LOCATION FOR SSE TO GMRS COMPARISON FOR 2.1 SCREENING

Purpose: This document provides a rationale for defining the elevation(s) for the SSE to GMRS comparison for use in the 2.1 screening.

General Discussion: The SSE to GMRS comparison for 2.1 screening per the 50.54(f) letter are recommended to be applied using the licensing basis definition of SSE control point. The SSE is part of the plant licensing basis which is typically documented in the FSAR. Three specific elements are required to fully characterize the SSE:

- Peak Ground Acceleration
- Response Spectral Shape
- Control point where the SSE is defined

The first two elements of the SSE characterization are normally available in the part of the FSAR that describes the site seismicity (typically section 2.5). The control point for the SSE is not always specifically defined in the FSAR and, as such, guidance is required to ensure that a consistent set of comparisons are made. Most plants have a single SSE, but several plants have two SSEs identified in their licensing basis (one at rock and one at top of a soil layer).

The seismic analysis and design of existing plants varied based on their vintage. Nuclear power plants used current state-of-the art for seismic analysis at the time the plants were analyzed, designed, constructed, and licensed. This means the SSE ground motion for input to these seismic analyses was treated differently depending on the seismic analysis methodologies currently accepted at the time. For example, most earlier plants simply applied the SSE at the foundation of simplified stick models of the seismic category I structures without considering embedment, depth of foundation, and the soil profile characteristics between plant grade down to the elevation of the bottom of the foundation. Later plants used more sophisticated SSI methodologies & models that explicitly accounted for embedment where the SSE control point was at plant grade or top of the highest component soil layer. Licensee using these more sophisticated methodologies were required to check that the deconvolved motion at the elevation of the bottom of foundation did not produce a free field ground response spectra at that elevation less than 60% of the input SSE ground response spectra at plant grade (control point), otherwise, the input motion had to be increased accordingly as described in Appendix A of a later version of NUREG 0800. We are not recommending using the applied values of the SSE for the GMRS to SSE comparison for 2.1.

Conclusions:
For purposes of the SSE to GMRS comparisons as part of the 50.54(f) 2.1 seismic evaluations, the following criteria are recommended to establish a logical comparison location:

1) If the SSE control point(s) is defined in the FSAR, use as defined.
2) If the SSE control point is not defined in FSAR then the following criteria should be used:
    a. For sites classified as soil sites with generally uniform, horizontally layered stratigraphy and where the key structures are soil founded (Figure 1), the control point is defined as the highest point in the material where a safety related structure is founded (i.e. bottom of structure foundation), regardless of the shear wave velocity.
    b. For sites classified as a rock site or where the key safety related structures are rock founded (Figure 2), then the control point is located at the top of the rock.
    c. The SSE control point definition is meant for the main power block area at a site even where soil/rock horizons could vary for some smaller structures located away from the main power block (e.g. an intake structure located away from the main power block area where the soil/rock horizons are different).

