211b for the Y-direction, and on Figure 3.7.2-212a and Figure 3.7.2-212b for the vertical direction. The Fermi 3 site-specific SSI floor response spectra at 5 percent damping are compared with the Referenced DCD Subsection 3A.9.2 enveloping floor response spectra at 5 percent damping as shown on Figure 3.7.2-210a through Figure 3.7.2-212b (solid black lines). The Fermi 3 site-specific SSI floor response spectra at 5 percent damping at the locations presented in the Referenced DCD, Subsection 3A.9.2 in the CB model are considerably lower than the DCD enveloping floor response spectra at 5 percent damping, indicating that the ESBWR Standard Plant design for the CB is acceptable at the Fermi 3 site.

3.7.2.4.1.7 **Conclusions**

The results of the Fermi 3 site-specific SSI analyses for the RB/FB and CB performed to consider partial embedment into the Bass Islands Group bedrock, without taking credit for the lateral support of the backfill located above the top of Bass Islands Group bedrock (Elevation 168.2 m [552.0 ft] NAVD 88, Table 2.5.4-201) shows the following:

- That seismic forces, floor response spectra, and accelerations are significantly less than for the Referenced DCD design values for the ESBWR Standard Plant based on the CSDRS.

- That the factors of safety for sliding and overturning are significantly greater than the required factor of safety of 1.1 in SRP 3.8.5.
- That the dynamic bearing demands are much smaller than the allowable dynamic bearing capacity on the Bass Islands Group dolomite presented in Table 2.5.4-227.

The results from the Fermi 3 site-specific SSI analyses using the BE, LB, and UB subsurface profiles show that the seismic forces in members, floor response spectra, and acceleration are bounded by values presented in the Referenced DCD for both the RB/FB and CB. In addition, Subsection 3.8.5 demonstrates that the actual factors of safety for overturning and sliding are greater than the required factors of safety.

The Fermi 3 site-specific SSI soil dynamic bearing demands for the RB/FB and CB are greater than the Referenced DCD maximum dynamic bearing demands for the material properties consistent with the BE, LB, and UB subsurface profiles (Subsection 3.8.5). However, the Fermi 3 site-specific SSI dynamic bearing demands for the RB/FB and CB are less than the allowable dynamic bearing capacity in Subsection 2.5.4.10, Table 2.5.4-227.

Based on the Fermi 3 site-specific SSI analyses, the following conclusions apply to the Fermi 3 site:

- The Referenced DCD standard plant design (ESBWR Standard Plant) is applicable to the RB/FB and CB Seismic Category I structures at the Fermi 3 site with partial embedment into bedrock and neglecting the contribution of the surrounding backfill.
- The DCD backfill requirements for the backfill above the top of the Bass Islands Group bedrock (Elevation 168.2 m [552 ft] NAVD 88) that surrounds the embedded walls of the Fermi 3 Seismic Category I structures are shown to be unnecessary. Therefore, the backfill above the top of the Bass Islands Group bedrock is not Seismic Category I backfill.
- The following Fermi 3 site-specific SSI dynamic responses using the SSI FIRS and the BE, LB, and UB subsurface profiles are less than the corresponding dynamic responses in the referenced DCD using the CSDRS:
    - o Fermi 3 site-specific SSI enveloping seismic loads are less than the Referenced DCD enveloping seismic loads. The Fermi 3 site-specific SSI enveloping seismic loads are a

maximum of 56 and 46 percent of the Referenced DCD values for the RB/FB and CB, respectively.

- o Fermi 3 site-specific SSI enveloping maximum vertical accelerations are less than the Referenced DCD enveloping maximum vertical accelerations. The Fermi 3 site-specific SSI enveloping maximum vertical accelerations are a maximum of 55 and 48 percent of the Referenced DCD values for the RB/FB and CB, respectively.
- o Fermi 3 site-specific SSI floor response spectra are considerably less than the Referenced DCD enveloping floor response spectra at the same locations.

- The Fermi 3 site-specific foundation stability (sliding and overturning) evaluation was performed without taking credit for the backfill located above the top of the Bass Islands Group bedrock that surrounds the embedded walls of the RB/FB and CB, and by neglecting the side frictional resistance along the sides of the basemats and the shear keys beneath the basemats. The Fermi 3 site-specific foundation stability evaluation demonstrated that the minimum Fermi 3 site-specific factors of safety for sliding and overturning for the RB/FB and CB are 2.59 for sliding and 1,715 for overturning (presented in Subsection 3.8.5).
- The Fermi 3 RB/FB and CB are stable against floatation with a minimum factor of safety of 1.85 (presented in Subsection 3.8.5).
- The dynamic bearing demands from the Fermi 3 site-specific SSI analyses are considerably below the allowable dynamic bearing capacities for the Bass Islands Group bedrock at the Fermi 3 site (presented in Subsection 3.8.5).

3.7.2.8 Interaction of Non-Category I Structures with Seismic Category I Structures

Add the following at the end of this section.

EF3 SUP 3.7-5

The locations of structures are provided in Figure 2.1-204. Non-Category I structures within the scope of the DCD are addressed in the DCD. Non-Category I structures outside the scope of the DCD are located at least a distance of its height above grade from Seismic Category I structures. Thus, the collapse of any site specific non-Category I structure, system, or component will not cause the non-Category I structure, system, or component to strike a Seismic Category I structure, system, or component.

For the Seismic Category II structures and Radwaste Building, Fermi 3 site-specific analyses will be performed if the Referenced DCD backfill requirements are not met.

The locations of structures are provided in Figure 2.1-204. Non-Category I structures within the scope of the DCD are addressed in the DCD. Each site-specific non-Category I structure outside the scope of the DCD is located at least a distance of the structure's height above grade from Seismic Category I structures. Thus, the collapse of any site specific non-Category I structure, system, or component will not cause the non-Category I structure, system, or component to strike a Seismic Category I structure, system, or component.

The design and analysis of the Seismic Category II structures (TB, SB, and ADB) and the Seismic Category NS Radwaste Building (RW) structure will be completed as part of the detailed design phase for the ESBWR standard plant. The design and analysis for these structures will be in accordance with the ESBWR DCD, considering the soil property requirements in DCD Tier 1 Table 5.1-1, to ensure that the acceptance criteria in DCD Tier 1 ITAAC Tables 2.16.8-1, 2.16.9-1, 2.16.10-1, and 2.16.11-1 are met. DCD Section 3.7.2.8 describes the seismic design and analysis for the TB, SB, ADB and RW structures to preclude any adverse interaction with Seismic Category I structures.

If the soil property requirements in DCD Tier 1 Table 5.1-1 are not met, Fermi 3 site-specific seismic SSI analyses using the Fermi 3 soil properties will be performed to demonstrate the adequacy of the standard plant design for the TB, SB, ADB, and the RW structures, as follows:

- These Fermi 3 site-specific seismic SSI analyses for the TB, RW, SB, and ADB structures will be consistent with the site-specific seismic SSI analyses for the Seismic Category I RB/FB and CB structures presented in FSAR Subsection 3.7.2.4 and will be performed using the Fermi 3 soil properties and the methodologies described in DCD Subsections 3.7.2.8.1, 3.7.2.8.2, 3.7.2.8.3, and 3.7.2.8.4, respectively, and DCD Appendix 3A.

- In addition to these site-specific seismic SSI analyses, site-specific seismic structure-soil-structure interaction (SSSI) analyses to evaluate any adverse effects between the TB, RW, SB, and ADB structures and adjacent Seismic Category I structures will be performed using the methodologies described in DCD Subsections 3.7.2.8.1, 3.7.2.8.2, 3.7.2.8.3, and 3.7.2.8.4, respectively, and DCD Appendix 3A.

Results of these site-specific seismic SSI and seismic SSSI analyses, if needed, will be discussed as part of the ITAAC completion package for the TB, RW, SB, and ADB structures to demonstrate that acceptance criteria in ITAAC Tables 2.4.15-1, 2.4.16-1, 2.4.17-1 and 2.4.18-1, respectively, are met.

3.7.2.14 Determination of Seismic Category I Structure Overturning Moments

Add the following at the end of the Subsection 3.7.2.14.

The Fermi 3 site-specific stability evaluation against overturning is presented in Subsection 3.8.5.

Table 3.7.2-201 RB/FB Soil-Structure Interaction Analysis Cases [EF3 SUP 3.7-4]

Building	Case ID No.	Model* (DCD)	Input Motion	Subsurface Profile		
				BE	LB	UB
RB/FB	RFI-1	Base	FIRS	✓	--	--
	RFI-2			--	✓	--
	RFI-3			--	--	✓

Note *: As shown in the DCD Table 3A.6-1, there are some models with minor modifications to evaluate the modeling effects. For the Fermi 3 SSI analyses, the most basic model, “Base,” is applied.

BE = Best estimate

LB = Lower bound

UB = Upper bound

Table 3.7.2-202 CB Soil-Structure Interaction Analysis Cases [EF3 SUP 3.7-4]

Building	Case ID No.	Model* (DCD)	Input Motion	Subsurface Profile		
				BE	LB	UB
CB	CFI-1	Base	FIRS	✓	--	--
	CFI-2			--	✓	--
	CFI-3			--	--	✓

Note *: As shown in the DCD Table 3A.6-1, there are some models with minor modifications to evaluate the modeling effects. For the Fermi 3 SSI analyses, the most basic model, “Base,” is applied.

BE = Best estimate

LB = Lower bound

UB = Upper bound

Table 3.7.2-203a Ratio with DCD Enveloping Seismic Loads: RB/FB Stick [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads					Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)				
			Shear		Moment			Shear		Moment		
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	Torsion (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.	Torsion
52.40 *	1110	110			701.5	703.7				43%	39%	
		109	63.1	59.8	1612.6	1653.9	441.2	42%	38%	37%	37%	32%
34.00	1109	109			2108.3	2171.5				38%	39%	
		108	73.4	59.7	2571.8	2557.2	665.0	38%	39%	40%	40%	28%
27.00	1108	108			2869.6	2958.5				37%	42%	
		107	177.4	137.8	3530.0	3493.0	1287.9	42%	34%	39%	41%	39%
22.50	1107	107			3853.5	3745.0				39%	41%	
		106	198.2	156.6	4719.7	4380.4	2433.8	41%	34%	41%	39%	40%
17.50	1106	106			5109.0	4580.2				41%	38%	
		105	206.6	186.0	5853.9	5137.2	2061.2	39%	33%	42%	37%	41%
13.57	1105	105			6078.0	5279.5				43%	37%	
		104	216.2	196.7	6977.0	5950.8	2176.5	38%	33%	42%	36%	41%
9.06	1104	104			7129.7	6069.0				42%	35%	
		103	233.0	205.5	8039.8	6751.4	2368.5	38%	31%	41%	34%	40%
4.65	1103	103			5255.2	3920.8				28%	19%	
		102	259.2	188.8	6511.3	4584.7	2882.3	31%	22%	28%	19%	25%
-1.00	1102	102			6764.6	4940.4				29%	20%	
		101	279.1	208.8	8107.4	5654.3	3209.1	32%	22%	29%	19%	28%
-6.40	1101	101			4766.1	3592.4				17%	12%	
-11.50		2	122.2	96.7	5286.3	3743.2	1861.8	13%	9%	16%	11%	16%

Note: Total torsional moments are obtained by the absolute sum of the accidental torsional moments and the values of the geometric torsional moments shown. The accidental torsional moment is the product of the horizontal force component and an eccentricity of 5% of the larger horizontal dimension at various elevations.

* : The difference between the modeled elevation 52.4 m and the actual elevation 52.7 m at the RB roof is negligibly small.

MN = Mega Newton; MN-m = Mega Newton-meter; m = meter

Table 3.7.2-203b Ratio with DCD Enveloping Seismic Loads: RCCV Stick [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads					Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)				
			Shear		Moment			Shear		Moment		
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	Torsion (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.	Torsion
34.00	1209	209			67.0	163.5				34%	28%	
		208	61.6	67.5	433.4	591.0	10.0	45%	37%	41%	40%	28%
27.00	1208	208			573.8	899.5				34%	36%	
		206	70.5	80.5	1114.7	1591.8	752.3	43%	32%	38%	36%	41%
17.50	1206	206			1206.3	1743.0				36%	37%	
		205	93.8	81.8	1507.7	2024.7	815.3	41%	28%	36%	35%	41%
13.57	1205	205			1546.5	2110.4				36%	35%	
		204	102.9	88.4	1956.1	2446.1	910.8	39%	27%	36%	34%	42%
9.06	1204	204			1999.4	2550.5				36%	34%	
		203	110.0	97.0	2438.3	2879.2	1040.5	36%	27%	36%	32%	40%
4.65	1203	203			2554.6	3005.1				37%	33%	
		202	57.4	54.7	2829.0	3189.3	773.9	25%	19%	36%	30%	27%
-1.00	1202	202			2948.6	3345.5				37%	31%	
		201	78.0	69.8	3311.9	3717.9	813.7	29%	21%	35%	30%	28%
-6.40	1201	201			3387.7	3766.1				36%	30%	
-11.50		2	29.3	23.8	3472.4	3857.5	312.5	11%	8%	32%	27%	16%

Note: Total torsional moments are obtained by the absolute sum of the accidental torsional moments and the values of the geometric torsional moments shown. The accidental torsional moment is the product of the horizontal force component and an eccentricity of 5% of the larger horizontal dimension at various elevations.
MN = Mega Newton; MN-m = Mega Newton-meter; m = meter

Table 3.7.2-203c Ratio with DCD Enveloping Seismic Loads: Vent Wall/Pedestal Stick [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads					Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)				
			Shear		Moment			Shear		Moment		
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	Torsion (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.	Torsion
17.50	701	701			22.9	18.1				30%	21%	
		702	6.5	6.7	26.0	21.4	12.4	19%	18%	23%	16%	11%
14.50	702	702			28.0	27.8				24%	19%	
		703	7.4	6.4	34.5	40.6	13.1	20%	16%	15%	16%	11%
11.50	703	703			38.5	43.2				17%	16%	
		704	8.1	7.1	52.0	60.0	14.0	22%	17%	15%	15%	12%
8.50	704	704			53.7	61.7				16%	16%	
		705	8.9	7.3	60.1	68.6	14.3	24%	16%	16%	16%	12%
7.4625	705	705			65.4	58.0				18%	13%	
		706,303	5.6	4.8	75.2	68.9	7.2	14%	12%	16%	13%	7%
4.65	1303	303			163.8	148.7				28%	24%	
		377	12.0	10.8	176.9	167.9	38.2	37%	24%	30%	25%	27%
2.4165	1377	377			218.2	206.2				30%	25%	
		302	17.6	15.9	246.3	262.5	46.4	36%	24%	32%	28%	27%
-1.00	1302	302			228.3	237.0				27%	25%	
		376	23.1	20.1	257.9	266.8	40.6	35%	25%	28%	25%	28%
-2.75	1376	376			258.0	266.8				28%	25%	
		301	23.3	20.2	326.4	334.3	40.6	35%	25%	29%	25%	28%
-6.40	1301	301			307.9	332.5				27%	25%	
-11.50		2	11.1	8.5	348.3	362.4	18.8	11%	7%	21%	18%	16%

Note: Total torsional moments are obtained by the absolute sum of the accidental torsional moments and the values of the geometric torsional moments shown. The accidental torsional moment is the product of the horizontal force component and an eccentricity of 5% of the larger horizontal dimension at various elevations.
MN = Mega Newton; MN-m = Mega Newton-meter; m = meter

Table 3.7.2-203d Ratio with DCD Enveloping Seismic Loads: RSW Stick [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads					Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)				
			Shear		Moment			Shear		Moment		
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	Torsion (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.	Torsion
24.18	707	707			0.61	0.68				29%	40%	
			0.84	0.67	3.94	3.34	0.15	28%	25%	30%	27%	37%
20.20	708	708			5.91	5.65				32%	34%	
			4.86	3.17	26.45	17.01	0.51	33%	26%	33%	25%	37%
15.775	709	709			27.63	17.74				34%	25%	
			5.30	3.50	51.21	32.71	0.72	31%	24%	32%	24%	38%
11.35	710	710			51.56	32.83				32%	24%	
			5.49	4.14	72.11	47.27	0.74	28%	25%	31%	24%	31%
7.4625	711	711			61.40	53.29				31%	29%	
			14.43	12.48	86.62	83.18	7.59	35%	35%	30%	33%	32%
4.65	712	712			34.94	30.29				28%	23%	
			5.26	4.63	40.46	38.19	8.17	37%	24%	30%	25%	27%
2.4165	713	713			1.18	1.02				33%	32%	
			0.44	0.37	0.97	0.86	0.06	29%	29%	33%	32%	24%
1.96	714	714			0.90	0.75				33%	32%	
-0.80		715	0.29	0.23	0.18	0.14	0.03	33%	31%	34%	27%	25%

Note: Total torsional moments are obtained by the absolute sum of the accidental torsional moments and the values of the geometric torsional moments shown. The accidental torsional moment is the product of the horizontal force component and an eccentricity of 5% of the larger horizontal dimension at various elevations.
MN = Mega Newton; MN-m = Mega Newton-meter; m = meter

Table 3.7.2-203e Ratio with DCD Enveloping Seismic Loads: RPV Stick (Sheet 1 of 7) [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads				Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)			
			Shear		Moment		Shear		Moment	
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.
27.64	801	801			0.0	0.0				
26.792		802	0.2	0.1	0.2	0.1	37%	25%	37%	25%
26.792	802	802			0.2	0.1			37%	25%
25.944		803	0.6	0.4	0.7	0.4	37%	25%	37%	25%
25.944	803	803			0.7	0.4			37%	25%
25.03		804	1.2	0.7	1.8	1.1	37%	24%	37%	25%
25.03	804	804			1.8	1.1			37%	25%
24.3188		805	1.5	1.0	2.9	1.8	35%	23%	36%	24%
24.3188	805	805			2.9	1.8			36%	24%
22.276		806	2.2	1.4	7.4	4.6	36%	23%	36%	24%
22.276	806	806			7.4	4.6			36%	24%
21.8247		807	3.0	1.8	8.7	5.5	37%	23%	36%	24%
21.8247	807	807			8.7	5.5			36%	24%
20.2		808	3.3	2.0	14.1	8.7	37%	23%	36%	23%
20.2	808	808			14.1	8.7			36%	23%
19.5278		809	1.1	0.7	14.8	9.1	30%	23%	36%	24%
19.5278	809	809			14.8	9.1			36%	24%
17.2677		810	1.8	1.0	18.8	11.0	35%	25%	37%	24%
17.2677	810	810			18.8	11.0			37%	24%
16.365		811	2.2	1.5	20.7	12.1	36%	29%	37%	24%
16.365	811	811			20.7	12.1			37%	24%
14.51		812	3.9	2.2	27.2	16.0	43%	28%	40%	25%

