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NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

September 15, 2009

UN#09-372

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

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Updated Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI No. 19, Revision 2, Seismic Instrumentation

References:
1) John Rycyna (NRC) to George Wrobel (UniStar Nuclear Energy), "RAI No 19 RGS 1210.doc," email dated October 14, 2008

2) UniStar Nuclear Energy Letter UN#08-067, from Greg Gibson to Document Control Desk, U.S. NRC, Submittal of Response to RAI No. 19, Revision 2, Seismic Instrumentation and Operating Basis Earthquake, dated December 19, 2008

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated October 14, 2008 (Reference 1). This RAI addresses Seismic Instrumentation, as discussed in Section 3.7.1.1 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 5.

Reference 2 provided a response to RAI No. 19, Revision 2, Question 03.07.04-1. During the NRC geology-related CCNPP Unit 3 site visit on February 24-25, 2009, the NRC staff participated in a phone call with UniStar Nuclear Energy personnel to discuss the response provided in Reference 2. As a result of the phone call discussion, UniStar Nuclear Energy

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agreed to supplement the response to RAI No. 19, Revision 2, Question 03.07.04-1, with additional details regarding the operating basis earthquake. The enclosure provides the updated response to RAI No. 19, Revision 2, Question 03.07.04-1, and includes revised COLA content. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA.

Our response to RAI No. 19, Revision 2, Question 03.07.04-1 does not include any new regulatory commitments.

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Michael J. Yox at (410) 495-2436.

*I declare under penalty of perjury that the foregoing is true and correct.*

Executed on September 15, 2009

for Greg Gibson

Enclosure: Updated Response to NRC Request for Additional Information, RAI No. 19, Revision 2, Seismic Instrumentation, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Loren Plisco, Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
U.S. NRC Region I Office

GTG/RDS/mf

# Enclosure

## Updated Response to NRC Request for Additional Information
## RAI No. 19, Revision 2, Seismic Instrumentation,
## Calvert Cliffs Nuclear Power Plant, Unit 3

**RAI No 19**

**Question 03.07.04-1**

In order to determine whether plant shutdown is required after an earthquake, Regulatory Position 4.1.1 of Regulatory Guide 1.166 states that "[t]he OBE [operating basis earthquake ground motion] response spectrum check is performed using the lower of:

1. The spectrum used in the certified standard design, or
2. A spectrum other than (1) used in the design of any Seismic Category I structure."

Section 3.7.4.4 of the U.S. EPR FSAR states that "the application of OBE Exceedance Criteria is based on the following:
"i. For the certified design portion of the plant, the OBE ground motion is one-third of the certified seismic design response spectra (CSDRS).
"ii. For the safety-related noncertified design portion of the plant, the OBE ground motion is one-third of the site-specific SSE design motion response spectra, as described in Section 3.7.1.
"iii. The threshold response spectrum ordinate criterion to be used in conjunction with RG 1.166 is the lowest of (i) and (ii)."

Section 3.7.1.1.1 of the applicant's FSAR states that "[t]he horizontal SSE [safe-shutdown earthquake] ground motion is defined as the envelope of the GMRS [Ground Motion Response Spectra] and the set of CSDRS [Certified Seismic Design Response Spectra] curves anchored at 0.1 g peak ground acceleration. The vertical SSE spectrum is defined as the vertical GMRS." In addition, the applicant's FSAR, in Section 3.7.1.1.1, describes the design response spectra of several site-specific Category I structures (including the Ultimate Heat Sink Makeup Water Intake Structure), which differ from the SSE. The NRC staff requests the applicant to specify the OBE which would be used to determine whether shutdown would be required following a seismic event.

**Response**

FSAR Section 3.7.1.1.1 will be revised to specify that the safe shutdown earthquake (SSE) spectrum for the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 site is the envelope of the U.S. EPR FSAR European Utility Requirements (EUR) Soft Soil spectrum anchored at 0.15g and the Regulatory Guide 1.60 spectrum anchored at 0.10g. Both spectra are shown in FSAR Figure 3.7-38. FSAR Figure 3.7-3 will be revised to show the SSE spectrum. This spectrum is applicable for both horizontal and vertical directions. FSAR Figure 3.7-4 and Figure 3.7-5 will also be revised to show a comparison of the foundation input response spectra (FIRS), set of certified seismic design response spectra (CSDRS) curves, and the updated SSE spectrum. Similarly, the SSE discussed in the "Foundation Input Response Spectra for Site-Specific Structures" portion of FSAR Section 3.7.1.1.1 will be revised to consistently define SSE.