Figure 1 – Soil Site Example

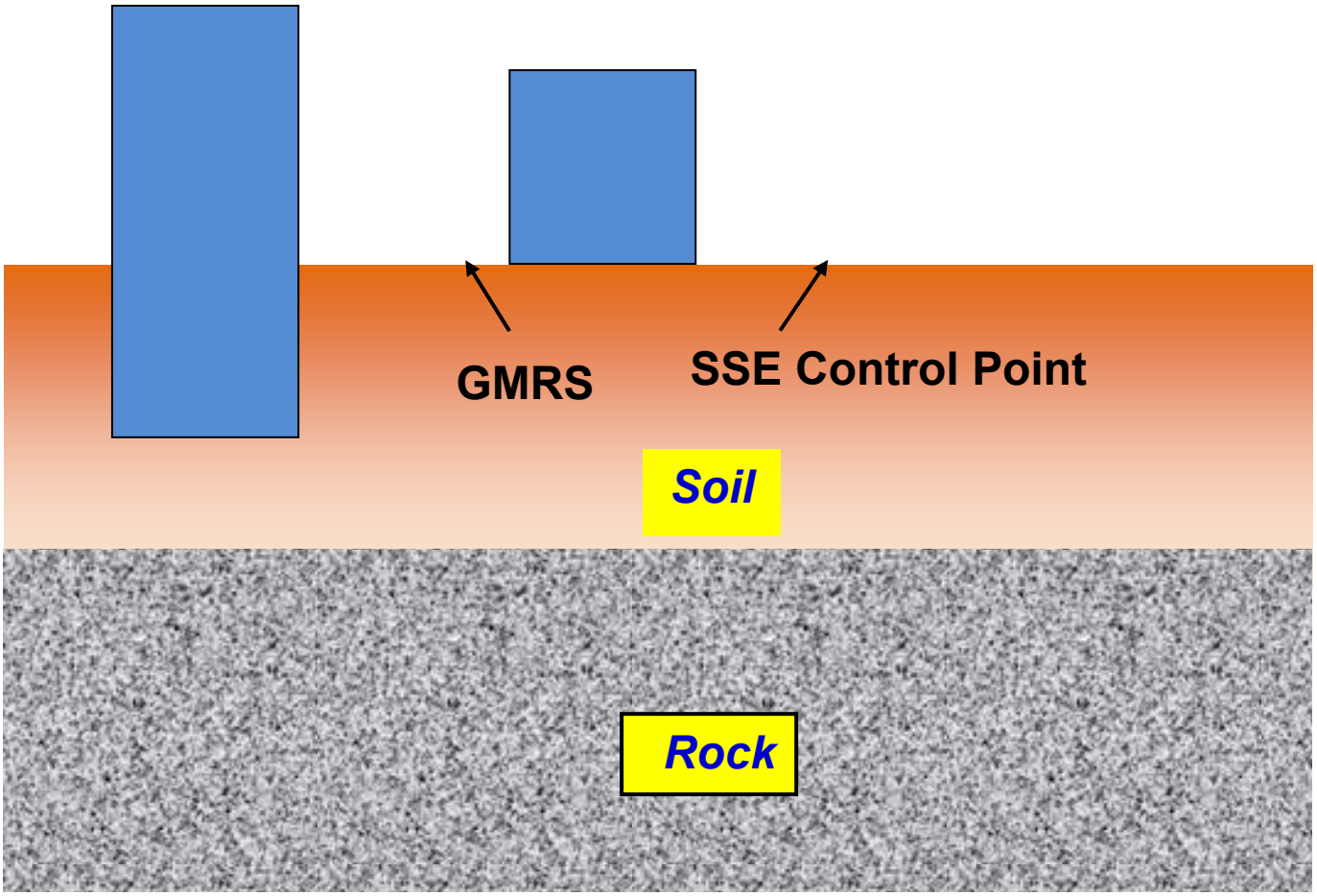
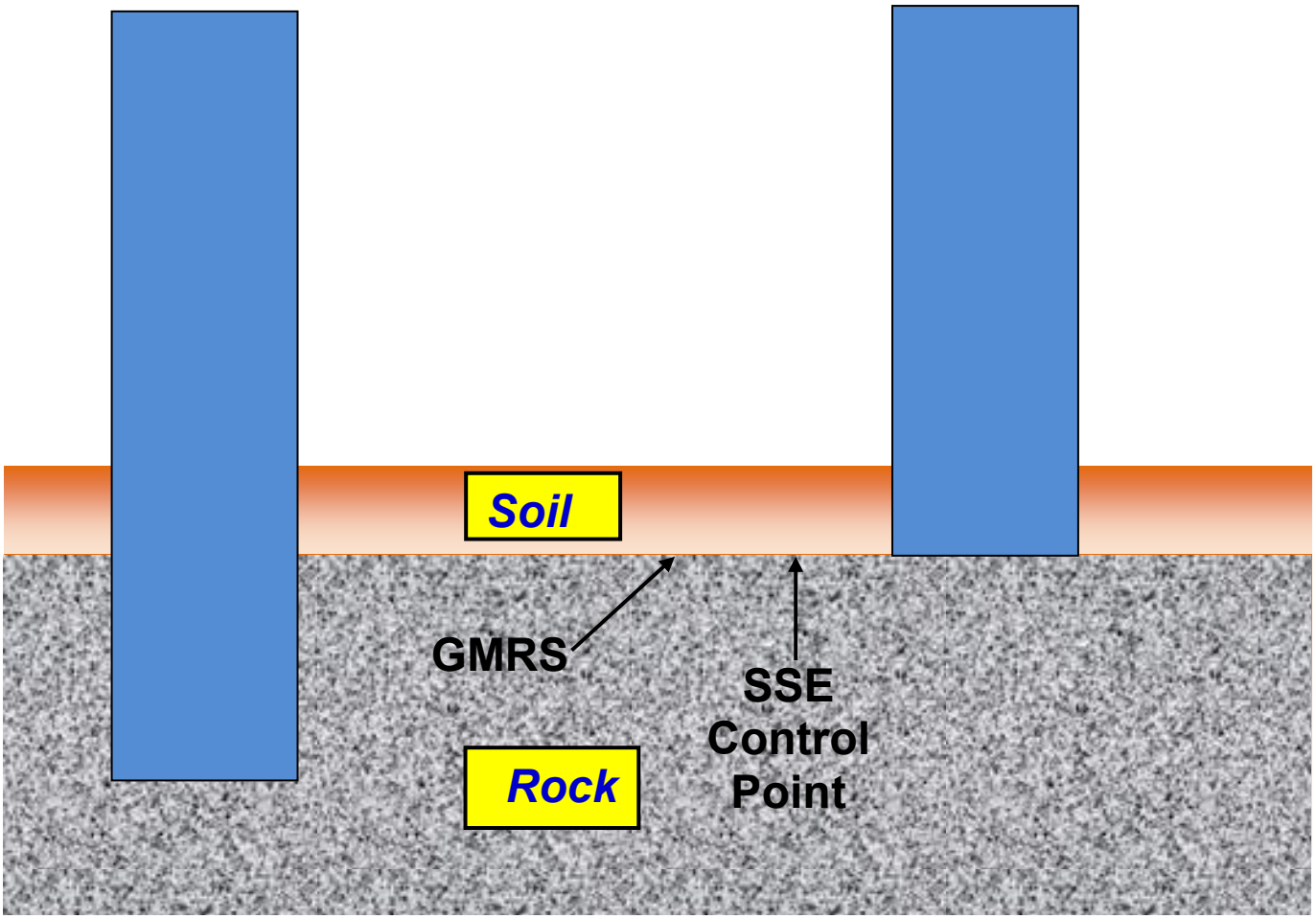