Table 3.7.2-203e Ratio with DCD Enveloping Seismic Loads: RPV Stick (Sheet 2 of 7) [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads				Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)			
			Shear		Moment		Shear		Moment	
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.
14.51	812	812			27.2	16.0			40%	25%
12.491		813	3.6	2.2	34.1	20.3	37%	27%	40%	26%
12.491	813	813			34.1	20.3			40%	26%
10.472		814	3.5	2.3	40.4	24.2	34%	30%	39%	27%
10.472	814	814			40.4	24.2			39%	27%
8.453		815	4.2	2.8	45.0	28.2	41%	31%	36%	26%
8.453	815	815			31.8	23.0			44%	38%
7.8071		816	5.6	4.0	28.1	20.6	44%	35%	44%	38%
7.8071	816	816			28.1	20.6			44%	38%
7.111		817	5.6	3.7	24.1	18.1	44%	33%	44%	38%
7.111	817	817			24.1	18.1			44%	38%
6.401		818	5.5	3.3	20.4	15.7	45%	30%	43%	39%
6.401	818	818			20.4	15.7			43%	39%
5.691		819	5.3	3.0	17.4	13.4	45%	28%	42%	40%
5.691	819	819			17.4	13.4			42%	40%
4.981		820	5.3	2.8	15.4	11.5	47%	27%	42%	42%
4.981	820	820			15.4	11.5			42%	42%
4.2713		821	4.9	2.7	13.4	9.8	46%	27%	41%	44%
4.2713	821	821			13.4	9.8			41%	44%
3.7593		822	4.7	2.6	12.4	8.6	47%	27%	41%	41%
3.7593	822	822			12.4	8.6			41%	41%
3.215		823	4.6	2.5	11.6	7.7	48%	27%	42%	38%

Table 3.7.2-203e Ratio with DCD Enveloping Seismic Loads: RPV Stick (Sheet 3 of 7) [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads				Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)			
			Shear		Moment		Shear		Moment	
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.
3.215	823	823			11.6	7.7			42%	38%
2.365		824	4.5	2.4	11.3	6.6	49%	26%	46%	31%
2.365	824	824			3.4	2.8			40%	43%
1.785		825	2.4	1.8	2.1	1.7	41%	41%	40%	43%
1.785	825	825			2.1	1.7			40%	43%
1.2		826	2.1	1.7	0.8	0.7	42%	43%	39%	38%
1.2	826	826			0.8	0.7			39%	38%
0.7657		827	1.9	1.5	0.2	0.2	43%	44%	38%	35%
0.7657	827	827			0.2	0.2			35%	36%
-0.1315		828	1.4	1.1	1.4	1.0	44%	46%	45%	49%
8.453	871	815			56.0	43.5			39%	32%
7.4625		711	8.7	7.2	56.4	43.4	47%	40%	40%	32%
21.8247	828	829			0.0	0.0				
20.2		830	0.1	0.1	0.2	0.1	29%	17%	29%	17%
20.2	829	830			0.2	0.1			29%	17%
19.5278		831	0.3	0.2	0.7	0.4	33%	20%	56%	26%
19.5278	830	831			0.7	0.4			56%	26%
17.2677		832	0.4	0.2	1.3	0.6	34%	15%	32%	15%
17.2677	831	832			1.3	0.6			32%	15%
16.365		833	0.5	0.2	1.7	0.8	35%	14%	32%	15%
16.365	832	833			1.7	0.8			32%	15%
14.51		834	2.2	1.2	4.1	2.3	44%	24%	44%	23%

Table 3.7.2-203e Ratio with DCD Enveloping Seismic Loads: RPV Stick (Sheet 4 of 7) [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads				Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)			
			Shear		Moment		Shear		Moment	
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.
14.51	833	834			4.1	2.3			44%	23%
12.491		835	1.6	0.7	6.9	3.5	52%	22%	47%	24%
12.491	834	835			6.9	3.5			47%	24%
10.472		836	0.6	0.5	8.1	3.9	38%	23%	50%	23%
10.472	835	836			8.1	3.9			50%	23%
8.453		837	1.3	0.9	6.1	2.5	50%	42%	42%	17%
8.453	836	837			6.1	2.5			42%	17%
7.8071		838	1.7	1.0	5.2	2.5	46%	32%	39%	17%
7.8071	837	838			5.2	2.5			39%	17%
7.111		839	1.9	1.2	4.3	2.2	48%	30%	38%	17%
7.111	838	839			4.3	2.2			38%	17%
6.401		840	2.2	1.2	3.6	2.4	49%	26%	34%	22%
6.401	839	840			3.6	2.4			34%	22%
5.691		841	2.5	1.2	2.9	2.6	49%	24%	28%	25%
5.691	840	841			2.9	2.6			28%	25%
4.981		842	2.8	1.2	3.8	2.8	50%	22%	41%	26%
4.981	841	842			3.8	2.8			41%	26%
4.2713		843	3.5	1.3	4.9	3.1	55%	23%	44%	29%
4.2713	842	843			4.9	3.1			44%	29%
3.7593		844	3.5	1.4	6.2	3.6	54%	23%	45%	29%
3.7593	843	844			6.2	3.6			45%	29%
3.215		845	3.1	1.7	7.3	3.8	44%	26%	45%	27%

Table 3.7.2-203e Ratio with DCD Enveloping Seismic Loads: RPV Stick (Sheet 5 of 7) [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads				Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)			
			Shear		Moment		Shear		Moment	
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.
3.215	844	845			7.3	3.8			45%	27%
2.365		846	3.2	1.7	10.2	4.6	44%	24%	48%	27%
0.7657	859	827			0.1	0.0			30%	18%
-0.788		861	0.1	0.1	0.1	0.1	43%	32%	41%	36%
-0.788	861	861			0.1	0.1			41%	36%
-1.443		863	0.0	0.0	0.1	0.1	37%	25%	45%	39%
-1.443	863	863			0.1	0.1			45%	39%
-2.098		865	0.0	0.0	0.1	0.1	37%	26%	52%	33%
-2.098	865	865			0.1	0.1			52%	33%
-2.753		867	0.1	0.1	0.1	0.1	36%	27%	51%	30%
-2.753	867	867			0.1	0.1			51%	30%
-3.4715		869	0.1	0.1	0.0	0.0	50%	31%	51%	29%
-3.4715	869	869			0.0	0.0			51%	29%
-4.2237		871	0.1	0.0	0.0	0.0	51%	29%	0%	0%
7.896	845	847			0.0	0.0				
7.8071		848	0.4	0.6	0.0	0.1	35%	52%	35%	52%
7.8071	846	848			0.0	0.1			35%	52%
7.111		849	0.4	0.6	0.3	0.4	41%	54%	40%	53%
7.111	847	849			0.3	0.4			40%	53%
6.401		850	0.3	0.3	0.5	0.7	45%	53%	42%	54%
6.401	848	850			0.5	0.7			42%	54%
5.691		851	0.1	0.1	0.5	0.7	47%	37%	42%	53%

Table 3.7.2-203e Ratio with DCD Enveloping Seismic Loads: RPV Stick (Sheet 6 of 7) [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads				Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)			
			Shear		Moment		Shear		Moment	
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.
5.691	849	851			0.5	0.7			42%	53%
4.981		852	0.3	0.3	0.3	0.4	45%	53%	40%	52%
4.981	850	852			0.3	0.4			40%	52%
4.2713		853	0.4	0.5	0.0	0.0	41%	52%	39%	46%
4.2713	851	853			0.0	0.0			39%	46%
4.1784		854	0.4	0.5	0.0	0.0	39%	46%	2%	4%
4.1784	852	854			0.0	0.0				
4.065		855	0.5	0.4	0.1	0.0	47%	50%	47%	50%
4.065	853	855			0.1	0.0			47%	50%
3.215		856	0.4	0.3	0.4	0.3	46%	50%	46%	50%
3.215	854	856			0.4	0.3			46%	50%
2.365		857	0.1	0.1	0.5	0.4	47%	44%	46%	49%
2.365	855	857			0.5	0.4			46%	49%
1.785		858	0.3	0.2	0.4	0.3	46%	50%	46%	49%
1.785	856	858			0.4	0.3			46%	49%
1.2		859	0.6	0.5	0.0	0.0	46%	49%	27%	22%
1.2	857	859			0.0	0.0			2%	2%
0.7657		860	0.9	0.7	0.4	0.3	46%	49%	46%	49%
0.7657	858	860			0.4	0.3			46%	49%
-0.1315		828	1.0	0.8	1.3	1.0	46%	50%	46%	50%
-0.1315	860	828			0.1	0.1			38%	34%
-0.788		862	0.1	0.1	0.1	0.1	40%	26%	43%	37%

Table 3.7.2-203e Ratio with DCD Enveloping Seismic Loads: RPV Stick (Sheet 7 of 7) [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads				Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)			
			Shear		Moment		Shear		Moment	
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.
-0.788	862	862			0.1	0.1			43%	37%
-1.443		864	0.0	0.0	0.1	0.1	33%	25%	44%	38%
-1.443	864	864			0.1	0.1			44%	38%
-2.098		866	0.0	0.0	0.1	0.1	37%	26%	46%	33%
-2.098	866	866			0.1	0.1			46%	33%
-2.753		868	0.1	0.1	0.1	0.1	42%	27%	47%	30%
-2.753	868	868			0.1	0.1			47%	30%
-3.4715		870	0.1	0.1	0.0	0.0	48%	30%	45%	29%
-3.4715	870	870			0.0	0.0			45%	29%
-4.2237		872	0.1	0.0	0.0	0.0	45%	29%	0	0

MN = Mega Newton; MN-m = Mega Newton-meter; m = meter

Table 3.7.2-204 Ratio with DCD Enveloping Seismic Loads: CB Stick [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Seismic Loads					Ratio of (Fermi 3 SSI Enveloping Loads) to (DCD Enveloping Seismic Loads)				
			Shear		Moment			Shear		Moment		
Elev. (m)	Elem No.	Node No.	X-Dir. (MN)	Y-Dir. (MN)	X-Dir. (MN-m)	Y-Dir. (MN-m)	Torsion (MN-m)	X-Dir.	Y-Dir.	X-Dir.	Y-Dir.	Torsion
13.80		6			52.1	33.5				33%	27%	
	6		12.4	13.4	87.1	73.5	9.0	37%	46%	35%	37%	12%
9.06		5			118.2	90.7				33%	33%	
	5		23.9	25.2	209.3	195.2	19.9	45%	46%	37%	44%	16%
4.65		4			124.8	61.4				17%	11%	
	4		33.0	31.5	314.9	270.2	17.1	44%	39%	28%	27%	10%
-2.00		3			269.2	269.0				22%	26%	
-7.40	3	2	37.6	33.2	446.1	434.9	18.5	30%	33%	28%	29%	7%

Note: Total torsional moments are obtained by the absolute sum of the accidental torsional moments and the values of the geometric torsional moments shown. The accidental torsional moment is the product of the horizontal force component and an eccentricity of 5% of the larger horizontal dimension at various elevations.
MN = Mega Newton; MN-m = Mega Newton-meter; m = meter

Table 3.7.2-205a Ratio with DCD Enveloping Maximum Vertical Acceleration: RB/FB [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Maximum Vertical Acceleration	Ratio of (Fermi 3 SSI Enveloping Maximum Vertical Acceleration) to (DCD Enveloping Maximum Vertical Acceleration)
Elev. (m)	**Node No.**	**Stick Model**	**Max. Vertical Acceleration (g)**	**Max. Vertical Acceleration**
52.40 *	110	RB/FB	0.38	30%
34.00	109	RB/FB	0.31	38%
27.00	108	RB/FB	0.29	39%
22.50	107	RB/FB	0.25	34%
17.50	106	RB/FB	0.24	33%
13.57	105	RB/FB	0.23	31%
9.06	104	RB/FB	0.21	29%
4.65	103	RB/FB	0.20	26%
-1.00	102	RB/FB	0.20	27%
-6.40	101	RB/FB	0.20	29%
-11.50	2	RB/FB	0.18	29%
-15.50	1	RB/FB	0.18	36%

Note: For structural design use only.

* : The difference between the modeled elevation 52.4 m and the actual elevation 52.7 m at the RB roof is negligibly small.
m = meter

Table 3.7.2-205b Ratio with DCD Enveloping Maximum Vertical Acceleration: RCCV [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Maximum Vertical Acceleration	Ratio of (Fermi 3 SSI Enveloping Maximum Vertical Acceleration) to (DCD Enveloping Maximum Vertical Acceleration)
Elev. (m)	Node No.	Stick Model	Max. Vertical Acceleration (g)	Max. Vertical Acceleration
34.00	209	RCCV	0.31	34%
27.00	208	RCCV	0.30	34%
17.50	206	RCCV	0.25	35%
13.57	205	RCCV	0.23	30%
9.06	204	RCCV	0.23	36%
4.65	203	RCCV	0.22	32%
-1.00	202	RCCV	0.21	36%
-6.40	201	RCCV	0.20	34%

Note: For Structural design use only.
m = meter

Table 3.7.2-205c Ratio with DCD Enveloping Maximum Vertical Acceleration: VW/Pedestal [EF3 SUP 3.7-4]

Elev. (m)	Node No.	Stick Model	Fermi 3 SSI Enveloping Maximum Vertical Acceleration: Max. Vertical Acceleration (g)	Ratio of (Fermi 3 SSI Enveloping Maximum Vertical Acceleration) to (DCD Enveloping Maximum Vertical Acceleration): Max. Vertical Acceleration
17.50	701	VW	0.26	24%
14.50	702	VW	0.26	25%
11.50	703	VW	0.26	28%
8.50	704	VW	0.25	33%
7.4625	705	VW	0.24	34%
4.65	706,303	Pedestal	0.23	34%
-1.00	302	Pedestal	0.20	35%
-6.40	301	Pedestal	0.19	38%

Note: For Structural design use only.
m = meter

Table 3.7.2-205d Ratio with DCD Enveloping Maximum Vertical Acceleration: RSW [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Maximum Vertical Acceleration	Ratio of (Fermi 3 SSI Enveloping Maximum Vertical Acceleration) to (DCD Enveloping Maximum Vertical Acceleration)
Elev. (m)	Node No.	Stick Model	Max. Vertical Acceleration (g)	Max. Vertical Acceleration
24.18	707	RSW	0.31	32%
20.20	708	RSW	0.31	33%
15.775	709	RSW	0.29	35%
11.35	710	RSW	0.27	36%
7.4625	711	RSW	0.24	34%
4.65	712	RSW	0.23	34%
2.4615	713	RSW	0.21	33%
1.96	714	RSW	0.21	33%
-0.80	715	RSW	0.22	34%

Note: For structural design use only.
m = meter

Table 3.7.2-205e Ratio with DCD Enveloping Maximum Vertical Acceleration: RB/FB Flexible Slab Oscillators (Sheet 1 of 2)

[EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Maximum Vertical Acceleration	Ratio of (Fermi 3 SSI Enveloping Maximum Vertical Acceleration) to (DCD Enveloping Maximum Vertical Acceleration)
Elev. (m)	**Node No.**	**Stick Model**	**Max. Vertical Acceleration (g)**	**Max. Vertical Acceleration**
52.40*	9101	Oscillator	0.33	28%
	9102	Oscillator	0.73	40%
	9103	Oscillator	1.04	33%
	9104	Oscillator	0.69	28%
	9105	Oscillator	0.51	22%
	9106	Oscillator	0.70	23%
	9107	Oscillator	0.66	24%
	9108	Oscillator	0.56	21%
34.00	9091	Oscillator	0.41	32%
	9092	Oscillator	0.39	36%
27.00	9081	Oscillator	0.37	32%
	9082	Oscillator	0.37	37%
	9083	Oscillator	0.36	33%
	9084	Oscillator	0.39	29%
	9085	Oscillator	0.34	35%
22.50	9071	Oscillator	0.62	39%
	9072	Oscillator	0.72	55%
	9073	Oscillator	0.77	38%
	9074	Oscillator	0.42	32%
	9075	Oscillator	0.35	30%
17.50	9061	Oscillator	0.60	33%
	9062	Oscillator	0.52	35%
	9063	Oscillator	0.29	36%

Table 3.7.2-205e Ratio with DCD Enveloping Maximum Vertical Acceleration: RB/FB Flexible Slab Oscillators (Sheet 2 of 2)

[EF3 SUP 3.7-4]

Elev. (m)	Node No.	Stick Model	Fermi 3 SSI Enveloping Maximum Vertical Acceleration Max. Vertical Acceleration (g)	Ratio of (Fermi 3 SSI Enveloping Maximum Vertical Acceleration) to (DCD Enveloping Maximum Vertical Acceleration) Max. Vertical Acceleration
	9064	Oscillator	0.63	34%
	9065	Oscillator	0.36	26%
13.57	9051	Oscillator	0.28	34%
	9052	Oscillator	0.35	24%
9.06	9041	Oscillator	0.26	30%
	9042	Oscillator	0.35	25%
4.65	9031	Oscillator	0.47	40%
	9032	Oscillator	0.31	32%
	9033	Oscillator	0.43	42%
	9034	Oscillator	0.51	34%
	9035	Oscillator	0.34	25%
-1.00	9021	Oscillator	0.43	39%
	9022	Oscillator	0.50	35%
	9023	Oscillator	0.38	38%
	9024	Oscillator	0.29	33%
	9025	Oscillator	0.37	28%
	9026	Oscillator	0.55	35%
	9027	Oscillator	0.26	30%
-6.40	9011	Oscillator	0.39	42%
	9012	Oscillator	0.34	37%
	9013	Oscillator	0.41	31%

Note: For structural design use only.