The operating basis earthquake (OBE) is one-third of the site SSE spectrum discussed above.

**COLA Impact**

FSAR Section 3.7.1.1.1 will be revised as follows in a future COLA revision:

### 3.7.1.1.1 Design Ground Motion Response Spectra

**Seismic Reconciliation of CSDRS and GMRS for the Nuclear Island Common Basemat**

The GMRS for the horizontal direction in the free-field at the foundation level of the NI Common basemat structure has a peak ground acceleration of ~~0.067~~ 0.076 g. Appendix S of 10 CFR Part 50 (CFR, 2008) requires that the horizontal component of the SSE ground motion in the free-field at the foundation level of the structures must be an appropriate response spectrum with a peak ground acceleration of at least 0.1 g. The horizontal site-specific SSE ground motion is the envelope of the U.S. EPR FSAR European Utility Requirements (EUR) Soft Soil spectrum anchored at 0.15 g and the RG 1.60 spectrum anchored at 0.1 g. The site-specific SSE ground motion is shown in Figure 3.7-3. A comparison of the horizontal and vertical GMRS (or Foundation Input Response Spectra (FIRS)) versus the ~~0.1 g European Utility Requirements (EUR) based CSDRS curves~~ site-specific SSE and CSDRS is shown in Figure ~~3.7-3,~~ 3.7-4 and Figure ~~3.7-4~~ 3.7-5, respectively. As shown, ~~and it shows that~~ the horizontal and vertical GMRS ~~is~~ are enveloped by the ~~0.1 g CSDRS curves~~ site-specific SSE and CSDRS. ~~except for the very low frequency range. The minimum horizontal SSE ground motion is defined as the envelope of the GMRS and the set of CSDRS curves anchored at 0.1 g peak ground acceleration.~~

~~The SSE for CCNPP Unit 3 is defined as the lowest design spectrum used for the design of Seismic Category I structures. Therefore, the SSE for CCNPP Unit 3 is the EUR Soft Soil spectrum curve anchored at 0.15g for the horizontal and vertical directions.~~

The CCNPP Unit 3 seismic design parameters are enveloped by the CSDRS and the generic site soil profiles used in the ~~certified design~~ U.S. EPR FSAR as described below:

**Confirmatory Analyses**

*~~Minimum~~ Ground Motion*

~~In accordance with Appendix S of 10 CFR Part 50, the minimum horizontal SSE ground motion for CCNPP Unit 3 is the envelope of the horizontal GMRS and the 0.1g EUR-based CSDRS. The minimum vertical SSE ground motion is defined as the vertical GMRS.~~ Confirmatory soil-structure interaction (SSI) analyses use the site-specific SSE, which is the envelope of the EUR Soft Soil input motion anchored at 0.15 g PGA and the RG 1.60 spectrum anchored at 0.1 g PGA.~~for horizontal as well as vertical directions. The EUR Soft Soil input motion is selected because the low-strain best estimate CCNPP Unit 3 soil profile has a shear wave velocity range of approximately 1100 fps to 2330 fps and is considered a soft soil. It is observed that although the EUR Soft spectrum at 0.1g PGA is exceeded by the minimum horizontal SSE ground motion for frequencies less than 0.7 Hz, the exceedance occurs outside the frequency range of interest for the SSI analysis. It is also noted that the Design Certification EUR Soft spectrum (at 0.3g PGA) completely envelops the CCNPP Unit 3 SSE ground motion in both horizontal and vertical directions, so the certified design bounds the exceedances noted above for the 0.1g SSE spectra.~~