Figure 2 – Rock Site Example



Appendix A

NUREG-0800 USNRC Standard Review Plan Rev. 2 1989:

The FSAR 2.5.2 Vibratory Ground Motion described the development of the site SSE. Typically a peak ground acceleration (PGA) is determined and a generic spectral shape was defined; e.g, Housner spectra, Modified Newmark spectra, RG 1.60 spectra.

In FSAR 3.7.1 the implementation of the SSE ground motion for seismic analysis and design is described. As discussed above the methodologies for seismic analysis and design varied depending on the vintage of the Plant.

NUREG-0800 Rev. 2 August 1989 provides the acceptance criteria for the later set of existing NNP designs:

3.7.1 Seismic Design Parameters states under 1. Design Ground Motion the following:

"The control motion should be defined to be a free ground surface...Two cases are identified depending on the soil characteristics at the site...uniform sites of soil or rock with smooth variation of properties with depth, the control point (location at which the control motion is applied) should be specified on the soil surface at the top of finished grade...for sites composed of one or more thin soil layers overlaying a competent material...the control point is specified on an outcrop or a hypothetical outcrop at a location on the top of the competent material..."

3.7.2 Seismic System Analysis states under II Acceptance Criteria the following:

"Specific criteria necessary to meet the relevant requirements of GDC 2 and Appendix A to Part 100 are as follows:

4. Soil-Structure Interaction...
C. Generation of Excitation System...
The control point...for profile consisting of component soil or rock, with relatively uniform variations of properties with depth the control motion should be located...at top of the finish grade...For profiles consisting of one or more thin soil layers overlaying component material, the control motion should be located at an outcrop (real or hypothetical) at top of the competent material...

...The spectral amplitude of the acceleration response spectra (horizontal component of motion) in the free field at the foundation depth shall be not less than 60 percent of the corresponding design response spectra at the finish grade in the free field..."