*: The difference between the modeled elevation 52.4 m and the actual elevation 52.7 m at the RB roof is negligibly small.

m = meter

Table 3.7.2-206 Ratio with DCD Enveloping Maximum Vertical Acceleration: CB [EF3 SUP 3.7-4]

			Fermi 3 SSI Enveloping Maximum Vertical Acceleration			Ratio of (Fermi 3 SSI Enveloping Maximum Vertical Acceleration) to (DCD Enveloping Maximum Vertical Acceleration)		
Elev. (m)	Node No.	Stick Model	X-dir. (g)	Y-dir. (g)	Max. Vertical Acceleration (g)	X-dir.	Y-dir.	Max. Vertical Acceleration
13.80	6	CB	0.47	0.51	0.30	37%	46%	30%
9.06	5	CB	0.41	0.43	0.29	46%	48%	34%
4.65	4	CB	0.33	0.31	0.26	38%	38%	35%
-2.00	3	CB	0.25	0.24	0.21	32%	34%	37%
-7.40	2	CB	0.21	0.17	0.18	39%	32%	36%
-10.40	1	CB	0.21	0.18	0.18	39%	34%	36%
13.80	9001	Oscillator	---	---	0.87	---	---	40%
	9002	Oscillator	---	---	0.49	---	---	37%
	9003	Oscillator	---	---	0.48	---	---	34%
9.06	9101	Oscillator	---	---	0.81	---	---	41%
	9102	Oscillator	---	---	0.55	---	---	44%
	9103	Oscillator	---	---	0.46	---	---	32%
4.65	9201	Oscillator	---	---	0.45	---	---	35%
	9202	Oscillator	---	---	0.44	---	---	31%
-2.00	9301	Oscillator	---	---	0.50	---	---	36%

Note: For structural design use only.
m = meter

Figure 3.7.2-201 SASSI2000 Plate Element for RB/FB Basemat [EF3 SUP 3.7-4]

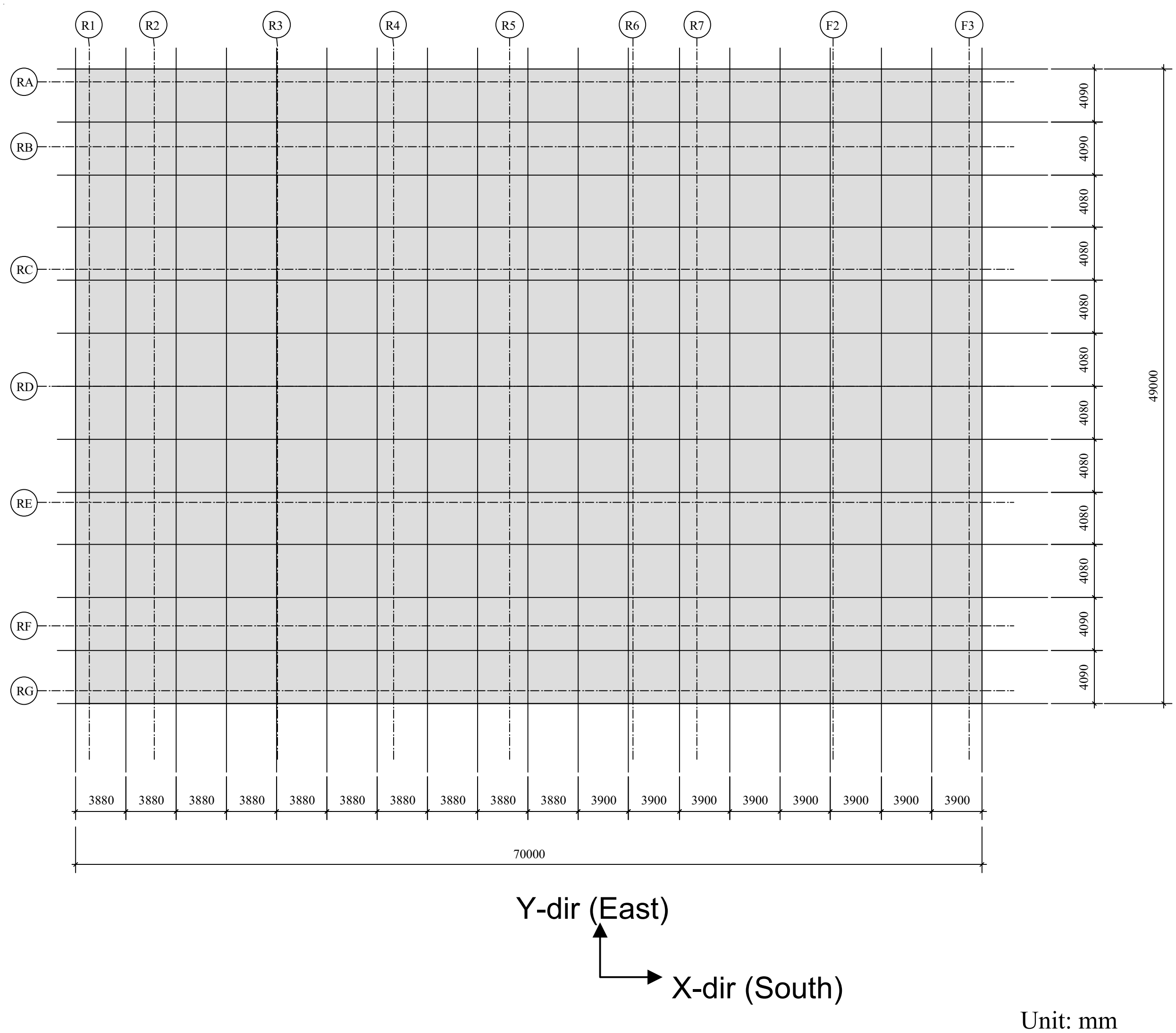
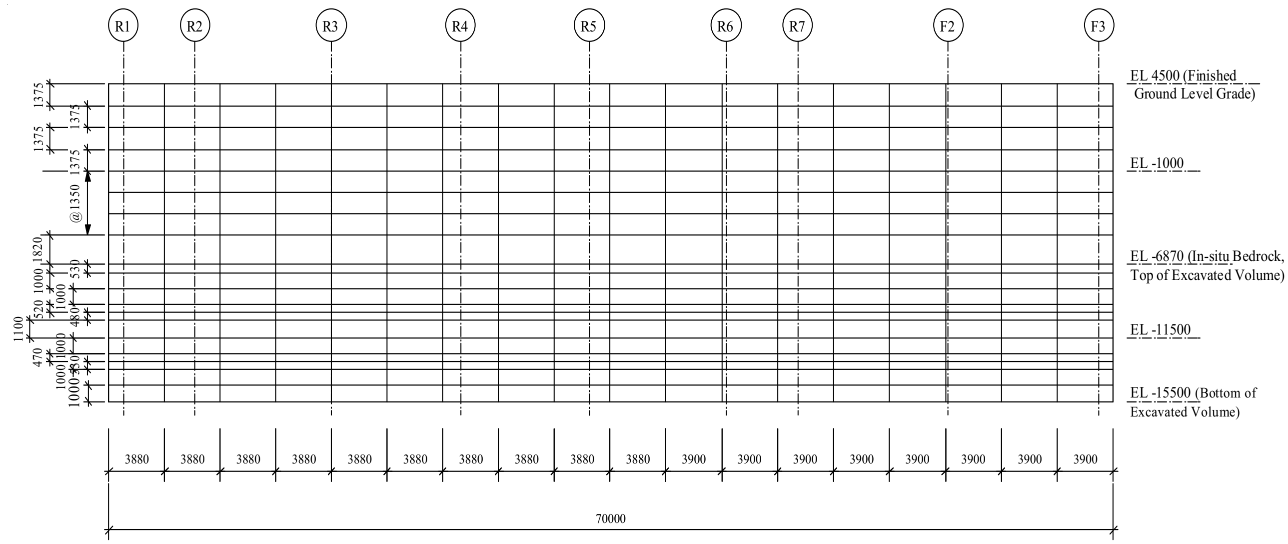
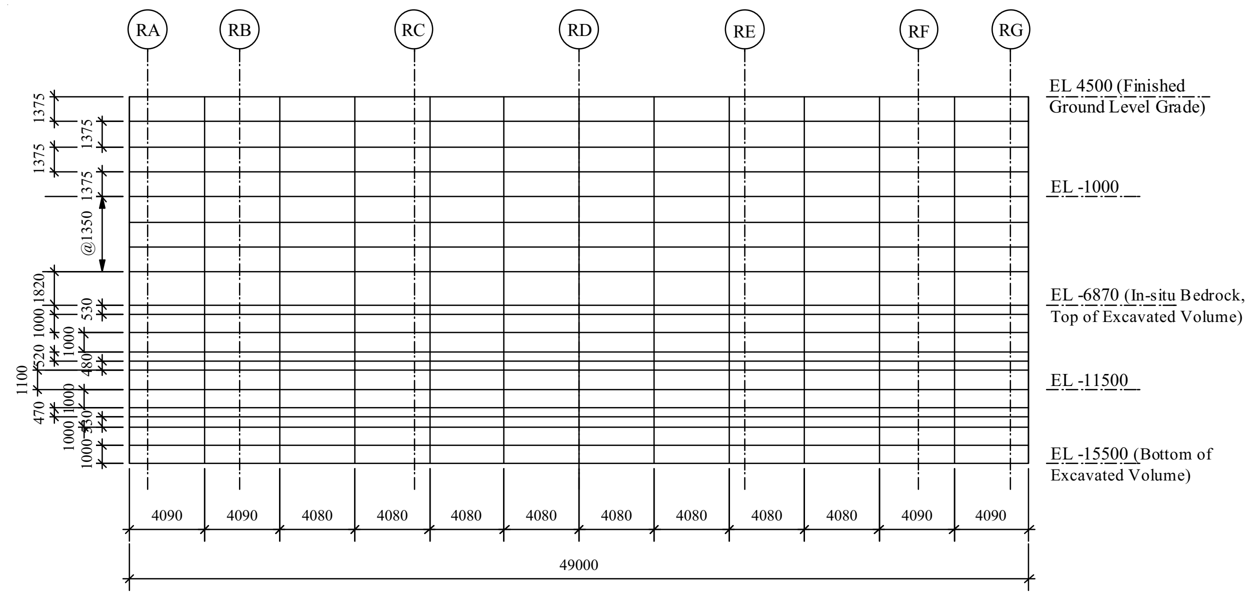


Figure 3.7.2-202 SASSI2000 Plate Elements for RB/FB Exterior Walls [EF3 SUP 3.7-4]



(a) Walls on Column Rows RA and RG



(b) Walls on Column Rows R1 and F3

Unit: mm

Figure 3.7.2-203 Overview of SASSI2000 SSI RB/FB Model [EF3 SUP 3.7-4]

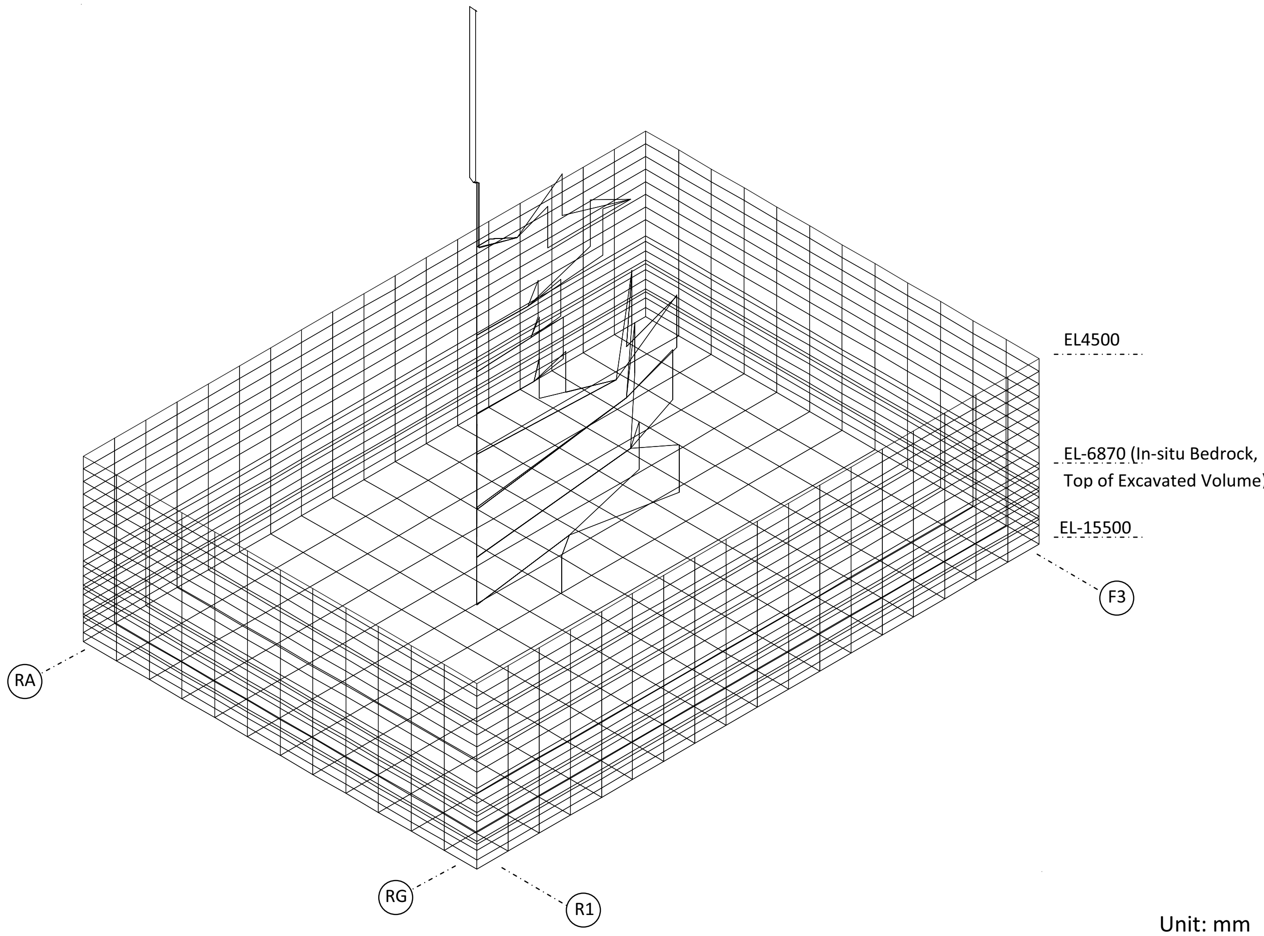


Figure 3.7.2-204 SASSI2000 Plate Elements for CB Basemat [EF3 SUP 3.7-4]

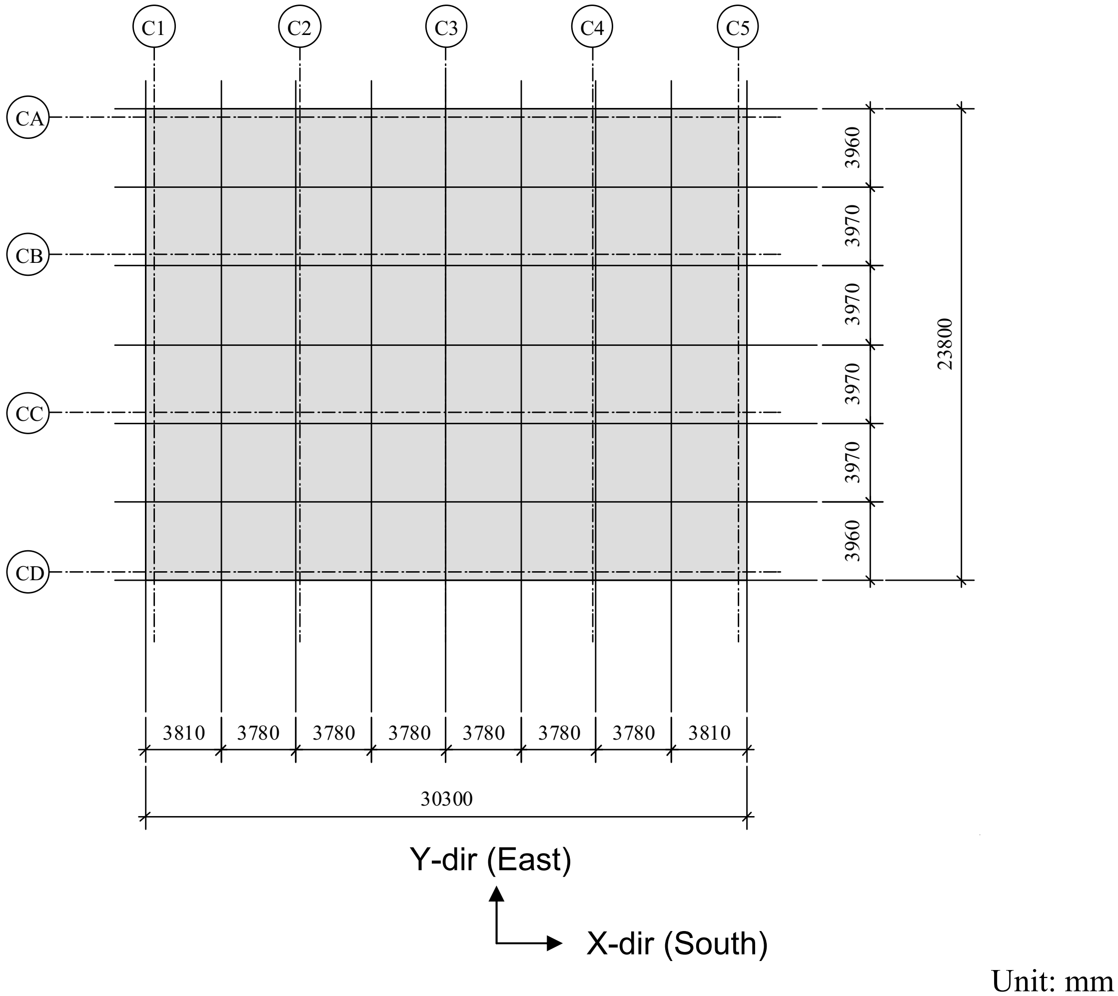
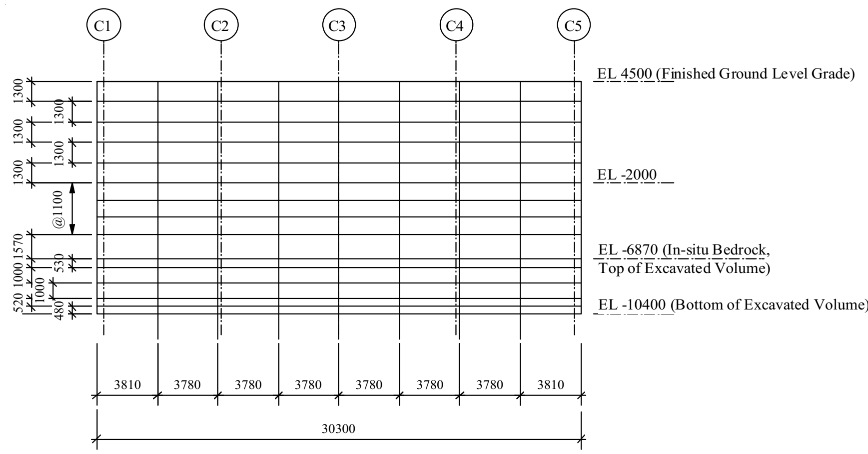
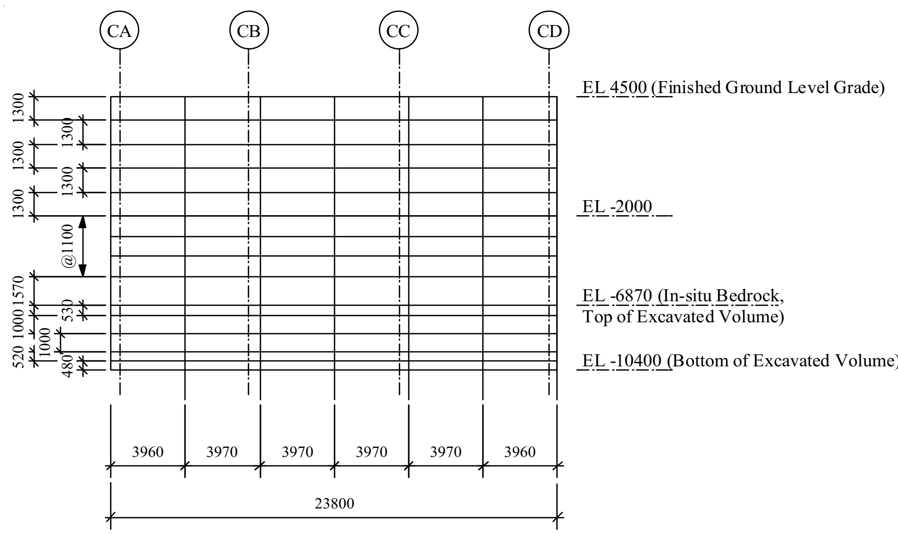