~~The use of the 0.1g spectrum in the vertical direction is conservative (as it far exceeds the demand for the vertical GMRS in the frequency range of interest for the SSI analysis as shown in Figure A-5) and chosen as a matter of convenience as the time histories are readily available.~~

FSAR Figure 3.7-3 through Figure 3.7-5 will be revised as follows in a future COLA revision:

**Figure 3.7-3—{CCNPP Unit 3 Safe Shutdown Earthquake (SSE) - Horizontal and Vertical}**

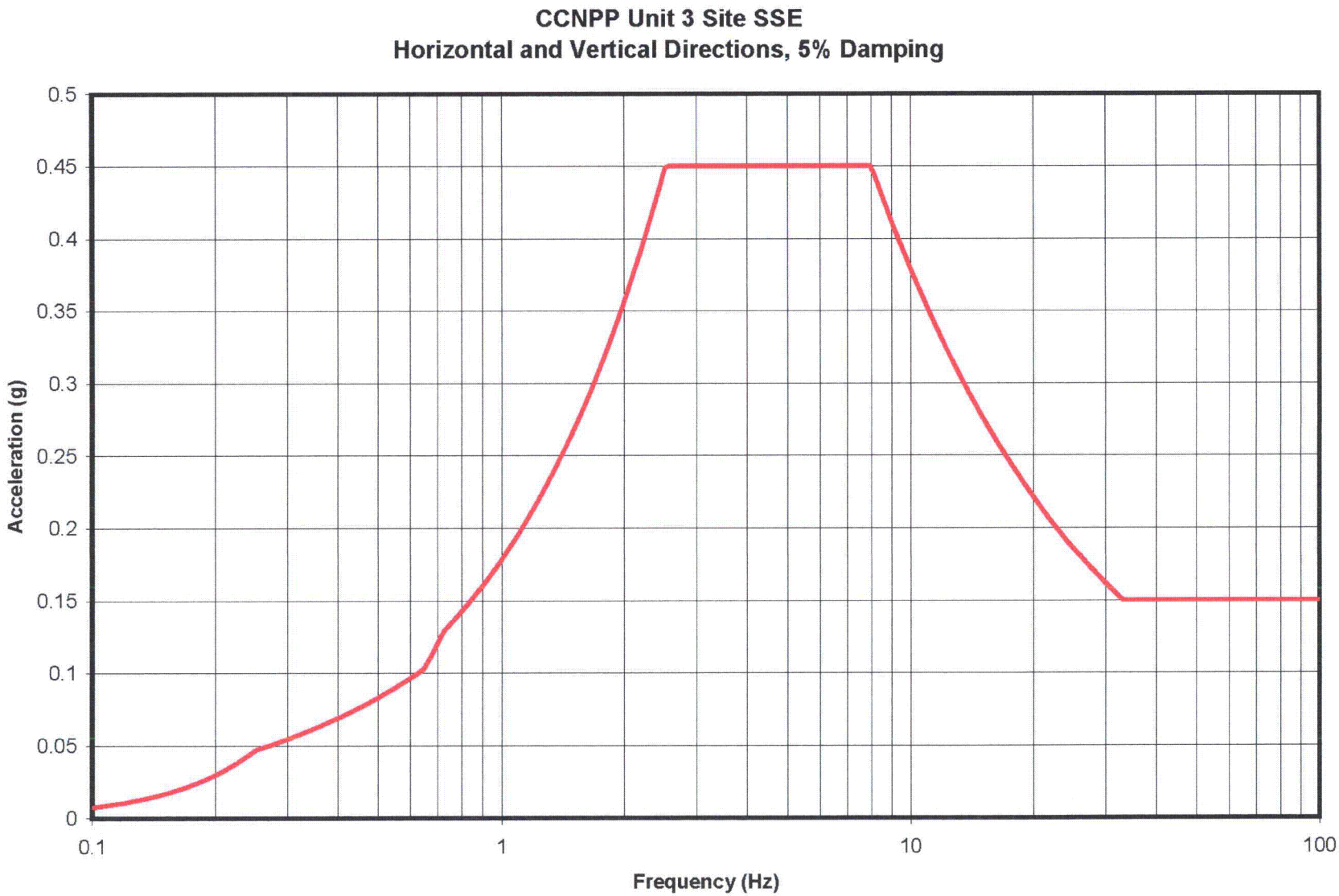