Figure 3.7.2-205 SASSI2000 Plate Elements for CB Exterior Walls [EF3 SUP 3.7-4]



(a) Walls on Column Rows CA and CD



(b) Walls on Column Rows C1 and C5

Unit: mm

Figure 3.7.2-206 Overview of CB SASSI2000 SSI Model [EF3 SUP 3.7-4]

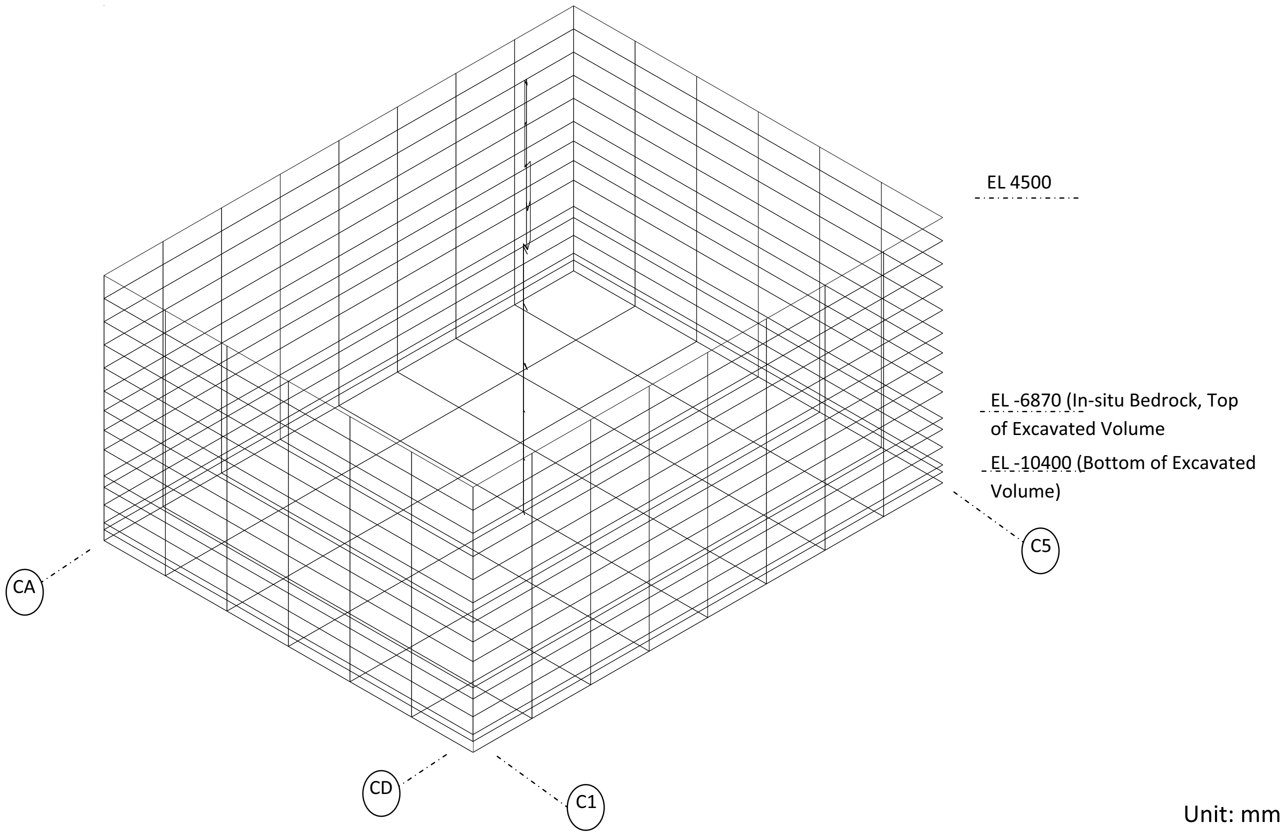
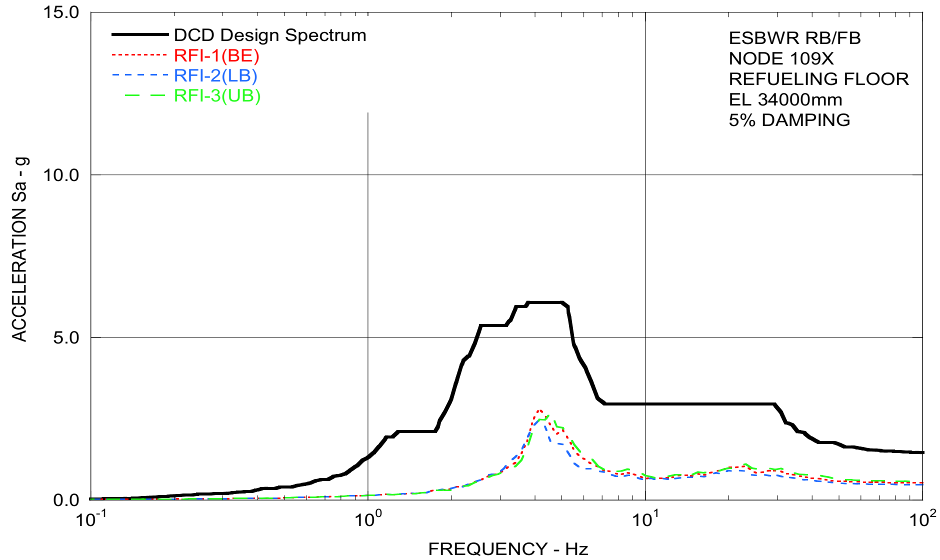
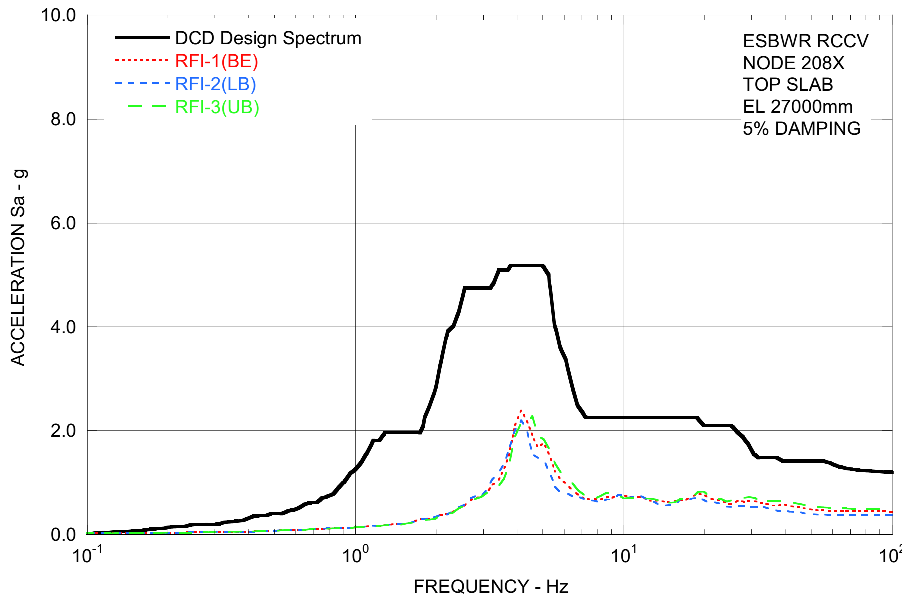


Figure 3.7.2-207a Comparison of Floor Response Spectra - RB/FB Refueling Floor in X-Direction [EF3 SUP 3.7-4]



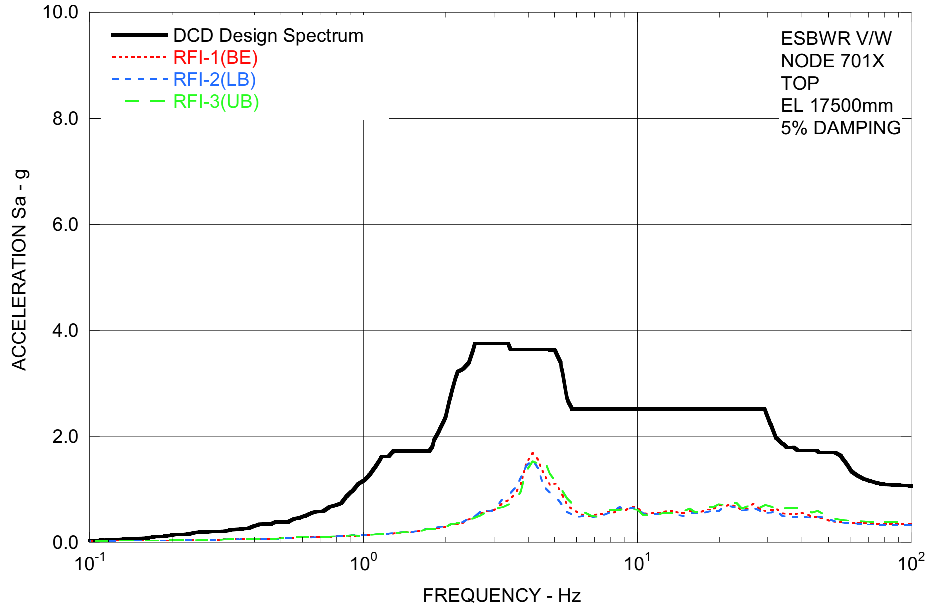
Note: Sa = Spectral Acceleration

Figure 3.7.2-207b Comparison of Floor Response Spectra - RCCV Top Slab in X-Direction [EF3 SUP 3.7-4]



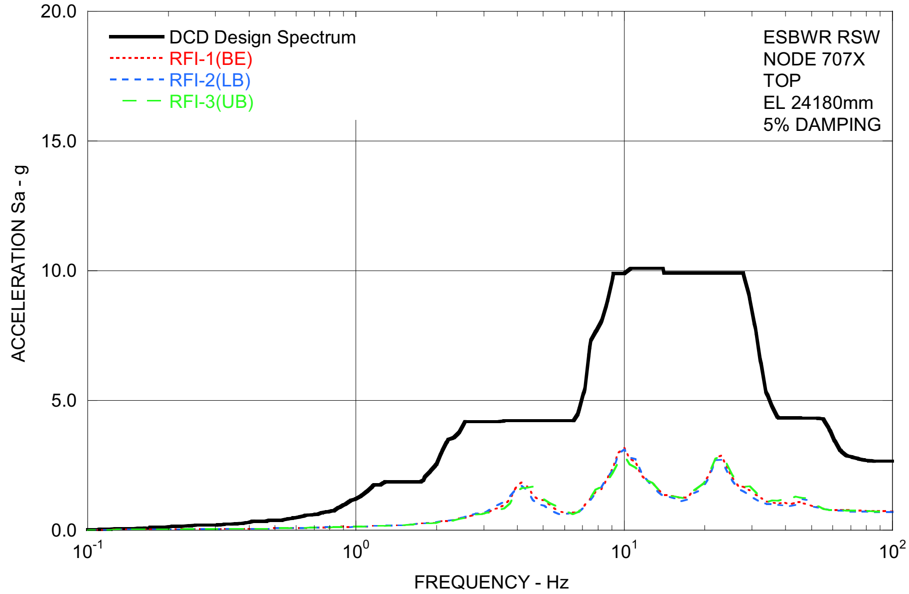
Note: Sa = Spectral Acceleration

Figure 3.7.2-207c Comparison of Floor Response Spectra - Vent Wall Top in X-Direction [EF3 SUP 3.7-4]



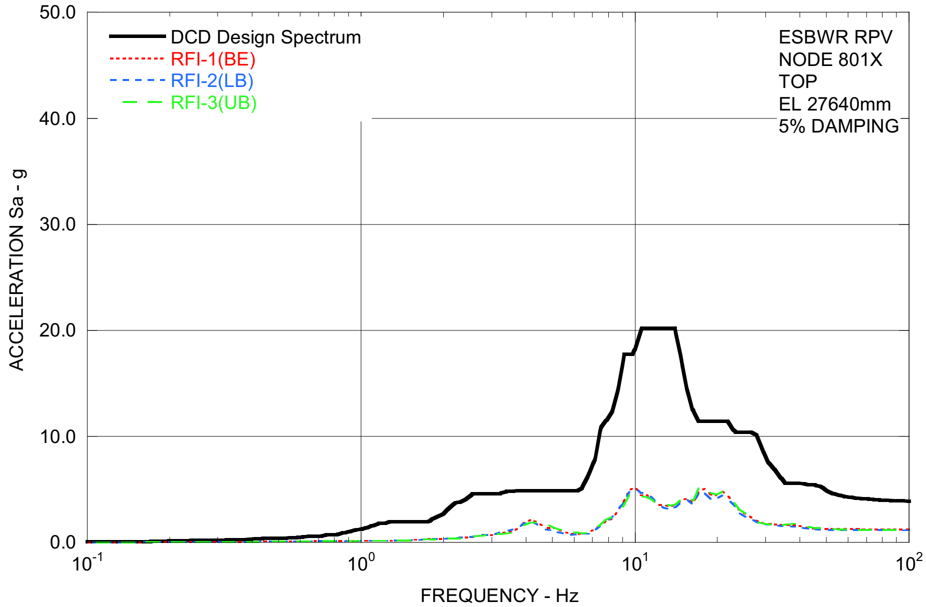
Note: Sa = Spectral Acceleration

Figure 3.7.2-207d Comparisonof Floor Response Spectra - RSW Top in X-Direction [EF3 SUP 3.7-4]



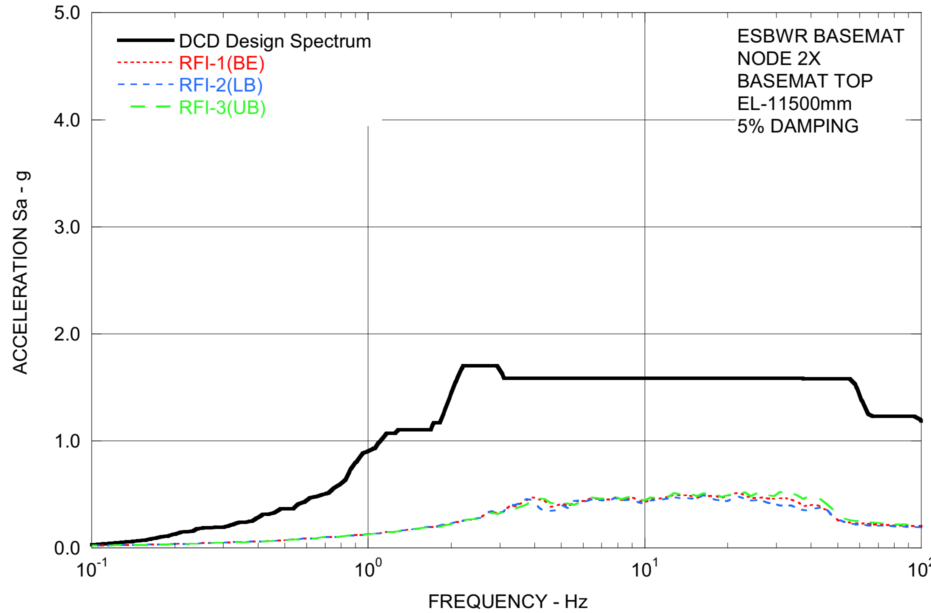
Note: Sa = Spectral Acceleration

Figure 3.7.2-207e Comparison of Floor Response Spectra - RPV Top in X-Direction [EF3 SUP 3.7-4]



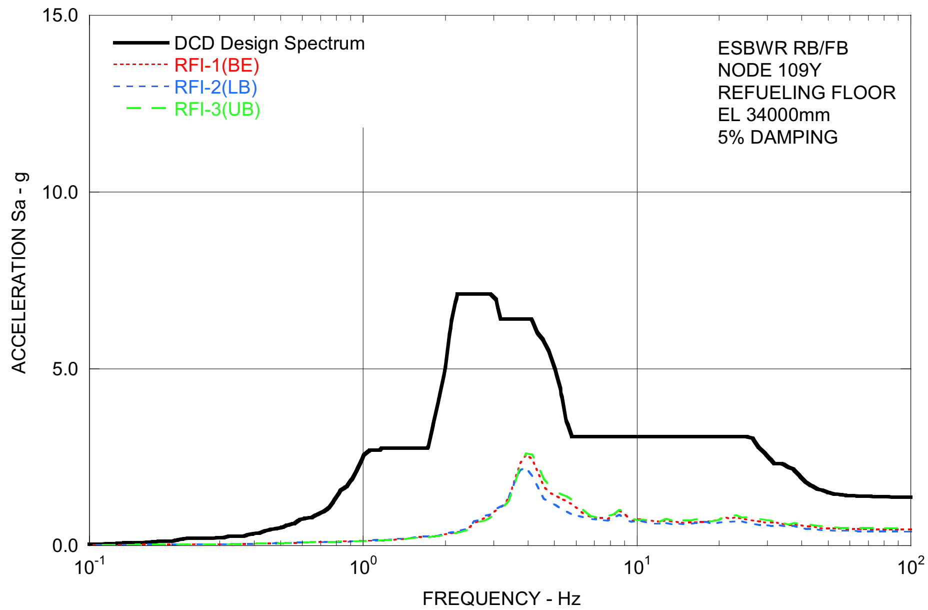
Note: Sa = Spectral Acceleration

Figure 3.7.2-207f Comparison of Floor Response Spectra - RB/FB Basemat in X-Direction [EF3 SUP 3.7-4]



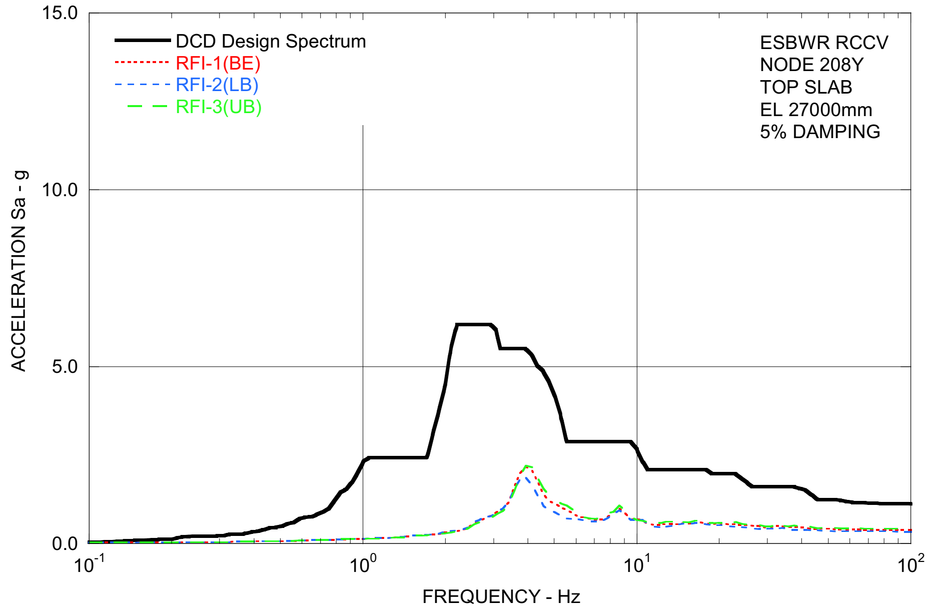
Note: Sa = Spectral Acceleration

Figure 3.7.2-208a Comparison of Floor Response Spectra - RB/FB Refueling Floor in Y-Direction [EF3 SUP 3.7-4]



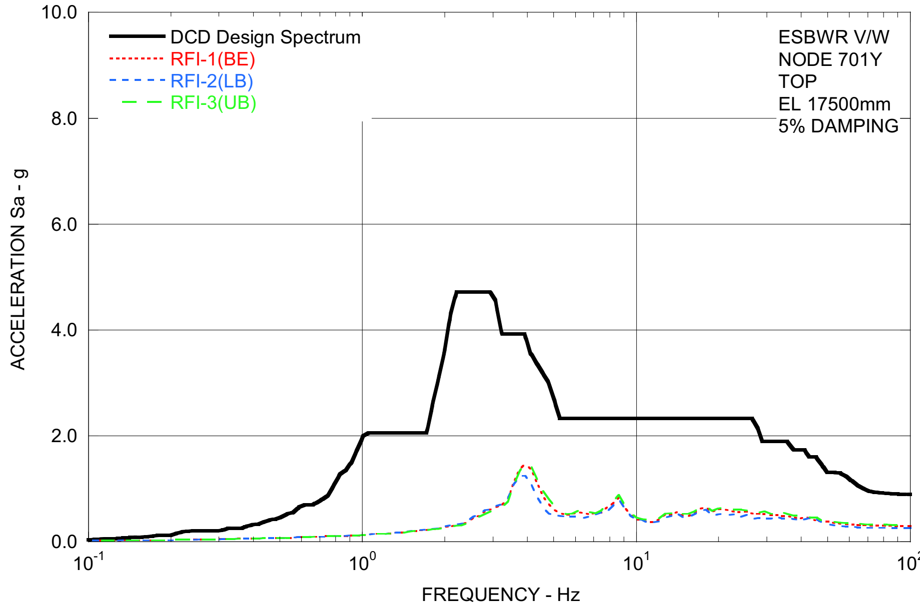
Note: Sa = Spectral Acceleration

Figure 3.7.2-208b Comparison of Floor Response Spectra - RCCV Top Slab in Y-Direction [EF3 SUP 3.7-4]



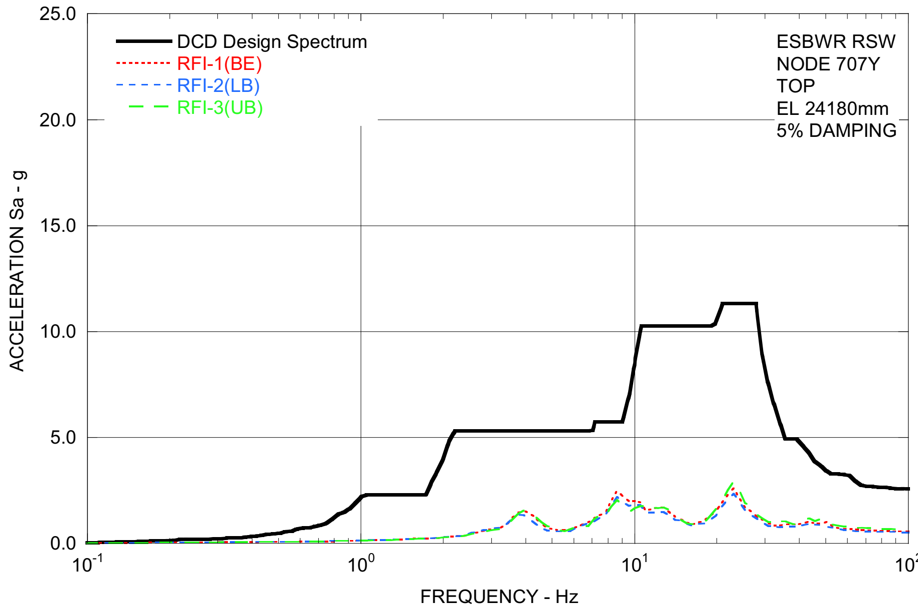
Note: Sa = Spectral Acceleration

Figure 3.7.2-208c Comparison of Floor Response Spectra - Vent Wall Top in Y-Direction [EF3 SUP 3.7-4]



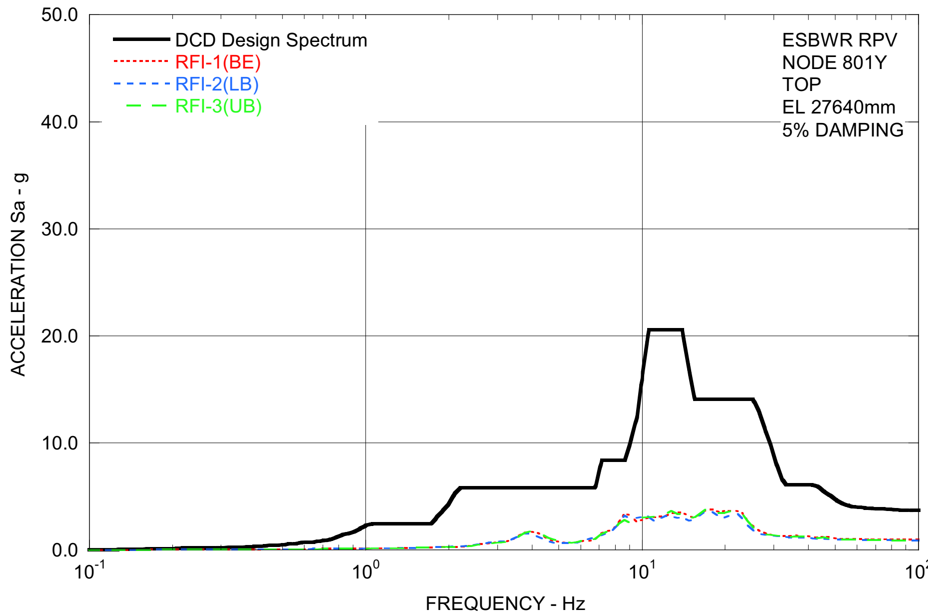
Note: Sa = Spectral Acceleration

Figure 3.7.2-208d Comparison of Floor Response Spectra - RSW Top in Y-Direction [EF3 SUP 3.7-4]



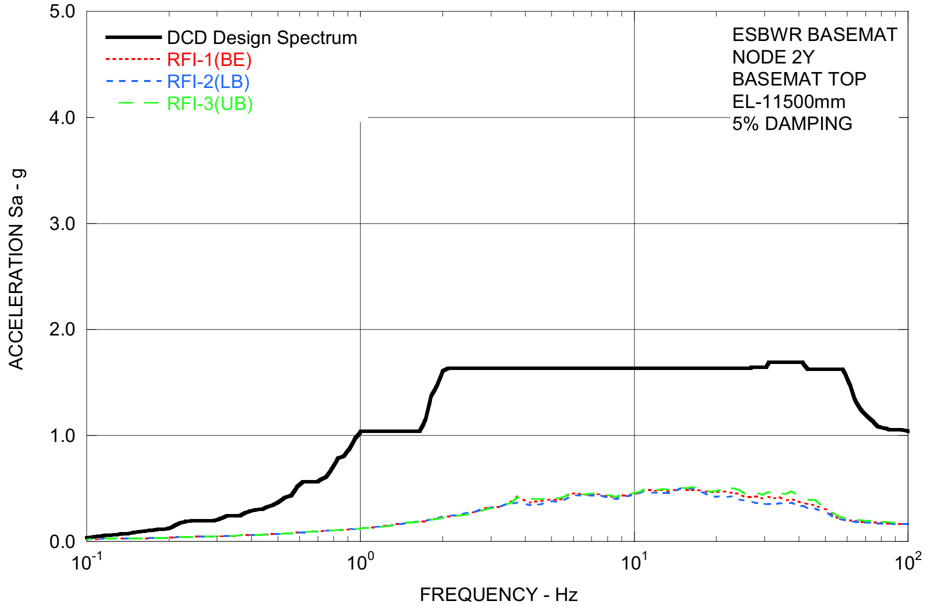
Note: Sa = Spectral Acceleration

Figure 3.7.2-208e Comparison of Floor Response Spectra - RPV Top in Y-Direction [EF3 SUP 3.7-4]



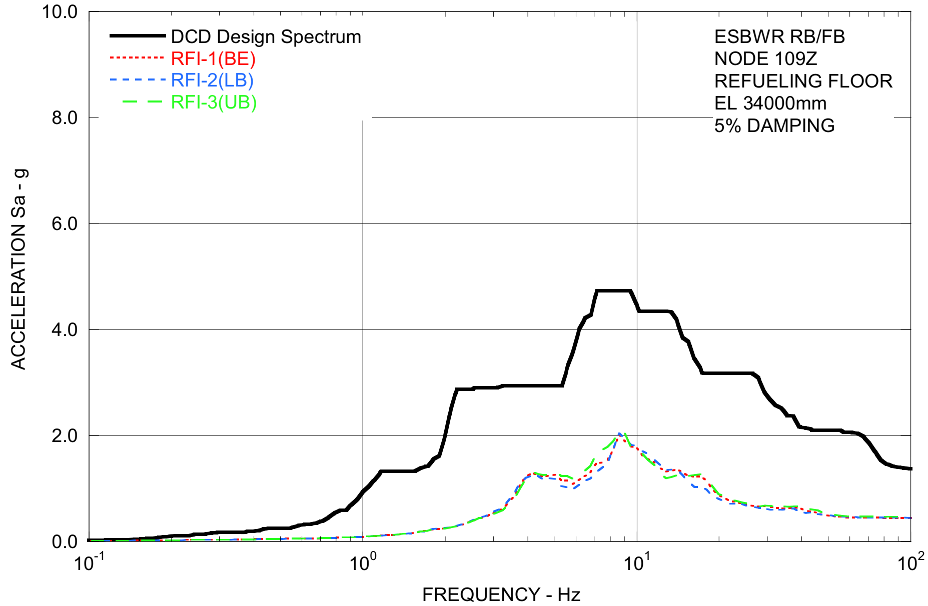
Note: Sa = Spectral Acceleration

Figure 3.7.2-208f Comparison of Floor Response Spectra - RB/FB Basemat in Y-Direction **[EF3 SUP 3.7-4]**



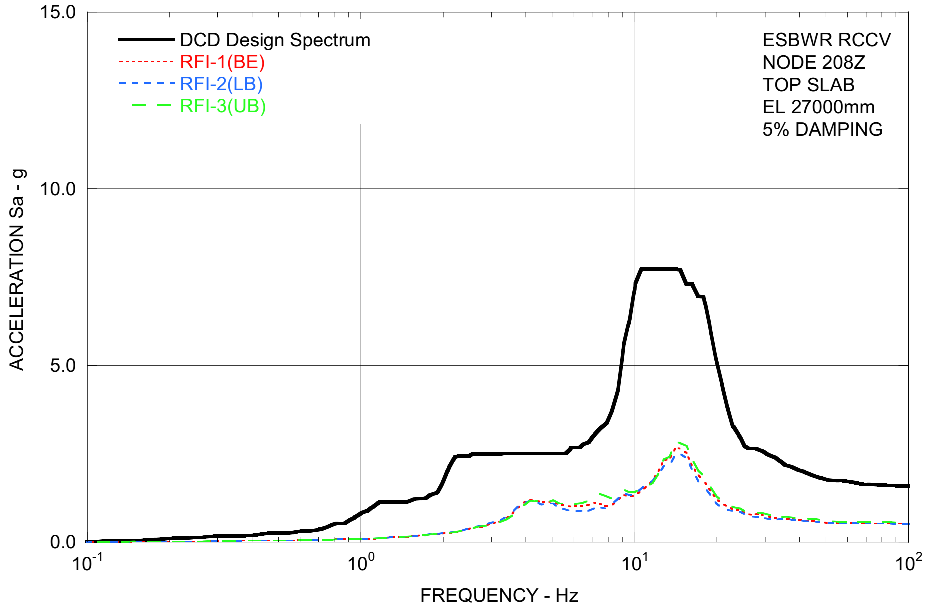
Note: Sa = Spectral Acceleration

Figure 3.7.2-209a Comparison of Floor Response Spectra - RB/FB Refueling Floor in Z-Direction **[EF3 SUP 3.7-4]**



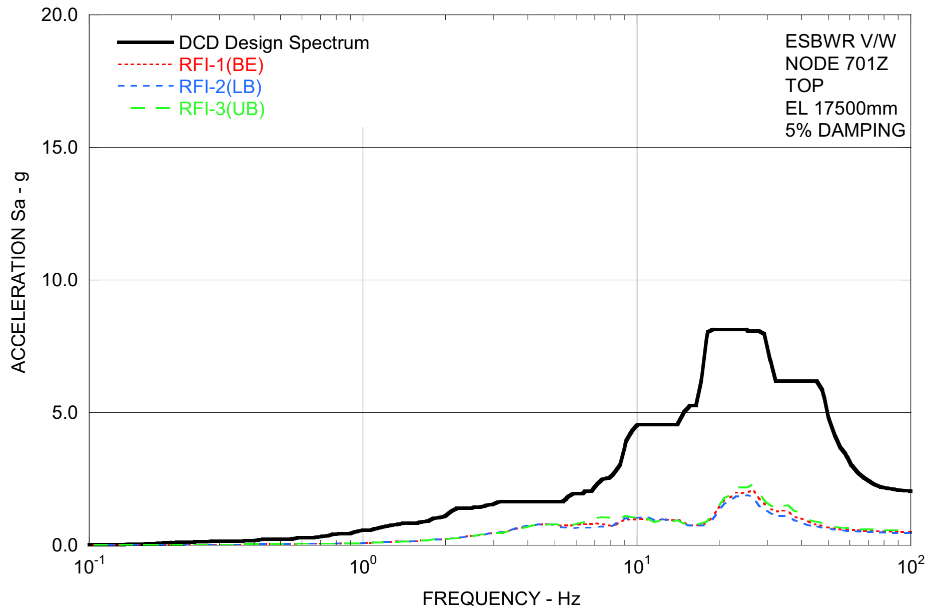
Note: Sa = Spectral Acceleration

Figure 3.7.2-209b Comparison of Floor Response Spectra - RCCV Top Slab in Z-Direction [EF3 SUP 3.7-4]