**Figure 3.7-4—{Comparison of CSDRS and CCNPP Unit 3 Foundation Input Response Spectrum and SSE (Horizontal)}**

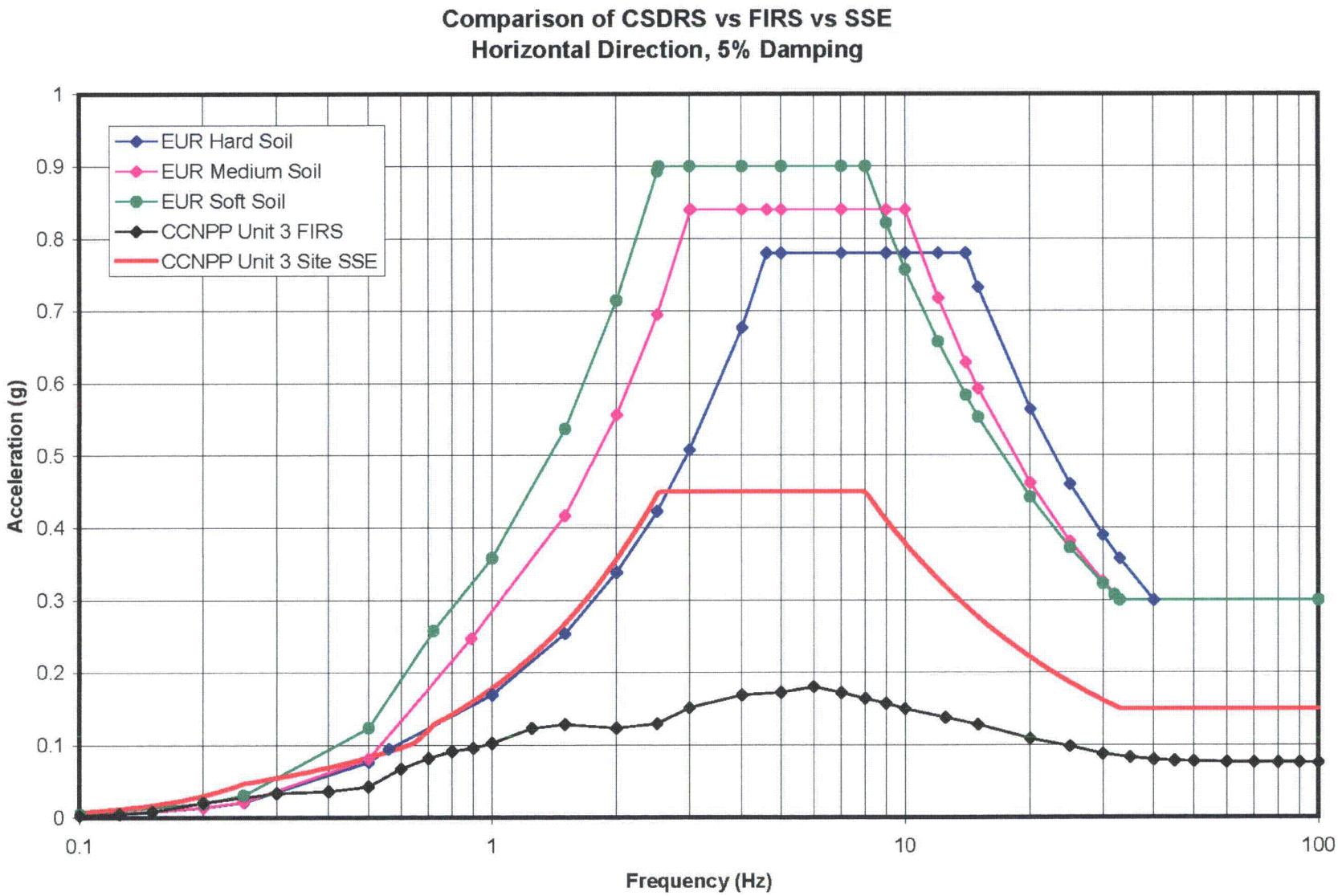
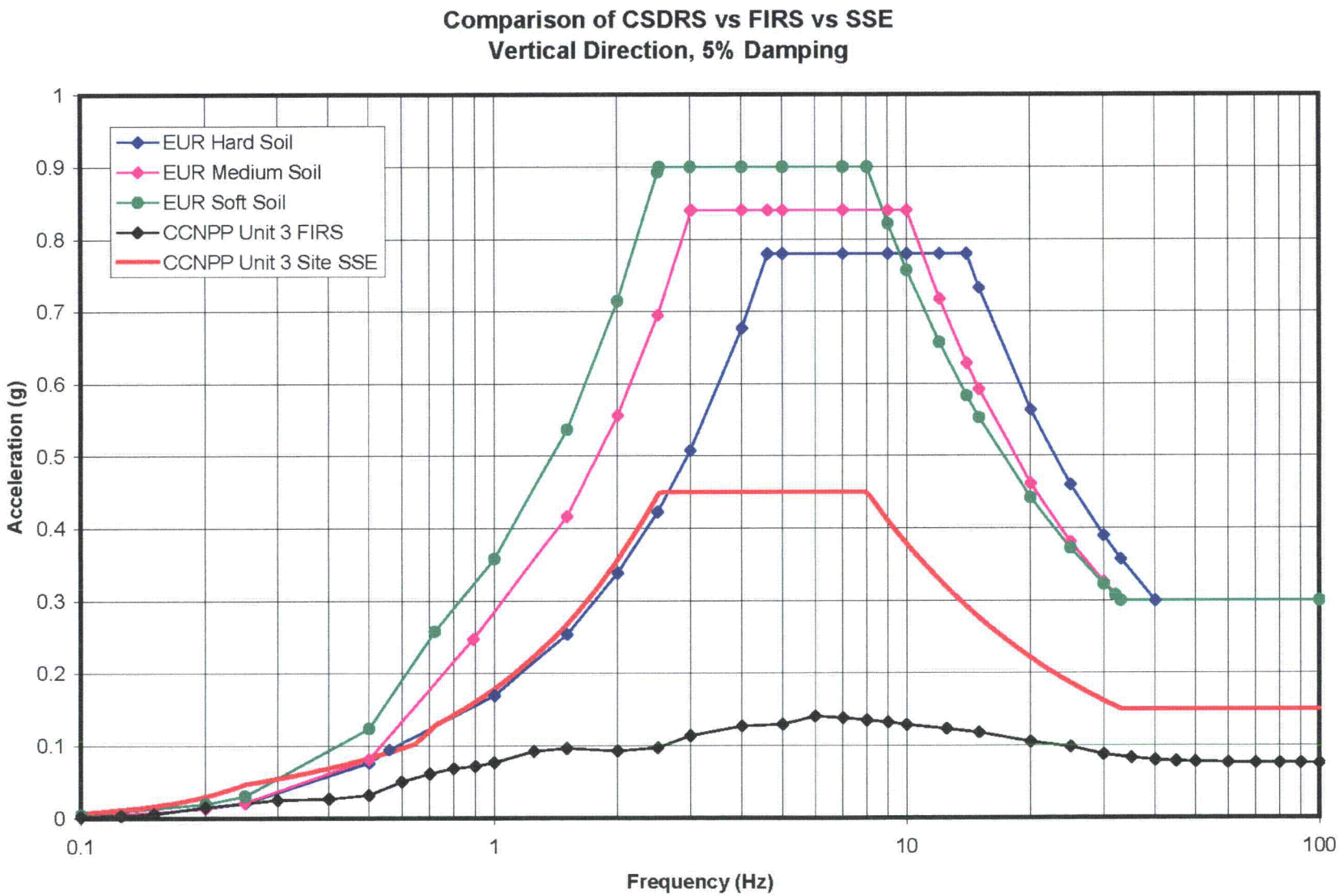
**Figure 3.7-5—{Comparison of CSDRS and CCNPP Unit 3 Foundation Input Response Spectrum and SSE (Vertical)}**