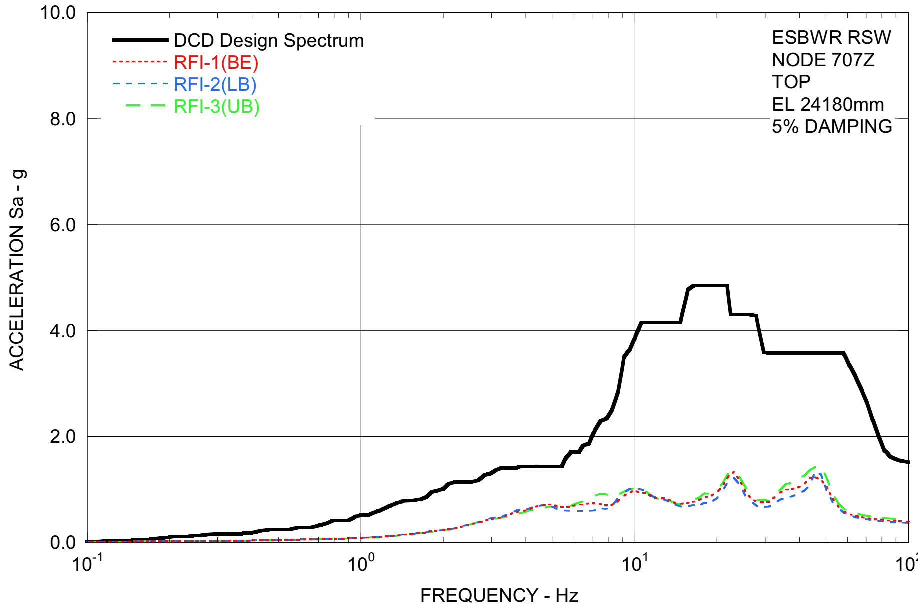
Note: Sa = Spectral Acceleration

Figure 3.7.2-209c Comparison of Floor Response Spectra - Vent Wall Top in Z-Direction [EF3 SUP 3.7-4]



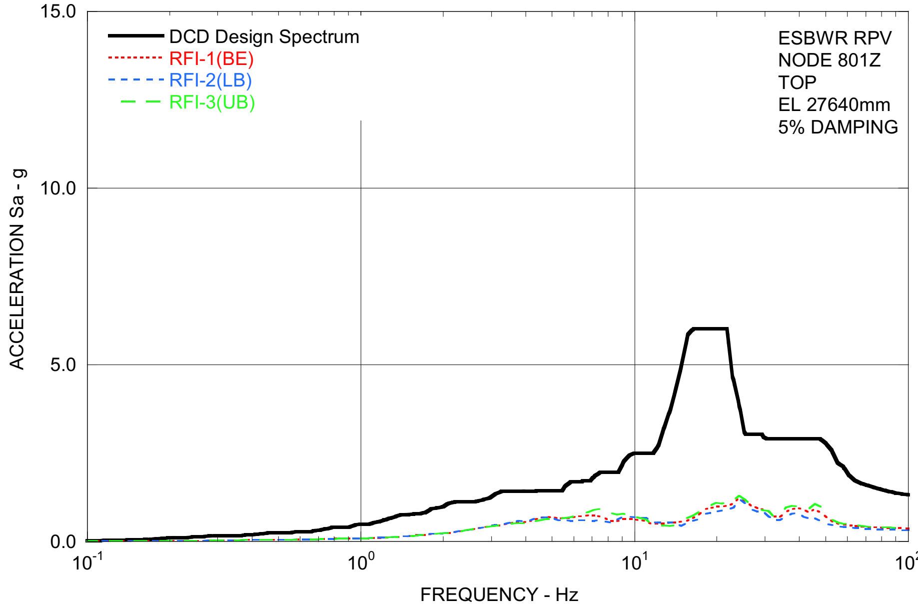
Note: Sa = Spectral Acceleration

Figure 3.7.2-209d Comparison of Floor Response Spectra - RSW Top in Z-Direction [EF3 SUP 3.7-4]



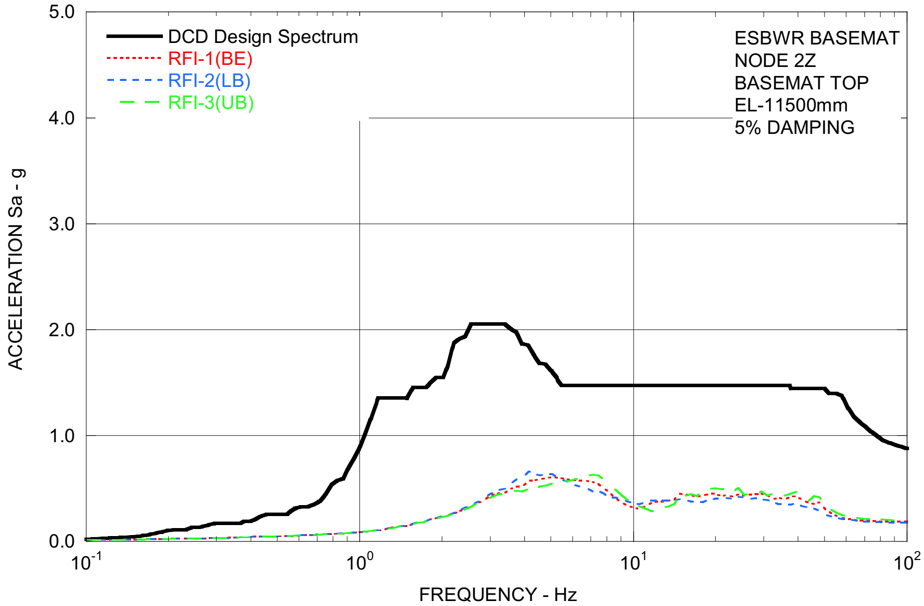
Note: Sa = Spectral Acceleration

Figure 3.7.2-209e Comparison of Floor Response Spectra - RPV Top in Z-Direction [EF3 SUP 3.7-4]



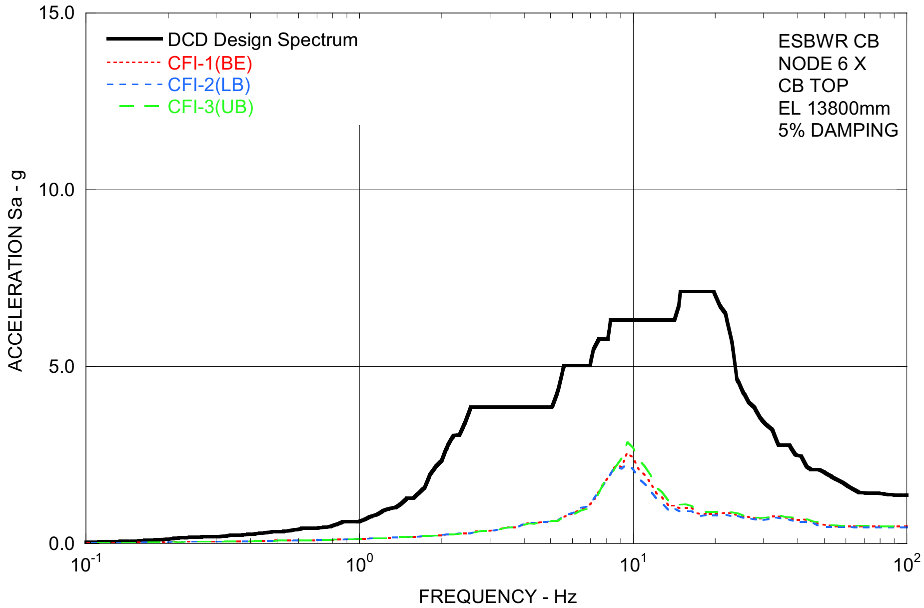
Note: Sa = Spectral Acceleration

Figure 3.7.2-209f Comparison of Floor Response Spectra - RB/FB Basemat in Z-Direction [EF3 SUP 3.7-4]



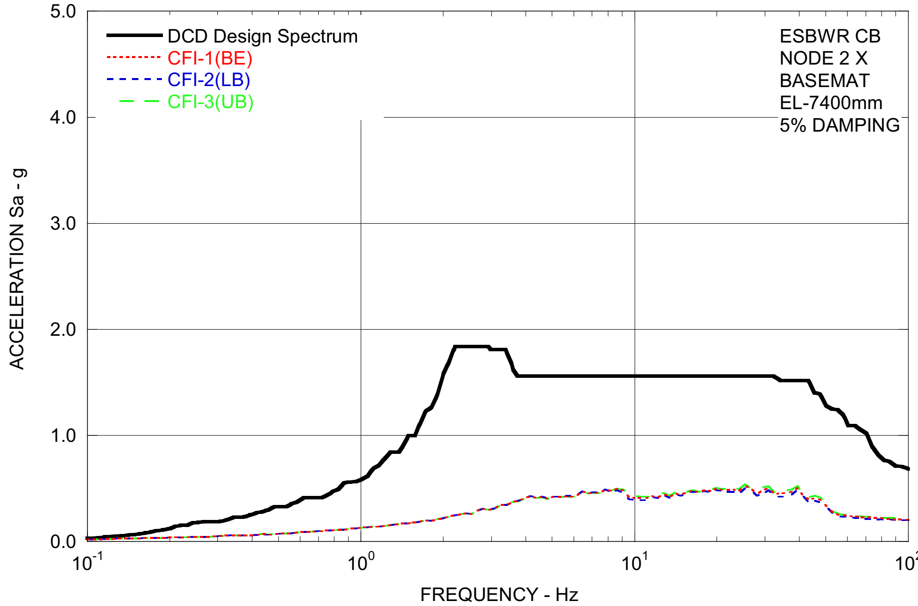
Note: Sa = Spectral Acceleration

Figure 3.7.2-210a Comparison of Floor Response Spectra - CB Top in X-Direction [EF3 SUP 3.7-4]



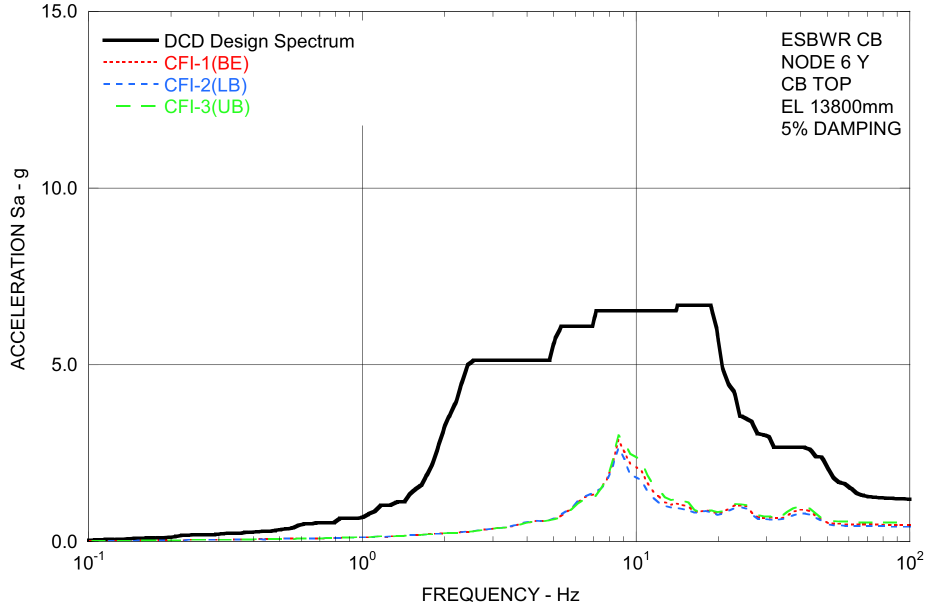
Note: Sa = Spectral Acceleration

Figure 3.7.2-210b Comparison of Floor Response Spectra - CB Basemat in X-Direction [EF3 SUP 3.7-4]



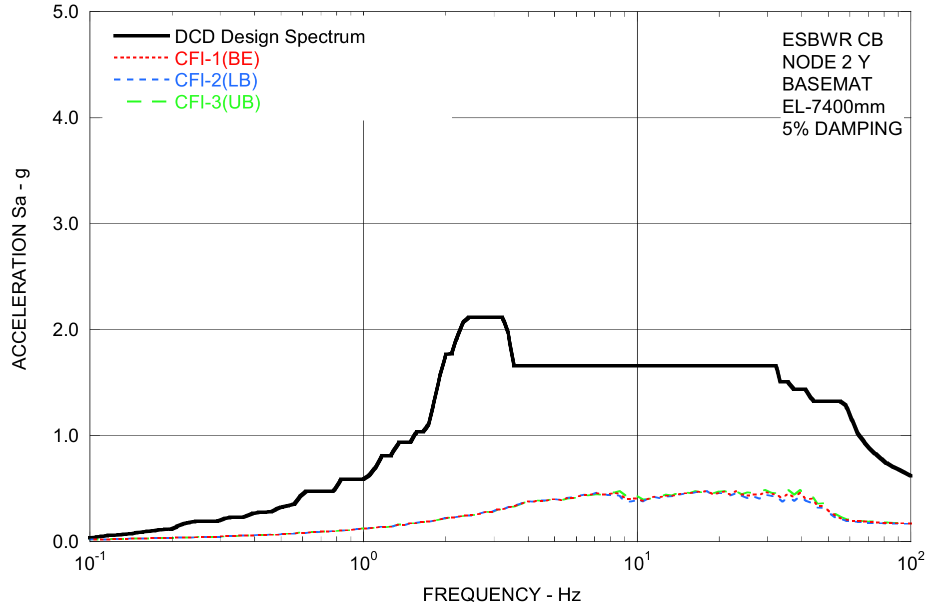
Note: Sa = Spectral Acceleration

Figure 3.7.2-211a Comparison of Floor Response Spectra - CB Top in Y-Direction [EF3 SUP 3.7-4]



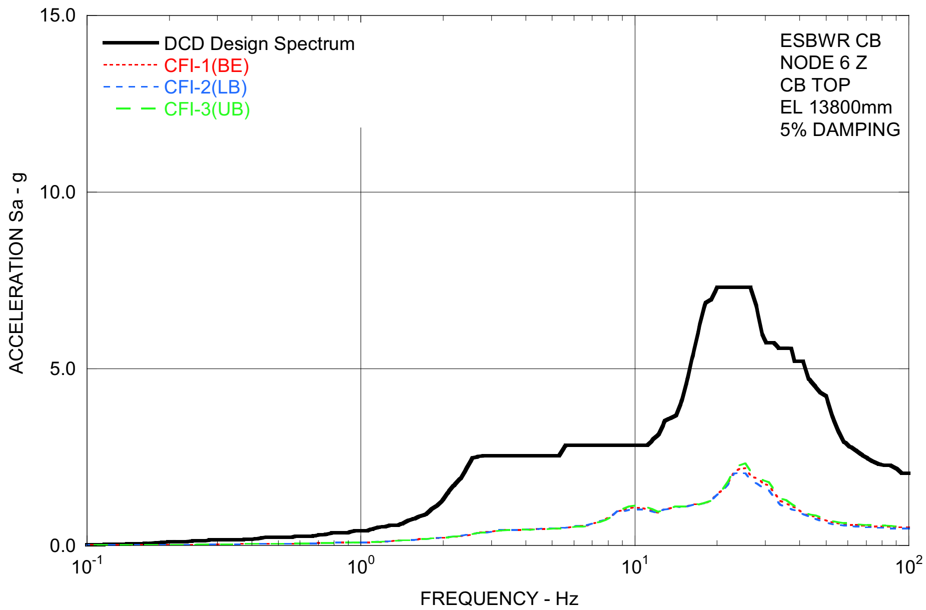
Note: Sa = Spectral Acceleration

Figure 3.7.2-211b Comparison of Floor Response Spectra - CB Basemat in Y-Direction [EF3 SUP 3.7-4]



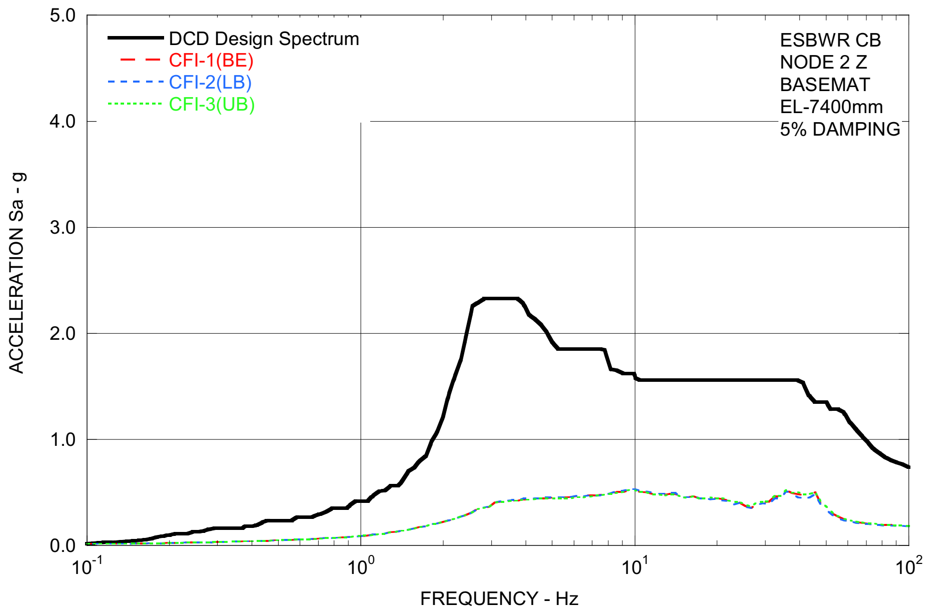
Note: Sa = Spectral Acceleration

Figure 3.7.2-212a Comparison of Floor Response Spectra - CB Top in Z-Direction [EF3 SUP 3.7-4]



Note: Sa = Spectral Acceleration

Figure 3.7.2-212b Comparison of Floor Response Spectra - CB Basemat in Z-Direction [EF3 SUP 3.7-4]



Note: Sa = Spectral Acceleration

3.7.4 Seismic Instrumentation

Add the following at the end of this section.

EF3 SUP 3.7-6

[START COM 3.7-001] The seismic monitoring program described in this subsection, including the necessary test and operating procedures, will be implemented prior to receipt of fuel on site. **[END COM 3.7-001]**

3.8 Seismic Category I Structures

This section of the Referenced DCD is incorporated by reference with the following departures and/or supplements.

3.8.5 Foundations

3.8.5.5 Structural Acceptance Certeria

Add the following subsections at the end of this section.

EF3 SUP 3.8-1

3.8.5.5.1 Foundation Stability

The Fermi 3 site-specific foundation stability for the RB/FB and CB are evaluated against overturning, sliding, and floatation based on the results from the Fermi 3 site-specific SSI analyses for the RB/FB and CB presented in Subsection 3.7.2.4.1. The stability calculations against overturning, sliding, and floatation are executed according to the procedure presented in Referenced DCD Section 3.8.5.5.

The factor of safety against overturning due to earthquake loading is determined by the energy approach described in Referenced DCD Subsection 3.7.2.14. The calculated Fermi 3 site-specific factors of safety against overturning based on the Fermi 3 site-specific SSI for the RB/FB and CB are shown in Table 3.8.5-201 and Table 3.8.5-202, respectively. It is shown that the Fermi 3 site-specific factors of safety against overturning for the RB/FB and CB are 1,923 and 1,715 (greater than 1.1 as required by SRP 3.8.5), respectively. These factors of safety indicate that the Fermi 3 RB/FB and CB are stable against overturning.

The Fermi 3 site-specific sliding evaluation is performed using forces generated during the Fermi 3 site-specific SSI analyses, which neglects the backfill above the top of the bedrock and with the RB/FB and CB in firm contact with the bedrock using fill concrete as backfill in the gap between the RB/FB and CB, and the bedrock up to the top of Bass Islands Group bedrock at Elevation 168.2 m (552.0 ft) NAVD 88. The gap between the RB/FB and CB up to the top of the Bass Islands Group bedrock at Elevation 168.2 m (552.0 ft) NAVD 88 is also filled with fill concrete. As the Fermi 3 site-specific SSI neglects the backfill above the top of the bedrock, forces associated with the backfill are not included in the sliding analysis; therefore, the bedrock alone supplies the resistance to sliding of both the RB/FB and the CB. In the sliding evaluation for the Fermi 3 RB/FB and CB, the following skin friction resistance forces are neglected:

1. F_{us} = Skin friction resistance force provided by basemat side parallel to the direction of motion (i.e., F_{us} = 0)
2. F_{us}' = Skin friction resistance force provided by shear key side parallel to the direction of motion (when shear keys are used (i.e., F_{us}' = 0).

The calculated Fermi 3 site-specific factors of safety against sliding for the RB/FB and CB are shown in Table 3.8.5-201 and Table 3.8.5-202, respectively. The Fermi 3 site-specific factors of safety against sliding for the RB/FB and CB are 3.90 and 2.59 (greater than minimum factor of safety of 1.1 as required by SRP 3.8.5), respectively. These factors of safety indicate that the Fermi 3 RB/FB and CB are stable against sliding.

The sliding of the FWSC was evaluated using the driving forces (the base shear time history forces) based on the governing factor of safety cases from the Referenced DCD SSI analysis results without crediting the backfill surrounding the basemat. The sliding evaluation also includes the fill concrete below the FWSC in which the shear keys are embedded. The presence of the shear keys results in potential failure occurring within the fill concrete. The fill concrete was evaluated in accordance with ACI 318 and the corresponding portions of ACI 349 considering the following:

- Failure of the fill concrete in compression from lateral pressure applied by the shear keys. This potential failure condition is checked using the ACI 318 Section 22.5.5.
- Failure through the fill concrete at or below the base of the shear keys considering the maximum amount of shear resistance from shear-friction reinforcement allowed in ACI 318, Section 11.6 and the corresponding portions of ACI 349, Section 11.7.

The resulting factor of safety against sliding is greater than 15, which is greater than the minimum factor of safety of 1.1 as required by SRP 3.8.5. During detailed design, the amount of shear-friction reinforcement in the fill concrete is selected to provide a minimum factor of safety of 1.1 against sliding for the FWSC, which provides a minimum 10 percent design margin for the shear-friction reinforcement.

The calculated Fermi 3 site-specific factors of safety against floatation for the RB/FB and CB are shown in Table 3.8.5-201 and Table 3.8.5-202, respectively. It is shown that the Fermi 3 site-specific factors of safety against floatation for the RB/FB and CB are 3.48 and 1.85 (greater than minimum factor of safety of 1.1 as required by SRP 3.8.5), respectively. These factors of safety indicate that the Fermi 3 RB/FB and CB are stable against floatation.

3.8.5.5.2 **Soil Bearing Pressures**

The maximum soil dynamic bearing pressure demand at the Fermi 3 site for the BE, UB, and LB subsurface profiles, based on the results from the Fermi 3 site-specific SSI analyses for the RB/FB and CB presented in Subsection 3.7.2.4.1, are evaluated using the Modified Energy Balance Method according to the Referenced DCD Section 3G.1.5.5.

The Fermi 3 site-specific SSI maximum dynamic soil bearing pressure demands are summarized in Table 3.8.5-203 for the RB/FB and CB. As described in Section 3.7.2.4.1.6, the Fermi 3 site-specific enveloping SSI seismic loads are lower than the Referenced DCD enveloping seismic loads. However, the Fermi 3 site-specific SSI maximum soil bearing pressure demands for the BE, LB, and UB subsurface profile cases are all larger than the Referenced DCD maximum dynamic bearing demands for both the RB/FB and the CB in Referenced DCD, Table 2.0-1 for the hard soil site (Table 3.8.5-203). This is because the Referenced DCD SSI analyses were performed considering full embedment up to the finished ground level grade, while the Fermi 3 site-specific SSI analyses were performed considering partial embedment condition without taking credit for the backfill above the top of the Bass Islands Group bedrock at Elevation 168.2 m (552.0 ft) NAVD 88. Therefore, the Fermi 3 site-specific structure overturning moments resulting from the Fermi 3 site-specific SSI analyses become larger than the structure overturning moments resulting from the Referenced DCD SSI analyses. As a result, the Fermi 3 site-specific dynamic soil bearing pressure demands calculated based on the Fermi 3 site-specific SSI analyses are larger compared to the Referenced DCD hard soil site dynamic soil bearing pressure demands.

The Fermi 3 site-specific SSI maximum dynamic soil bearing pressure demands presented in Table 3.8.5-203 for the RB/FB and the CB are compared with the Fermi 3 site-specific allowable bearing capacity under the dynamic condition in Table 2.5.4-227 in Subsection 2.5.4.10. It is confirmed that the Fermi 3 site-specific maximum dynamic soil bearing pressure demands for the RB/FB and CB are less than the allowable bearing capacity under dynamic condition presented in Table 2.5.4-227 in Section 2.5.4.10.

Table 3.8.5-201 Factors of Safety for RB/FB Foundation Stability [EF3 SUP 3.8-1]

	Overturning		Sliding		Floatation	
Load Combination	**SRP 3.8.5 Minimum FS**	**Calculated FS**	**SRP 3.8.5 Minimum FS**	**Calculated FS**	**SRP 3.8.5 Minimum FS**	**Calculated FS**
D + H + E’	1.1	1923	1.1	3.90	--	--
D + F’	--	--	--	--	1.1	3.48

Where,
D = Dead Load
H = Lateral soil pressure
E‘ = Safe Shutdown Earthquake
F‘ = Buoyant forces of design basis flood
FS = Factor of Safety

Table 3.8.5-202 Factors of Safety for CB Foundation Stability [EF3 SUP 3.8-1]

	Overturning		Sliding		Floatation	
Load Combination	SRP 3.8.5 Minimum FS	Calculated FS	SRP 3.8.5 Minimum FS	Calculated FS	SRP 3.8.5 Minimum FS	Calculated FS
D + H + E’	1.1	1715	1.1	2.59	--	--
D + F’	--	--	--	--	1.1	1.85

Where,
D = Dead Load
H = Lateral soil pressure
E‘ = Safe Shutdown Earthquake
F‘ = Buoyant forces of design basis flood
FS =Factor of safety

Table 3.8.5-203 Maximum Soil Dynamic Bearing Pressure Demand for RB/FB and CB [EF3 SUP 3.8-1]

	Dynamic Bearing Pressure Demand			
	RB/FB		CB	
Subsurface Condition	**Fermi 3 Site-Specific SSI (Static + FIRS(1))**	**Referenced DCD, (Static + SSE(2))**	**Fermi 3 Site-Specific SSI (Static + FIRS(1))**	**Referenced DCD, (Static + SSE(2))**
Fermi 3 Lower Bound Subsurface Profile	1,160 KPa (24,300 lbf/ft^2)	NA	490 KPa (10,300 lbf/ft^2)	NA
Fermi 3 Best Estimate Subsurface Profile	1,040 KPa (21,800 lbf/ft^2)	NA	520 KPa (10,900 lbf/ft^2)	NA
Fermi 3 Upper Bound Subsurface Profile	1,260 KPa (26,400 lbf/ft^2)	NA	540 KPa (11,300 lbf/ft^2)	NA
Referenced DCD, Hard Soil Site	NA	1,100 kPa (23,000 lbf/ft^2)	NA	420 kPa (8,800 lbf/ft^2)

Notes:

(1) FIRS is the SSI FIRS developed in Subsection 3.7.1
(2) SSE is the Referenced DCD CSDRS

KPa = kilopascal
NA = Not applicable

3.9 Mechanical Systems and Components

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

3.9.2.4 Initial Startup Flow-Induced Vibration Testing of Reactor Internals

Replace the last paragraph with the following.

EF3 COL 3.9.9-1-A

The vibration assessment program, as specified in RG 1.20, is provided in DCD Appendix 3L and the following referenced GEH Reports.

- NEDE-33259P, “Reactor Internals Flow Induced Vibration Program”
- NEDE-33312P, “Steam Dryer - Acoustic Load Definition”
- NEDE-33313P, “Steam Dryer - Structural Evaluation”
- NEDC-33408P, “ESBWR Steam Dryer - Plant Based Load Evaluation Methodology”
- NEDC-33408P, Supplement 1, “ESBWR Steam Dryer - Plant Based Load Evaluation Methodology Supplement 1”

The classification of the Fermi 3 reactor internals in accordance with RG 1.20 is dependent on ESBWR status, i.e. if Fermi 3 is the initial ESBWR to perform testing of the reactor internals, or if testing is performed at another reactor prior to Fermi 3 testing. There are two different scenarios:

1. A valid prototype for the Fermi 3 reactor internals does not exist. Under this scenario, Fermi 3 reactor internals is classified as a prototype per Regulatory Guide 1.20.
2. A valid prototype for Fermi 3 reactor internals does exist. If the prototype testing is performed outside the United States, the guidance in Regulatory Guide 1.20, Revision 3, Regulatory Position 1.2 would need to be satisfied in order for this reactor to be considered a “valid prototype”. Assuming that Fermi 3 reactor internals are substantially similar to the valid prototype and that the valid prototype does not experience inservice problems that result in component or operational modifications, Fermi 3 reactor internals will be classified as non-prototype category I. If any changes to classification for Fermi 3 reactor internals are later determined to be necessary, the classification change will be

addressed at the time the change is proposed with proper evaluation/justification and documented in a revision to the FSAR.

[START COM-FSAR-3.9-001] The comprehensive vibration assessment program will be developed and implemented as described in DCD Appendix 3L with no departures. The vibration measurement and inspection programs will comply with the guidance specified in RG 1.20, Revision 3, consistent with the Fermi 3 reactor internals classification. A summary of the vibration analysis program and description of the vibration measurement (including measurement locations and analysis predictions) and inspection phases of the comprehensive vibration inspection program will be submitted to the NRC six months prior to implementation. **[END COM-FSAR-3.9-001]**

[START COM-FSAR-3.9-006] The preliminary and final reports (as necessary), which together summarize the results of the vibration analysis, measurement and inspection programs will be submitted to the NRC within 60 and 180 days, respectively, following the completion of the programs. **[END COM-FSAR-3.9-006]**

3.9.3.1 Loading Combinations, Design Transients and Stress Limits

Replace the last sentence with the following.

STD COL 3.9.9-2-A

[START COM 3.9-002] The piping stress reports identified in this DCD section will be completed within six months of completion of DCD ITAAC Table 3.1-1. **[END COM 3.9-002] [START COM 3.9-004]** The FSAR will be revised as necessary in a subsequent update to address the results of this analysis. **[END COM 3.9-004]**

3.9.3.7.1(3)e Snubber Preservice and Inservice Examination and Testing

Preservice Examination and Testing

Add the following at the end of this section.

STD COL 3.9.9-4-A

A preservice thermal movement examination is also performed; during initial system heatup and cooldown, for systems whose design operating temperature exceeds 121°C (250°F), snubber thermal movement is verified.

Additionally, preservice operational readiness testing is performed on all snubbers. The operational readiness test is performed to verify the parameters of ISTD-5120. Snubbers that fail the preservice operational readiness test are evaluated to determine the cause of failure, and are retested following completion of corrective action(s).

Snubbers that are installed incorrectly or otherwise fail preservice testing requirements are re-installed correctly, adjusted, modified, repaired or replaced, as required. Preservice examination and testing is re-performed on installation- corrected, adjusted, modified, repaired or replaced snubbers as required.

The preservice inspection and testing programs for snubbers will be completed in accordance with milestones described in Section 13.4.

Inservice Examination and Testing

Add the following at the beginning of this section.

STD COL 3.9.9-4-A

Inservice examination and testing of all safety-related snubbers is conducted in accordance with the requirements of the ASME OM Code, Subsection ISTD. Inservice examination is initially performed not less than two months after attaining 5 percent reactor power operation and will be completed within 12 calendar months after attaining 5 percent reactor power. Subsequent examinations are performed at intervals defined by ISTD-4252 and Table ISTD-4252-1. Examination intervals, subsequent to the third interval, are adjusted based on the number of unacceptable snubbers identified in the then current interval.

An inservice visual examination is performed on all snubbers to identify physical damage, leakage, corrosion, degradation, indication of binding, misalignment or deformation and potential defects generic to a particular design. Snubbers that do not meet visual examination requirements are evaluated to determine the root cause of the unacceptability, and appropriate corrective actions (e.g., snubber is adjusted, repaired, modified, or replaced) are taken. Snubbers evaluated as unacceptable during visual examination may be accepted for continued service by successful completion of an operational readiness test.

Snubbers are tested inservice to determine operational readiness during each fuel cycle, beginning no sooner than 60 days before the scheduled start of the applicable refueling outage. Snubber operational readiness tests are conducted with the snubber in the as-found condition, to the extent practical, either in place or on a test bench, to verify the test parameters of ISTD-5210. When an in-place test or bench test cannot be performed, snubber subcomponents that control the parameters to be verified are examined and tested. Preservice examinations are performed on snubbers after reinstallation when bench testing is used (ISTD-5224), or on snubbers where individual subcomponents are reinstalled after examination (ISTD-5225).

Defined test plan groups (DTPG) are established and the snubbers of each DTPG are tested according to an established sampling plan each fuel cycle. Sample plan size and composition are determined as required for the selected sample plan, with additional sampling as may be required for that sample plan based on test failures and failure modes identified. Snubbers that do not meet test requirements are evaluated to determine root cause of the failure, and are assigned to failure mode groups (FMG) based on the evaluation, unless the failure is considered unexplained or isolated. The number of unexplained snubber failures not assigned to an FMG determines the additional testing sample. Isolated failures do not require additional testing. For unacceptable snubbers, additional testing is conducted for the DTPG or FMG until the appropriate sample plan completion criteria are satisfied.

Unacceptable snubbers are adjusted, repaired, modified, or replaced. Replacement snubbers meet the requirements of ISTD-1600. Post-maintenance examination and testing, and examination and testing of repaired snubbers, is done to ensure that test parameters that may have been affected by the repair or maintenance activity are verified acceptable.

Service life for snubbers is established, monitored and adjusted as required by ISTD-6000 and the guidance of ASME OM Code Nonmandatory Appendix F .

The inservice inspection and testing programs for snubbers will be completed in accordance with milestones described in Section 13.4.

Delete the last two sentences of the last paragraph.

3.9.3.7.1(3)f Snubber Support Data

Replace the first sentence with the following.

STD COL 3.9.9-4-A

[START COM 3.9-003] For the ASME Class 1, 2, and 3 systems listed in DCD Tier 1, Section 3.1, that contain snubbers, a plant specific table will be prepared in conjunction with the closure of the system-specific ITAAC for piping and component design and will include the following specific snubber information. **[END COM 3.9-003]**

Add the following at the end of this section.

STD COL 3.9.9-4-A

[START COM 3.9-005] This information will be included in the FSAR as part of a subsequent FSAR update. **[END COM 3.9-005]**

3.9.6 Inservice Testing of Pumps and Valves

Replace the last sentence of the last paragraph with the following.

STD COL 3.9.9-3-A

Milestones for implementation of the ASME OM Code preservice and inservice testing programs are defined in Section 13.4.

3.9.6.1 Inservice Testing of Valves

Add the following before the last paragraph.

STD. COL 3.9.9-3-A

Each valve subject to inservice testing is also tested during the preservice test (PST) period. Preservice tests are conducted under conditions as near as practicable to those expected during subsequent inservice testing. Valves (or the control system)that have undergone maintenance that could affect performance, or valves that are repaired or replaced, are re-tested to verify performance parameters that could have been affected are within acceptable limits. Safety and relief valves and nonreclosing pressure relief devices are preservice tested in accordance with the requirements of the ASME OM Code, Mandatory Appendix I.

3.9.6.1.4 **Valve Testing**

Add the following at the end of the introduction to this section

STD COL 3.9.9-3-A Other specific testing requirements for power-operated valves include stroke-time testing and, as applicable, diagnostic testing to evaluate valve condition and to verify the valve will continue to function under design-basis conditions.

(1) Valve Excercise Tests

Add the following after the second sentence of the first paragraph.

STD COL 3.9.9-3-A Valves are tested by full-stroke exercising, during positions required to fulfill their functions.

Add the following after the third sentence of the first paragraph.

STD COL 3.9.9-3-A If full-stroke exercising is not practicable, part-stroke exercising is performed during operation at power or during cold shutdown.

Add the following new paragraph after the first paragraph

STD COL 3.9.9-3-A During extended shutdowns, valves that are required to be operable must remain capable of performing their intended safety function. Exercising valves during cold shutdown commences within 48 hours of achieving cold shutdown and continues until testing is complete or the plant is ready to return to operation at power. Valve testing required to be performed during a refueling outage is completed before returning the plant to operation at power.

Add the following after the first sentence of the second paragraph.

STD COL 3.9.9-3-A Valve testing uses reference values determined from the results of PST or IST. These tests that establish reference values are performed under conditions as near as practicable to those expected during the IST. Stroke time is measured and compared to the reference value, except for valves classified as fast-acting (e.g., solenoid-operated valves (SOVs) with stroke time less than 2 seconds), for which a stroke time limit of 2 seconds is assigned.

Add the following after the third paragraph.

STD COL 3.9.9-3-A SOVs are tested to confirm the valves move to their energized positions and are maintained in those positions, and to confirm that the valves move to the appropriate failure mode positions when de-energized. Pre-conditioning of valves or their associated actuators or controls prior to IST undermines the purpose of IST and is prohibited. Pre-conditioning includes manipulation, pre-testing, maintenance, lubrication, cleaning, exercising, stroking, operating, or disturbing the valve to be tested in any way, except as may occur in an unscheduled, unplanned, and unanticipated manner during normal operation

(4) Special Tests

Add the following after the second paragraph under the second bullet.

STD COL 3.9.9-3-A Industry and regulatory guidance is considered in development of IST program for explosively actuated valves. In addition, the IST program for explosively actuated valves incorporates lessons learned from the design and qualification process for these valves such that surveillance activities provide reasonable assurance of the operational readiness of explosively actuated valves to perform their safety functions.

3.9.6.1.5 **Specific Valve Test Requirements**

(1) Power-Operated Valve Tests

Replace the last paragraph with the following

STD COL 3.9.9-3-A Subsection 3.9.6.8 describes additional (non-Code) testing of power-operated valves as discussed in Regulatory Issue Summary 2000-03.

(3) Check Valve Excercise Tests

Add the following as the first sentence of the second paragraph.

STD COL 3.9.9-3-A Check valve testing requires verification that obturator movement is in the direction required for the valve to perform its safety function.

Add the following before the last paragraph.

STD COL 3.9.9-3-A Acceptance criteria for this testing consider the specific system design and valve application. For example, a valve's safety function may require obturator movement in both open and closed directions. A mechanical exerciser may be used to operate a check valve for testing. Where a mechanical exerciser is used, acceptance criteria are provided for the force or torque required to move the check valve's obturator. Exercise tests also detect missing, sticking, or binding obturators.

If these test methods are impractical for certain check valves, or if sufficient flowcannot be achieved or verified, a sample disassembly examination program verifies valve obturator movement. The sample disassembly examination program groups check valves by category of similar design, application, and service condition.

During the disassembly process, the full-stroke motion of the obturator is verified. Nondestructive examination is performed on the hinge pin to assess wear, and seat contact surfaces are examined to verify adequate contact. Full-stroke motion of the obturator is re-verified immediately prior to completing reassembly. At least one valve from each group is disassembled and examined at each refueling outage, and all the valves in each group are disassembled and examined at least once every eight years. Before being returned to service, valves disassembled for examination or valves that received maintenance that could affect their performance are exercised with a full- or part-stroke. Details and bases of the sampling program are documented and recorded in the test plan.

When operating conditions, valve design, valve location, or other considerations prevent direct observation or measurements by use of conventional methods to determine adequate check valve function, diagnostic equipment and nonintrusive techniques are used to monitor internal conditions. Nonintrusive tests used are dependent on system and valve configuration, valve design and materials, and include methods such as ultrasonic (acoustic), magnetic, radiography, and use of accelerometers to measure system and valve operating parameters (e.g., fluid flow, disk position, disk movement, disk impact, and the presence or absence of cavitation and back-tapping). Nonintrusive techniques also detect valve degradation. Diagnostic equipment and techniques used for valve operability determinations are verified as effective and accurate under the PST program.

Testing is performed, to the extent practical, under normal operation, cold shutdown, or refueling conditions applicable to each check valve. Testing includes effects created by sudden starting and stopping of pumps, if applicable, or other conditions, such as flow reversal. When maintenance that could affect valve performance is performed on a valve in the IST program, post-maintenance testing is conducted prior to returning the valve to service.

Preoperational testing is performed during the initial test program (refer to Section 14.2) to verify that valves are installed in a configuration that allows correct operation, testing, and maintenance. Preoperational testing verifies that piping design features accommodate check valve testing requirements. Tests also verify disk movement to and from the seat and determine, without disassembly, that the valve disk positions correctly, fully opens or fully closes as expected, and remains stable in the open position under the full spectrum of system design-basis fluid flow conditions.

Data acquired during check valve testing and inspections, and the maintenance history of a valve or group of valves is collected and maintained in order to establish the basis for specifying inservice testing, examination, and preventive maintenance activities that will identify and/or mitigate the failure of the check valves or groups of check valves tested. This data is also used to determine if certain check valve condition monitoring tests, such as nonintrusive tests, are feasible and effective in monitoring for these identified failure mechanisms, whether periodic disassembly and examination activities would be effective in monitoring for these failure mechanisms, as well as to determine possible valve groupings to implement in a future check valve condition monitoring program as allowed by ISTC-5222, the requirements of which are described in ASME OM Code, Appendix II.

3.9.6.5 Valve Replacement, Repair and Maintenance

Add the following to the end of the paragraph.

STD COL 3.9.9-3-A

When a valve or its control system has been replaced, repaired, or has undergone maintenance that could affect valve performance, a new reference value is determined, or the previous value is reconfirmed by an inservice test. This test is performed before the valve is returned to service, or immediately if the valve is not removed from service. Deviations between the previous and new reference values are identified and analyzed. Verification that the new values represent acceptable operation is documented.

3.9.6.6 10 CFR 50.55a Relief Requests and Code Cases

Add the following at the end of the first paragraph.

STD SUP 3.9-1

No relief from or alternative to the ASME OM Code is being requested.

3.9.6.7 Inservice Testing Program Implementation

Delete the last paragraph

3.9.6.8 Non-Code Testing of Power-Operated Valves

Replace the second sentence of the first paragraph with the following.

STD COL 3.9.9-3-A

These tests, which are typically performed under static (no flow or pressure) conditions, also document the "baseline" performance of the valves to support maintenance and trending programs.

Replace the fifth sentence of the first paragraph with the following.

STD COL 3.9.9-3-A

Uncertainties associated with performance of these tests and use of the test results (including those associated with measurement equipment and potential degradation mechanisms) are addressed appropriately.

Replace the last sentence of the first paragraph with the following.

STD COL 3.9.9-3-A

Uncertainties affecting both valve function and structural limits are addressed.

Replace the second paragraph with the following.

STD COL 3.9.9-3-A Additional testing is performed as part of the air-operated valve (AOV) program, which includes the key elements for an AOV Program as identified in the JOG AOV program document, Joint Owners Group Air Operated Valve Program Document, Revision 1, December 13, 2000 (Reference 3.9-201) and (Reference 3.9.1-202). The AOV program incorporates the attributes for a successful power-operated valve long-term periodic verification program, as discussed in RIS 2000-03, Resolution of Generic Safety Issue 158: Performance of Safety-related Power- Operated Valves Under Design Basis Conditions, (Reference 3.9.1-203) by incorporating lessons learned from previous nuclear power plant operations and research programs as they apply to the periodic testing of air- and other power- operated valves included in the IST program. For example, key lessons learned addressed in the AOV program include:

- Valves are categorized according to their safety significance and risk ranking.
- Setpoints for AOVs are defined based on current vendor information or valve qualification diagnostic testing, such that the valve is capable of performing its design-basis function(s).
- Periodic static testing is performed, at a minimum on high risk (high safety significance) valves, to identify potential degradation, unless those valves are periodically cycled during normal plant operation under conditions that meet or exceed the worst case operating conditions within the licensing basis of the plant for the valve, which would provide adequate periodic demonstration of AOV capability. If required based on valve qualification or operating experience, periodic dynamic testing is performed to re-verify the capability of the valve to perform is required functions.
- Sufficient diagnostics are used to collect relevant data (e.g., valve stem thrust and torque, fluid pressure and temperature, stroke time, operating and/or control air pressure, etc.) to verify the valve meets the functional requirements of the qualification specification.
- Test frequency is specified, and is evaluated each refueling outage based on data trends as a result of testing. Frequency for periodic testing is in accordance with (Reference 3.9-201) and (Reference

3.9.1-202), with a minimum of 5 years (or 3 refueling cycles) of data collected and evaluated before extending test intervals.

- Post-maintenance procedures include appropriate instructions and criteria to ensure baseline testing is re-performed as necessary when maintenance on the valve, valve repair or replacement, have the potential to affect valve functional performance.
- Guidance is included to address lessons learned from other valve programs in procedures and training specific to the AOV program.
- Documentation from AOV testing, including maintenance records and records from the corrective action program are retained and periodically evaluated as a part of the AOV program.

The attributes of the AOV testing program described above, to the extent that they apply to and can be implemented on other safety-related power-operated valves, such as electro-hydraulic valves, are applied to those other power-operated valves.

3.9.7 Risk-Informed Inservice Testing

Replace this section with the following.

STD SUP 3.9-2 Risk informed inservice testing is not being utilized.

3.9.8 Risk-Informed Inservice Inspection of Piping

Replace this section with the following.

STD SUP 3.9-3 Risk informed inservice inspection is not being utilized.

3.9.9 COL Information

3.9.9-1-A Reactor Internals Vibration Analysis, Measurement and Inspection Program

EF3 COL 3.9.9-1-A This COL item is addressed in Subsection 3.9.2.4.

3.9.9-2-A ASME Class 2 or 3 or Quality Group D Components with 60 Year Design Life

STD COL 3.9.9-2-A This COL item is addressed in Subsection 3.9.3.1.

3.9.9.3-A **Inservice Testing Programs**

STD COL 3.9.9-3-A This COL item is addressed in Subsection 3.9.6.

3.9.9.4-A **Snubber Inspection and Test Program**

STD COL 3.9.9-4-A This COL item is addressed in Subsection 3.9.3.7.1(3)e and Subsection 3.9.3.7.1(3)f.

3.9.10 **References**

3.9-201 Joint Owners Group Air Operated Valve Program Document, Revision1, December 13, 2000.Joint Owners Group Air Operated Valve Program Document, Revision 1, December 13, 2000.

3.9.1-202 USNRC, Eugene V. Imbro, letter to Mr. David J. Modeen, Nuclear Energy Institute, Comments On Joint Owners' Group Air Operated Valve Program Document, October 8, 1999.

3.9.1-203 Regulatory Issue Summary 2000-03, Resolution of Generic Safety Issue 158: Performance of Safety-related Power-Operated Valves Under Design Basis Conditions, March 15, 2000.

3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

3.10.1.4 **Dynamic Qualification Report**

Replace the last paragraph with the following.

STD COL 3.10.4-1-A **[START COM 3.10-003]** Detroit Edison shall submit to the NRC, no later than 1 year after issuance of the combined license or at the start of construction as defined in 10 CFR 50.10(a), whichever is later, its implementation schedules for completing of the following ITAACs. Detroit Edison shall submit updates to the ITAAC schedules every 6 months thereafter and, within 1 year of its scheduled date for initial loading of fuel, and shall submit updates to the ITAAC schedules every 30 days until the final notification is provided to the NRC under paragraph (c)(1) of this section." **[END COM 3.10-003]**

[START COM 3.10-001] The Dynamic Qualification Report and documentation that describe the seismic and dynamic qualification methods will be made available for NRC staff review, inspection, and audit. Information that verifies the seismic and dynamic qualification will be made available to the NRC to facilitate reviews, inspections, and audits throughout the process. **[END COM 3.10-001] [START COM 3.10-002]** FSAR information will be revised, as necessary, as part of a subsequent FSAR update. **[END COM 3.10-002]**

STD SUP 3.10-1

Section 17.5 defines the Quality Assurance Program requirements that are applied to equipment qualification files, including requirements for handling safety-related quality records, control of purchased material, equipment and services, test control, and other quality related processes.

3.10.4 COL Information

STD COL 3.10.4-1-A

3.10.4-1-A Dynamic Qualification Report

This COL item is addressed in Subsection 3.10.1.4.

3.11 Environmental Qualification of Mechanical and Electrical Equipment

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

3.11.4.4 Environmental Qualification Documentation

Replace the last paragraph with the following.

STD COL 3.11-1-A

The documentation necessary to support the continued qualification of the equipment installed in the plant that is within the Environmental Qualification (EQ) Program scope is available in accordance with 10 CFR 50 Appendix A, General Design Criterion 1. EQ files are maintained for equipment and certain post-accident monitoring devices that are subject to a harsh environment. The files are maintained for the operational life of the plant.

Central to the EQ Program is the EQ Master Equipment List (EQMEL). The EQMEL identifies the electrical and mechanical equipment or components that must be environmentally qualified for use in a harsh environment. The EQMEL consists of equipment that is essential to emergency reactor shutdown, containment isolation, reactor core cooling, or containment and reactor heat removal, or that is otherwise essential in preventing a significant release of radioactive material to the environment. This list is developed from the equipment list provided in DCD Table 3.11-1. The EQMEL and a summary of equipment qualification results are maintained as part of the equipment qualification file for the operational life of the plant.

Administrative programs are in place to control revisions to the EQ files and the EQMEL. When adding or modifying components in the EQ Program, EQ files are generated or revised to support qualification. The EQMEL is revised to reflect these new components. To delete a component from the EQ Program requires a deletion justification to be prepared that demonstrates why the component can be deleted. This justification consists of an analysis of the component, an associated circuit review, if appropriate and a safety evaluation. The justification is released and/or referenced on the appropriate change document.

For changes to the EQMEL, supporting documentation is completed and approved prior to issuing the changes. This documentation includes safety reviews and new or revised EQ files. Plant modifications and design basis changes are subject to change process reviews, e.g., reviews in accordance with 10 CFR 50.59 or the change control requirements of the ESBWR-specific appendix to 10 CFR Part 52, in accordance with appropriate plant procedures. These reviews address EQ issues associated with the activity. Any changes to the EQMEL that are not the result of a modification or design basis change are subject to a separate review that is accomplished and documented in accordance with plant procedures.

Engineering change documents or maintenance documents generated to document work performed on an EQ component are reviewed against the current revision of the EQ files for potential impact. Changes to EQ documentation may be due to, but not limited to, plant modifications, calculations, corrective maintenance, or other EQ concerns.

The operational aspects of the EQ program include:

- Evaluation of EQ results for design life to establish activities to support continued EQ

- Determination of surveillance and preventive maintenance activities based on EQ results
- Consideration of EQ maintenance recommendations from equipment vendors
- Evaluation of operating experience in developing surveillance and preventive maintenance activities for specific equipment
- Development of plant procedures that specify individual equipment identification, appropriate references, installation requirements, surveillance and maintenance requirements, post-maintenance testing requirements, condition monitoring requirements replacement part identification, and applicable design changes and modifications
- Development of plant procedures for reviewing equipment performance and EQ operational activities, and for trending the results to incorporate lessons learned through appropriate modifications to the operational EQ program
- Development of plant procedures for the control and maintenance of EQ records

Implementation of the environmental qualification program, including development of the plant specific Environmental Qualification Document (EQD), will be in accordance with the milestone defined in Section 13.4.

3.11.7 **COL Information**

3.11-1-A **Environmental Qualification Document**

STD COL 3.11-1-A This COL item is addressed in Subsection 3.11.4.4.

STD SUP 3.12-1

3.12 Piping Design Review

Information on seismic Category I and II, and nonseismic piping analysis and their associated supports is presented in DCD Sections 3.7, 3.9, 3D, 3K, 5.2 and 5.4.

STD SUP 3.13-1

3.13 Threaded Fasteners - ASME Code Class 1, 2, and 3

Criteria applied to the selection of materials, design, inspection and testing of threaded fasteners (i.e., threaded bolts, studs, etc.) are presented in DCD Section 3.9.3.9, with supporting information in DCD Sections 4.5.1, 5.2.3, and 6.1.1.

Appendix 3A Seismic Soil-Structure Interaction Analysis

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

3A.1 Introduction

Replace the last sentence in the second paragraph with the following.

EF3 CDI

Site-specific geotechnical data is described in Chapter 2. This data is compatible with the site enveloping parameters considered in the standard design.

3A.2 ESBWR Standard Plant Site Plan

Replace the first two sentences of the first paragraph with the following.

EF3 CDI

The site plan is shown in Figure 2.1-204. The plan orientation is denoted on the figure.

3A.5 SOIL-STRUCTURE INTERACTION ANALYSIS METHOD

3A.5.2 SASSI2000 Analysis Method

Replace the second sentence of the first paragraph with the following.

EF3 CDI

The program uses finite elements with complex moduli for modeling the structure and foundation properties and is based on the direct method and the frequency domain complex response method.

Appendix 3B Containment Hydrodynamic Load Definitions

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 3C Computer Programs Used in the Design and Analysis of Seismic Category I Structures

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 3D Computer Programs Used in the Design of Components, Equipment, and Structures

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 3E [Deleted]

Appendix 3F Response of Structures to Containment Loads

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 3G Design Details and Evaluation Results of Seismic Category I Structures

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 3H Equipment Qualification Design Environmental Conditions

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 3I Designated NEDE-24326-1-P Material Which May Not Change Without Prior NRC Approval

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 3J Evaluation of Postulated Ruptures in High Energy Pipes

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 3K Resolution of Intersystem Loss of Coolant Accident

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 3L Reactor Internals Flow Induced Vibration Program

This section of the referenced DCD is incorporated by reference with no departures or supplements.